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Research Article

A District Level Investigation of Family Planning Program in Rural India: Stagnant or Progressive?

Nizamuddin Khan[1,*], Abhishek Gautam[2], Gopal Agrawal[3]& Tilottama Ghosh[4]

Abstract

Decentralized district-based health planning is essential in India because of large inter-district variations. Presently, there are 640 districts in India with an average population of two million per district. There is a need for studying the performance of family planning programs at district level. Current paper aims to explore the district-level differences in the use of modern family planning methods (mCPR) in rural areas, changes in contraceptive usage over time, and the association between changes and macro-level socio-demographic characteristics. Current paper uses data from the third round of District Level Household Survey conducted in 2007-08 (DLHS-3) and the latest round of National Family Health Survey conducted in 2015-16 (NFHS-4). The sample size for representing a district varies from 1000 to 1500 households in DLHS-3 and 836 to 1800 households in NFHS-4. Out of the total 640 districts as per Census 2011, the 506 districts which have common geographical boundary in DLHS-3 and NFHS-4 have been considered for analysis. Results show a wide variation in mCPR at district level in India. Only 91out of 506 districts have more than 64% mCPR, majority being from Andhra Pradesh, Haryana, Maharashtra, and Punjab. Six out of 10 districts have CPR below 50% and majority of them being from central, north-eastern, and eastern regions of India. Since 2007-08, there has been significant decline in them CPR among half of the districts (256/506), majority decline being in the southern and western regions of India. Only in 69 districts mCPR increased by more than 10 percentage points from 2007-08 to 2015-16. At the same time, it declined by more than 5 percentage points in one-third of the districts. Findings reveal that marginal changes in female literacy, child marriage, unmet need for spacing family planning methods, antenatal care and institutional delivery have no impact on mCPR over time, but significant changes in these contextual factors of more than 10 percentage points increase/decrease have greater impact on the mCPR decline/increase. Study suggests that policymakers and programme managers need to re-consider district specific strategies to address the barriers in the use of contraceptives in rural India to achieve family planning 2020 goals.

Introduction

India, home to 17.5% of the world population, has a potential to influence the global health indicators due to its sheer population size. In recent years, it has been widely recognized that without increasing access to quality family planning services and meeting unmet need for contraception, it would be difficult to reduce prevailing rates of maternal and child mortality (UN Population Division 2015). The London summit of family planning in 2012 provided a platform to bring family planning program back to the centre stage. As part of its FP2020 efforts, India is now committed to cover at least 48 million additional women which would mean reaching contraceptive prevalence rate (CPR) of 63.7% by the year 2020.India is the first country in the world to initiate National Family Welfare Programme in 1951 to reduce birth rate to the extent necessary for population stabilization. The

[1]Senior Program Officer, Population Council, Zone 5A, Ground Floor, India Habitat Centre, Lodi Road, New Delhi-110003, India
[2]Technical Specialist, International Centre for Research on Women (ICRW), C-59, South Ext, Part II, New Delhi-110049, India
[3]Program Officer, Population Council, Zone 5A, Ground Floor, India Habitat Centre, Lodi Road, New Delhi-110003, India
[4]Research Associate, Cooperative Institute for Research in Environmental Sciences, University of Colorado at Boulder, Boulder, CO 80309
*Corresponding Author: Nizamuddin Khan, Email: iipsnizam@yahoo.com; nkhan@popconcil.org

National Health Policy (NHP) developed in 1983, emphasized the need for 'securing the small family norm through voluntary efforts and moving towards the goal of population stabilization' (NHP 1983). Later, the National Population Policy (NPP 2000) affirms the commitment of government towards voluntary and informed choice and consent of citizens while availing the target free approach in administering family planning services. The immediate objective was to expand and ensure quality family planning services in the country to address the unmet need for contraception.

Since its inception, the family planning programme in India has achieved significant growth in terms of service delivery points and the range of contraceptive methods offered with the help of numerous local and international partners. The contraceptive prevalence rate (CPR) in India has increased from 13% in 1970 to 56% in 2006 and total fertility rate (TFR) declined by more than half (from 6.0 in 1970 to 2.7 in 2005-06) (United Nations, 2009).

Despite universal implementation approach of family welfare programme, large variations and diversities in the demographic and socio-economic situations and across different cultural settings between and within districts and regions exist in the country. Fertility remains very high in most of the northern and central states of India. The contraceptive usage among these states is relatively lower than the southern and western states (NFHS-4). Also, the findings of recently completed fourth round of the National Family Health Survey (NFHS-4) indicate that overall TFR in the country has declined from 2.7 (in 2005-06) to 2.2 (in 2015-16). However, at the same time, the overall CPR has declined by 2 percentage points (NFHS-4 Fact Sheet), which is not encouraging.

Studies in India have pointed out significant gaps among family planning service providers in their knowledge and practice (Roy and Verma, 1999). The quality of family planning services is poor in the northern states of the country, particularly in the states of Uttar Pradesh and Bihar in terms of provider and method availability, counseling and attention to follow-up of new clients (Khan, et al., 1999; Santhya, 2004 and Timothy, 2013). Recognizing the need and challenges in implementation of family welfare program, government of India continues to adopt new innovative approaches for increasing accessibility and availability of quality family planning services by means of new policy reformulations. The National Rural Health Mission (NRHM) launched in 2005 led to a significant strengthening of public health systems. Large number of Accredited Social Health Activists (ASHAs) were introduced, who brought the community closer to public services, improving utilization of services and health behaviours (NRHM, 2005). The family planning services are provided to rural communities at the household level through the ASHAs. Moreover, the latest National Health Mission (NHM) encompasses two Sub-Missions, the National Rural Health Mission (NRHM) and the newly launched National Urban Health Mission (NUHM).

Issues and hypothesis

Modern family planning methods are widely believed to influence fertility reduction worldwide (World Bank, 2009). The use of contraceptive methods has not only improved the health-related outcomes such as reduced maternal mortality and infant mortality (Ahmed and Mosley, 2002;Ahmed, et al., 2012; Bhutta, et al., 2014; Rutstein and Winter, 2015), but also contributed to improvements in the well-being and autonomy of women (Canning and Schultz, 2012; Schultz and Joshi, 2013). However, women across the world continue to lack access to quality family planning services that provide high-quality information, counseling and care necessary to meet their fertility desires. Numerous studies over the last two decades support this notion, validating a close association between quality of care and initiation and continuation of contraceptives in different settings (Jain, 1989; Judith Bruce, 1990; Vinod, et al., 1999).

Several hypotheses on the relationship of demographic and socio-cultural factors with contraceptive use have been tested using Indian national level demographic survey including the National Family Health Survey (NFHS), the District Level Household Survey (DLHS), and Sample Registration System (SRS) data. The key explanatory variables were place of residence, female literacy, and women's age at marriage (Guhbhaju, 2009; Santhya, et al., 2010). Previous studies have clearly shown that the better educated a woman is, the more likely she is to use contraception (Jain, 1989; Judith, 1990; Vinod, et al., 1999; Koenig,et al., 2000).

Son preference over daughter is a recognized social determinant of gender discrimination. Studies from Bangladesh, India, Nepal, Pakistan, and Sri Lanka have confirmed the widespread presence of son preference in South Asia and its impact on reproductive attitudes are well established (Stash, 1996; Fred, 2001; Bairagi. 2001; Kamal, 2008, Jayaraman, et al., 2009; Kamal and Hassan, 2013). Studies also suggest that the increased use of maternal and child health services contribute to greater use of contraceptive. Zerai and Tsui (2001) reported in Bolivia, Egypt, and Thailand and Mishra, et al., 1998, reported in India a strong influence of the ante-natal care (ANC) use on subsequent use of modern contraception. Several studies in India have shown that providers have a preference for promoting ANC and institutional delivery but are less likely to provide advice on contraception (Ahmad, et al., 2012; Prashant, et al., 2012; Yadav and Dhillon, 2015).

Drawing from the above background, the present study aims to study a) the district-level differences in the use of modern family planning methods in terms of modern contraceptive prevalence rate (mCPR) in rural areas; b) the changes in contraceptive usage in these rural districts over time; and c) the association between changes and macro-level indicators such as female literacy, early marriage, unmet need for family planning, antenatal care, and institutional delivery. The hypothesis to be tested in present paper - Is there any significant relationship between macro level indicators and mCPR in the districts over a period of time?

Table 1: Number of districts included and excluded by states, India

State/UTs	Total number of districts	Districts included	District excluded		
		Common districts[1]	New districts[2]	Urban districts[3]	Other districts[4]
Andaman & Nicobar Islands	3	1	2	0	0
Andhra Pradesh	13	13	0	0	0
Arunachal Pradesh	16	10	6	0	0
Assam	27	16	10	1	0
Bihar	38	36	2	0	0
Chandigarh	1	0	0	1	0
Chhattisgarh	18	14	4	0	0
Dadra & Nagar Haveli	1	1	0	0	0
Daman & Diu	2	1	0	1	0
Goa	2	2	0	0	0
Gujarat	26	23	1	2	0
Haryana	21	16	4	1	0
Himachal Pradesh	12	12	0	0	0
Jammu & Kashmir	22	6	15	1	0
Jharkhand	24	12	12	0	0
Karnataka	30	23	6	1	0
Kerala	14	14	0	0	0
Lakshadweep	1	0	0	1	0
Madhya Pradesh	50	38	10	2	0
Maharashtra	35	32	0	3	0
Manipur	9	9	0	0	0
Meghalaya	7	7	0	0	0
Mizoram	8	7	0	1	0
Nagaland	11	0	0	0	11
NCT Delhi	9	0	0	2	7
Odisha	30	30	0	0	0
Puducherry	4	2	0	2	0
Punjab	20	13	7	0	0

Rajasthan	33	29	4	0	0
Sikkim	4	4	0	0	0
Tamil Nadu	32	25	4	3	0
Telangana	10	8	0	2	0
Tripura	4	4	0	0	0
Uttar Pradesh	71	69	2	0	0
Uttarakhand	13	13	0	0	0
West Bengal	19	16	2	1	0
All	**640**	**506**	**91**	**25**	**18**

[1]No change in geographical boundary since 2001Census
[2]Either new district created or boundary changed since 2001 Census
[3]100% sample drawn from urban areas either in NFHS-4 or DLHS-3
[4]Data not available either in DLHS-3 or in NFHS-4

Data and methods

The administrative divisions of India, the states and the union territories, are subdivided into districts. Districts are the cutting edge of administration and contain both rural and urban population. According to Census 2011, there are 640 districts in India with an average population of two million. Family planning decisions tend to be highly interdependent, owing inter alia to the influence of social norms and diffusion effects. To capture these social dimensions on family planning, district is considered as the unit for analysisin the current paper.

The Ministry of Health and Family Welfare (MoHFW), Government of India has designated the International Institute for Population Sciences (IIPS), Mumbai as the nodal agency for conducting the District Level Household Survey (DLHS) and National Family Health Survey (NFHS) in India. Both the surveys are designed to provide information on family planning, maternal and child health, reproductive health of currently married women aged 15-49 years. Four rounds of DLHS and NFHS have been conducted since the first round of survey conducted respectively in 1998-99 and 1992-93. The present study uses the data of third round of DLHS (DLHS-3) conducted in 2007-08 and the latest fourth round of NFHS (NFHS-4) conducted in 2015-16.Both the surveys provide district level information on various population and health aspects. The sample size for representing a district varies from 1000 to 1500 households in DLHS-3 and 836 to 1800 households in NFHS-4. Out of 640 districts, the present paper focuses on 506 districts which are common and have same geographical boundary in both DLHS-3 and NFHS-4. The paper excludes 28 newly formed districts carved out from 63 old districts after 2001 Census, and also those districts where 100% population is urban or data for the districts werenot available in DLHS-3 or NFHS-4. Our final sample consists of 506 districts, covering all the states and union territories and over 90% of India's rural population. The ‘missing states’ are Nagaland, where no survey took place in DLHS-3 and Delhi where rural estimates were not available in NFHS-4. Table 1 provides the state-wise details of districts.

Description of variables used

Table 2 summarizes the variables used in the present study. The t-test statistics is applied to test significant change in mCPR between 2007-08 and 2015-16. The use of modern family planning methods noted as mCPR is the dependent variable in the present study. mCPR is defined as the percentage of currently married women aged 15-49 years who currently use modern methods of contraception. In this study, female/male sterilization, Intra-Uterine Contraceptive Device (IUCD), Oral Contraceptive Pills (OCPs), Condom, and Injectables are considered as the modern methods of contraception. Results indicate that mCPR significantly decreased by 2 percentage points from 47% in 2007-08 to 45% in 2015-16. The standard deviation of mCPR (17.3 in 2007-08 and 17.4 in 2015-16) suggests that wide variations exist in mCPR at district level. Review of literature suggests that female literacy, child marriage, unmet need for spacing, sex ratio, antenatal care, and institutional delivery are significant predictors of the use of modern contraceptives. Female literacy has significantly increased from 51% to 65% between 2007-08 and 2015-16. At the same time, inter-district variations

in female literacy havedeclined. However, the study has found wide inter-district variations in higher education attainment among women in rural India.

Table 2: Details of indicators from DLHS-3 and NFHS-4 and percentage change

Indicator	Indicator definition	DLHS-3 2007-08 Mean (SD)	NFHS-4 2015-16 Mean (SD)	Change# Mean difference (95% CI)
Modern contraceptive prevalence rate (mCPR)	Percentage of currently married women aged 15-49 years who currently use modern method of contraception or whose husbands are using a contraceptive method. Female/Male Sterilization, Intra-Uterine Contraceptive Device (IUCD), Oral Contraceptive Pills (OCPs), Condom, and Injectable are considered as the modern methods of contraception.	47.5 (17.3)	45.4 (17.4)	-2.1*** (-3.2, -1.1)
Female literacy	Percentage of women age 15-49 yeas who are literate.	51.0 (20.3)	64.5 (15.5)	13.5*** (12.8, 14.3)
Women with 10+ years of schooling	Percentage of women who have completed 10 or more years of schooling.	13.3 (10.2)	29.1 (14.4)	15.8*** (15.2, 16.3)
Child marriage	Percentage of currently married women age 20-24 years married before age 18 years.	43.7 (21.0)	26.9 (14.4)	-16.7*** (-17.9, -15.6)
Unmet need for spacing methods	Percentage of currently married women who are neither in menopause or had hysterectomy nor are currently pregnant and who want more children but after two years or later and are currently not using any family planning method.	5.1 (2.6)	6.4 (3.4)	1.3*** (1.0, 1.5)
Sex ratio at birth	Sex ratio at birth for children born in the last five years preceding the survey date (females per 1,000 males).	917 (127)	939 (129)	22.0** (6.3, 37.7)
ANC in first trimester	Percentage of mothers who had antenatal check-up in the first trimester for their last birth.	56.9 (17.3)	59.1 (17.8)	2.2** (0.9, 3.5)
Institutional delivery	Percentage of live births which took place in a public or private health facility.	44.7 (23.9)	78.3 (17.0)	33.5*** (32.2, 34.9)
Geographical region (no. of districts)				
North (89)	Dummy = 1 for districts in Rajasthan, Jammu & Kashmir, Haryana, Punjab, Uttarakhand, Himachal Pradesh			
Central (121)	Dummy = 1 for districts in Uttar Pradesh, Madhya Pradesh, Chhattisgarh			
East (94)	Dummy = 1 for districts in Bihar, Odisha, Jharkhand, West Bengal			
North-east (57)	Dummy = 1 for districts in Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Sikkim, Tripura			
West (59)	Dummy = 1 for districts in Maharashtra, Gujarat, Goa, D&N Haveli, Daman & Diu			
South (86)	Dummy = 1 for districts in Karnataka, Tamil Nadu, Kerala, Andhra Pradesh, Telangana, Andaman & Nicobar Islands, Puducherry			

Note: #Percentage point change from 2007-08 to 2015-16; CI: Confidence interval
*Significant at 10% level; **Significant at 5% level; ***Significant at 1% level using independent samples t-test

Significant decline is observed in child marriages from DLHS-3 to NFHS-4. Surprisingly, there is a significant increase in unmet need for family planning during the period 2007-16. Sex ratio has improved over time, but still there exists a wide variation among the districts in India. There is marginal improvement in the practices of availing antenatal care services in the first trimester of pregnancy during 2007-08 and 2015-16. The institutional deliveries in rural India have increased from

44.7% in 2007-08 to 78.3% in 2015-16. India is demographically a very diverse country with wide intra- and inter-district variations in demographic and socio-cultural characteristics of the population. To capture the regional variations in mCPR, we have used regional dummy variables. The whole country is divided into six regions: North, Central, East, North-east, West, and South. More detailed information on the regional classification of the country and states and number of districts falling in each region are provided in Table 2.

Statistical approach

We used both bi- and multi-variate statistical methods. Descriptive t-tests were performed to examine the association between explanatory variables- female literacy, child marriage, unmet need for mCPR, sex ratio, antenatal care, institutional delivery, and mCPR. Panel regression models were fitted (generalized least square with fixed effect and random effect) to understand the association of change in mCPR with change in population characteristics over time. Panel data allows to control for variables which can't be observed, such as cultural factors that change over time but not across districts. In the present study, panel data refers to the pooling of cross-sectional observations of districts measured at two points of time, 2007-08 and 2015-16. Our panel regression models take the form of:

$$mCPR_{dt} = \alpha_d + \beta X_{dt} + \gamma_t + \varepsilon_{dt}$$

Where, $mCPR_{dt}$ is the modern contraceptive prevalence rate in district d at time t, α_d is a district-specific effect, β is a vector of coefficients, X_{dt} is a vector of explanatory variables, γ_t is a time dummy and ε_{dt} is an error term.

We estimated the district-specific effects (α_d) in two ways: fixed and random effects. In the fixed-effects approach, the district effect is estimated as the coefficient of a district-specific dummy variable by ordinary least squares (OLS). In the random-effects approach, the district-specific effect is modeled as an additional time-invariant error term for each district. The composite error term, $\alpha_d + \varepsilon_{dt}$, has a particular covariance structure, allowing estimation by generalized least squares (GLS) (Hsiao 1986). The random-effects approach has the advantage of saving many degrees of freedom (using a dummy for every district halves the number of observations). Also, unlike the fixed-effects approach, it does not preclude the inclusion of time-invariant variables such as regional dummies. However, the random-effects approach assumes that the district-specific random error is uncorrelated with the other explanatory variables, which may not be the case. To check whether the random-effects approach is appropriate, we tested for the orthogonality of the random effects and the regressors using a test devised by Hausman (1978). To perform all tests (including tests of significance and the Hausman test), we used the robust Huber-White estimate of variance, which allows for different error variances across districts as well as correlation across time for given districts.

Results

Current situation of mCPR

India Map 1 depicts district-level variations in mCPR. Fifty-eight percent of the districts (294/506) in the country have mCPR below 50% (below 30% in 99 districts and 30-50% in 195 districts). All the poor performing 294 districts belong to central, eastern, and north-eastern regions of the country. Only 91 districts have mCPR more than 64%, majority of them are from Andhra Pradesh, Haryana, Maharashtra and Punjab.

Table 3 presents the categorization of the districts by current levels of mCPR against the FP2020 target (63.7%) as well as the average change in mCPR from 2007-08 to 2015-16. All the districts (415) of Assam, Arunachal Pradesh, Bihar, Jharkhand, Kerala, Odisha, Manipur, Meghalaya, Mizoram, Tripura, and Uttar Pradesh are lagging behind the FP2020 target. On the other hand, majority of the districts of Andhra Pradesh (11), Haryana (14), Maharashtra (23), and Punjab (9) have already achieved the FP2020 target. Results depict that mCPR has declined in 256 districts between 2007-08 and 2015-16 (Table 3). Majority of such districts are from Bihar, Gujarat, Karnataka, Madhya Pradesh, Rajasthan, Tamil Nadu, and Uttar Pradesh. In almost all the districts of Union territories, Goa, Himachal Pradesh, Manipur, Mizoram and Telangana, mCPR has declined.

India Map 1: Current use of modern contraception (mCPR) in the districts of India

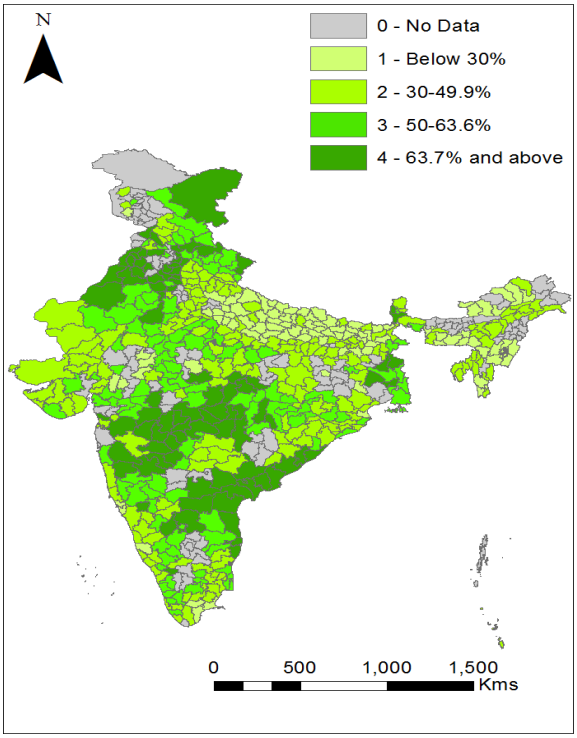
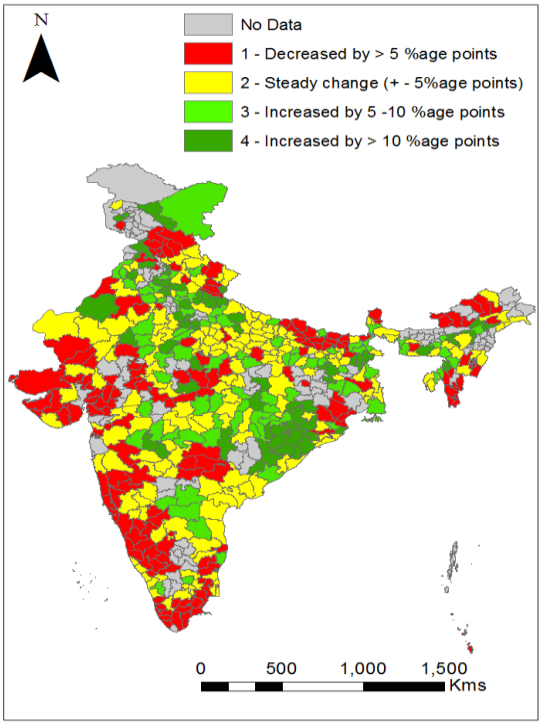


Table 3: Status and change in modern contraceptive prevalence rate (mCPR) in districts

State (no, of districts)	Current status of mCPR		Change in mCPR from	
	Number of districts		Number of districts with	
	Below target	Above target	Decline	Increase
A & N Islands (1)	1	0	1	0
Andhra Pradesh (13)	2	11	4	9
Arunachal Pradesh (10)	10	0	10	0
Assam (16)	16	0	2	14
Bihar (36)	36	0	21	15
Chhattisgarh (12)	12	2	2	12
Dadra & Nagar Haveli (1)	1	0	1	0
Daman & Diu (1)	1	0	0	1
Goa (2)	2	0	2	0
Gujarat (23)	22	1	22	1
Haryana (16)	2	14	2	14
Himachal Pradesh (12)	10	2	12	0
Jammu & Kashmir (6)	5	1	1	5
Jharkhand (12)	12	0	4	8
Karnataka (23)	21	2	17	6
Kerala (14)	14	0	11	3
Madhya Pradesh (38)	31	7	20	18
Maharashtra (32)	9	23	11	21
Manipur (9)	9	0	9	0
Meghalaya (7)	7	0	3	4

Mizoram (7)	7	0	7	0
Odisha (30)	30	0	6	24
Puducherry (2)	1	1	2	0
Punjab (13)	4	9	4	9
Rajasthan (29)	25	4	16	13
Sikkim (4)	3	1	2	2
Tamil Nadu (25)	22	3	22	3
Telangana (8)	5	3	7	1
Tripura (4)	4	0	2	2
Uttar Pradesh (69)	69	0	22	47
Uttarakhand (13)	11	2	8	5
West Bengal (16)	11	5	3	13
Total (506)	**415**	**91**	**256**	**250**

India Map 2: Change in modern contraceptive prevalence rate (mCPR) between 2007-08 and 2015-16 in the districts of India



India Map 2 shows the changes in mCPR between 2007-08 and 2015-16. The mCPR declined by more than 5 percentage points in 167 districts which are mostly from northern and southern regions of the country. In more than one-third of the districts (183/506), mCPR changed steadily (increased/decreased by less than five percentage points) mostly in northern, central, and western regions of the country. Only 69 districts recorded more than 10 percentage points increase in the mCPR and 17% of districts (87/506) have shown 5-10 percentage points increase in the last 8 years.

Association of mCPR with socio-demographic characteristics

Table 4 shows how mCPR changed with the changes in socio-demographic condition of population between 2007-08 and 2015-16 in the rural districts of India. Overall, mCPR has declined by 2.2 percentage points in the last 8 years. We have focused on variables which are theoretically expected to influence mCPR but not be influenced by it. Examples of variables that stand in a relation of mutual interdependence with mCPR are unmet need for spacing methods, sex ratio at birth and

antenatal care (Bhargava, 1998; Das andbhat, 1997). For instance, unmet need for family planning may both lead to and result from lower mCPR. Similarly, one should expect mutual influences between sex ratio at birth and mCPR due to son preference (Arnold, et al., 1998; Arokiasamy, 2000; Arnold, 2001).

Table 4: Association between change in modern contraceptive prevalence rate (mCPR) and change in selected indicators from 2007-08 to 2015-16

Selected indicators	Average percentage point change in mCPR	95% Confidence Interval (CI)		Number of districts
		Lower bound	Upper bound	
Change in female literacy				
Increased <10 %age points	-6.6	-8.6	-4.5	169
Increased 10-20 %age points	-1.6	-3.3	-0.1	203
Increased >20 %age points	2.3	1.1	4.1	134
Change in 10+ years of female education				
Increased <10 %age points	-4.7	-7.4	-2.0	108
Increased 10-20 %age points	-0.2	-1.4	1.4	249
Increased >20 %age points	-3.9	-5.9	-1.9	149
Change in child marriage				
Decreased >20 %age points	0.7	-0.8	2.1	186
Decreased 5-20 %age points	-2.3	-4.0	-0.6	227
Decreased <5 %age points or increased	-7.5	-10.3	-4.6	93
Change in unmet need for spacing family planning methods				
Decreased	2.4	0.8	4.1	171
Increased up to 3 %age points	-2.6	-4.0	-1.2	233
Increased >3 %age points	-8.8	-11.5	-6.1	102
Change in antenatal check-up in first trimester of pregnancy				
Decreased >10 %age points	-10.5	-13.2	-7.7	106
Decreased up to 10 %age points	-2.3	-4.9	-1.0	130
Increased	1.5	0.3	2.7	270
Change in institutional delivery				
Increased <20 %age points	-11.4	-14.1	-8.7	95
Increased 20-40 %age points	-2.5	-4.1	-0.8	214
Increased >40 %age points	2.6	1.3	4.0	197
Geographical region				
North	-0.1	-2.5	2.4	89
Central	1.3	-0.5	3.1	121
East	2.2	-0.2	4.6	94
North-east	-6.2	-10.4	-2.0	57
West	-5.7	-8.7	-2.8	59
South	-8.8	-11.3	-6.4	86
Overall	**-2.2**	**-3.2**	**-1.1**	**506**

Table 4 reveals that improvements in female literacy, antenatal care, and institutional delivery in last 8 years are positively associated with the change in mCPR. In contrast, change in child marriage and unmet need for spacing methods have negatively influenced the mCPR in the rural districts of India. mCPR increased in those districts where significant change was detected in female literacy (more than 20 percentage points increase). However, this association wasin reverse direction in the districts where marginal increase was observed in female literacy (<20 percentage points). Child marriage and mCPR shows direct association as the districts where child marriage has decreased by more than 20 percentage points, mCPR increased by three times in past eight years. Change in unmet need for spacing family planning methods is positively associated with mCPR. The districts where there has been an increase of more than three percentage points in unmet need, the change in mCPR declined by 9 percentage points. Whereas, in the districts where unmet need declined, average change of 2.4 percentage point is observed in mCPR. Change in antenatal check-up in first trimester of pregnancy has greater influence on mCPR, as districts where there has been an

increase in antenatal check-up, change in mCPR is positive. The districts where ANC declined by more than 10 percentage points, the change in mCPR declined by 11 percentage points. Institutional delivery has gone up in the entire country and the results also reveal the association in positive direction. The increase in mCPR can be seen in the districts where institutional delivery increased more than 40 percentage points between 2007-08 and 2015-16. However, districts where there has been marginal change in institutional delivery, no change has been observed in mCPR, districts where change in institutional delivery increased by less than 20 percentage points the change in mCPR declined by 11 percentage points. mCPR has significantly declined in the districts of southern, western and north-eastern regions of India between 2007-08 and 2015-16. However, eastern and central region districts show increase in mCPR.

Table 5 presents results from the multivariate panel regression models fitted to examine how the long-term changes in population characteristics and maternal and child health practices contribute to the changes in mCPR in rural districts of India. We estimated both fixed- and random-effects models. No regional dummies were estimated in the fixed-effects specification, where they are superseded by district dummies. Both models broadly confirm the cross-sectional findings. The explanatory variables account for more than half of the overall variation in mCPR across districts in both the models (Pseudo-R2: Model I-0.50; Model II- 0.64). When the district effects are taken as fixed, the coefficients are estimated with less precision except the time dummy. This is because a great deal of the cross-sectional information is absorbed in the district-specific dummies. Coefficient of female literacy, child marriage, antenatal care in first trimester and institutional delivery remains positive and highly significant. On the other hand, women with more than 10 years of schooling and unmet need for spacing family planning methods show significantly negative association with mCPR over time. Regional location exerts a strong influence on mCPR even after controlling for other factors. Showing the negative association with mCPR could be the regional effect (regional dummy included in model).

Table 5: Results from GLS panel regression
(Dependent variable: mCPR Panel 2007-08 – 2015-16)

Selected indicators	**GLS-Fixed Effect** Coefficient(95% CI)	**GLS-Random Effect** Coefficient(95% CI)
Female literacy	0.044(-0.095, 0.183)	0.234***(0.151, 0.317)
Women with 10+ years of schooling	-0.023(-0.158, 0.112)	-0.325***(-0.418, -0.232)
Child marriage	-0.034(-0.111, 0.043)	0.053*(0.002, 0.108)
Unmet need for spacing family planning methods	-1.183***(-1.477, -0.890)	-1.853***(-2.088, -1.618)
ANC in first trimester	0.209***(0.147, 0.270)	0.190***(0.139, 0.242)
Institutional delivery	0.201***(0.127, 0.276)	0.112***(0.060, 0.164)
Geographical region (dummy)		
North^{R}	–	Reference
Central	–	-11.608***(-14.759, -9.210)
East	–	-14.850***(-17.804, -11.895)
North-east	–	-20.346***(-24.017, -16.675)
West	–	-3.531*(-6.728, 0.334)
South	–	-4.524**(-7.532, -1.516)
2015-16 time dummy	-8.669***(-12.049, -5.288)	-1.134(-3.353, 1.085)
Constant	32.314***(23.752, 40.875)	40.361***(34.431, 46.290)
R^2 (within, between, overall)	0.38, 0.52, 0.50	0.35, 0.68, 0.64
F, (p-value)	43.77 (0.000)	-
Wald χ^2 (p-value)	-	1305.33 (0.000)
Sample size (no. of groups)	1012 (506)	1012 (506)
Intra-class correlation (rho)	0.73	0.52
GLS vs. FE, chi2(7) (p-value)		74.28 (0.000)

GLS: generalized least squares
*Significant at 10 percent level; **Significant at 5 percent level; ***Significant at 1 percent level
The Hausman test (GLS vs. FE) is a test of random versus fixed effects.

In particular, compared to the default region (north as reference), mCPR is distinctly lower in central, east and north-east regions of India. Under the assumption that the district-specific effects are random, the results are very similar with the cross-sectional results. However, the large standard errors suggest that the coefficients are not significantly different from the random-effects estimates.

Discussion and conclusion

The findings above are in agreement with the available evidence on the relationship between use of modern contraceptives and female literacy, utilization of maternal and child health (MCH) services and other socio-demographic population characteristics at district level. It is observed that out of 506 common districts in the country, half of them have mCPR below 50% and one-fifth have mCPR below 30%. Majority of poor performing districts belong to the states of Bihar, Karnataka, Gujarat, Madhya Pradesh, Rajasthan, Tamil Nadu, and Uttar Pradesh. Only 91 districts have mCPR more than FP2020 target, and most of them are from the states of Andhra Pradesh, Haryana, Maharashtra and Punjab.

The overall use of modern contraceptive declined by two percentage points in the last 10 years, raising concerns around the government's family planning programme in the country. However, the decrease in contraceptive prevalence does not corroborate with other fertility and family planning indicators like total fertility rate which has declined and awareness about use of contraceptive where there has been substantial increase over time. There is a need to further investigate and conduct in-depth research to understand the causality.

Examples of variables that stand in a relation of mutual interdependence with mCPR are unmet need for spacing methods, sex ratio at birth and antenatal care (Bhargava, 1998; Das and Bhat, 1997). mCPR did not change in the districts where there has beena marginal change (increase/decrease) in selected indicators. mCPR increased in those districts where significant change wasdetected in female literacy (more than 20 percentage points increase).

The present analyses help to understand these relationships beyond the well-known facts in several respects. First, the multivariate approach helps to establish the robust connection of female education, child marriage and other program parameters with mCPR. Among the parameters considered in the analysis it is observed that child marriage, unmet need for spacing methods, female literacy and interaction with health care providers for availing the services showed a significant effect on mCPR. On the other hand, child marriage and unmet need for spacing family planning methods has significant effect on mCPR. The robustness of the coefficients indicates that there is a strong and direct link between the selected predictors and mCPR and is stronger than the joint influence of selected and unobserved variables. The inclusion of district-specific effects substantially enhances the plausibility of this interpretation.

There are socio-demographic and cultural practices which have direct as well as indirect influences on quality of mCPR in rural areas (Koenig, et al., 2000; Bhatnagar, et al., 2011; Koringa, et al., 2015). The present study has documented wide gaps in improvement in the mCPR among the rural districts in the last eight years, influenced by the change in socio-demographic and program characteristics (female literacy, child marriage, unmet need for family planning, antenatal care in first trimester and institutional delivery). The results also highlight the role of programme variables such as antenatal care and institutional delivery. It is evident that a marginal increase in antenatal check-up during the first trimester of pregnancy increases the mCPR. However, it does not show similar pattern for institutional delivery. The mCPR increased in those districts where percent institutional delivery increased by more than 40 percentage points (see findings from table 4). This finding has a clear implication for family planning policies and programmes. This suggests how the availability, accessibility and quality of reproductive health services matter to achieve our family planning targets. The decline in the use of modern contraceptive methods in the districts where institutional delivery increased by less than 40 percentage points could be due to the facts that the prime focus of service providers in these districts was to increase institutional delivery and they could not provide related MCH services.More research is needed to understand the actual reasons.

Unmet need for family planning is highly associated with the mCPR at both points of time. Furthermore, higher education of women (10+ years of schooling) did not show as having much impact on mCPR, which seems to be an implausible relationship and further micro data based research is required to understand this relationship. This study has documented interesting findings on the relationships between female literacy, child marriage and mCPR. The mCPR has increased only when female literacy increased by more than 20 percentage points and child marriage declined by 20 percentage points or greater. This finding suggests that the increase or decrease in female literacy and child marriage by less than 20 percentage points could be natural, and thus there is no substantial effect of these program variables on mCPR.

Regional analyses of the distribution of the mCPR highlight the extent of disparity in uptake of family planning services across the regions and among the districts in India, even though the family welfare programs are uniformly implemented across all the states and union territories of India. To ensure a greater thrust on spacing methods, the health ministry has also created specific schemes for ASHAs to encourage promoting spacing methods and motivating the couples to have spacing in births. Under the schemes, ASHAs provide counseling to newly married couples to ensure delay of two years before having their first child after marriage and couples who already have a child are encouraged to have a spacing of three years after the birth of the first child. Between 2007-08 and 2015-16, the mCPR has significantly declined in north-eastern, eastern, and central regions compared to the northern region of the country.

The decrease in mCPR in 2015-2016 as compared to 2007-2008 is indeed alarming. Such poor family planning performing districts in this span are mostly from south, west, and north-eastern regions of the country. This might be a case of the preferred method not being available, as frontline family planning health workers including ASHAs, medical stores, and primary health centres (PHC) may not be having more than one or two government-promoted brands, particularly in rural areas. The available methods may not be that interesting or not that pleasurable to the couples. Despite the greater access to knowledge, fewer people are accessing contraceptives, by choice or for factors that still require more in-depth research (Chandrasekaran, 1956; Hetal, et al., 2015).

Contraceptive practice is based on community acceptance irrespective of uniform implementation of family planning programs in an administrative area. It has been seen that in some of the districts few methods get well accepted by the community in comparison to other districts, and it becomes an integral part of community practice; and accordingly demand gets addressed at lower administrative level in those areas. In Uttar Pradesh, Jhansi and Kanpur are the districts where female sterilization is high compared to other districts due to demand from community irrespective of same policy and program implementation for all districts. Despite uniform policy and program implementation at the district level, the prevalence of mCPR in community varies from one district to another. Decentralized district-based health planning is essential in India because of the large inter-district variation (Roy, et al., 2003; Pachauri, 2014).

The remainder, reflected in "time" dummy, involves a shift in the structural relation between mCPR and the explanatory variables included in our analysis. Possible interpretations of that shift include inter-district diffusion effects, the expansion of family planning programs, and the delayed impact of earlier improvements in economic and social conditions. Family welfare programme can use community intervention to address cultural beliefs and customs to increase approval of family planning. Districts with higher than expected use may be examples of good practice that providers and policymakers could learn from to improve policy and practice, and districts of lower use could be targeted for future interventions. This study is based on a nationally representative data, relying solely on macro-level quantitative data, district being a unit of analyses. It provides a first-hand quick understanding of the effects of specific socio-cultural factors that influence the contraceptive use. However, the geographical variation of mCPR needs further research by using micro-level data, particularly identifying the contextual factors (age, education, standard of living, ethnicity, religion, number of living children, son preference, etc.) contributing to the uptake of contraception in high prevalence districts and the low prevalence districts.

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