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Trend and Future Perspective of Modern Contraceptive Prevalence, Unmet Need, and Demand Satisfied for Modern Methods for All 38 Districts of Bihar State in India: Application of Family Planning Estimation Tool at District Level

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Abstract

Background: Estimating couples in need and demand of contraceptives for a country helps policy makers for better planning, budget allocation and implement a focused program to achieve the desired goals, especially at district level. In Bihar, the state with India's highest population density and lowest socioeconomic standing. The family planning indicators have been estimated and projected at the national and state levels in most attempts, while estimation at the district level has rarely been attempted. **Methods:** We have used a statistical model that can generate estimates and projections of rates and trends of indicators related to access to reproductive health at the national and sub-national levels. Avenir Health has 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 with little external support. We present here annual estimates and projections of rates and trends of the modern contraceptive prevalence rate, unmet need, and demand satisfied for modern family planning methods at state level and its 38 districts from 1991 to 2030 with application of FPET. **Findings:** There is a large amount of heterogeneity between the districts; only three districts have high modern contraceptive prevalence rate (mCPR > 54%) and high met demand with a modern contraception of more than 74 percent in 2021; whereas five districts have low mCPR of less than 40 percent in 2021. It is estimated that 11 districts out of 38 districts are likely to reach met demand with a modern method greater than 74 percent by 2030. Overall Bihar requires additional 3.6 million users of

modern contraceptives from 2021 to reach 74 percent of demand satisfied with modern contraceptive methods by 2030. But the findings estimate that approximately 3 million additional MWRA will be using modern contraceptive methods during 2021 and 2030 in Bihar. Indeed, the estimates suggest that the increase in the mCPR needed to achieve 74 percent or more demand satisfied with modern methods by 2030 in Bihar, four districts, namely, Kisanganj, Katihar, Gopalganj and Saran should be focused and prioritized followed by another five districts, namely, Siwan, Arwal, Purba Champaran, Sitamarhi, and Sheohar as these districts will be at the bottom of the table with less than 70 percent of demand satisfied with modern methods by 2030. **Conclusion:** The identification of districts that are performing better or worse helps decentralized planning effectively. The analysis can be generalized to other states and districts as well as other types of population subgroups.

Keywords

FPET, mCPR, Unmet Need, Demand Satisfied, Estimates, NFHS

1. Background

The fundamental family planning (FP) variables that affect fertility status, women's reproductive and sexual health, women's empowerment, and population dynamics of the nation are the modern contraception prevalence rate (mCPR), unmet need for spacing and limiting, and demand satisfied (Cavallaro et al., 2017). India committed to accelerating family planning success at the 2012 London Summit by outlining concrete targets and strategies under the global FP2020 effort (New et al., 2017). Additionally, perinatal outcomes, maternal health, and infant survival have all improved because of the use of current modern contraceptive methods (Ahmed et al., 2012; Stover & Ross, 2010).

Family planning programs in India were instrumental in increasing contraceptive use among married women from 36 percent to 56 percent between 1992 and 2021 and in lowering the total fertility rate from 3.4 in 1992 to below replacement level e.g. 2.0 in 2021 (IIPS & ICF, 2021). But Bihar, India's densest and poorest state is lagging in terms of achieving the demographic and family planning targets. Administratively, the state is divided into 38 districts, and the state's large population and high fertility rate draw the attention of professionals from various fields to estimate various health parameters and propose strategies for the state. When looking at the progress of key family planning indicators in Bihar, according to NFHS-5 (2019-2021), 44.4 percent of women of reproductive age who are married or in union use modern contraceptive methods, compared to 18.5 percent in 1991-1992 (NFHS-1). In absolute terms, this translates to a fourfold increase in the number of women using modern contraceptive methods from 2.6 million in NFHS-1 to 10.3 million in NFHS-5. In other words, the state contributes only one in every fifteen modern family planning users in the country, despite accounting for one-tenth of the country's population. Unmet need

for modern family planning methods has decreased slightly from 26.6 percent in NFHS-1 to 24.0 percent in NFHS-5, while demand for modern family planning has increased from 44.8 percent to 64 percent in the state during the same period. The state of Bihar's improvement is extremely low when compared to India's advancement in the previously discussed important family planning indicators, demonstrating the discrepancy in advancement in contraceptive behavior that exists in the nation. Within the state of Bihar, districts show similarly stark variations in contraceptive use, with mCPR recorded by NFHS-5 ranging from 21 percent in Kishanganj district to 59.7 percent in Kaimur (Bhabua) district. All 38 districts of the state have been included in the study because of the large variances in mCPR, as well as in unmet need and demand satisfied (IIPS & ICF, 2021).

Therefore, it is crucial to be able to monitor progress toward the goal at ever-lower levels of geography, from the national to the provincial (state) and sub-provincial (district). These subgroups might be categorized geographically (for example, by states, urban/rural residences, or districts) or based on socioeconomic considerations. This shift in emphasis from national assessments and targets to sub-national ones is especially important given the SDG agenda's equity focus. Additionally, it is crucial to give state and district stakeholders the authority they need to participate independently in local planning, monitoring, and evaluation. This is only possible if they are aware of the heterogeneity and have the skills necessary to produce accurate estimates and projections of the relevant indicators of access to reproductive health with little help from outside sources.

To the best of our knowledge, prior research on rates and trends in family planning indicators for Indian states and union territories (UTs) has primarily relied on state- and UT-level observations from household surveys (Kumar & Singh, 2013; New et al., 2017). In this study, we present the Family Planning Estimation Tool (FPET), a user-friendly web application that can be used to monitor state and district levels locally and provide an annual series of estimates and projections of rates and trends in indicators of contraceptive use, unmet need, and met demand for the state of Bihar and at district level. For India and 29 States & Union Territories, an earlier attempt to estimate these indicators using FPET was made and published in the Lancet (Cahill, Sonneveldt, Stover, Weinberger, Williamson, Wei, Brown, Alkema et al., 2018; New et al., 2017). A brief description of FPET is given at **Annexure A**.

1.1. Research Process and Structure

Subnational level data on family planning in India are primarily available from surveys. We searched PubMed and Scopus using a combination of text terms and subject headings, and open-ended search dates. Previous studies related to the analysis of rates and trends in family planning indicators at the subnational level states/union territories (UTs) in India have mainly relied on direct report-

ing of the survey results (New et al., 2017). We did not find studies that produce model based estimates and projections at district level except the one done in Uttar Pradesh (Gupta et al., 2021). The current study is one of the first attempts in this direction.

Selection of FPET to conduct the analysis was naturally inspired as previous studies (Alkema et al., 2013, 2021; Cahill, Sonneveldt, Stover, Weinberger, Williamson, Wei, Brown, & Alkema, 2018) have shown that it brings reliable estimates of key family planning indicators at national and subnational levels. In the implementation of the FPET at subnational level, each geography is considered as a separate "entity" within the subregion of its respective nation. For example, in district level implementation, districts are considered as countries within the subregion of India and consider model parameters as applicable. Since the FPET package is automated to do these processes, we as users of this tool, did not typically face any issues. Further details of this tool and its functionalities are discussed in the following section.

Statistical model for subnational estimates and projections builds upon the Bayesian hierarchical model that was used by the UNPD to assess progress towards MDG 5 (Alkema et al., 2013; UNDESA Population Division, 2015). This model, which we refer to as the global family planning estimation model, combines systematic trends in total contraceptive prevalence and the ratio of modern to total prevalence, modeled by logistic growth curves, with a time series model for fluctuations layered around these trends.

This model was originally launched under the support of the Track20 Project as a tool—popularly known as FPET—to monitor progress towards the achievement of the goals of the global FP2020 initiative (Track20, 2019). This tool was motivated by the need for a monitoring tool which is not only less intensive computationally and time consuming than the global family planning estimation model (which requires at least 10 hours of computation time on an average personal computer with 4 core processors) 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 (UNDESA Population Division, 2021) or Track20, 2020 or user's own input database. This web-based application was created with the R package Shiny and runs using R (R, D. C. T., 2011) however, all that is required for the user to run FPET is an internet connection and any modern web browser. More about the FPET model descriptions and its advancements over the period are available in the literature (Alkema et al., 2013; Cahill, Sonneveldt, Stover, Weinberger, Williamson, Wei, Brown, & Alkema, 2018; New & Alkema, 2015).

In addition to provide national estimates, FPET can also be fitted to sub-national data to obtain sub-national estimates annually. In this paper, we extended FPET to obtain district-level estimates of key family planning indicators for the state of

Bihar by broadening the hierarchical structure used and captured spatial differentials where appropriate. The main challenge involved while constructing estimates for sub-national populations is a paucity of data. However, in India's case, there are 10 multiple rounds of three surveys (DHS/NFHS, DLHS and AHS) spanned over 1991 to 2021 which provide input data at the district and state level for modeling purposes.

1.2. Study Objective

In view of the recent advancement in the FPET methodologies (Cahill, Sonneveldt, Stover, Weinberger, Williamson, Wei, Brown, Alkema et al., 2018; UNDESA Population Division, 2021), it has been proposed to conduct small area estimation (SAE) and projection of three key family planning indicators for all 38 districts of Bihar state in India. FPET allows to produce either national or subnational estimates depending on the data entered the tool (Track20, http://www.track20.org/pages/track20_tools/FPET.php). Since the availability of input data is ensured for all the 38 districts of Bihar state, we tried to estimate and project three key family planning indicators—contraceptive prevalence of modern methods (mCPR), unmet need for modern methods and demand satisfied for all the 38 districts of the state using FPET in this paper.

2. Methods and Materials

2.1. Definition of Indicators

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 any modern contraceptive method, including sterilization (male & female), injectables, intrauterine devices (IUDs/PPIUDs), contraceptive pills, implants, condoms (male & female), diaphragm, foam/jelly, the standard days method, lactational amenorrhea method, 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 currently not using any contraceptive method. Demand for family planning satisfied with modern methods is defined as the percentage of women who use modern contraceptive methods divided by total demand for family planning, where total demand is the sum of total contraceptive prevalence and unmet need for family planning. In this paper, all these indicators are restricted to women of reproductive age who are married or in the union in the Indian context.

2.2. State Selection

In this study the state of Bihar and its all38 districts have been selected to meet two strategic decisions—1) the state has considerable impact in achieving India's ambitious Sustainable Development Goals (SDGs) and 2) the state is technically supported by the Bill & Melinda Gates Foundation (BMGF). As described earli-

er, the state's progress in family planning is disproportionately diverse among districts. To ensure more equitable progress among districts, it is necessary to estimate the district-wise family planning indicators and identify the districts that are not performing well in order to focus by family planning program.

2.3. Data and Methods

The database for this study comprises observations of the family planning indicators like contraceptive prevalence rate and unmet need for family planning as well as estimates of the number of the base population of women for the state of Bihar and its 38 districts. Values of these indicators for the state of Bihar have been obtained from household surveys for the state and districts, specifically multiple rounds of the District Level Household & Facility Survey (DLHS), Annual Health Survey (AHS), three rounds of Currently Married Women in Reproductive Age (CMWRA) Surveys conducted by CARE India, Bihar State Technical Support Unit between 2016 and 2021, District level SWASTH survey (DLSS) 2015-2016 and Demographic and Health Survey (DHS) (also known as the National Family Health Survey (NFHS)) conducted between 1992-1993 and 2019-2021. For district level indicators, contraceptive prevalence rate and unmet need for family planning have been taken from two rounds of DLHS from 2002-2004 to 2012-2013, three rounds of AHS from 2010-2011 to 2012-2013, three rounds of CMWRA survey from 2016 to 2021 and NFHS-5 during 2019-2021. There are 386 (373 district level and 13 state level for Bihar state) observations each of the total contraceptive prevalence rate, modern contraceptive prevalence rate—and the unmet need for family planning from 1992-1993 to 2021 obtained from a total of 13 multiple rounds of different surveys listed above, as summarized in Table A1 and Table A2 (**Annexure A**). These have been used as input data for FPET. The base population of women refers to women of reproductive age who are married or in union (MWRA). The projections of MWRA for Bihar were obtained from the report published by the National Commission on Population, 2020. District projections of MWRA for 38 districts were proportionately calculated from the state projections using the proportion of MWRA obtained from Censuses 1991, 2001 and 2011 for each district.

By combining insights from population surveys and historical trends, FPET provides annual estimates of mCPR, unmet need and demand satisfied for modern methods of family planning between surveys and builds futuristic scenarios to help countries track progress and inform future programming needs. The most advanced version of FPET also estimates these key family planning indicators separately for all women and women in union/married with three different sets of confidence intervals.

3. Results and Discussion

We present here the results on three key family planning indicators for the state of Bihar and its 38 districts: namely, modern contraceptive prevalence, unmet

need for modern contraceptive methods (a broader definition of unmet need that includes women currently using traditional contraceptive methods as having an unmet need for modern contraceptive methods, since traditional methods tend to have higher failure rates compared to modern ones) and demand for family planning satisfied with modern contraceptive methods, including an assessment of the uncertainty bounds in their levels for the years 1991, 2021 and 2030 and the progress made during this period. The report also identifies and discusses the districts in Bihar and their geographic locations that will be lagging in meeting the specified FP objective based on districts level estimations of three family planning indicators for the years 2021 and 2030.

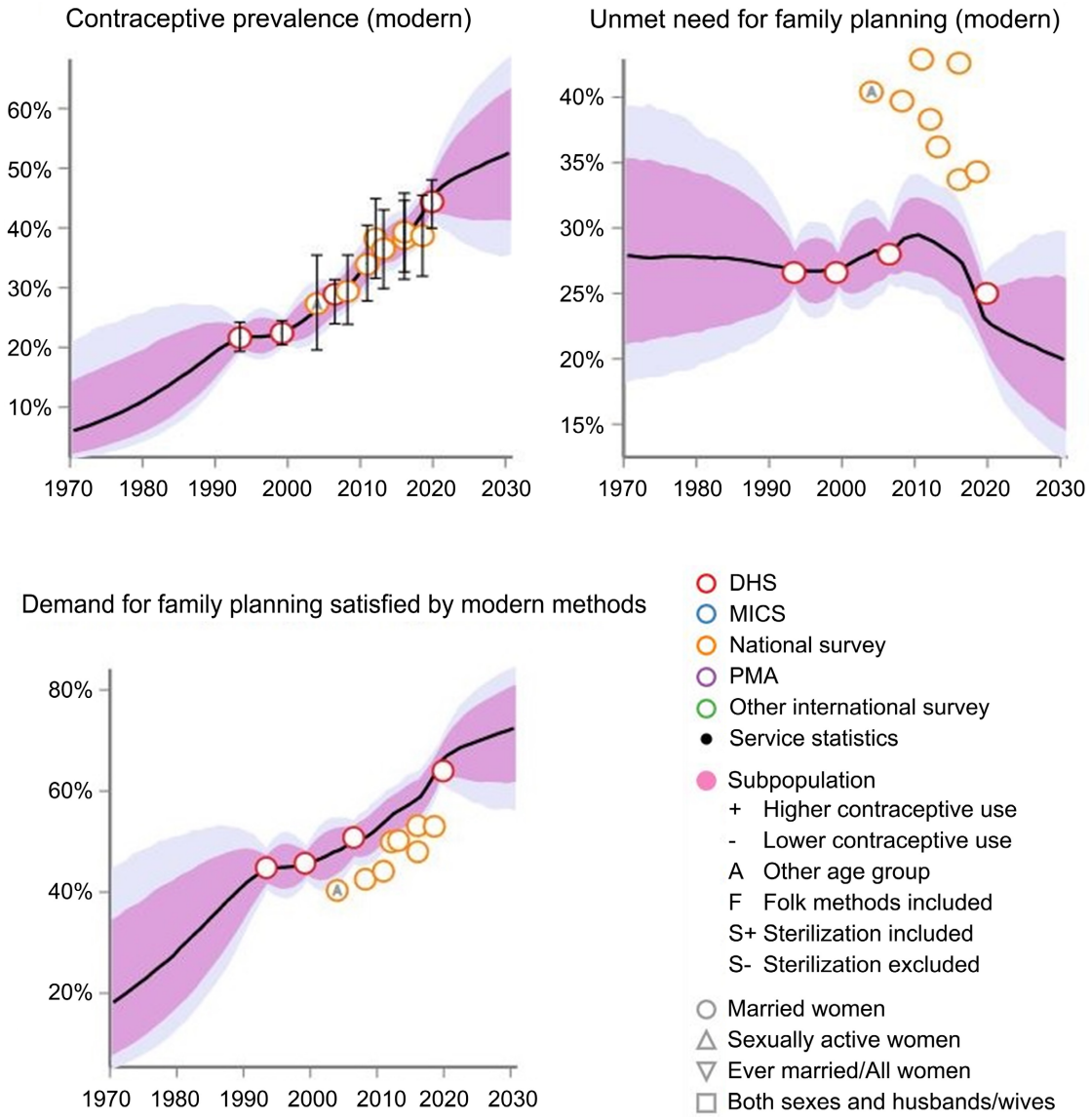
3.1. State Results

FPET Modeled estimates, trends, and projections of three key family planning indicators along with survey-based estimates for Bihar state are presented here (Graph 1). The chart shows that the modeled estimates match closely with the level and trend of the DHS data for the state of Bihar. Based on historical trend and 95 percent uncertainty bound, Bihar will be reaching around 50% level of mCPR by the year 2030. Simultaneously, around demand of 70% currently married women of reproductive age (CMWRA) will be met or satisfied with family planning method by 2030. Even though, around 20% of CMWRA in Bihar will have unmet need for modern contraceptive method at the same time (2030) (Graph 1).

The comparison of the modeled estimates with data points from other survey sources shows differences that are due to model assumptions and findings of the global model. Firstly, for non-standard data (e.g., other age group of women), the model considers potential biases associated with the non-standard characteristics in producing the estimates. Secondly, when fitting the model, data are classified into DHS, Multiple Indicator Cluster Surveys (MICS), national survey data or other survey data to provide weightages while modeling. 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 (Alkema et al., 2013). 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 Annual Health Survey (AHS) data and the modeled estimates for unmet need.

3.2. District Level FPET Estimates of mCPR (1991-2021)

The estimates of mCPR, met demand for modern methods of contraceptives and unmet need for modern family planning methods along with respective 95 percent uncertainty bounds for the years 1991 and 2021 derived using FPET model for the state of Bihar and its 38 districts have been presented in Table B1 (**Annexure B**). Modern contraceptive prevalence rate for the state has more than



Graph 1. Modelled (FPET) estimates and trends of modern contraceptive prevalence rate, unmet need for modern contraceptive methods and demand satisfied with modern contraceptive methods for Bihar.

doubled from 20.0 percent (95% UI: 15.7% - 25.0%) in 1991 to 45.2 percent (95% UI: 40.7% - 50.0%) in 2021, indicating an increase of 25.2 percentage points in three decades. The district level mCPR ranges from a low of 29.3 percent (95% UI: 4.2% - 5.4%) in Kishanganj district to a high of 56.2 percent (95% UI: 55.7% - 62.3%) in Rohtas district in the year 2021. In 2021, mCPR of four districts namely, Rohtas (56.2%), Muzaffarpur (55.8%), Kaimur (Bhabua) (55.0%) and Supaul (54.0%) were found to be 54 percent or above, which was much higher than the state average (45.2%). Out of 38 districts in state, 9 have high prevalence where mCPR is greater than 50 percent (Figure 1) and 10 have low prevalence where mCPR is below 42 percent in 2021 (Figure 2); Whereas performance of 19 districts was found to be modest with mCPR ranges between 42 and 50 percent (**Annexure B**, Table B1).

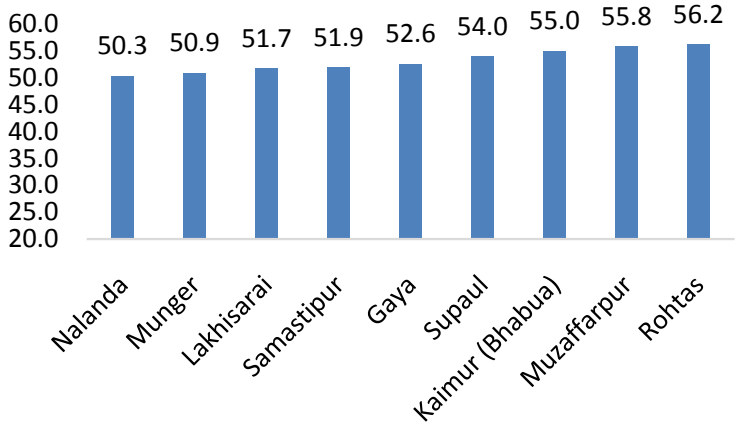


Figure 1. Top 9 districts where MCP is >50% in 2021.

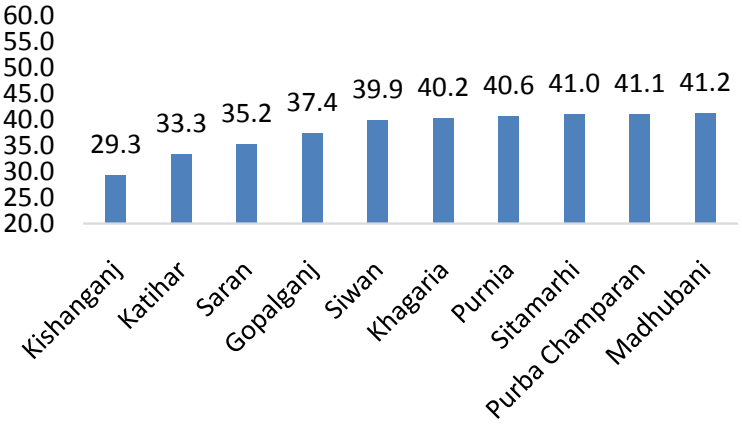


Figure 2. Bottom 10 districts where MCP is <42% in 2021.

However, 5 districts namely Kishanganj, Katihar, Saran, Gopalganj, and Siwan performed very poorly with mCPR less than 40 percent in 2021 (**Figure 2**). During 1991-2021 period, the maximum gain in mCPR of 39 percent has been observed in Rohtas district (17.2% to 56.2%) whereas the minimum gain in mCPR of 15.8 percent has been observed in Kishanganj (13.5% to 29.3%) (**Annexure B**, Table B1).

3.3. District Level FPET Estimates of Unmet Need for a Modern Contraceptive Method (1991-2021)

Regarding the second key family planning indicator, unmet need for a modern contraceptive method, the situation in the state has not improved much as the model estimate shows 22.4 percent (95% UI: 18.6% - 27.0%) of MWRA have an unmet need for modern family planning methods in 2021, a marginal decline of nearly 5 percent from the 1991 estimate (27.2%). More than 25 percent of unmet need for a modern contraceptive recorded in 6 districts, and 10 districts have shown less than 20 percent unmet need in the state in 2021 (**Figure 3** & **Figure 4**); remaining 22 districts have the unmet need for a modern method ranges between 20 and 25 percent. Overall, the lowest unmet need for modern contraceptives

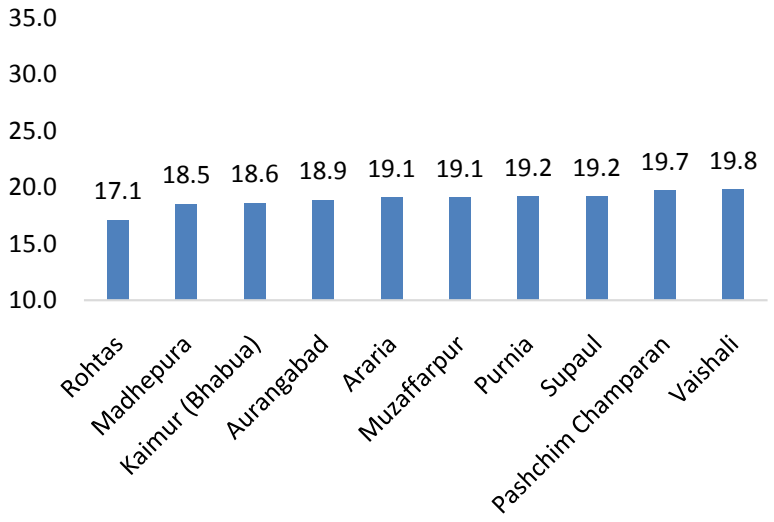


Figure 3. Top 10 districts where unmet need for modern methods < 20% in 2021.

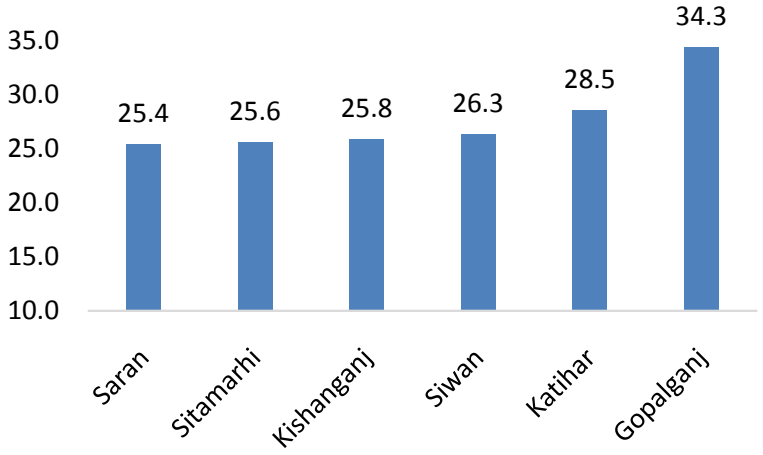


Figure 4. Bottom 6 districts where unmet need for modern methods is >25% in 2021.

was recorded in Rohtas district (17.1%, 95% UI: 13.6% - 22.1%) and the highest 34.3 percent (95% UI: 29.4% - 39.7%) in Gopalganj district in 2021. A significant decrease with 15 or more percentage point in unmet need for modern contraceptives has been observed in 6 districts, along with 28 districts who have also shown an improvement range between 10 and 15 percentage points during the period 1991 to 2021 in the state. However, during the same period, four districts of Bihar have observed a decline less than 10 percentage point (**Annexure B**, Table B1).

3.4. District Level FPET Estimates of Demand Satisfied with Modern Family Planning Methods (1991-2021).

Bihar has made considerable progress in the third key family planning indicator—the demand satisfied with modern family planning methods. The estimate improved from 42.4 percent (95% UI: 35.2% - 50.0%) in 1991 to 66.8 percent (95% UI: 60.8% - 72.3%) in 2021. Performance in three districts, namely Rohtas,

Kaimur (Bhabua) and Muzaffarpur, is found to be far better with more than 74 percent demand satisfied with a modern contraceptive method in the state in the year 2021. The district Gopalganj placed at the lowest in the list of 38 districts where only 52.1 percent (95% UI: 46.0% - 58.4%) of MWRA's demand for modern methods, satisfied in 2021. While considering the distribution of districts at different levels, more than 70 percent of women's demand for modern FP methods was met in 12 districts; proportion of women in 22 districts have demand satisfied in the range of 60 - 70 percent, and 4 districts in the lowest category of less than 60 percent demand satisfied for modern FP methods. Levels of this indicator have improved in all the 38 districts in the state from 1991 to 2021 (Table B1).

There are top 10 districts where demand satisfied with modern methods were greater than 70 percent and 9 districts where demand satisfied with modern methods were low and less than 65 percent (Figure 5 & Figure 6).

4. Futuristic Scenarios

Until now, we looked at the past performances in terms of three key family

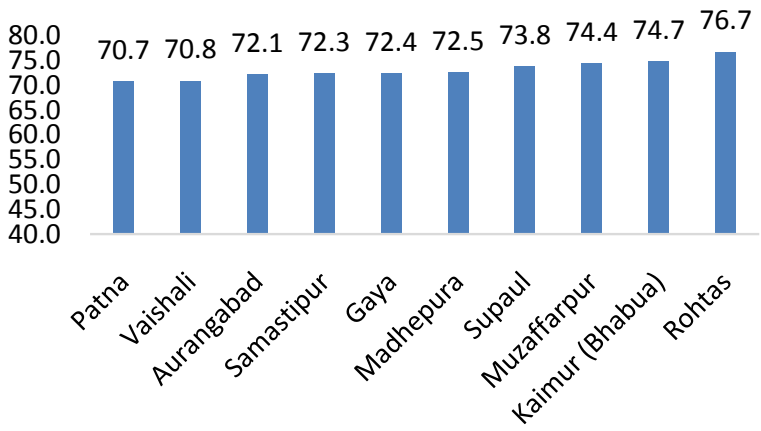


Figure 5. Top 10 districts where demand satisfied with modern method is >70% in 2021.

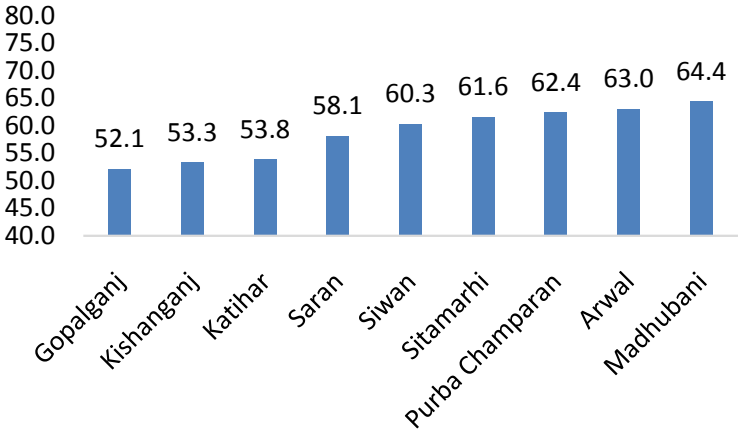


Figure 6. Bottom 9 districts where demand satisfied with a modern method is <65% in 2021.

planning indicators for the state and districts during 1991-2021 period. When considering the list of districts to prioritize in terms of service provision, we need to further examine how futuristic scenarios for the districts and state would look like in 2030. Using FPET modeling, we can estimate mCPR, unmet need for modern contraceptives and demand satisfied by modern methods with uncertainty bounds of 95 percent for districts and state beyond 2021.

4.1. The Projected FPET Estimates of Three Key Parameters for 38 Districts and State for the Year 2030

Coverage of modern family planning methods is expected to reach 49.9 percent (95% UI: 34.7% - 64.6%) in the state in 2030, resulting in a growth of 4.7 percentage points in 9 years. Prevalence rate is expected to reach 59.2 percent (95% UI: 43.8% - 72.8%) in Rohtas district (Table B2). Four districts namely Kishanganj, Katihar, Saran and Gopalganj are expected to have less than 45 percent of mCPR in 2030-ranked lowest among 38 districts. Further, Figure 7 shows the bottom 10 districts where estimated mCPR will be less than 48% and Figure 8 shows the top 7 districts where estimated mCPR will be greater than 54% in the year 2030.

The unmet need scenario in the state in 2030 is not very encouraging. The unmet need for modern FP method is expected to go down to 20.5 percent (95% UI: 13.3% - 29.8%) in 2030 from 22.4% in 2021 in the state, resulting in decline of around 2 percentage point in 9 years (Table B2). Even the leading two districts Rohtas and Purnia are estimated to have as high as 16.4% and 16.7% MWRA with unmet need for modern family planning methods, respectively in 2030 (Figure 9); whereas the bottom two districts Gopalganj (29.7%) and Katihar (25.9%) will have more than one-fourth of MWRA with unmet need for modern method in 2030 (Figure 10). Simultaneously, Figure 9 shows the top 10 districts where unmet need for modern contraceptive method will be less than 20% and Figure 10 predict the bottom 10 districts where unmet need for modern method will be greater than 20% in the year 2030.

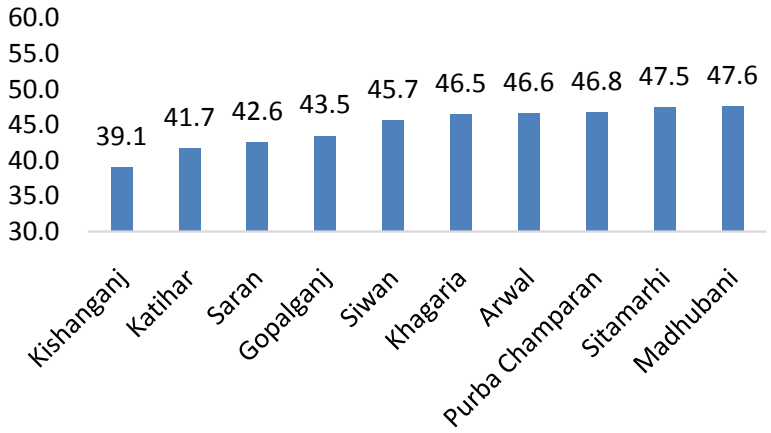


Figure 7. Bottom 10 districts where MCP will be <48% in 2030.

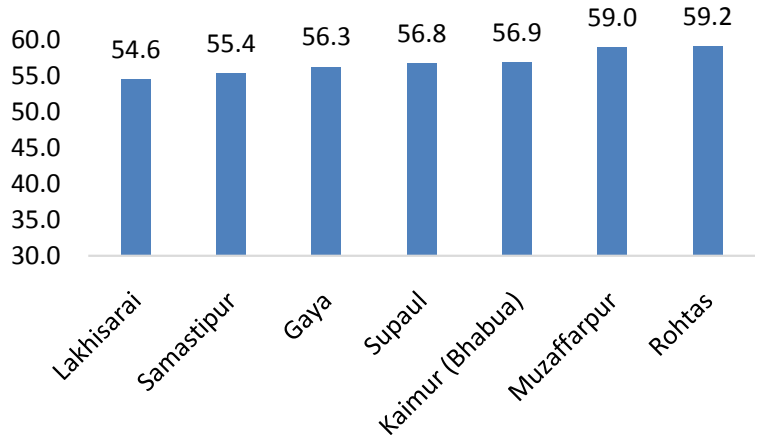


Figure 8. Top 7 districts where MCP will be >54% in 2030.

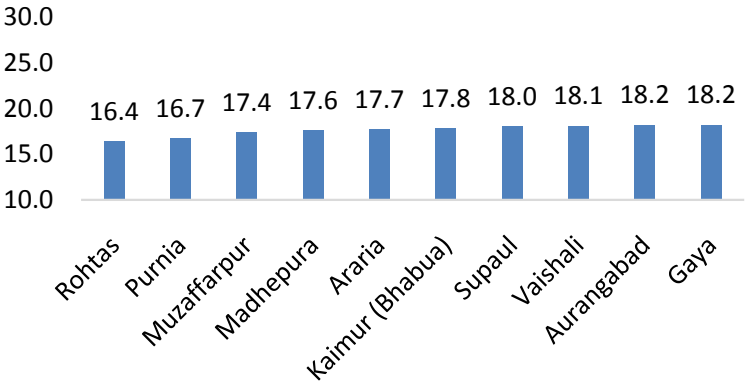


Figure 9. Top 10 districts where unmet need for modern methods will <20% in 2030.

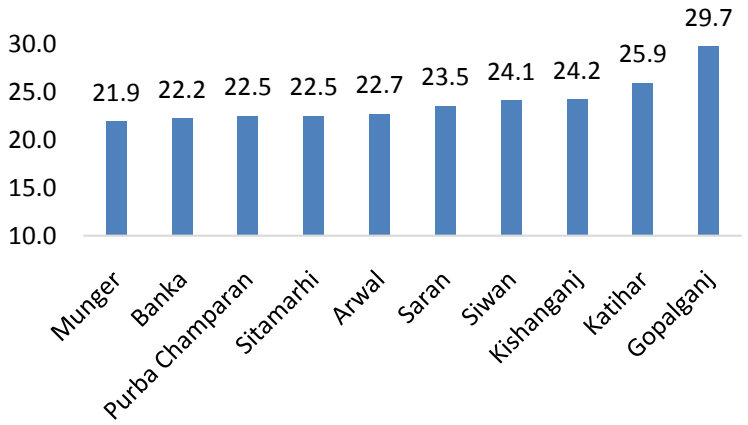


Figure 10. Bottom 10 districts where unmet need for modern methods will >20% in 2030.

In 2017, India updated its commitment to FP2020 by ensuring that 74 percent of the demand for modern contraceptives will be satisfied by 2020 (Family Planning 2020 Commitment. Family Planning Summit, 2017). Timeframe to achieve this goal for Bihar and its districts has been revised in view of state's below average performance and current level of contraceptive behavior. In this paper, we shall consider the target of 74 percent of the demand satisfied with modern con-

traceptive methods by 2030 for the state and districts by extending ten years to India's time frame of 2020. The state is likely to achieve 71.1 percent demand satisfied with modern methods by 2030 with 11 districts expected to cross 74 percent met demand target. Rohtas district tops the list with 78.3 percent followed by Muzaffarpur district with 77.1 percent demand satisfied with modern contraceptives by 2030. In contrast, districts of Gopalganj (59.4 percent) and Kishanganj (61.6 percent) are at the bottom in the list with nearly 60 percent of demand met with modern methods in the state. Further, Figure 11 shows the bottom 11 districts where demand satisfied with modern method will be less than 70% and Figure 12 depicts the top 11 districts where demand met with modern FP method will be greater than 74% in the year 2030.

4.2. Graphical Presentation of District-Wise Coverage of Modelled Estimates of Three Family Planning Indicators (2021-2030)

To visualize the district-wise coverage of these three indicators, the district's estimates have been plotted on state map as per FPET modelled. Figures 13-18 provide the details of mCPR, unmet need and demand satisfied with modern contraceptives, respectively for 2021 and 2030. Such plots will help the program

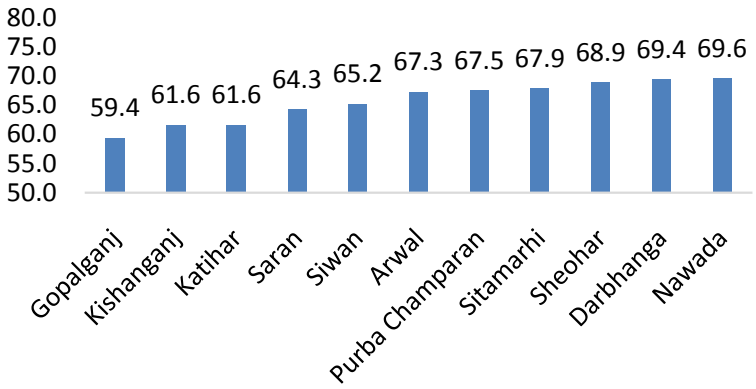


Figure 11. Bottom 11 districts where demand satisfied with a modern method will <70% in 2030.

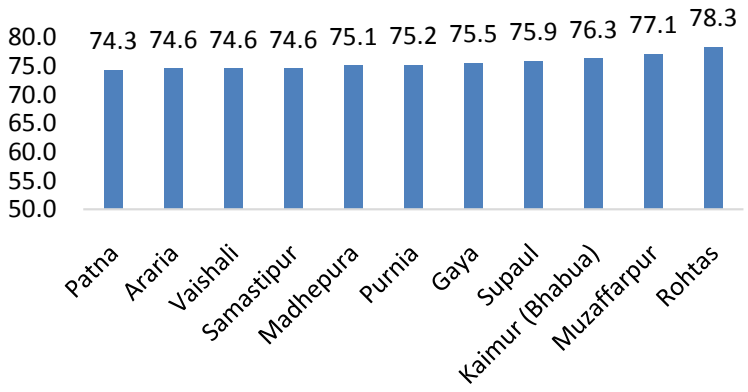


Figure 12. Top 11 districts where demand satisfied with a modern method will >74% in 2030.

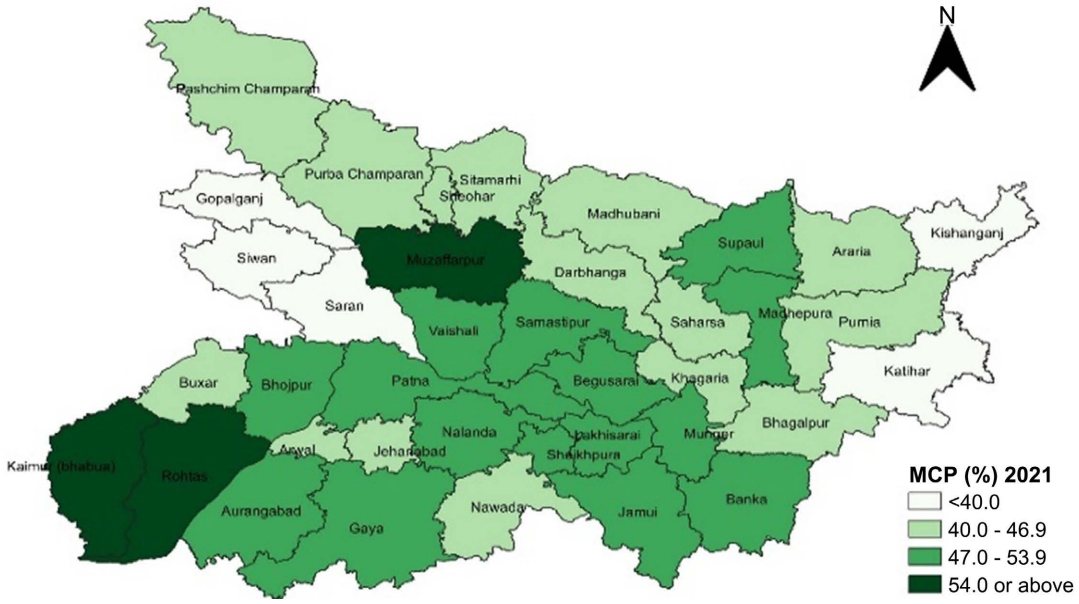


Figure 13. Modelled estimate of MCP (%) in 2021.

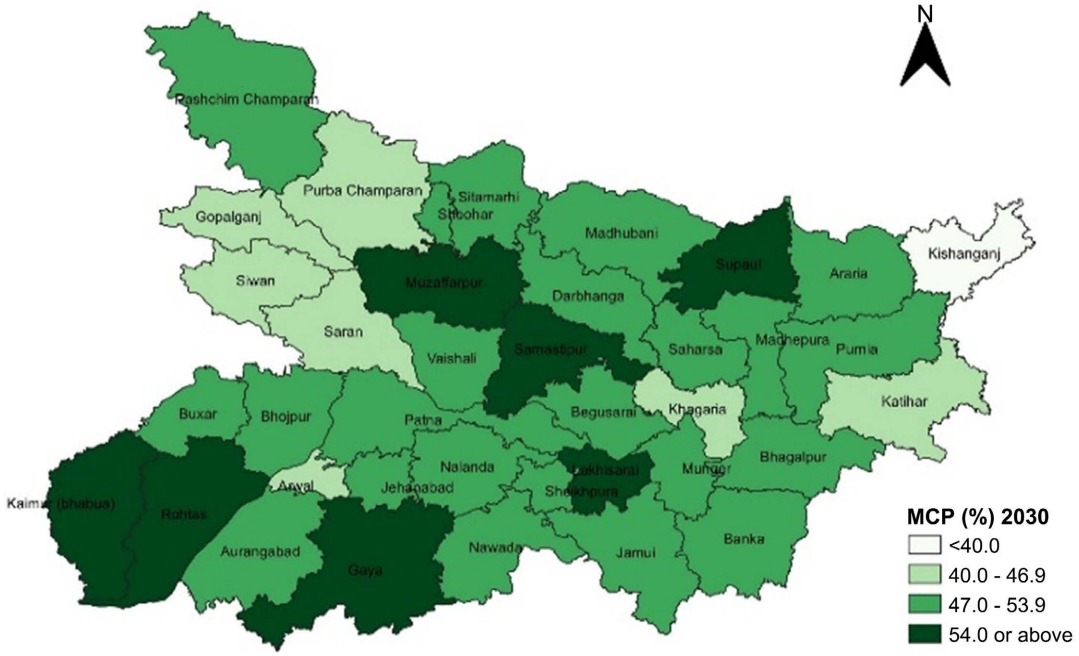


Figure 14. Modelled estimate of MCP (%) in 2030.

implementers to identify the districts where programs are to be focused. To distinguish the levels in indicators, four gradient colors are used in the map—from dark green that signifies districts with 54 percent and above mCPR (better performance), to gradually lighter green color is associated with poorer mCPR in those districts in 2021 & 2030 (Figure 13 and Figure 14). Out of five poorest performing districts in 2021, one district (Kishanganj) has shown no progress with less than 40 percent mCPR in both the year 2021 and 2030 and need more attention in program implementation.

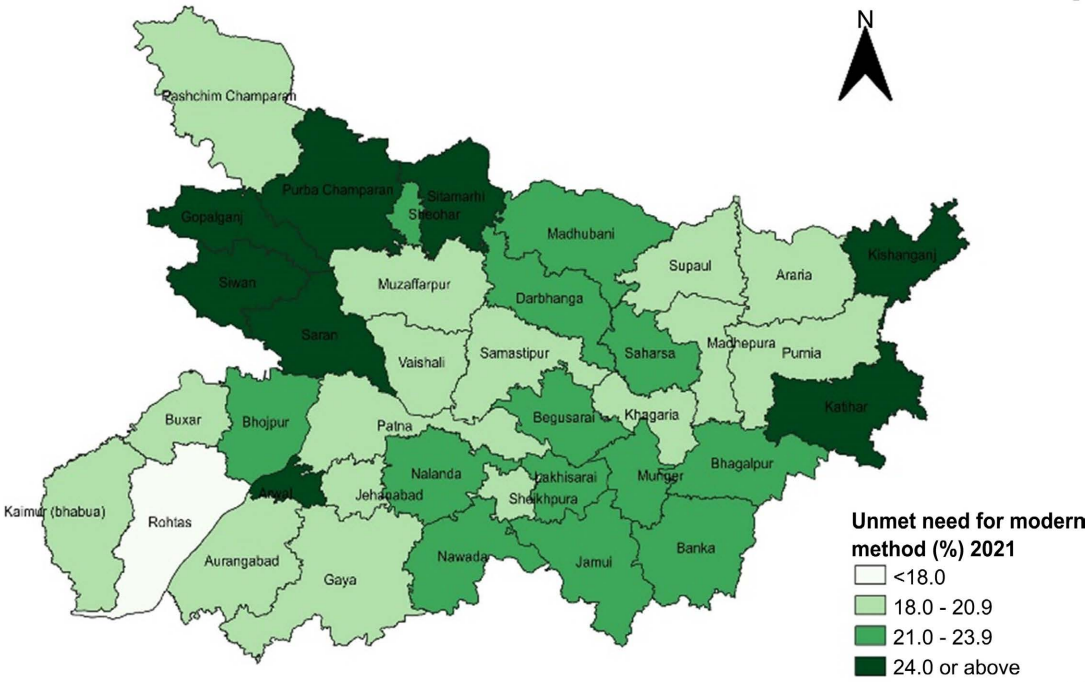


Figure 15. Modelled estimate of unmet need for modern method (%) in 2021.

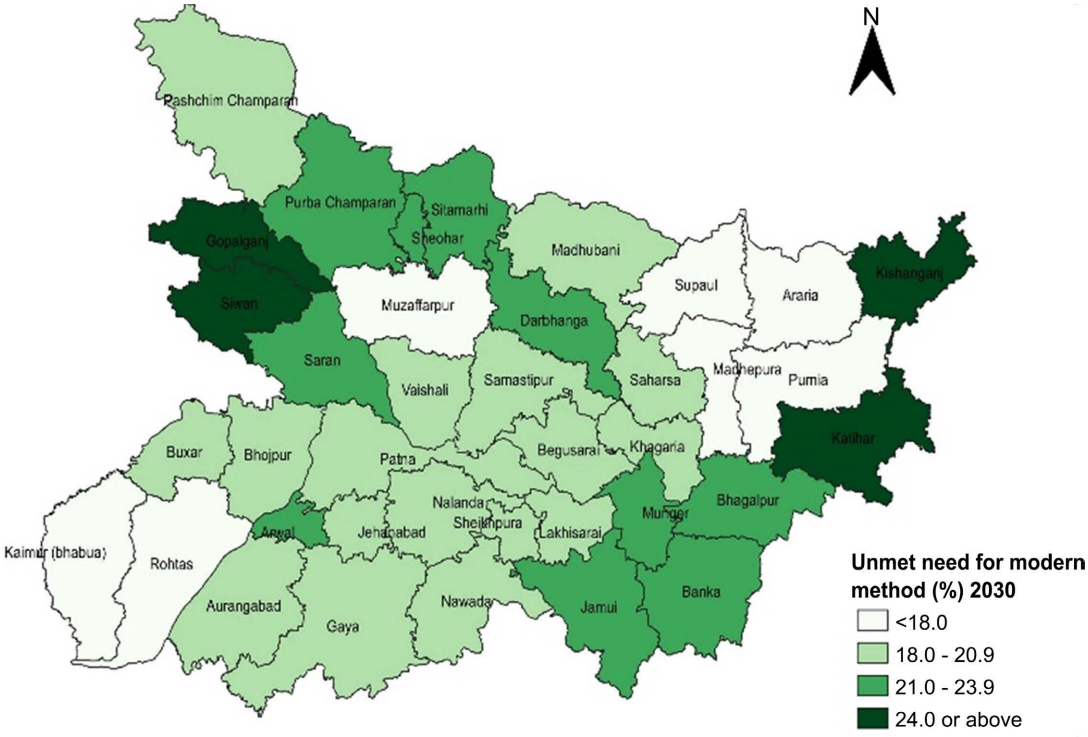


Figure 16. Modelled estimate of unmet need for modern method (%) in 2030.

Similarly, Figure 15 & Figure 16 provide the details of unmet need for modern methods in 2021 and 2030. In this map, dark gradient colors denote poor performing districts to lighter color for better performing districts unlike the color gradient in the previous maps. Out of eight poorest performing districts in

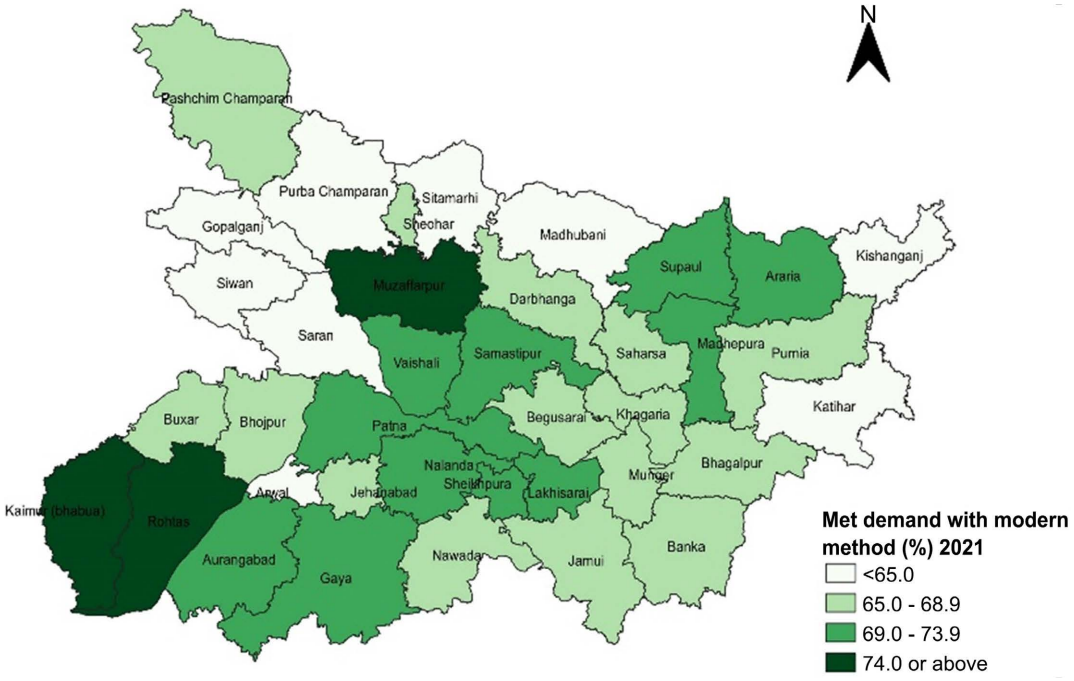


Figure 17. Modelled estimate of met demand with modern method (%) in 2021.

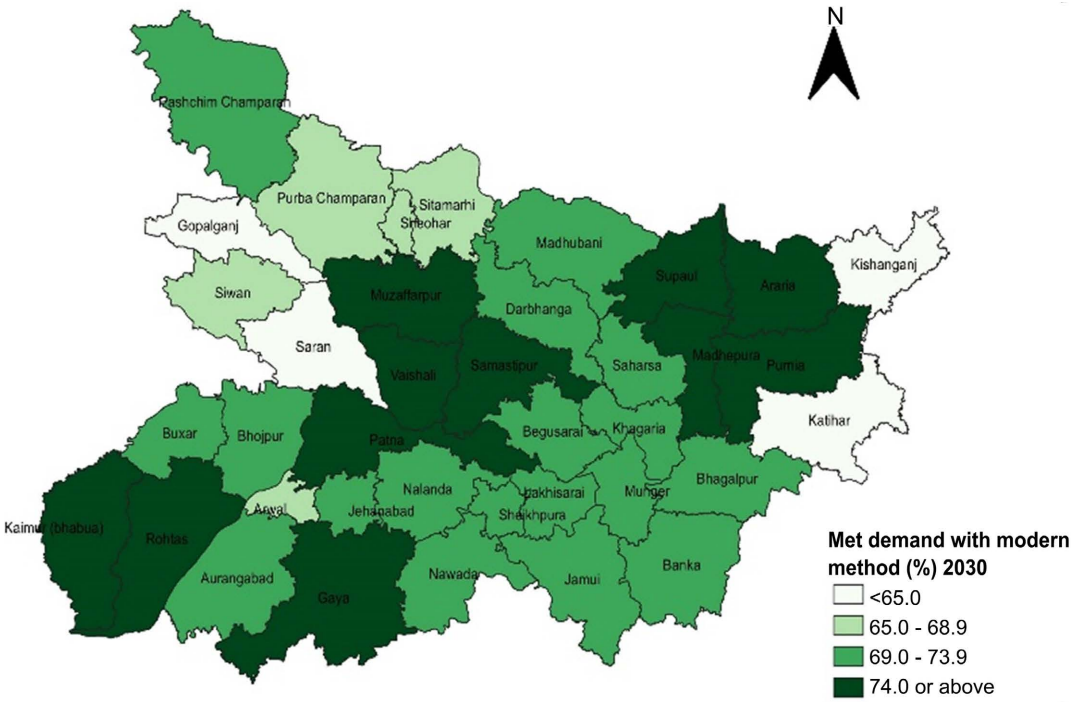


Figure 18. Modelled estimate of met demand with modern method (%) in 2030.

2021, four districts namely Kishanganj, Katihar, Gopalganj and Siwan has shown no progress with greater than 24 percent unmet need for modern methods in both the year 2021 and 2030 that need focus in terms of family planning program preference and implementation.

Further, percent demand satisfied with modern methods is plotted in **Figure**

17 and Figure 18 for the year 2021 and 2030. Color gradient applied in this map is like Figure 13 and Figure 14—lighter color suggests poor performance and darker shades denote better performance. Accordingly, only three districts in dark green in 2021 increases to 11 districts in the year 2030 signifies good performance of these districts to achieve 74 percent or more e met demand for modern family planning methods in the state from 2021 and 2030, respectively. On the contrary, four districts namely Kishanganj, Katihar, Gopalganj and Saran with lighter shades in both the figures (Figure 17 & Figure 18) have shown no significant progress (less than 65 percent) in demand satisfied for modern methods in both reference years i.e., 2021 and 2030.

We further estimated the number of married women in reproductive age who will be using modern contraceptive methods whose demands for modern methods met in 2021 and 2030 using the FPET model (Table B3, **Annexure B**). These numbers will help the family planning program implementors to quantify their task to ensure enough supply of family planning products and services in the state and districts.

In terms of the absolute count of MWRA rather than the percentage, Bihar presents the biggest challenge with an increase of approximately 3.6 million MWRA on modern contraceptive methods required by 2030 from 2021 to reach 74 percent demand satisfied with modern method. Though the modelled estimate suggest that Bihar will add around 3 million new modern contraceptive users between 2021 to 2030 and fall short by 0.6 million MWRA on modern contraceptive methods from the target of 74 percent met demand with modern method (Table B3, **Annexure B**). To achieve this target, five districts of north Bihar namely Kishanganj, Katihar, Gopalganj, Saran and Siwan must be on prime focus for FP program as well as to reduce the higher unmet need among MWRA in these districts.

5. Conclusion

Fundamentally, FPET is an effective instrument for applying and estimating important family planning parameters at the sub-provincial level (small area estimation). Program implementers and policy makers need the least amount of administrative-level data possible to develop and modify specific strategies that significantly enhance the effectiveness of family planning programs. The state of Bihar is made up of several districts with a range of mCPR levels and performance levels. In this paper, we identified a list of districts in 2030 that will have very low mCPR (<40%), demand satisfied with modern methods (<65%), and high unmet need (>24%) that require special attention. Similarly, many districts in the state's northernmost region that are geographically adjacent to, and border Nepal require special attention. Monitoring and follow-up mechanism should be strengthened to ensure uninterrupted availability of family planning products and services in these districts as many remote health facilities are found to have supply and logistic issues. Furthermore, efforts to increase FP service

coverage in these districts by strengthening supply chain and demand for family planning services are critical to meeting state and, thus, national family planning goals set for both FP2020 and the SDGs.

Contributors

AK created input data sets. YPG and AK carried out the data analysis. YPG prepared the first draft of the manuscript. All authors reviewed results and provided inputs and comments on the paper.

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Conflicts of Interest

We declare that we have no conflicts of interest.

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Annexure A

1) Data for the subnational level analysis of Bihar

An overview of the data series and observations available at the subnational (state/districts) level in Bihar used in the estimation process, is given in Table A1. Links to the data sources are provided in Table A2.

Table A1. Overview of data series and observations for Uttar Pradesh and 75 districts.

Data series	Source Category used in global FPEM and local FPEM-FPET	Number of districts in UTTAR PRADESH with an observation for each data series
Data series used for state level estimates		
Annual Health Survey 2010-2011	Other survey	1
Annual Health Survey 2011-2012	Other survey	1
Annual Health Survey 2012-2013	Other survey	1
District Level Household and Facility Survey 2002-2004	National Survey	1
District Level Household and Facility Survey 2007-2008	National Survey	1
National Family Health Survey 1992-1993	DHS (NFHS)	1
National Family Health Survey 1998-1999	DHS (NFHS)	1
National Family Health Survey 2004-2005	DHS (NFHS)	1
National Family Health Survey 2019-2021	DHS (NFHS)	1
District Level SWASTH Survey 2015-2016	National Survey	1
Currently Married Women in Reproductive Age Survey 2016	National Survey	1
Currently Married Women in Reproductive Age Survey 2018	National Survey	1
Currently Married Women in Reproductive Age Survey 2021	National Survey	1
Total number of observations		**13**
Data series used for district level estimates		
Annual Health Survey 2010-2011	Other survey	38
Annual Health Survey 2011-2012	Other survey	38
Annual Health Survey 2012-2013	Other survey	38
District Level Household and Facility Survey 1998-1999	National Survey	31
District Level Household and Facility Survey 2002-2004	National Survey	38
District Level Household and Facility Survey 2007-2008	National Survey	38
National Family Health Survey 2019-2021	DHS (NFHS)	38
Currently Married Women in Reproductive Age Survey 2016	National Survey	38
Currently Married Women in Reproductive Age Survey 2018	National Survey	38
Currently Married Women in Reproductive Age Survey 2021	National Survey	38
Total number of observations		373

Table A2. Links to data series for Bihar and its districts.

Data Series	Link
Annual Health Survey 2010-2011	http://ghdx.healthdata.org/record/india-annual-health-survey-2010-2011
Annual Health Survey 2011-2012	http://ghdx.healthdata.org/record/india-annual-health-survey-2011-2012
Annual Health Survey 2012-2013	http://ghdx.healthdata.org/record/india-annual-health-survey-2012-2013
District Level Household and Facility Survey 1998-1999	http://rchiips.org/pdf/rch1/National_Report_RCH-1.pdf
District Level Household and Facility Survey 2002-2004	http://rchiips.org/pdf/rch2/National_Report_RCH-II.pdf
District Level Household and Facility Survey 2007-2008	http://rchiips.org/pdf/INDIA_REPORT_DLHS-3.pdf
National Family Health Survey 1992-1993	http://www.dhsprogram.com/pubs/pdf/FRIND1/FRIND1.pdf
National Family Health Survey 1998-1999	http://www.dhsprogram.com/pubs/pdf/FRIND2/FRIND2.pdf
National Family Health Survey 2005-2006	http://dhsprogram.com/pubs/pdf/FRIND3/FRIND3-Vol1andVol2.pdf
National Family Health Survey 2019-2021	http://rchiips.org/nfhs/nfhs5.shtml

2) The Family Planning Estimation Tool (FPET)

FPET is a web-based application available at http://fpet.track20.org that allows users to generate view and compare national and subnational estimates and projections of family planning indicators.

With FPET user can:

- View the data used and results of an existing run.
- Start a new run using the default database or his own data and view the results of the new run.
- Compare the results of two different runs.
- Get information about how realistic/ambitious a specific goal would be given the current model projections for target-setting purposes. For example, the user would provide a target level of modern contraceptive prevalence for the year 2030 and the app would then give the estimated probability that that target would be reached in that year given the current model projections. Vice versa a target could be based on the modern contraceptive prevalence level in 2020 for which the current projected probability of obtaining is only 10%.
- Result tables can be downloaded as CSV files and result figures as PDF files.

Annexure B

Table B1. Estimates and 95 percent uncertainty intervals (percent) of modern contraceptive prevalence, demand satisfied, and unmet need for modern contraceptive methods in 1991 and 2021 and their percentage points change between 1991 and 2021 for Bihar and its districts.

State/Districts	Modern contraceptive prevalence (%) [95% uncertainty interval]			Demand satisfied with modern methods (%) [95% uncertainty interval]			Unmet need for modern methods (%) [95% uncertainty interval]		
	1991	2021	Change 2021-1991	1991	2021	Change 2021-1991	1991	2021	Change 2021-1991
Bihar	**20.0** (15.7 - 25)	**45.2** (40.7 - 50)	**25.2** (25 - 25)	**42.4** (35.2 - 50)	**66.8** (60.8 - 72.3)	**24.4** (25.6 - 22.3)	**27.2** (23.1 - 31.7)	**22.4** (18.6 - 27)	**−4.8** (−4.5 - −4.7)
Araria	**22.8** (11.6 - 37.8)	**46.2** (41.6 - 50.7)	**23.4** (30 - 12.9)	**37.2** (21.9 - 54.8)	**70.7** (65.5 - 75.6)	**33.5** (43.6 - 20.8)	**37.7** (28.4 - 48.8)	**19.1** (16 - 22.6)	**−18.6** (−12.4 - −26.2)
Arwal	**14.6** (7.2 - 25.8)	**41.8** (37 - 46.6)	**27.2** (29.8 - 20.8)	**30.5** (16.9 - 48.7)	**63.0** (56.4 - 68.9)	**32.5** (39.6 - 20.2)	**33.3** (23.8 - 44.6)	**24.6** (20.6 - 29.5)	**−8.7** (−3.2 - −15.2)
Aurangabad	**16.3** (8.5 - 29.3)	**48.8** (44.3 - 53.7)	**32.5** (35.8 - 24.4)	**35.1** (20.9 - 53.7)	**72.1** (65.8 - 77.3)	**37.0** (44.9 - 23.6)	**30.0** (21 - 40)	**18.9** (15.1 - 23.4)	**−11.1** (−5.9 - −16.5)
Banka	**17.4** (7.6 - 34.8)	**49.8** (44.6 - 54.4)	**32.4** (37 - 19.6)	**32.1** (16.3 - 53.6)	**67.7** (61 - 72.8)	**35.6** (44.7 - 19.2)	**36.7** (26.6 - 48.8)	**23.7** (19.6 - 29.2)	**−13.0** (−7 - −19.6)
Begusarai	**16.8** (9 - 28.8)	**48.8** (44.1 - 53.6)	**32.0** (35.1 - 24.8)	**29.6** (16.9 - 45.5)	**68.8** (63.4 - 73.5)	**39.2** (46.5 - 28.1)	**40.1** (30.1 - 51.5)	**22.1** (18.7 - 25.9)	**−18.0** (−11.5 - −25.6)
Bhagalpur	**20.7** (11.4 - 36.1)	**45.4** (40.5 - 50)	**24.7** (29.1 - 13.8)	**36.2** (21.9 - 55.1)	**66.5** (60.3 - 72.2)	**30.3** (38.4 - 17.1)	**36.2** (26.7 - 46.5)	**22.8** (18.6 - 27.6)	**−13.4** (−8.1 - −18.9)
Bhojpur	**16.9** (8.9 - 29.3)	**49.2** (44.5 - 53.9)	**32.3** (35.6 - 24.6)	**32.0** (18.5 - 48.6)	**68.7** (62.7 - 74)	**36.7** (44.2 - 25.4)	**36.2** (25.9 - 47.1)	**22.4** (18.6 - 27.3)	**−13.8** (−7.3 - −19.8)
Buxar	**15.6** (8.1 - 27.5)	**44.4** (39.5 - 49)	**28.8** (31.4 - 21.5)	**31.2** (18.3 - 48.2)	**68.0** (61.1 - 73.6)	**36.8** (42.8 - 25.4)	**34.2** (25.1 - 44)	**20.9** (17.1 - 26)	**−13.3** (−8 - −18)
Darbhanga	**19.9** (11.1 - 35.4)	**43.8** (39.2 - 48.3)	**23.9** (28.1 - 12.9)	**37.5** (23.4 - 55.7)	**65.7** (60.2 - 71)	**28.2** (36.8 - 15.3)	**33.1** (23.7 - 42.7)	**22.9** (19.1 - 26.8)	**−10.2** (−4.6 - −16)
Gaya	**14.1** (7 - 25)	**52.6** (47.3 - 57.4)	**38.5** (40.4 - 32.5)	**30.3** (16.6 - 47.4)	**72.4** (65.2 - 78.4)	**42.1** (48.6 - 31)	**32.3** (23 - 42.6)	**20.0** (15.5 - 25.4)	**−12.3** (−7.5 - −17.1)
Gopalganj	**11.6** (6 - 20.9)	**37.4** (32.9 - 42.1)	**25.8** (26.9 - 21.2)	**21.6** (12 - 35.4)	**52.1** (46 - 58.4)	**30.5** (34 - 23.1)	**41.8** (31.2 - 53)	**34.3** (29.4 - 39.7)	**−7.5** (−1.8 - −13.2)
Jamui	**15.8** (6.8 - 31.9)	**49.9** (44.8 - 54.9)	**34.1** (38 - 22.9)	**30.6** (15.2 - 51.8)	**68.4** (61.9 - 74.2)	**37.8** (46.7 - 22.3)	**35.4** (25.4 - 46.8)	**23.0** (18.7 - 28.2)	**−12.4** (−6.7 - −18.6)
Jehanabad	**14.9** (7.4 - 25.8)	**45.0** (40.6 - 49.6)	**30.1** (33.2 - 23.8)	**31.2** (17.4 - 46.9)	**68.9** (63.5 - 74.3)	**37.7** (46.1 - 27.4)	**32.6** (23.9 - 42.7)	**20.2** (16.6 - 24.1)	**−12.4** (−7.2 - −18.6)
Kaimur (Bhabua)	**17.2** (7.3 - 37.3)	**55.0** (49.4 - 60.3)	**37.8** (42.1 - 22.9)	**34.6** (17.2 - 57.8)	**74.7** (66.7 - 80.4)	**40.1** (49.4 - 22.6)	**32.2** (22.6 - 43.5)	**18.6** (14.2 - 24.9)	**−13.6** (−8.4 - −18.6)

Continued

Katihar	**11.6** (6.1 - 21.4)	**33.3** (29.3 - 37.3)	**21.7** (23.2 - 15.8)	**21.6** (11.8 - 35.3)	**53.8** (48 - 59.4)	**32.2** (36.2 - 24.1)	**43.1** (32.8 - 53.6)	**28.5** (24.4 - 33.2)	**−14.6** (−8.4 - −20.4)
Khagaria	**20.0** (11.6 - 34.4)	**40.2** (36 - 44.6)	**20.2** (24.4 - 10.2)	**37.1** (23.2 - 54.7)	**66.7** (60.9 - 71.7)	**29.6** (37.7 - 17)	**33.7** (24.6 - 43.6)	**20.1** (16.9 - 24)	**−13.6** (−7.7 - −19.6)
Kishanganj	**13.5** (6.8 - 24.5)	**29.3** (25.4 - 33.5)	**15.8** (18.7 - 9)	**25.8** (13.3 - 42)	**53.3** (47.3 - 58.9)	**27.5** (34.1 - 16.9)	**39.0** (28.1 - 49.6)	**25.8** (22 - 30.1)	**−13.2** (−6 - −19.6)
Lakhisarai	**19.1** (8.7 - 37.1)	**51.7** (47 - 56.2)	**32.6** (38.4 - 19.1)	**35.0** (18.4 - 56.2)	**69.8** (64 - 74.9)	**34.8** (45.6 - 18.8)	**35.1** (25.1 - 46.1)	**22.4** (18.5 - 27)	**−12.7** (−6.6 - −19.1)
Madhepura	**18.6** (9.8 - 31)	**48.7** (44.4 - 53.3)	**30.1** (34.6 - 22.4)	**33.6** (20.2 - 51)	**72.5** (66.9 - 77.5)	**38.9** (46.7 - 26.5)	**36.0** (26.5 - 46.5)	**18.5** (15.1 - 22.5)	**−17.5** (−11.5 - −24)
Madhubani	**16.3** (8.9 - 28.9)	**41.2** (36.7 - 45.7)	**24.9** (27.8 - 16.8)	**32.6** (19.3 - 49.6)	**64.4** (58.9 - 69.7)	**31.8** (39.6 - 20.1)	**33.8** (24.7 - 43.9)	**22.8** (19.3 - 26.8)	**−11.0** (−5.4 - −17.1)
Munger	**16.4** (8.4 - 31.2)	**50.9** (45.8 - 55.7)	**34.5** (37.5 - 24.5)	**29.5** (16.2 - 48)	**68.4** (61.9 - 73.8)	**38.9** (45.7 - 25.8)	**39.1** (30 - 49.8)	**23.5** (19.2 - 28.7)	**−15.6** (−10.8 - −21.2)
Muzaffarpur	**18.1** (9.4 - 32.7)	**55.8** (51.4 - 60.5)	**37.7** (42 - 27.8)	**34.3** (19.6 - 53.3)	**74.4** (69.7 - 79.1)	**40.1** (50.1 - 25.8)	**34.7** (25 - 44.8)	**19.1** (15.7 - 22.9)	**−15.6** (−9.4 - −21.9)
Nalanda	**18.1** (9.3 - 31.8)	**50.3** (45.3 - 55.2)	**32.2** (35.9 - 23.4)	**31.7** (17.5 - 49.8)	**69.9** (63.2 - 75.6)	**38.2** (45.7 - 25.8)	**39.2** (28.7 - 49.8)	**21.7** (17.3 - 27.1)	**−17.5** (−11.4 - −22.7)
Nawada	**13.0** (7 - 22.5)	**43.2** (38.1 - 47.9)	**30.2** (31.1 - 25.4)	**27.6** (16.6 - 43.3)	**65.9** (57.9 - 72.1)	**38.3** (41.4 - 28.7)	**33.9** (24.1 - 44.3)	**22.4** (18 - 28.3)	**−11.5** (−6.1 - −16)
Pashchim Champaran	**18.5** (10.3 - 31.3)	**43.2** (38.6 - 48.1)	**24.7** (28.3 - 16.8)	**35.8** (21.5 - 52.6)	**68.7** (62.6 - 74.1)	**32.9** (41.1 - 21.5)	**33.4** (23.9 - 43.9)	**19.7** (16.1 - 23.9)	**−13.7** (−7.8 - −20)
Patna	**28.3** (15.9 - 46.8)	**48.5** (43.8 - 53.1)	**20.2** (27.9 - 6.3)	**49.0** (31.9 - 69)	**70.7** (65.4 - 75.6)	**21.7** (33.5 - 6.6)	**28.6** (19.6 - 38.7)	**20.1** (16.7 - 23.9)	**−8.5** (−2.9 - −14.8)
Purba Champaran	**13.7** (6.8 - 25.9)	**41.1** (36.7 - 45.7)	**27.4** (29.9 - 19.8)	**25.7** (14.1 - 42.7)	**62.4** (56.7 - 68)	**36.7** (42.6 - 25.3)	**39.5** (28.3 - 50.5)	**24.8** (20.9 - 29.1)	**−14.7** (−7.4 - −21.4)
Purnia	**19.3** (9.6 - 32.3)	**40.6** (36.3 - 45.1)	**21.3** (26.6 - 12.8)	**35.3** (20.5 - 52.3)	**68.0** (62.6 - 73)	**32.7** (42.1 - 20.7)	**34.6** (25.4 - 44.6)	**19.2** (16.1 - 22.6)	**−15.4** (−9.3 - −21.9)
Rohtas	**17.2** (8.8 - 31.5)	**56.2** (51.2 - 60.8)	**39.0** (42.4 - 29.2)	**33.2** (18.3 - 52.2)	**76.7** (70.1 - 81.4)	**43.5** (51.8 - 29.2)	**34.8** (25.4 - 45.6)	**17.1** (13.6 - 22.1)	**−17.7** (−11.8 - −23.5)
Saharsa	**20.4** (10.7 - 34.8)	**44.7** (40 - 49.6)	**24.3** (29.3 - 14.8)	**38.0** (22.8 - 56.1)	**67.7** (62.1 - 73.1)	**29.7** (39.4 - 17)	**33.0** (23 - 43.1)	**21.3** (17.7 - 25.4)	**−11.7** (−5.3 - −17.7)
Samastipur	**16.1** (7.9 - 28.7)	**51.9** (47.2 - 56.6)	**35.8** (39.3 - 27.9)	**31.9** (17.9 - 50.1)	**72.3** (66.8 - 77.2)	**40.4** (49 - 27.1)	**34.1** (24.5 - 44.9)	**19.9** (16.3 - 24)	**−14.2** (−8.2 - −20.9)
Saran	**13.4** (7.3 - 23)	**35.2** (30.9 - 39.6)	**21.8** (23.6 - 16.6)	**26.3** (14.6 - 41)	**58.1** (52.3 - 64)	**31.8** (37.7 - 23.1)	**38.3** (27.7 - 49.3)	**25.4** (21.2 - 29.8)	**−12.9** (−6.5 - −19.5)
Sheikhpura	**14.8** (6.2 - 31.3)	**47.2** (41.7 - 52.3)	**32.4** (35.4 - 21.1)	**31.3** (15.8 - 54.3)	**70.4** (61.6 - 77.4)	**39.1** (45.8 - 23.2)	**31.9** (22.1 - 43)	**19.9** (14.9 - 26.6)	**−12.0** (−7.2 - −16.4)

Continued

Sheohar	**13.2** (5.7 - 27.1)	**44.3** (39.5 - 49.1)	**31.1** (33.8 - 22)	**25.9** (12.1 - 45.3)	**66.1** (60.1 - 71.6)	**40.2** (48 - 26.3)	**37.4** (26.8 - 49.5)	**22.6** (18.9 - 27.2)	**−14.8** (−8 - −22.3)
Sitamarhi	**12.0** (6.3 - 21)	**41.0** (36.7 - 45.1)	**29.0** (30.4 - 24)	**25.9** (14.6 - 41.5)	**61.6** (55.8 - 67)	**35.7** (41.2 - 25.5)	**34.3** (25.2 - 44.8)	**25.6** (21.7 - 29.8)	**−8.7** (−3.5 - −15)
Siwan	**14.9** (8 - 26.3)	**39.9** (35.2 - 44.2)	**25.0** (27.2 - 17.8)	**27.2** (15.3 - 42.6)	**60.3** (54.1 - 65.7)	**33.1** (38.8 - 23.1)	**40.2** (29.8 - 51.9)	**26.3** (22.2 - 31.2)	**−13.9** (−7.6 - −20.8)
Supaul	**24.2** (10.8 - 49.3)	**54.0** (49.5 - 58.4)	**29.8** (38.8 - 9.1)	**41.8** (22.4 - 68.5)	**73.8** (68.6 - 78)	**32.0** (46.1 - 9.5)	**33.0** (21.8 - 44.1)	**19.2** (16.1 - 23.2)	**−13.8** (−5.7 - −21)
Vaishali	**19.3** (10.2 - 33)	**48.0** (43.6 - 52.5)	**28.7** (33.4 - 19.5)	**37.1** (21.4 - 55.6)	**70.8** (65.8 - 75.3)	**33.7** (44.4 - 19.7)	**32.7** (23.7 - 42.8)	**19.8** (16.7 - 23.5)	**−12.9** (−7 - −19.3)

Table B2. Estimates and 95% uncertainty intervals (%) of modern contraceptive prevalence, demand satisfied, and unmet need for modern contraceptive methods in 2030 and the increase in the modern contraceptive prevalence needed from 2021 to attain 74% demand satisfied for modern methods by 2030.

State/Districts	Percentage of modern contraceptive prevalence (95% uncertainty interval)		Percentage of demand satisfied with modern methods (95% uncertainty interval)		Percentage of unmet need for modern methods (95% uncertainty interval)		Percentage increase in mCPR to achieve 74% of met demand from 2021 to 2030
	2021	2030	2021	2030	2021	2030	
Bihar	**45.2** (40.7 - 50)	**49.9** **(34.7 - 64.6)**	**66.8** (60.8 - 72.3)	**71.1** **(56.2 - 82.3)**	**22.4** (18.6 - 27)	**20.5** **(13.3 - 29.8)**	
Araria	**46.2** **(41.6 - 50.7)**	**52.2** **(37 - 67.4)**	**70.7** **(65.5 - 75.6)**	**74.6** **(59.8 - 86.2)**	**19.1** **(16 - 22.6)**	**17.7** **(10.5 - 26.2)**	**6.0**
Arwal	**41.8** (37 - 46.6)	**46.6** (31.5 - 60.8)	**63.0** (56.4 - 68.9)	**67.3** (51.1 - 79.6)	**24.6** (20.6 - 29.5)	**22.7** (15 - 33.1)	
Aurangabad	**48.8** (44.3 - 53.7)	**51.9** (36.8 - 66.1)	**72.1** (65.8 - 77.3)	**73.9** (58.8 - 84.5)	**18.9** (15.1 - 23.4)	**18.2** (11.6 - 28.3)	
Banka	**49.8** (44.6 - 54.4)	**52.1** (37.5 - 67.3)	**67.7** (61 - 72.8)	**70.1** (54.1 - 83)	**23.7** (19.6 - 29.2)	**22.2** (13.6 - 33.2)	
Begusarai	**48.8** (44.1 - 53.6)	**53.9** (38.8 - 68.6)	**68.8** (63.4 - 73.5)	**73.1** (57.4 - 84.4)	**22.1** (18.7 - 25.9)	**19.9** (12.2 - 29.9)	
Bhagalpur	**45.4** (40.5 - 50)	**49.8** (34.7 - 64.7)	**66.5** (60.3 - 72.2)	**70.0** (54 - 82.4)	**22.8** (18.6 - 27.6)	**21.2** (13.4 - 31.8)	
Bhojpur	**49.2** (44.5 - 53.9)	**52.7** (38.2 - 67.8)	**68.7** (62.7 - 74)	**71.7** (56.7 - 83.7)	**22.4** (18.6 - 27.3)	**20.7** (12.8 - 30.8)	
Buxar	**44.4** (39.5 - 49)	**48.2** (32.9 - 63.2)	**68.0** (61.1 - 73.6)	**70.2** (54.3 - 82.4)	**20.9** (17.1 - 26)	**20.4** (13 - 30.7)	
Darbhanga	**43.8** (39.2 - 48.3)	**48.0** (33.4 - 62.7)	**65.7** (60.2 - 71)	**69.4** (53.9 - 81.7)	**22.9** (19.1 - 26.8)	**21.1** (13.4 - 30.4)	

Continued

Gaya	**52.6** (47.3 - 57.4)	**56.3** (40.2 - 70.3)	**72.4** (65.2 - 78.4)	**75.5** (59.1 - 86.1)	**20.0** (15.5 - 25.4)	**18.2** (11 - 29.8)	**3.7**
Gopalganj	**37.4** (32.9 - 42.1)	**43.5** (29.1 - 57.8)	**52.1** (46 - 58.4)	**59.4** (42.6 - 73.4)	**34.3** (29.4 - 39.7)	**29.7** (20.5 - 41.1)	
Jamui	**49.9** (44.8 - 54.9)	**53.4** (38.1 - 68.2)	**68.4** (61.9 - 74.2)	**71.4** (55.4 - 83.7)	**23.0** (18.7 - 28.2)	**21.3** (12.9 - 32.2)	
Jehanabad	**45.0** (40.6 - 49.6)	**50.6** (36 - 64.6)	**68.9** (63.5 - 74.3)	**72.9** (57.3 - 83.8)	**20.2** (16.6 - 24.1)	**18.8** (11.7 - 27.9)	
Kaimur (Bhabua)	**55.0** (49.4 - 60.3)	**56.9** (41.1 - 70.7)	**74.7** (66.7 - 80.4)	**76.3** (60.5 - 86.3)	**18.6** (14.2 - 24.9)	**17.8** (10.6 - 28.9)	**1.9**
Katihar	**33.3** (29.3 - 37.3)	**41.7** (27.5 - 56.2)	**53.8** (48 - 59.4)	**61.6** (45 - 75.8)	**28.5** (24.4 - 33.2)	**25.9** (17.4 - 35.7)	
Khagaria	**40.2** (36 - 44.6)	**46.5** (31.4 - 60.8)	**66.7** (60.9 - 71.7)	**70.7** (55.1 - 82.4)	**20.1** (16.9 - 24)	**19.2** (12.6 - 27.4)	
Kishanganj	**29.3** (25.4 - 33.5)	**39.1** (25.5 - 54.8)	**53.3** (47.3 - 58.9)	**61.6** (45.2 - 75.4)	**25.8** (22 - 30.1)	**24.2** (16.6 - 33.2)	
Lakhisarai	**51.7** (47 - 56.2)	**54.6** (39.6 - 69.9)	**69.8** (64 - 74.9)	**72.6** (57.7 - 84.8)	**22.4** (18.5 - 27)	**20.6** (12.4 - 30.8)	
Madhepura	**48.7** (44.4 - 53.3)	**53.4** (39.3 - 67.9)	**72.5** (66.9 - 77.5)	**75.1** (61.3 - 85.7)	**18.5** (15.1 - 22.5)	**17.6** (10.9 - 26)	**4.7**
Madhubani	**41.2** (36.7 - 45.7)	**47.6** (31.9 - 63)	**64.4** (58.9 - 69.7)	**70.0** (53.5 - 82.2)	**22.8** (19.3 - 26.8)	**20.3** (13.2 - 29.6)	
Munger	**50.9** (45.8 - 55.7)	**53.7** (38.1 - 68.5)	**68.4** (61.9 - 73.8)	**70.9** (55.7 - 83.4)	**23.5** (19.2 - 28.7)	**21.9** (13.1 - 32.7)	
Muzaffarpur	**55.8** (51.4 - 60.5)	**59.0** (43.9 - 73.6)	**74.4** (69.7 - 79.1)	**77.1** (63 - 87.6)	**19.1** (15.7 - 22.9)	**17.4** (10.1 - 26.6)	**3.2**
Nalanda	**50.3** (45.3 - 55.2)	**53.2** (38.4 - 68.2)	**69.9** (63.2 - 75.6)	**72.1** (56.7 - 84.5)	**21.7** (17.3 - 27.1)	**20.5** (12.2 - 30.8)	
Nawada	**43.2** (38.1 - 47.9)	**47.9** (33.1 - 63.8)	**65.9** (57.9 - 72.1)	**69.6** (52.6 - 82.8)	**22.4** (18 - 28.3)	**21.0** (12.8 - 32.5)	
Pashchim Champaran	**43.2** (38.6 - 48.1)	**48.4** (33.9 - 63.4)	**68.7** (62.6 - 74.1)	**71.8** (57 - 83.4)	**19.7** (16.1 - 23.9)	**18.9** (12.2 - 27.6)	
Patna	**48.5** (43.8 - 53.1)	**53.9** (37.9 - 68.5)	**70.7** (65.4 - 75.6)	**74.3** (59.3 - 85.4)	**20.1** (16.7 - 23.9)	**18.5** (11.3 - 28)	**5.4**
Purba Champaran	**41.1** (36.7 - 45.7)	**46.8** (32.7 - 62)	**62.4** (56.7 - 68)	**67.5** (52.9 - 80.2)	**24.8** (20.9 - 29.1)	**22.5** (14.9 - 32.1)	
Purnia	**40.6** (36.3 - 45.1)	**50.8** (35.2 - 65.9)	**68.0** (62.6 - 73)	**75.2** (60 - 86.1)	**19.2** (16.1 - 22.6)	**16.7** (10.4 - 25)	**10.2**

Continued

Rohtas	**56.2** (51.2 - 60.8)	**59.2** (43.8 - 72.8)	**76.7** (70.1 - 81.4)	**78.3** (63.7 - 87.5)	**17.1** (13.6 - 22.1)	**16.4** (9.9 - 26.2)	**3.0**
Saharsa	**44.7** (40 - 49.6)	**51.2** (36.2 - 65.9)	**67.7** (62.1 - 73.1)	**72.2** (57.9 - 83.6)	**21.3** (17.7 - 25.4)	**19.5** (12.5 - 28.5)	
Samastipur	**51.9** (47.2 - 56.6)	**55.4** (40.4 - 69.9)	**72.3** (66.8 - 77.2)	**74.6** (60.7 - 85.8)	**19.9** (16.3 - 24)	**18.6** (11.3 - 27.8)	**3.5**
Saran	**35.2** (30.9 - 39.6)	**42.6** (28.3 - 57.6)	**58.1** (52.3 - 64)	**64.3** (48.1 - 78)	**25.4** (21.2 - 29.8)	**23.5** (15.7 - 33.4)	
Sheikhpura	**47.2** (41.7 - 52.3)	**49.6** (34.6 - 64.8)	**70.4** (61.6 - 77.4)	**72.0** (55.1 - 83.8)	**19.9** (14.9 - 26.6)	**19.3** (11.9 - 30.9)	
Sheohar	**44.3** (39.5 - 49.1)	**47.9** (33.4 - 62.1)	**66.1** (60.1 - 71.6)	**68.9** (53.5 - 80.8)	**22.6** (18.9 - 27.2)	**21.5** (14.2 - 30.4)	
Sitamarhi	**41.0** (36.7 - 45.1)	**47.5** (32.8 - 62)	**61.6** (55.8 - 67)	**67.9** (52.1 - 80.5)	**25.6** (21.7 - 29.8)	**22.5** (14.2 - 31.7)	
Siwan	**39.9** (35.2 - 44.2)	**45.7** (30.9 - 60.8)	**60.3** (54.1 - 65.7)	**65.2** (49.3 - 78.9)	**26.3** (22.2 - 31.2)	**24.1** (15.7 - 34.2)	
Supaul	**54.0** (49.5 - 58.4)	**56.8** (42.2 - 71.8)	**73.8** (68.6 - 78)	**75.9** (62.6 - 87)	**19.2** (16.1 - 23.2)	**18.0** (10.6 - 26.6)	**2.8**
Vaishali	**48.0** (43.6 - 52.5)	**53.6** (38.9 - 68.9)	**70.8** (65.8 - 75.3)	**74.6** (60.4 - 85.9)	**19.8** (16.7 - 23.5)	**18.1** (11 - 26.9)	**5.6**

State/Districts that can't attain 74% met demand for modern methods in 2030 have a shaded grey in the last column. For districts those are going achieve 74% of demand satisfied with modern methods by 2030 shaded green.

Table B3. Estimates of increase required in MWRA from 2021 in using modern contraceptive methods to achieve specified demand satisfied with modern methods by 2030.

State/Districts	Number of MWRA using modern methods in 2021 (95% CI)	Percentage of demand satisfied with modern method by 2030 (95% CI)	Number of MWRA using modern methods in 2030 for demand satisfied with modern method (95% CI)	Increase in the number of MWRA between 2021-2030 in using modern methods for demand satisfied in 2030 (Col 3)
(Col 1)	(Col 2)	(Col 3)	(Col 4)	(Col 5)
Bihar	**10,602,739** (9,552,578 - 11,727,914)	**71.1** (56.2 - 82.3)	**13,615,587** (9,486,770 - 17,648,768)	**3,012,848**
Araria	**286,102** (257,607 - 313,676)	**74.6** (59.8 - 86.2)	**376,365** (266,753 - 486,313)	**90,263**
Arwal	**66,008** (58,479 - 73,519)	**67.3** (51.1 - 79.6)	**85,763** (57,986 - 111,813)	**19,755**
Aurangabad	**277,075** (251,520 - 305,068)	**73.9** (58.8 - 84.5)	**343,598** (243,821 - 437,590)	**66,523**

Continued

Banka	**232,270** (208,046 - 253,743)	**70.1** (54.1 - 83)	**283,181** (203,653 - 365,442)	**50,911**
Begusarai	**323,537** (292,045 - 354,776)	**73.1** (57.4 - 84.4)	**415,640** (299,507 - 529,615)	**92,103**
Bhagalpur	**292,597** (261,289 - 322,243)	**70.0** (54 - 82.4)	**3,74,365** (260,467 - 486,186)	**81,768**
Bhojpur	**298,096** (26,9580 - 326,682)	**71.7** (56.7 - 83.7)	**372,273** (269,776 - 478,669)	**74,177**
Buxar	**167,066** (148,743 - 184,245)	**70.2** (54.3 - 82.4)	**211,378** (144,003 - 277,054)	**44,312**
Darbhanga	**378,563** (339,284 - 417,677)	**69.4** (53.9 - 81.7)	**483,140** (335,902 - 631,192)	**104,577**
Gaya	**526,072** (473,970 - 575,023)	**75.5** (59.1 - 86.1)	**656,871** (469,026 - 819,347)	**130,799**
Gopalganj	**214,025** (188,727 - 241,205)	**59.4** (42.6 - 73.4)	**290,053** (194,243 - 385,607)	**76,029**
Jamui	**2,08,531** (187,206 - 229,251)	**71.4** (55.4 - 83.7)	**259,689** (185,244 - 331,996)	**51,157**
Jehanabad	**116,413** (105,083 - 128,295)	**72.9** (57.3 - 83.8)	**152,487** (108,367 - 194,616)	**36,075**
Kaimur (Bhabua)	**197,668** (177630 - 216662)	**76.3** (60.5 - 86.3)	**238,187** (172,139 - 295,954)	**40,519**
Katihar	**217,885** (192,152 - 244,143)	**61.6** (45 - 75.8)	**317,914** (209,675 - 428,793)	**100,029**
Khagaria	**1,46,417** (131,075 - 162,622)	**70.7** (55.1 - 82.4)	**197,504** (133,146 - 257,839)	**51,087**
Kishanganj	**99,143** (85,942 - 113,059)	**61.6** (45.2 - 75.4)	**153,893** (100,363 - 215,777)	**54,750**
Lakhisarai	**115,673** (105,295 - 125,891)	**72.6** (57.7 - 84.8)	**142,446** (103,353 - 182,199)	**26,773**
Madhepura	**222,007** (202,369 - 243,365)	**75.1** (61.3 - 85.7)	**283,530** (208,733 - 360,968)	**61,523**
Madhubani	**419,558** (373,665 - 465,827)	**70.0** (53.5 - 82.2)	**565,167** (378,790 - 747,587)	**145,610**
Munger	**152,220** (137,169 - 166,673)	**70.9** (55.7 - 83.4)	**187,148** (132,959 - 238,683)	**34,928**
Muzaffarpur	**588,260** (541,127 - 636,997)	**77.1** (63 - 87.6)	**724,154** (538,615 - 903,771)	**135,894**

Continued

Nalanda	**324,660** (291,984 - 356,261)	**72.1** (56.7 - 84.5)	**399,909** (288,680 - 512,353)	**75,249**
Nawada	**222,984** (196,915 - 247,562)	**69.6** (52.6 - 82.8)	**288,411** (199,285 - 383,732)	**65,428**
Pashchim Champaran	**372,969** (333,494 - 415,382)	**71.8** (57 - 83.4)	**487,005** (340,567 - 637,573)	**114,036**
Patna	**631,848** (570,630 - 691,741)	**74.3** (59.3 - 85.4)	**818,528** (575,003 - 1,040,575)	**186,680**
Purba Champaran	**461,424** (412,208 - 513,165)	**67.5** (52.9 - 80.2)	**612,999** (427,476 - 811,103)	**151,574**
Purnia	**282,410** (252,085 - 313,472)	**75.2** (60 - 86.1)	**411,206** (285,393 - 533,240)	**128,796**
Rohtas	**372,067** (339,075 - 402,234)	**78.3** (63.7 - 87.5)	**456,245** (338,114 - 561,079)	**84,178**
Saharsa	**192,342** (172,081 - 213,297)	**72.2** (57.9 - 83.6)	**256,816** (181,526 - 330,165)	**64,475**
Samastipur	**494,932** (450,895 - 540,304)	**74.6** (60.7 - 85.8)	**615,543** (449,332 - 777,580)	**120,611**
Saran	**296,829** (260,409 - 333,808)	**64.3** (48.1 - 78)	**418,763** (277,960 - 566,502)	**121,934**
Sheikhpura	**67,143** (59,203 - 74,393)	**72.0** (55.1 - 83.8)	**82,056** (57,205 - 107,334)	**14,913**
Sheohar	**62,225** (55,570 - 69,092)	**68.9** (53.5 - 80.8)	**78,455** (54,633 - 101,647)	**16,231**
Sitamarhi	**305,958** (273,922 - 336,381)	**67.9** (52.1 - 80.5)	**412,453** (285,294 - 538,859)	**106,495**
Siwan	**287,024** (252,884 - 317,593)	**65.2** (49.3 - 78.9)	**382,540** (258,635 - 508,735)	**95,516**
Supaul	**2,76,805** (253,880 - 299,245)	**75.9** (62.6 - 87)	**339,194** (251,951 - 428,452)	**62,388**
Vaishali	**373,053** (338,982 - 408,798)	**74.6** (60.4 - 85.9)	**485,440** (352,858 - 624,295)	**112,387**

Estimation: Only 11 out of 38 districts of Bihar will be achieving the target of 74% of demand satisfied by 2030 at current pace.