Mending the Gaps in Differential Contraceptive Use in India: The Crucial Role of Identifying Disadvantaged Population

Introduction

Modern contraception prevalence rate (mCPR), unmet need for spacing and limiting and demand satisfied are the core indicators of family planning (FP) that determine fertility status, women's reproductive and sexual health, women empowerment, and population dynamics of the country.(1) In 2012 London Summit, under global FP2020 initiative, India has laid out specific goals and strategies as part of commitment to accelerate progress on family planning.(2)

Family Planning programs in India played the leading role in improving contraceptive prevalence from 13 percent to 48 percent of married women from 1970-2015 and directly influencing fertility rate reduction from 5.2 in 1971 to 2.2 in 2018.(3,4) Use of various modern methods of spacing and limiting of contraceptives has also improved perinatal outcomes, maternal health and child survival in India.(5) Utilization on modern spacing methods helps in lengthening interpregnancy intervals as pregnancy intervals of less than 18 months are often associated with risk of low birth weight, preterm birth, small size for gestational age and stillbirth.(6,7)

The prevalence rate of modern contraceptives, which is highly effective in spacing, limiting, preventing unintended pregnancies, and addressing high number of births was only about 47.8 percent among all married women in India in 2017. Overall, three forth of all modern contraceptive method users were long acting permanent method users. (8) The skewed method-mix use across all states in India remain a big challenge for policy makers.

A variety of socio-economic, demographic, geographic region, cultural and societal norms determine the spacing, limiting and overall modern contraceptive methods in India. Various studies conducted in India have found that women, mainly those residing in urban areas, prefer

small family and favor late marriage but there are major socio-cultural barriers against the adoption of modern contraceptive methods which include norms against spacing (pro-natal social norms, early pregnancy expectations in marriage), gender bias (son preference), family resistance to adopt contraceptives (primarily husband and mother-in-law) and religious beliefs (especially among Muslim and for permanent methods).(9–11)

Despite high investment and variety in availability of different modern FP methods, its adoption and utilization differ across states, region, community, education, and culture.(12,13) Many states like Kerala, Tamil Nadu, Andhra Pradesh, Punjab etc. have already achieved the replacement levels of fertility rate i.e., 2.1, but, some states (Bihar, Uttar Pradesh, Meghalaya, Nagaland, Manipur and Jharkhand) especially Bihar, having the high fertility rate of 3.2 and are far behind.(4) There is wide gap between knowledge and adoption of modern family planning methods. For example, 80 percent of currently married women in Bihar in age group 15-49 were having knowledge about FP methods but only 40% were using any contraceptive method.(14). This means the knowledge is high, but practice is low.

Although several contextual factors have been suggested as barriers to use of modern contraceptive methods including lack of user awareness, lack of provider knowledge and training, stocking, logistic and administrative obstacles, and cost. Only few studies have evaluated the population sub-group characteristics associated with lower and higher acceptance of modern contraceptive methods and differences in using modern spacing and limiting contraceptives. Understanding the factors that influence access to contraceptive use is key to reducing the disparities that exist in family planning uptake and levels of unmet needs for family planning in different settings. This analysis sought to examine the contextual characteristics associated with use of modern spacing and limiting contraceptive methods and overall mCPR among the classified population groups of

different geographies in India using data from a large population-based survey of married women in reproductive age (MWRA) 15-49 years (NFHS-4).

Objectives

The aim of the study is to determine:

- The extent of use of modern family planning methods by different population subgroups in different geographical locations.
- Identify socio-economic-demographic and cultural factors that are challenges in the use of modern family planning methods – limiting as well as spacing; and
- Track changes in these influencing factors across different states representing different levels of mCPR.

Material and methods

Data and Sample

It is important to understand the reasons for using or not using modern methods of contraception in the areas where use of FP ranges from highest to moderate to lowest. It is imperative that access to modern methods of contraception is necessary condition for FP use but availability itself may not be sufficient to significantly increase utilization.

To fulfil the study objectives, we grouped 36 states and union territories (at the time of NFHS-4 cross-sectional survey) into five clusters based on mCPR levels estimated from NFHS-4. One state each from these five clusters has been picked up keeping in mind ensuring regional representation for the detailed analysis. The sample size of MWRA (15-49 years) in the selected five states were- 35,443 from Bihar, 66,279 from Uttar Pradesh, 17,030 from Gujarat, 21,082 from Tamil Nadu and 21,518 from Maharashtra. The sampled women were asked about the current contraceptive method

use during the survey, which provide the information and estimate of prevalence of modern contraceptive use among MWRA.

Statistical analysis

The following methods have been applied for analysis:

Bivariate analysis has been conducted to determine the modern contraceptive use patterns of variations and comparisons between different population groups for different background characteristics considered for the analysis.

Logistic regression analysis is conducted to assess association between a list of predictors and modern contraceptive use separately for users of limiting methods and users of modern spacing methods for the selected five Indian States.

State specific multivariate analysis has been conducted to generate evidence on how predictors' influence on the use of modern contraceptive methods changes when mCPR changes from low to high.

While dealing with a long list of predictor variables, the binary logistic stepwise backward regression (conditional) method gives opportunity to remove the weaker variables from the equation/model in a step-wise manner (one by one) and provide a best fit model at the end with reduced number of stronger and significant predictors that influences the dependent variables. The whole analysis has been conducted using Statistical Package for the Social Sciences (SPSS Version-22).

Dependent Variables:

(1) Model 1 – current users of any modern contraceptive method: currently married women aged 15-49 years who are currently using any modern contraceptive methods either for

delaying or spacing for the next pregnancy or limiting the family size have been categorized into two i.e., any modern method users (code-1) and non-users and traditional method users are considered as reference group.

(2) Model 2 – current users of any modern spacing methods: currently married women aged 15-49 years using pills, condom (male/Female), IUCD, injectables, SDM, LAM and other modern methods to delay or spacing up to 2 years or more for next pregnancy.

(3) Model 3 – current users of any limiting methods: currently married women aged 15-49 years, or their husband have adopted female sterilization or non-scalpel vasectomy (NSV) to stop childbearing (limit the family size).

Construct of Independent Variables:

(1) Religion: Religious group is categorized into three i.e., Hindu, Muslim, and other religious groups. Muslim is considered as reference category.

(2) Women's education: divided into five groups based on years of schooling i.e., Illiterate/no schooling, 1-5 years of schooling (primary grade), 5-9 years of schooling (up to secondary grade), 10-11 years of schooling (up to higher secondary), and 12 years and more of schooling (university level). Illiterates/no schooling is considered as reference category.

(3) Five-point wealth Index: re-classified into three broad groups i.e., Rich (Rich and Richest), Poor (Poorest and Poor) and Middle; Poor as reference category. (a relative index of household wealth as a proxy of economic status was assessed using Principal Component Analysis based on assets, ownership of consumer items and dwelling characteristics)

(4) Social stratification: grouped into two i.e. Marginalized (Scheduled Tribes and Schedule Caste), and Non-marginalized (Other Backward Caste and General caste); Marginalized as reference category.

(5) Place of residence: divided into Urban, and Rural; Rural as reference category.

(6) Women's age: categorized into two i.e. 15-24 years and 25 years and above; Women's age 15-24 as reference category.

(7) Son Preference: to measure son preference, a proxy variable is created - Mothers having a child/children but no son coded -0 as reference category and mothers with at least one male child coded-1.

(8) FLW visit: Married women met or interacted with ASHA/ANM/AWW/LHV in last three months categorized as Yes-1 and others No-0 as reference category.

(9) FP media exposure: Married women who heard or seen family planning messages on Radio/TV/ Newspaper/Magazine/Wall Painting categorized as Yes-1 others as No=0 as reference category.

(10) Know FP methods: Respondents who knew at least 3 types of family planning methods coded-1 (to measure higher order knowledge) and those who don't know any methods or less than 3 methods are coded as 0, which represents reference category.

(11) Visit to a health facility: Respondents visited a health facility or a camp for self or for children in last 3 months categorized as Yes-1 and others as No-0 as reference category.

Results

Grouping of states/union territories

Table 1 provides the list of states and union territories arranged in ascending order of mCPR estimated from NFHS-4. Total fertility rates estimated from NFHS-4 are also provided in the table for a holistic picture to know the linkages between mCPR and Total Fertility Rate (TFR). States and union territories were grouped into five and one state each selected from each group while

considering geographic representation. We selected Bihar, Uttar Pradesh, Gujarat, Tamil Nadu and Maharashtra from these groups for further analysis.

Table 1: Grouping of states/union territories as per mCPR (NFHS-4)

States/Union Territories	mCPR	TFR	States/Union Territories	mCPR	TFR
Manipur	12.69	2.61	Andaman and Nicrobar Isl.	48.34	1.44
Lakshadweep	15.67	1.82	Delhi	48.55	1.78
Nagaland	21.25	2.74	Uttarakhand	49.34	2.07
Meghalaya	21.92	3.04	Madhya Pradesh	49.55	2.32
Bihar	23.25	3.41	Kerala	50.3	1.56
Goa	24.75	1.66	Karnataka	51.26	1.8
Arunachal Pradesh	26.6	2.1	Himachalane Pradesh	52.09	1.88
Daman and Diu	31.62	1.68	Tamil Nadu	52.59	1.7
Uttar Pradesh	31.7	2.74	Rajasthan	53.53	2.4
Mizoram	35.22	2.27	Chhattisgarh	54.5	2.23
Assam	36.99	2.21	Telangana	56.97	1.78
Jharkhand	37.45	2.55	West Bengal	56.98	1.77
Dedra and Nagar Haveli	37.87	2.32	Chandigarh	58.23	1.57
Tripura	42.82	1.68	Haryana	59.41	2.05
Gujarat	43.06	2.03	Puducherry	61.21	1.7
Odisha	45.43	2.05	Maharashtra	62.55	1.87
Sikkim	45.91	1.17	Punjab	66.34	1.62
Jammu and Kashmir	46.12	2.01	Andhra Pradesh	69.41	1.83

According to NFHS-4, mCPR ranges between 12.7 percent in Manipur to 69.4 percent in Andhra Pradesh while TFR varies from 3.41 in Bihar to 1.17 in Sikkim. However, linkage between mCPR and TFR is moderately correlated at R^2= -0.54. In the following sections we closely looked at the contraceptive prevalence by background characteristics for five selected states.

Details of modern contraceptive use in five selected states

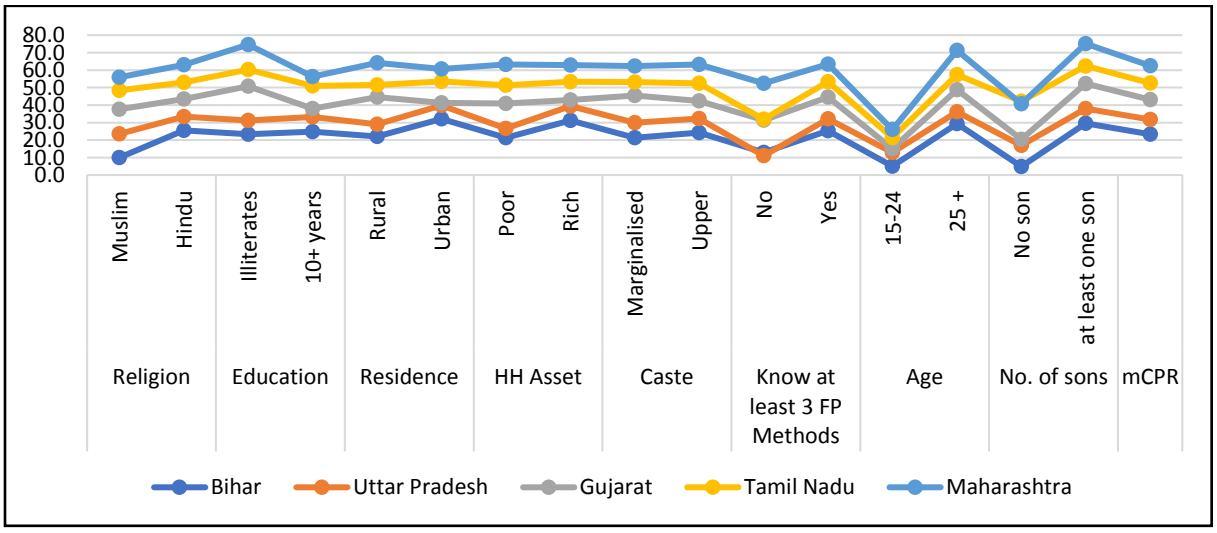
One of the objectives of this detailed analysis is to see how gaps in mCPR have been closing between different population groups within state and between states as we move from low mCPR regime to high mCPR regime. This section is divided into three – in first section we discuss about

the total modern method use, in the second section we discuss about the use of modern spacing methods and the third section about the limiting methods.

Overall use of modern contraceptives

Figure 1 provides the snapshot of mCPR levels by different population subgroups in five states estimated from NFHS-4. Each line in the graph represents each state with datapoints reflecting different subpopulation groups. Maharashtra leads the pack with more than 62 percent women use a modern family planning method, while nearly 53 percent in Tamil Nadu, 43 percent in Gujarat, while 32 percent and 23 percent women use any modern methods of family planning in Uttar Pradesh and Bihar in that order.

Figure 1: Pattern of mCPR by different subpopulation groups in five states, NFHS-4, 2015-16



Modern contraceptive use among women belonging different subgroups vary considerably as use among women with "no sons" estimated at 5 percent compared to nearly 30 percent among those who have at least one son in Bihar and these proportions vary from 17 percent to 38 percent in Uttar Pradesh, 21 percent to 52 percent in Gujarat, 42 percent to 62 percent in Tamil Nadu and 41 percent to 75 percent in Maharashtra, respectively. (***Table 2***)

Table 2: Distribution of use of *all* modern methods by background characteristics in selected five states, NFHS-4 (2015-16)

Background Characteristics	Bihar	Uttar Pradesh	Gujarat	Tamil Nadu	Maharashtra
Religion					
Muslim	10.0	23.6	37.7	48.4	55.9
Hindu	25.6	33.4	43.5	53.0	63.1
Others	12.9	41.2	42.1	48.8	66.3
Women's Education (in years of schooling)					
Illiterate	23.4	31.2	50.8	60.3	74.6
Below 5 years	22.8	32.5	51.8	62.3	73.4
5-9 years	23.0	31.8	39.9	57.1	62.9
10-11 years	24.8	33.3	38.0	51.0	56.2
12 & more years	22.0	32.0	36.3	41.0	51.6
Wealth Index					
Poor	21.3	26.6	40.9	51.4	63.3
Middle	26.5	32.3	45.6	51.9	60.9
Rich	31.2	39.4	43.0	53.3	62.9
Caste					
Marginalized	21.3	30.0	45.4	53.1	62.3
Non-marginalized	24.2	32.3	42.4	52.4	63.2
Place of Residence					
Rural	22.0	29.0	44.6	51.6	64.2
Urban	32.1	39.8	41.2	53.5	60.7
FLW Visit					
No	25.5	33.8	45.5	55.3	65.7
Yes	17.1	26.8	37.6	46.1	53.2
FP Media Exposure					
No	20.4	26.6	43.2	50.3	60.1
Yes	26.2	34.4	43.0	52.9	63.2
Know at least 3 FP Methods					
No	12.9	11.0	31.4	31.9	52.4
Yes	25.3	32.2	44.6	53.3	63.4
Visited Facility in last 3 months					
No	23.9	31.7	44.8	52.8	64.3
Yes	24.4	33.9	40.0	57.4	65.1
Son Preferences					
No Child	0.8	4.2	7.7	2.7	7.2
At least 1 son	29.6	38.0	52.3	62.4	75.1
No son	4.9	16.9	20.5	42.2	40.8
Women's Age					
15-24	5.1	13.0	15.1	21.4	26.0
25 & above	29.3	36.2	48.8	57.4	71.2
Total mCPR	**23.3**	**31.7**	**43.1**	**52.6**	**62.5**

The other subgroup with noticeable gap in mCPR level is between younger (15-24) and older (25 and above) cohorts of women where the mCPR among these two groups observed as 5 percent v/s 29 percent in Bihar, 13 percent and 36 percent in Uttar Pradesh, 15 percent and 49 percent in Gujarat, 21 percent and 57 percent in Tamil Nadu and 26 percent and 71 percent in Maharashtra. Another interesting highlight observed in this table is that difference between low performing subgroups and high performing subgroups in terms of modern contraceptive use is narrowing down when we move from states with lowest mCPR (here Bihar) to states with higher levels of mCPRs (here Maharashtra). The other population subgroups have shown lesser gaps in mCPR levels compared to their peer groups within each state.

Use of spacing methods of modern contraceptives.

Studying the use of spacing methods is an important component in the family planning program. Increasing its share in method mix and ensuring quality access and services of different spacing methods of family planning to all are now part of SDG (Target #3.7). Details in **Table 3** discuss about the use of modern spacing methods by background characteristics in five states using NFHS-4 data.

Theoretically, users of modern spacing methods likely to exhibit more control about their fertility and family planning behaviors. Overall, 14.3 percent of women reported using a modern method for spacing in Uttar Pradesh compared to 11.4 percent in Maharashtra, 9.4 percent use in Gujarat, 3.2 percent in Tamil Nadu and 2.5 percent use in Bihar.

Table 3: Distribution of modern *spacing* methods by background characteristics in the selected five states, NFHS-4 (2015-16)

Background Characteristics	Bihar	Uttar Pradesh	Gujarat	Tamil Nadu	Maharashtra
Religion					
Muslim	2.8	18.5	14.1	4.8	15.9
Hindu	2.5	13.4	9.0	3.0	10.7
Others	2.6	29.9	10.2	4.4	11.8
Women's Education (in years of schooling)					
Illiterate	1.3	9.4	3.2	0.6	3.0
Below 5 years	1.3	12.7	4.9	0.7	4.8
5-9 years	2.8	14.7	8.7	2.3	8.9
10-11 years	5.3	19.3	11.7	4.0	15.1
12 & more years	7.5	24.9	21.2	5.9	23.3
Wealth Index					
Poor	1.7	8.2	2.8	1.7	5.1
Middle	3.4	14.1	5.7	2.2	8.5
Rich	6.6	24	13.4	4.1	15.4
Caste					
Marginalized	1.4	10.4	5.7	2.4	8.6
Non-marginalized	2.9	15.6	10.6	3.5	12.7
Place of Residence					
Rural	2.1	10.9	5.9	2.2	7.6
Urban	5.3	24.7	13.7	4.1	15.8
FLW Visit					
No	2.5	13.9	8.8	2.4	10.1
Yes	2.7	15.3	10.6	5.1	15.4
FP Media Exposure					
No	1.3	8.6	5.9	1.8	5.1
Yes	3.8	17.3	11.5	3.3	13.2
Know at least 3 FP Methods					
No	0.3	0.6	0.7	0.1	1.2
Yes	3.0	14.7	10.5	3.3	12.3
Visited Facility in last 3 months					
No	2.4	13.3	8.9	2.5	10.2
Yes	3.4	16.8	11.2	3.8	15.4
Son Preferences					
No Child	0.7	4.0	7.5	0.6	6.7
At least 1 son	2.8	15.8	9.0	3.0	10.6
No son	2.8	14.7	12.9	4.7	19.1
Women's Age					
15-24	2.1	11.7	9.6	6.1	15.5
25 & above	2.7	15.0	9.3	2.7	10.5
Total modern spacing method users	**2.5**	**14.3**	**9.4**	**3.2**	**11.4**

Highly educated women (at least 10 years of schooling) are more likely to use spacing methods than any other women in any subgroups within the state or between states. In the educated groups, proportion of women using any modern methods for spacing varies from 4 percent among women with 10-11 years of schooling in Gujarat to nearly 25 percent by the women with more than 12 years of schooling in Uttar Pradesh.

The other subgroups who performed better in terms of modern spacing method users are women from urban areas, belong to "rich" wealth quintile, exposed to media and knowledge about at least more than 2 family planning methods. These phenomena have been observed within state and across states. Women from Muslim subgroup are reported to have higher use of spacing methods than their counterparts in other religious categories and their proportion varies from 2.8 percent in Bihar to 18.5 percent in Uttar Pradesh. Use of spacing methods is comparatively lower among Hindu women as their proportion ranges between 2.5 percent in Bihar and 13.4 percent in Uttar Pradesh.

Use of limiting methods of modern contraceptives.

Practically, couples who completed their family size are more likely to adopt permanent methods of family planning. Choosing a permanent method of contraception, a lifetime decision, couples are expected to be exercised after many discussions and thoughts. Historically, India observed to have highly distorted method-mix, skewed towards permanent methods – decreased from a high of nearly 85 percent in NFHS-1 to 76 percent in NFHS-4.

Distribution of users of modern permanent methods of contraception for five states obtained from NFHS-4 is provided in Table 4. Proportion of users of permanent method of contraception is estimated lowest in Uttar Pradesh at 17.4 percent, Bihar 20.7 percent, Gujarat 33.7 percent, Tamil Nadu 49.4 percent and highest in Maharashtra at 51.1 percent.

Table 4: Distribution of modern limiting methods by background characteristics in selected five states, NFHS-4 (2015-16)

Background Characteristics	Bihar	Uttar Pradesh	Gujarat	Tamil Nadu	Maharashtra
Religion					
Muslim	7.2	5.1	23.6	43.6	40.0
Hindu	23.1	20.0	34.6	50.0	52.4
Others	10.3	11.3	31.9	44.4	54.5
Women's Education (in years of schooling)					
Illiterate	22.1	21.9	47.6	59.6	71.6
Below 5 years	21.5	19.8	46.8	61.6	68.7
5-9 years	20.2	17.1	31.2	54.8	54
10-11 years	19.6	13.9	26.3	47	41.1
12 & more years	14.6	7.2	15	35.1	28.4
Wealth Index					
Poor	19.6	18.4	38.1	49.7	58.2
Middle	23.1	18.1	39.9	49.7	52.4
Rich	24.7	15.4	29.6	49.2	47.6
Caste					
Marginalized	19.8	19.6	39.7	50.7	53.7
Non-marginalized	21.4	16.7	31.8	48.9	50.4
Place of Residence					
Rural	19.9	18.1	38.7	49.4	56.6
Urban	26.8	15.1	27.5	49.4	44.9
FLW Visit					
No	23.1	19.9	36.7	53	55.6
Yes	14.5	11.5	27	41	37.9
FP Media Exposure					
No	19.1	18	37.2	48.4	55
Yes	22.4	17.1	31.5	49.5	50.1
Know at least 3 FP Methods					
No	12.7	10.4	30.8	31.8	51.2
Yes	22.3	17.5	34.1	50.1	51.1
Visited Facility in last 3 months					
No	21.5	18.4	36	50.2	54.1
Yes	21.1	17.1	28.9	53.5	49.8
Son Preferences					
No Child	0.1	0.2	0.2	2.1	0.4
At least 1 son	26.8	22.3	43.4	59.4	64.5
No son	2.2	2.2	7.6	37.5	21.8
Women's age					
15-24	3	1.3	5.5	15.3	10.5
25 & above	26.6	21.3	39.5	54.7	60.7
Total limiting method users	**20.7**	**17.4**	**33.7**	**49.4**	**51.1**

Such distribution brings out the contribution of permanent methods to total mCPR as 55 percent in Uttar Pradesh, 78 percent in Gujarat, 82 percent in Maharashtra, 89 percent in Bihar and 94 percent in Tamil Nadu, indicating a balanced method-mix in Uttar Pradesh.

Permanent method of family planning is found to be a popular choice among those who are less educated (illiterates and studied less than primary school), those who are in older age group (25 and above), and those who had at least one son across all the states. Limiting methods also more prevalent among women from Hindu religion with around 20 percent in Uttar Pradesh and Bihar to more than 50 percent in Tamil Nadu and Maharashtra reported using the method.

Accepting a limiting method after having at least one son is found to be crucial in completing the family building process which is true across all the five states as nearly 65 percent women/couples accepted permanent method in Maharashtra who are having at least one son. Similarly, as reported earlier, permanent methods highly popular among those women who are less educated and illiterates as 72 percent (highest) of illiterate women in Maharashtra have reported using this method.

Results from binary logistic stepwise backward regression (conditional) analysis

Logistic regression analysis was carried out separately to identify factors associated with the overall modern contraceptive use (Model 1), use of modern spacing methods (Model 2) and use of limiting methods (Model 3) for the five states. Results from this analysis have been discussed concisely in below sections. Only most significant predictors are displayed and discussed in this section. **Detailed Table 5, Table 6 and Table 7 are given in the appendix**.

Model 1 – Factors determine the overall users of any modern family planning methods.

Impact of son preference on use of any modern contraceptive methods: **Table 8** provides the details of the adjusted odds ratios of the most significant predictors influencing the use of any modern contraceptives by state. Impact of son preference is found to be one of the most significant factors that influence the use of any modern methods. Women with at least one son were found to be 6 times more likely to use a modern contraceptive than women with no sons in Bihar and in Uttar Pradesh this ratio is nearly 3 times.

Table 8: Details adjusted odds ratios of the most significant predictors on use of any modern contraceptive methods for five states.

Model 1	**(Adjusted) Odds Ratios of use of any modern contraception**			
Var v/s Ref category	Age (25 + v/s 15-24)	Son preference (at least a son v/s no sons)	Knowledge of FP methods (at least 3 method v/s other)	Religion (Hindu v/s Muslim)
Bihar	3.8*** (3.39 - 4.25)	6.17*** (5.29 - 7.19)	2.01*** (1.84 - 2.2)	3.43*** (3.1 - 3.79)
UP	2.01*** (1.88 - 2.15)	2.77*** (2.59 - 2.96)	2.71*** (2.29 - 3.21)	1.9*** (1.8 - 2.01)
Gujarat	3.63*** (3.14 - 4.21)	3.36*** (3 - 3.78)	2.21*** (1.95 - 2.49)	1.28*** (1.11 - 1.47)
Tamil Nadu	3.24*** (2.85 - 3.69)	1.99*** (1.84 - 2.15)	2.73*** (2.28 - 3.28)	1.41*** (1.2 - 1.66)
Maharashtra	3.86*** (3.46 - 4.3)	3.45*** (3.14 - 3.78)	2.28*** (1.99 - 2.6)	1.46*** (1.29 - 1.65)

****Highlighted cells show the highest values of AOR for each state.*

In Gujarat and Maharashtra, at least a son born to a woman assures the adoption of any modern family planning methods by 3.4 times than a woman with no sons. Women in Tamil Nadu show slightly lower adjusted odds ratio at 2 – implying that women with at least one son are twice likely to adopt a modern method of family planning than women with no sons.

Impact of Age on adoption of any modern family planning methods: Age is a crucial factor in influencing contraceptive behavior of a population. As age increases family building process likely to start and couples likely to adopt appropriate modern contraception to suit their reproductive intentions. In three states, namely, in Gujarat, Tamil Nadu and Maharashtra where mCPR is on

upper spectrum, women's age found to be the most significant predictor in terms of values of AOR. Women in older age group (25 & above) from these 3 states were found at least 3 times more likely to use a modern family planning method than women from the younger age cohort (15-24 years).

Impact of knowledge about at least 3 FP methods on adoption of any modern FP methods: Knowledge about any one of the family planning methods is universal in India and states. This prompted us to consider knowledge about 3 or more family planning methods which has been tested against knowledge about 1-2 FP methods or no knowledge about any FP methods. Results of this predictor are significant and consistent across all the five states by showing AOR more than 2 for the use of any modern family planning method. Impact of this predictor is particularly high in Uttar Pradesh and Tamil Nadu where women with knowledge about more than 3 family planning methods are at least 2.7 times more likely to use any modern contraception compared to women with fewer than 3 methods or no knowledge at all.

Impact of religious affiliation on the use of any modern methods of family planning: Religious affiliation considered to be another important predictor in adopting contraception. Here we considered this predictor in our model and found that though AORs are significant across all the states but the predictor's explaining power decreases when we move from Bihar to Maharashtra. In Bihar, women from Hindu religious group are 3.4 times more likely to use a modern method of family planning than women from Muslim category and AORs reduced to 1.9 in Uttar Pradesh, 1.3 in Gujarat, 1.4 in Tamil Nadu and 1.5 in Maharashtra implying that the religious affiliation is losing its importance while state achieves higher contraceptive levels.

Model 2 – Factors determining the use of modern spacing methods.

It would be interesting to identify parameters which are making influence on the use of any modern methods for spacing purposes. Only the indicators with the highest AORs are included in the **Table 9**. A detailed table is available in the appendix (**Table 6**).

Impact of knowledge about 3 or more family planning methods on use of any modern spacing methods: Knowledge about more than two family planning methods is turned out to be the most significant predictor holding highest AORs in 3 out of 5 states – in Bihar, Uttar Pradesh and Gujarat. Except for Tamil Nadu in other four states this predictor had shown a significant impact on women's choice of accepting modern spacing methods.

Table 9: Details adjusted odds ratios of the most significant predictors on use of any modern contraceptive methods for spacing purposes in five states.

Model 2	**(Adjusted) Odds Ratios of spacing method use**				
Var v/s Ref category	Age (25 + v/s 15-24)	Education (higher sec & above v/s illiterate)	Education (upto higher secondary v/s non-literates)	Knowledge of FP methods (at least 3 method v/s other)	Religion (Hindu v/s Muslim)
Bihar	1.3** (1.07 - 1.58)	3.72*** (2.99 - 4.65)	2.81*** (2.21 - 3.57)	9.26*** (4.76 - 18.01)	0.61*** (0.5 - 0.74)
UP	#N/A	2.16*** (2 - 2.33)	1.66*** (1.5 - 1.83)	17.14*** (8.03 - 36.59)	0.59*** (0.56 - 0.63)
Gujarat	#N/A	4.17*** (3.31 - 5.25)	2.22*** (1.71 - 2.87)	5.85*** (3.26 - 10.52)	0.61*** (0.5 - 0.74)
Tamil Nadu	0.45*** (0.36 - 0.57)	5.88*** (3.66 - 9.46)	4.09*** (2.5 - 6.7)	#N/A	0.61** (0.42 - 0.87)
Maharashtra	0.52*** (0.45 - 0.6)	7.23*** (5.54 - 9.42)	4.6*** (3.51 - 6.03)	6.43*** (3.59 - 11.52)	0.58*** (0.5 - 0.68)

****Highlighted cells show the highest values of AOR for each state.*

Impact of women's education on use of any modern spacing methods: Highly educated women are expected to be more likely to use a modern temporary family planning method than non-literate women in all the states. AORs suggest that highly educated (12 and more years of schooling) women in Tamil Nadu and Maharashtra are respectively 5.9 times and 7.2 times more likely to use a modern spacing method than women belong to non-literate category. Similar results are observed

in Bihar and Uttar Pradesh with slightly lesser AORs but at highly significant level. Women's education is expected to work favorably in choosing temporary methods of family planning.

Impact of religious affiliation on use of any modern spacing methods: Religious affiliation seems to be working in favor of Muslim group as women from this group are nearly 1.6 times more likely to have used a spacing method than women from Hindu group in all the five states. Spacing methods are likely choice of Muslim religious group.

Nonetheless, contrary with the AORs for mCPR, variable FLW interaction among married women in last three months preceding the survey had significant effect in increasing modern temporary methods for spacing purposes in all the states except in Bihar. (see Appendix Table 5, Table 6)

Model 3 – Factors determine the users of modern limiting methods.

Analysis further carried out to study how users of limiting methods are influenced by these attributes in five states. **Table 10** provides the details of highest valued AORs obtained from the logistics model built for users of permanent methods of family planning. The detailed tables are provided in the appendix.

Impact of son preference on use of limiting methods: Son preference is the most significant factor while adopting limiting methods in 3 states – in Bihar, Uttar Pradesh and Gujarat – as AORs of the variable range from 11.3 in Bihar to 8.0 in Uttar Pradesh and 6.2 in Gujarat. It can be noticed that more and more couples are likely to make conscious decision to end their fertility by choosing limiting methods after having at least one son in these 3 states. Son preference is not so strong in Tamil Nadu as other factors play major role in the state while in Maharashtra, women with at least one son were 4.5 times more likely to accept permanent method than women with no sons.

Table 10: Details adjusted odds ratios of the most significant predictors on use of any modern contraceptive methods for limiting purposes in five states.

Model 3	(Adjusted) Odds Ratios of Limiting methods			
Var v/s Ref category	Age (25 + v/s 15-24)	Son preference (at least a son v/s no sons)	Knowledge of FP methods (at least 3 method v/s other)	Religion (Hindu v/s Muslim)
Bihar	4.95*** (4.32 - 5.67)	11.28*** (9.06 - 14.05)	1.86*** (1.7 - 2.04)	4.47*** (3.98 - 5.01)
UP	7.55*** (6.4 - 8.9)	8.03*** (6.87 - 9.39)	1.83*** (1.53 - 2.18)	5.92*** (5.41 - 6.48)
Gujarat	6.0*** (4.92 - 7.33)	6.23*** (5.29 - 7.34)	2*** (1.76 - 2.27)	1.69*** (1.45 - 1.98)
Tamil Nadu	4.34*** (3.76 - 5.01)	2.05*** (1.89 - 2.22)	2.61*** (2.17 - 3.14)	1.52*** (1.29 - 1.79)
Maharashtra	7.28*** (6.38 - 8.31)	4.49*** (4.04 - 4.98)	1.92*** (1.67 - 2.2)	1.98*** (1.76 - 2.23)

****Highlighted cells show the highest values of AOR for each state.*

Impact of age on accepting limiting methods: Women from older age group (25 and more) are more likely to accept the limiting methods of contraception as expectedly they would have completed their family building process. This predictor is highly significant in Tamil Nadu and Maharashtra with respective AORs 4.3 and 7.3. In Bihar, Uttar Pradesh and Gujarat, age factor plays second to son preference while measuring the impact on using permanent family planning method.

Religious affiliation on users of limiting methods: Religious affiliation is found to be making a significant impact on couples choosing limiting methods in low performing states say in Bihar and Uttar Pradesh with AORs measured at 4.5 and 5.9, respectively. However, its impact is found to be not so prominent in better performing states like Gujarat, Tamil Nadu and Maharashtra where other factors determines the acceptance of limiting methods.

Knowledge about FP methods: Knowledge about at least 3 family planning methods is likely to influence moderately in adopting limiting methods by the couples in five states. In low performing states like Bihar or Uttar Pradesh, the AOR is 1.8 suggesting lowest value among other predictors.

Discussion

The analysis helped us categorically identify few key points.

Inequities: Inequities exist widely in the use of modern contraceptive methods for the most disadvantaged groups (e.g., women from younger age group, least educated women, certain geographies, certain religious group etc.) in various components of family planning programming (less use of spacing methods and over dependence on permanent methods). The findings are consistent with previous studies (15–18) Identification of such underserved communities or population groups and address their needs is particularly important for making more equitable society. Gaps in use of contraceptive use between different social, economic and demographic groups disappear in states with higher mCPR whereas the gaps are prominently visible in the states with lower mCPR.

Skewed method-mix: Except for Uttar Pradesh, all other four states considered for the analysis faced with highly imbalanced method-mix. Permanent methods are found to be promoted and accepted by couples across all the states as found in previous studies.(19) Those states with high mCPRs should focus on promoting spacing methods by providing quality services, ensuring wide scale availability and more choices so that couples make informed choices. States with low levels of mCPR need to focus on promoting both the methods – permanent and spacing methods – by providing quality family planning services across the states leaving no one behind.

Promotion of spacing methods: The analysis has clearly identified the most significant determinants of modern spacing methods as higher education of women and women's knowledge about at least 3 methods. The findings are consistent with previous studies (13) Women with at least 10 years of schooling are highly likely to use some form of modern methods of family planning for spacing than any women in other subgroups across all the states. Education is likely to provide women with more information about her reproductive health needs, increases their informed choice capacity, and help to take timely decisions.(20) Lesser educated women were less

likely to exercise their choices and more likely adopt permanent methods (as seen clearly in the analysis across all five states) after quickly completing their family building process without having proper spacing of births.

Another important factor that influenced the likelihood of use of spacing methods is the knowledge about at least three family planning methods. Knowledge about a greater number of family planning methods increases women's power of decision-making process. The emergence of this factor as one of the most significant ones while fitting model for users of spacing methods even after controlling all other variables in the model fitting, leads to the necessity of increasing awareness about more number of methods of family planning among women, especially who belong to marginalized groups.

Promotion of limiting methods: Multivariate analysis carried out to identify determinants of users of limiting methods provide insights into how different factors play important role when states are at low levels of mCPR or at higher levels. It is interesting to observe that values of AORs of different predictors vary within a limited rangebound in states with higher levels of mCPRs whereas AORs in states with relatively lower mCPRs are found to vary widely. This implies that larger variation in acceptance of limiting methods exists between population groups within states with low mCPR levels. However, such variability between population subgroups shrinks when mCPRs increase.

In overall, the analysis ultimately allows us to diagnose where inequities in use of modern family planning methods exist and who faces these inequities within a state or population subgroups. Identification of such inequities and recognizing is the first step towards ensuring more equitable society. Some of the societal norms like strong preference for sons to be born in the family before

completing the family building process still remain a herculean challenge impeding the acceptance of family planning methods in many states even after being identified by researchers long before.

Conclusion

A more equitable distribution of use of modern contraceptive methods may help accelerate mCPR growth and achieve better reproductive health conditions in low performing states. Policies and programs should weave strategies towards "closing the gap" in use of modern family planning methods among different disadvantaged population subgroups.

At the service delivery part, family planning program should try to overcome the over reliance on permanent methods of family planning which is prevalent among all states irrespective of whether states belong to low mCPR category or high mCPR category by promoting quality services of family planning spacing methods. Complete information about full basket of family planning methods should be disseminated across the country, across all population subgroups so that couples can be aware of at least 3 family planning methods which are likely to help promotion of spacing methods. Women's education at least high school level should be strongly promoted far and wide to help women take informed choices regarding their reproductive health needs.

In summary, this paper concludes by identifying key population subgroups, most disadvantaged group, within state, within the country and urge policy makers and program implementers to address their challenges, meet their needs and promote quality family planning services to each them. This ensures more equitable society without being marginalized from mainstreaming reproductive health services.

Ethics approval and consent to participant

The study is based on the National Family Health Survey (NFHS) 2015-16 dataset which is available in the public domain with no identifiable information on the survey participants; therefore, no ethics statement is required for this work. The data can be downloaded from www.DHSprogram.com on proper request. The study was performed in accordance with Helsinki Declaration. All subjects signed inform consent and volunteered to participate in the study.

Availability of data and materials

The datasets supporting the conclusions of the article are available from the demographic health and survey website upon request using http://dhsprogram.com/data/.

Abbreviations

ANM:	Auxiliary Nurse Midwife
AOR:	Adjusted Odds Ratio
ASHA:	Accredited Social Health Activist
AWW:	Anganwadi Worker
CPR:	Contraceptive Prevalence Rate
FP:	Family Planning
IUCD:	Intra-uterine Contraceptive Device
LAM:	Lactational Amenorrhea Method
LHV:	Lady Health Visitor
mCPR:	Modern Contraceptive Prevalence Rate
MWRA:	Married Women in Reproductive Age
NFHS:	National Family Health Survey

NSV: Non-scalpel Vasectomy

SDM: Standard Days Method

TFR: Total Fertility Rate

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Appendix

Table 5: Adjusted Odds of mCPR (95% CI) among currently married women aged 15-49 years by background variables in the selected States of India, NFHS-4 (2015-16)

Background Variables	Bihar (N=28469)	Uttar Pradesh (N=54869)	Gujarat (N=13594)	Tamil Nadu (N=15499)	Maharashtra (N=16330)
Age of Respondents					
15-24#					
25 & above	3.8***(3.39 - 4.25)	2.01***(1.88 - 2.15)	3.63***(3.14 - 4.21)	3.24***(2.85 - 3.69)	3.86***(3.46 - 4.3)
Religion					
Muslim#					
Hindu	3.43***(3.1 - 3.79)	1.9***(1.8 - 2.01)	1.28***(1.11 - 1.47)	1.41***(1.2 - 1.66)	1.46***(1.29 - 1.65)
Others	1.41(0.49 - 4.07)	1.88***(1.41 - 2.5)	1.17(0.77 - 1.78)	1.09(0.88 - 1.36)	1.65***(1.38 - 1.97)
Women's Education (in years of schooling)					
Illiterate					
Below 5 years	#N/A	1.04(0.94 - 1.16)	1.08(0.94 - 1.24)	1.15(0.97 - 1.36)	0.97(0.83 - 1.13)
5-9 years	#N/A	0.99(0.95 - 1.04)	0.76***(0.69 - 0.84)	0.99(0.91 - 1.1)	0.72***(0.64 - 0.81)
10-11 years	#N/A	0.95(0.88 - 1.03)	0.62***(0.54 - 0.72)	0.87**(0.78 - 0.98)	0.56***(0.49 - 0.65)
12 & more years	#N/A	0.86***(0.8 - 0.91)	0.62***(0.54 - 0.7)	0.58***(0.52 - 0.65)	0.46***(0.4 - 0.53)
Wealth Index					
Poor#					
Middle	1.11**(1.02 - 1.21)	1.33***(1.26 - 1.4)	1.26***(1.12 - 1.41)	1.02(0.91 - 1.13)	0.98(0.87 - 1.1)
Rich	1.13**(1.03 - 1.25)	1.64***(1.55 - 1.73)	1.32***(1.17 - 1.48)	1.2***(1.08 - 1.34)	1.2**(1.07 - 1.35)
Caste					
Marginalized#					
Non-marginalized	1.15***(1.07 - 1.23)	#N/A	0.81***(0.74 - 0.88)	#N/A	1.11**(1.01 - 1.22)
Place of Residence					
Rural#					
Urban	1.51***(1.39 - 1.66)	1.3***(1.23 - 1.36)	0.84***(0.77 - 0.91)	1.12**(1.04 - 1.21)	0.75***(0.69 - 0.82)
Son Preferences					
No son#					
At least 1 son	6.17***(5.29 - 7.19)	2.77***(2.59 - 2.96)	3.36***(3 - 3.78)	1.99***(1.84 - 2.15)	3.45***(3.14 - 3.78)
FLW interaction					
No#					
Yes	0.72***(0.67 - 0.78)	0.84***(0.8 - 0.88)	0.87***(0.8 - 0.94)	0.73***(0.66 - 0.81)	0.74***(0.67 - 0.82)
FP media exposure					
No#					
Yes	1.22***(1.15 - 1.3)	1.28***(1.23 - 1.34)	#N/A	1.18**(1.07 - 1.32)	1.43***(1.3 - 1.57)
Know At least 3 FP Method					
No#					
Yes	2.01***(1.84 - 2.2)	2.71***(2.29 - 3.21)	2.21***(1.95 - 2.49)	2.73***(2.28 - 3.28)	2.28***(1.99 - 2.6)
Visited Health Facility					
No#					
Yes	#N/A	1.07**(1.03 - 1.11)	#N/A	1.38***(1.27 - 1.49)	#N/A

#Reference Categories; *p< 0.1, **p<0.05, ***p<0.001; N=Selected cases included in analysis; #NA=Variables eliminated from the equation/model due to insignificant nature while backward stepwise regression modelling.

Table 6: Adjusted Odds of using modern spacing methods (95% CI) among currently married women aged 15-49 years by background characteristics in the selected States of India, NFHS-4 (2015-16)

Background Variables	Bihar (N=28469)	Uttar Pradesh (N=54869)	Gujarat (N=13594)	Tamil Nadu (N=15499)	Maharashtra (N=16330)
Age of Respondents					
15-24#					
25 & above	1.3**(1.07 - 1.58)	#N/A	#N/A	0.45***(0.36 - 0.57)	0.52***(0.45 - 0.6)
Religion					
Muslim#					
Hindu	0.61***(0.5 - 0.74)	0.59***(0.56 - 0.63)	0.61***(0.5 - 0.74)	0.61**(0.42 - 0.87)	0.58***(0.5 - 0.68)
Others	0.01(0 - 0)	0.89(0.66 - 1.21)	0.49**(0.26 - 0.94)	0.69(0.42 - 1.14)	0.55***(0.43 - 0.7)
Women's Education (in years of schooling)					
Illiterate					
Below 5 years	0.72(0.46 - 1.14)	1.22**(1.05 - 1.41)	1.31*(0.96 - 1.79)	0.72(0.25 - 2.07)	1.72***(1.25 - 2.38)
5-9 years	1.68***(1.37 - 2.08)	1.39***(1.3 - 1.48)	1.85***(1.49 - 2.29)	2.52***(1.56 - 4.09)	2.51***(1.94 - 3.24)
10-11 years	2.81***(2.21 - 3.57)	1.66***(1.5 - 1.83)	2.22***(1.71 - 2.87)	4.09***(2.5 - 6.7)	4.6***(3.51 - 6.03)
12 & more years	3.72***(2.99 - 4.65)	2.16***(2 - 2.33)	4.17***(3.31 - 5.25)	5.88***(3.66 - 9.46)	7.23***(5.54 - 9.42)
Wealth Index					
Poor#					
Middle	#N/A	1.34***(1.25 - 1.44)	1.52**(1.15 - 2.03)	#N/A	1.1(0.9 - 1.34)
Rich	#N/A	1.7***(1.58 - 1.83)	2.04***(1.56 - 2.68)	#N/A	1.23**(1.02 - 1.49)
Caste					
Marginalized#					
Non-marginalized	1.3**(1.05 - 1.61)	#N/A	1.29**(1.08 - 1.53)	1.37**(1.08 - 1.75)	1.21**(1.05 - 1.4)
Place of Residence					
Rural#					
Urban	1.39***(1.17 - 1.65)	1.5***(1.41 - 1.59)	1.46***(1.27 - 1.68)	1.47***(1.2 - 1.81)	1.57***(1.39 - 1.78)
Son Preferences					
No son#					
At least 1 son	#N/A	1.44***(1.34 - 1.55)	#N/A	#N/A	0.81***(0.72 - 0.91)
FLW interaction					
No#					
Yes	#N/A	1.25***(1.19 - 1.32)	1.38***(1.21 - 1.57)	2.01***(1.62 - 2.49)	1.74***(1.52 - 1.98)
FP media exposure					
No#					
Yes	1.41***(1.18 - 1.68)	1.28***(1.2 - 1.36)	#N/A	1.54**(1.02 - 2.32)	1.49***(1.27 - 1.76)
Know At least 3 FP Method					
No#					
Yes	9.26***(4.76 - 18.01)	17.14***(8.03 - 36.59)	5.85***(3.26 - 10.52)	#N/A	6.43***(3.59 - 11.52)
Visited Health Facility					
No#					
Yes	1.21*(1 - 1.45)	#N/A	1.17**(1.02 - 1.34)	#N/A	1.36***(1.19 - 1.54)

#Reference Categories; *p< 0.1, **p<0.05, ***p<0.001; N=Selected cases included in analysis; #NA=Variables eliminated from the equation/model due to insignificant nature while backward stepwise regression modelling.

Table 7: Adjusted Odds of using long-acting limiting methods (95% CI) among currently married women aged 15-49 years by background variables in the selected States of India, NFHS-4 (2015-16).

Background Variables	Bihar (N=28469)	Uttar Pradesh (N=54869)	Gujarat (N=13594)	Tamil Nadu (N=15499)	Maharashtra (N=16330)
Age of Respondents					
15-24#					
25 & above	4.95***(4.32 - 5.67)	7.55***(6.4 - 8.9)	6.0***(4.92 - 7.33)	4.34***(3.76 - 5.01)	7.28***(6.38 - 8.31)
Religion					
Muslim#					
Hindu	4.47***(3.98 - 5.01)	5.92***(5.41 - 6.48)	1.69***(1.45 - 1.98)	1.52***(1.29 - 1.79)	1.98***(1.76 - 2.23)
Others	2.06(0.72 - 5.92)	3.25***(2.11 - 4.99)	1.75**(1.1 - 2.77)	1.15(0.93 - 1.43)	2.23***(1.9 - 2.61)
Women's Education (in years of schooling)					
Illiterate					
Below 5 years	1.14**(1.01 - 1.3)	0.97(0.86 - 1.1)	1.08***(0.94 - 1.24)	1.19*(1 - 1.41)	0.92(0.79 - 1.06)
5-9 years	0.99(0.91 - 1.07)	0.81***(0.77 - 0.86)	0.69***(0.62 - 0.76)	0.98(0.89 - 1.08)	0.64***(0.57 - 0.71)
10-11 years	0.9*(0.8 - 1.02)	0.62***(0.56 - 0.69)	0.5***(0.43 - 0.58)	0.81***(0.72 - 0.91)	0.37***(0.32 - 0.42)
12 & more years	0.64***(0.56 - 0.73)	0.3***(0.27 - 0.33)	0.28***(0.24 - 0.32)	0.49***(0.44 - 0.55)	0.21***(0.18 - 0.24)
Wealth Index					
Poor#					
Middle	1.12**(1.02 - 1.23)	1.26***(1.19 - 1.35)	1.23***(1.09 - 1.38)	1.02(0.92 - 1.13)	0.97(0.87 - 1.09)
Rich	1.1(0.98 - 1.23)	1.32***(1.24 - 1.41)	1.15**(1.02 - 1.3)	1.22***(1.09 - 1.36)	1.1(0.98 - 1.23)
Caste					
Marginalized#					
Non-marginalized	1.13**(1.05 - 1.21)	#N/A	0.73***(0.67 - 0.8)	0.92**(0.85 - 1)	#N/A
Place of Residence					
Rural#					
Urban	1.48***(1.35 - 1.63)	#N/A	0.71***(0.65 - 0.77)	1.08*(1 - 1.16)	0.65***(0.59 - 0.7)
Son Preferences					
No son#					
At least 1 son	11.28***(9.06 - 14.05)	8.03***(6.87 - 9.39)	6.23***(5.29 - 7.34)	2.05***(1.89 - 2.22)	4.49***(4.04 - 4.98)
FLW interaction					
No#					
Yes	0.69***(0.64 - 0.74)	0.63***(0.59 - 0.67)	0.77***(0.7 - 0.84)	0.64***(0.58 - 0.71)	0.55***(0.5 - 0.61)
FP media exposure					
No#					
Yes	1.18***(1.11 - 1.26)	1.22***(1.16 - 1.28)	#N/A	1.15**(1.03 - 1.28)	1.25***(1.14 - 1.38)
Know At least 3 FP Method					
No#					
Yes	1.86***(1.7 - 2.04)	1.83***(1.53 - 2.18)	2***(1.76 - 2.27)	2.61***(2.17 - 3.14)	1.92***(1.67 - 2.2)
Visited Health Facility					
No#					
Yes	#N/A	1.06**(1.01 - 1.11)	0.86**(0.78 - 0.95)	1.37***(1.26 - 1.48)	0.89**(0.8 - 0.98)

#Reference Categories; *p< 0.1, **p<0.05, ***p<0.001; N=Selected cases included in analysis; #NA=Variables eliminated from the equation/model due to insignificant nature while backward stepwise regression modelling.