

A Cross-Sectional Analysis of Fertility Patterns in India: Evidence from NFHS-5

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Abstract

The present study examines some dimensions of fertility patterns across states in India using recent data on key indicators obtained from Round 5 of NFHS. The analysis of data shows considerable state-level heterogeneity in total fertility rate, total wanted fertility rate, early childbearing, and preference for sons. The study establishes that the state-level fertility patterns are correlated with socioeconomic covariates, like wealth, rural population, literacy levels, exposure to media, early marriage, and use of modern family planning practices. The classification of states based on total fertility, early marriage, adoption of modern family planning practices, and early childbearing indicates that fertility patterns are better understood in the context of the prevailing diversity in India's socioeconomic and cultural features. Using the NFHS classification of states into six regions- central, east, north, northeast, south, and west regions, the differences in means of observed fertility across regions are not found to be statistically significant for total fertility rate and total wanted fertility rate. We find the difference between east and northeast regions vs north region to be statistically significant for early childbearing and, east and west regions vs south to be significant in case of the preference for sons. Overall, the presence of overwhelming differences in regional patterns in the fertility indicators is not seen and we find no statistically significant evidence of a North-South divide. Our analysis shows that recognizing

within-region variations in fertility provides a better understanding of fertility patterns and is useful and relevant for policy purposes.

Keywords: Total Fertility; Total wanted fertility; Early childbearing; Son preference; Socioeconomic features; Regional variations

1. Introduction

While India's overall fertility rate of 2.0 children per woman is slightly lower than the replacement rate, there are wide spatial differences within the country. Several studies have examined fertility patterns and preferences and their determinants at the all-India level and for selected states. However, there is limited literature on the study of fertility patterns and behaviour across all 36 states and union territories (UTs) of India using the most recent data on such patterns. The present study seeks to fill the research gap by using recent national-level survey data from NFHS-5 to study fertility patterns across all states/UTs in India. The objectives of the study are (a) an empirical assessment of fertility variations across states/UTs in India in the dimensions of total fertility rate (TFR), total wanted fertility rate (TWFR), early childbearing given by teenage pregnancy and preference for sons by men and women (b) to examine the statistical significance of socioeconomic correlates of fertility behaviours like wealth, rural population, literacy levels, exposure to media, early marriage, and use of modern family planning practices etc., and (c) to statistically test for regional patterns in fertility

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behaviours to better understand fertility variations across the six regions as per NFHS classification, namely, central, east, north, northeast, south, and west regions.

In section 2 we provide a brief review of literature. In section 3, the data and methods used in the study are elaborated. Section 4.1 describes the spatial variations in fertility and related parameters. Section 4.2 presents the results from the correlation analysis of fertility behaviour and socioeconomic characteristics. Section 4.3 attempts to classify states/UTs based on fertility behaviour patterns followed by statistical tests for regional variations in fertility behaviour across the six regions of India in Section 4.4. Section 5 presents the discussion of the results and Section 6 concludes.

2. Literature Review

This paper examines state-level patterns in some important dimensions of fertility namely total fertility rate (TFR), total wanted fertility rate (TWFR), early childbearing given by teenage pregnancy i.e. women aged 15-19 who begin childbearing, and preference for sons by men and women. Literature has emphasized the role of individual or family socioeconomic features like literacy, wealth or income of the household, location i.e. rural or urban, status of women, religion, caste, etc. as being significant in influencing these dimensions of fertility patterns and preferences. In addition, relative bargaining power and negotiation between partners is also seen as influencing fertility preferences and patterns. The availability of family planning health systems is also a key factor in the adoption of contraception to determine spacing and limiting of fertility.

The prevalence of spatial variations in fertility preferences and births in India is well-documented (Chatterjee and Desai, 2020; Singh et al., 2022). Studies have shown the significance of economic and women's status in explaining fertility patterns and in explaining North-South differences (Dommaraju and Agadjanian, 2009) while variations between EAG state and other states have also been documented (Chatterjee and Desai,

2020). Tharun and Muniswamy (2022) examine the trends in Wanted Total Fertility Rate, Unwanted Total Fertility Rate and Total Fertility Rate as per NFHS-2, 3, and 4 for southern states of India, namely Andhra Pradesh, Tamil Nadu, Kerala, and Karnataka. The study found a declining trend in all states along with a high unwanted fertility among rural, SC/ST, Muslim and non-working women reiterating the need to strengthen family planning programmes. Roy et al (2016) study the trends in fertility rates in Uttar Pradesh for NFHS-1, 2 and 3. The study finds higher wanted, unwanted and actual fertility rates among women in rural areas, illiterate, Muslim, ST, non-working, and lower income group females. Shekar et al (2018) point out the spread of states below replacement level across the country and explain fertility transitions through sociocultural factors, shift away from agriculture, family planning programmes, women's education, empowerment, urbanisation, media exposure and access to health services. Singh et al (2022) find evidence of spatial heterogeneity in son preference across Indian districts, that is often masked by state level estimates. Fertility gap, which is the difference between preferred and actual fertility, is dependent on context specific experiences both within and outside the household (Dommaraju and Agadjanian, 2009). Within the household, it has been shown that husband's preferences also matter and significantly shape the fertility gap (Mishra and Parasnis, 2021). Across countries a strong relationship has been established between female empowerment and fertility (Doepke & Tertilt, 2018). Female empowerment which leads to greater women's bargaining power has been shown to lead to a decrease in fertility while a literature review study of 60 studies by Upadhyay et al. (2014) found some positive associations between women's empowerment and lower fertility, longer birth intervals, and lower rates of unintended pregnancy in a vast majority of studies but their review also showed variation in results. In many studies that were reviewed, they find a negative or an absence of a significant relationship between female empowerment and fertility levels pointing to the significance of the

measure of empowerment used, sociopolitical or gender environment and sub-population studied. Son preference due to deep-rooted cultural attitudes and for financial reasons as security in old-age often leads to gender-specific fertility stopping and gender-biased fertility strategies have been shown to lead to gender inequalities in education (Congdon Fors & Lindskog, 2023). Bose and Das (2024) in a study for rural India show that fertility increases with increased women's agency. They argue that son preference and lack of access to abortion services in rural areas leads empowered women to achieve their desired fertility and preferred number of sons through the stopping rule. Despite near-universal marriage and early childbearing, average fertility levels in India have declined to low levels due to earlier termination of childbearing via sterilization following the birth of two children (Park et al., 2023). Thus Park et al., (2023) argue that the pathways to a decline in fertility in India have been unique and that even with early and universal marriage and early childbearing, the adoption of family planning practices have led to limiting fertility after two births. Their study highlights the limitations of traditional socioeconomic indicators in explaining fertility declines.

3. Data and Methods

The study uses state/UT level data on fertility and socioeconomic indicators from the National Family Health Survey (NFHS-5) (IIPS, 2021). The NFHS surveys are conducted by the International Institute of Population Studies under the purview of the Ministry of Health and Family Welfare (MoHFW), Government of India. The NFHS surveys are large sample surveys that adopt a uniform sample design that is representative at the national, state/UT, and district levels. NFHS-5 was conducted in two stages between 2019-21 across 707 districts, 28 states, and eight UTs of India and survey information was gathered from 636,699 households comprising 724,115 women, and 101,839 men across states and UTs in India. The study follows the NFHS classification of states/UTs into six regions. The North region comprises nine states/UTs namely Chandigarh,

Delhi, Haryana, Himachal Pradesh, Jammu & Kashmir, Ladakh, Punjab, Rajasthan, and Uttarakhand. The Central region comprises three states of Chhattisgarh, Madhya Pradesh, and Uttar Pradesh. The East region consists of four states, namely Bihar, Jharkhand, Odisha, and West Bengal. The eight states of Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, and Tripura constitute the Northeast region. The West region constitutes Dadra & Nagar Haveli and Daman & Diu, Goa, Gujarat, and Maharashtra. The South region comprises eight states/UTs - Andaman & Nicobar Islands, Andhra Pradesh, Karnataka, Kerala, Lakshadweep, Puducherry, Tamil Nadu, and Telangana.

The study is based on secondary data. Graphs and statistical tests are used for analysis. Graphical representation is used to depict variations in fertility patterns across states/UTs and regional variations are shown through maps. We use correlation analysis to test association of fertility outcomes and preferences with their proximate socioeconomic determinants. Robust Analysis of Variance (ANOVA) is used to test the region-wise difference in means of fertility indicators across the six regions. Two robust ANOVA statistics-Welch's and Brown-Forsythe's are used to accommodate unequal variances across regions. Additionally, the Bonferroni method for pairwise comparison of means is used to determine the statistical significance across regions.

4. Results

4.1 Variations in fertility parameters across states/UTs in India

This section presents the state-level differences in fertility rates, namely TFR, TWFR, age at marriage as also the age of commencement of childbearing, adoption of Modern Family Planning Methods, the extent of unmet need for family planning, and preference for sons. We also analyze state-level variations in Total Unwanted Fertility Rate (TUFRR) computed as the gap between TFR and TWFR.

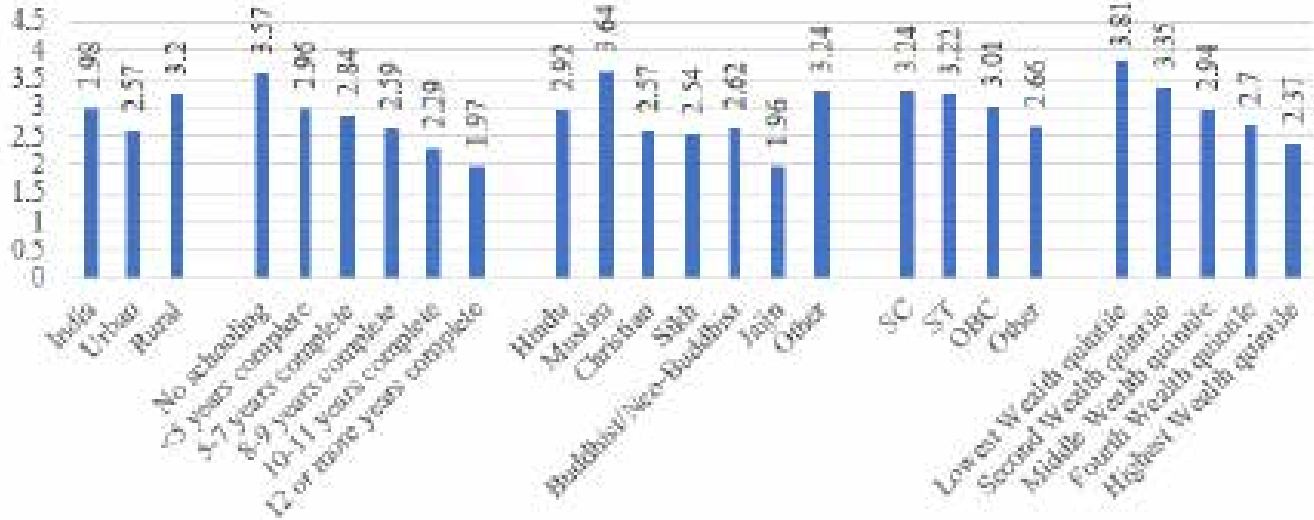
The mean number of children born to women aged 40-49 by background characteristics at all-India level

are presented in Fig. 1. Childbearing is observed to be higher in rural areas, and among women with least literacy levels and those belonging to lower wealth quintiles, and Muslim and SC/ST/OBC households.

TWFR in India ranges from 0.9 in Sikkim to 2.7 in Meghalaya. The lowest observed total fertility rate

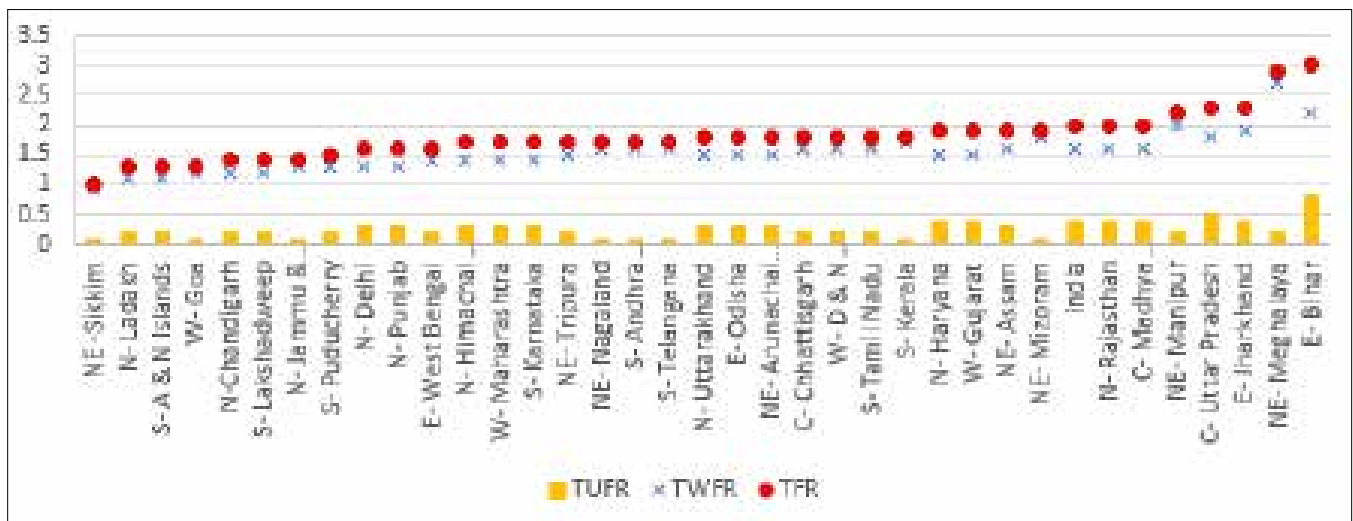
(TFR) is 1.0 in Sikkim. The highest TFR of 3.0 is observed in Bihar followed by Meghalaya (2.9), Uttar Pradesh, Jharkhand (2.3) and Manipur (2.2) (Fig. 2). All other states/UTs other than these five states have attained TFR below the replacement level of 2.1. TUFR is found to be highest in Bihar (0.8) followed by Uttar Pradesh (0.5), while the corresponding all-India figure is 0.4.

Fig. 1. Mean number of children born to women aged 40-49 at all-India level by socioeconomic characteristics.



Source: Authors' construction based on data from NFHS-5.

Fig. 2. TFR, TWFR and TUFR by states/UTs in India.



Source: Authors' construction based on data from NFHS-5.

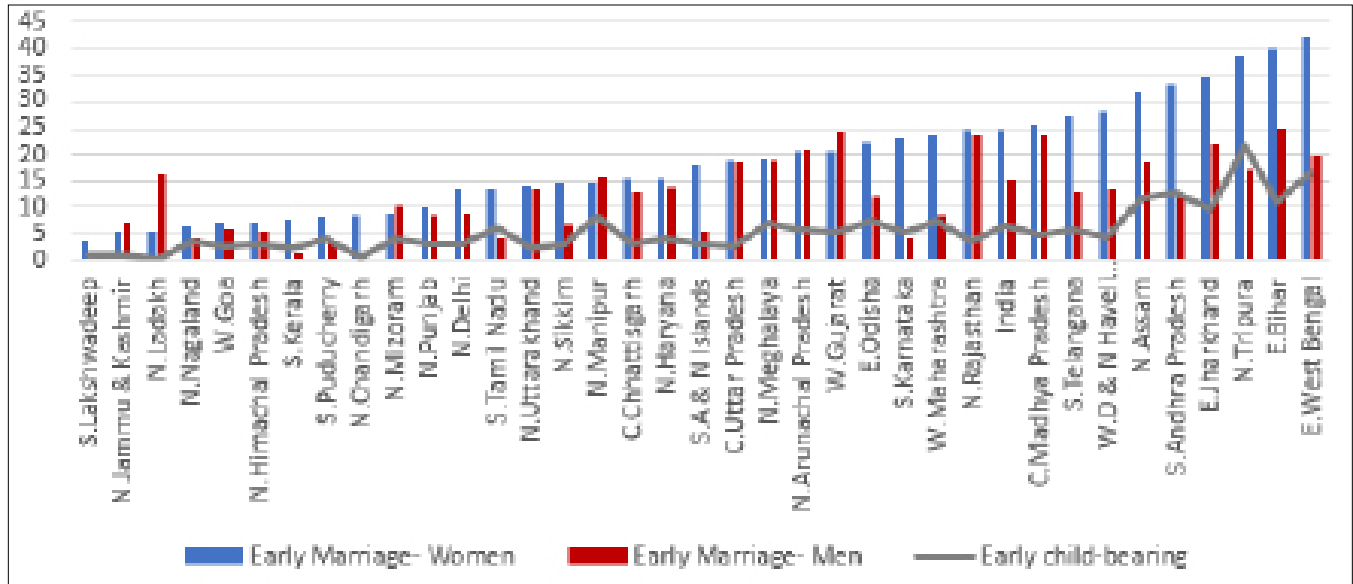
An important determinant of fertility patterns is the age at marriage as also the age of commencement

of childbearing. In India, the minimum legal age of marriage is 18 years for women and 21 years for men.

However, 24.7% women and 15.2% of men aged 18-29 at all-India level were married before they attained 18 and 21 years respectively. There is a huge variation across states in early marriage ranging from 3.8% women in Lakshadweep to more than 25% in Madhya Pradesh and Telangana, Assam, Andhra Pradesh,

Jharkhand, and Tripura; and exceeding 40% in Bihar and West Bengal (Fig. 3). Most states exhibit a greater prevalence of early marriage among women than men except six states of Jammu and Kashmir, Ladakh, Mizoram, Manipur, Arunachal Pradesh, and Gujarat.

Fig. 3. Early marriage and early child bearing by states/UTs in India (%).

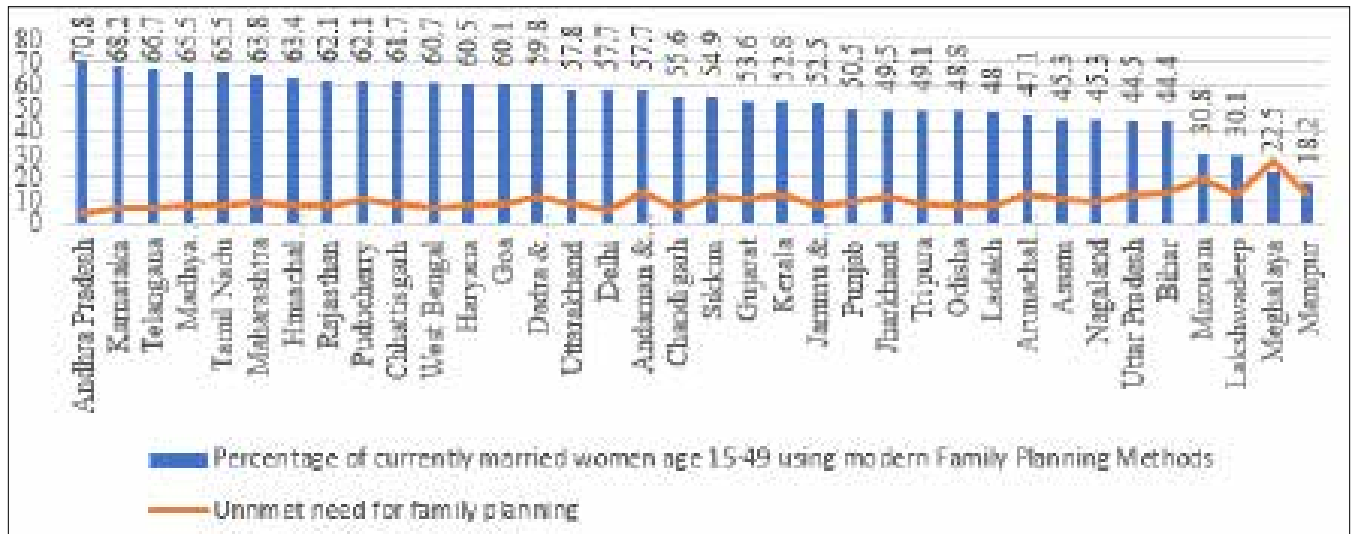


Source: Authors' construction based on data from NFHS-5.

Early childbearing refers to teenage pregnancy, that is, women aged 15-19 who begin childbearing. It is observed to be highest in Tripura (21.9%) followed by West Bengal (16.4%), Andhra Pradesh (12.6%), Assam (11.7%) and Bihar (11%). It is interesting to note the contrasting patterns in Bihar and Uttar Pradesh. While the two states exhibit highest TUFMR, Bihar also has a much higher prevalence of early marriage among women (40.3%) as well as early child bearing (11%) whereas only 18.8% of women get married early in Uttar Pradesh and 2.9% women have early childbearing. Fertility patterns are also affected by the adoption of Modern Family Planning Methods and the extent of unmet need

of family planning. Lowest adoption of modern family planning methods and larger unmet need is observed in Manipur (18.2%) followed by Meghalaya (22.5%) and Lakshadweep (30%), and highest in Andhra Pradesh (70.8%) followed by Karnataka and Telangana (see Fig. 4). It is interesting to note that while the five states with TFR of 2.1 and above namely Bihar, Meghalaya, Jharkhand, Uttar Pradesh, and Manipur are also the states with low use of modern family practices, not all states with low adoption of modern family planning practices have high TFR- examples being Lakshadweep and Ladakh.

Fig. 4. Adoption of modern family planning methods and unmet need by states/UTs in India.

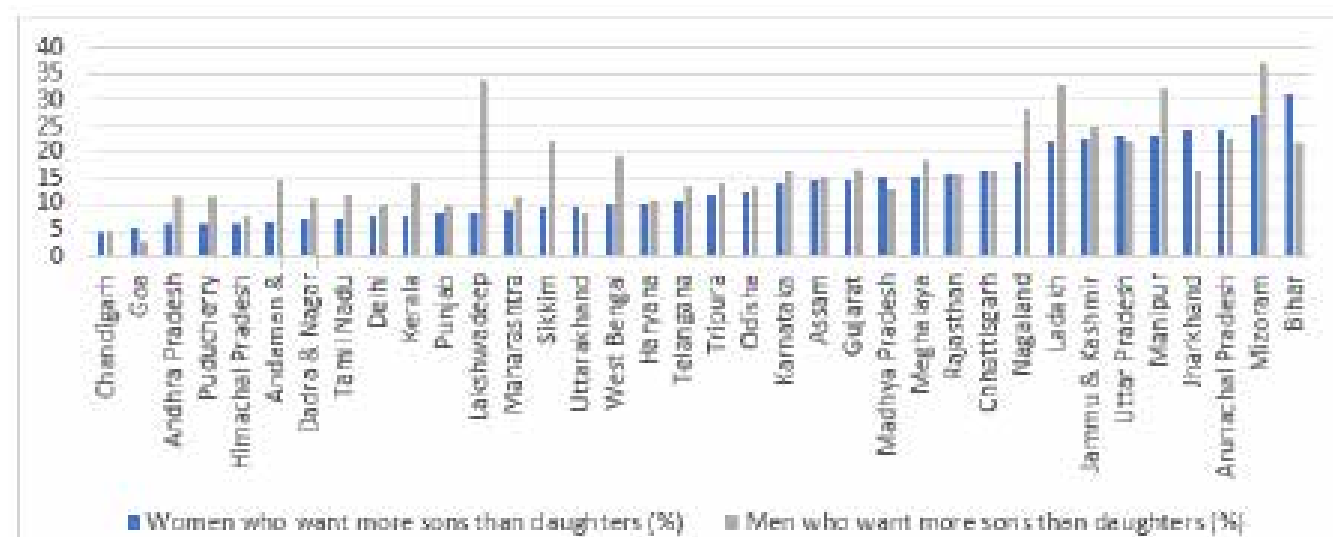


Source: Authors' construction based on data from NFHS-5.

In India, a major feature of fertility preferences is the preference for sons. Preference for a son is captured by data on the percentage of women and men who want more sons than daughters. Preference for a son among women is strongest in Bihar followed by Mizoram, Arunachal Pradesh, and Jharkhand. The percentage of

men wanting more sons than daughters is highest in Mizoram (37.3%) and lowest in Goa (3.1%). In most states, preference for sons than daughters is relatively stronger among men than among women except in the states of Goa, Madhya Pradesh, Uttar Pradesh, Jharkhand, Arunachal Pradesh and Bihar.

Fig. 5. Percent of women and men wanting more sons than daughters by states/UTs in India.



Source: Authors' construction based on data from NFHS-5.

4.2 Correlation Analysis of Fertility Behaviour and Socioeconomic Characteristics

We next examine the correlation of fertility outcomes (TFR and early childbearing) and preferences (TWFR

and preference for a son) with state-level socioeconomic characteristics. The correlation coefficients along with

their significance level are presented in Table 1. All four fertility behaviours are observed to be significantly and positively correlated with poverty and rural population and negatively correlated with male and female education levels and women's exposure to media. The percentage of SC and ST populations are not found to be associated with fertility levels and early childbearing. A higher son preference is observed in states with a larger ST population. The percentage of Muslim population,

women's participation in the labour force as well as women's empowerment, as captured by participation of women in three major household decisions regarding own healthcare, making major household purchases or visiting her family and friends are not found to be significantly correlated with fertility outcome as well as preferences. Usage of modern family planning methods is significantly and negatively associated with fertility outcomes.

Table 1. Correlation analysis between fertility indicators and socioeconomic characteristics.

	TFR	TWFR	Early childbearing	Preference for son (among women)
Percentage of population in lowest wealth quintile	0.6031*** (0.0001)	0.5435*** (0.0006)	0.5713*** (0.0003)	0.5837*** (0.0002)
Percentage of rural population	0.4717*** (0.0037)	0.4420*** (0.0070)	0.4173** (0.0113)	0.3675** (0.0275)
Percentage of SC population	0.1355 (0.4309)	-0.0134 (0.9383)	0.2538 (0.1353)	-0.2293 (0.1785)
Percentage of ST population	0.0989 (0.5659)	0.2381 (0.1619)	-0.0856 (0.6197)	0.4085** (0.0134)
Percentage of Muslim population	-0.2204 (0.1964)	-0.2275 (0.1820)	-0.1717 (0.3166)	0.0978 (0.5706)
Women literacy	-0.3896** (0.0188)	-0.2204 (0.1964)	-0.3158* (0.0606)	-0.4253*** (0.0097)
Women educated at least till class 12	-0.4824*** (0.0033)	-0.4317*** (0.0096)	-0.6311*** (0.0000)	-0.4761*** (0.0038)
Male literacy rate	-0.4443*** (0.0066)	-0.3507** (0.0360)	-0.7964*** (0.0000)	-0.2415 (0.1558)
Women labour force participation rate	0.0801 (0.6426)	0.2579 (0.1289)	0.0453 (0.7932)	0.1063 (0.5370)
Women participation in major household decisions	0.0369 (0.8309)	0.0955 (0.5795)	-0.0193 (0.9110)	-0.0609 (0.7244)
Early marriage	0.4366*** (0.0078)	0.3501** (0.0363)	0.8241 (0.0000)	0.1708 (0.3192)
Use of modern family planning methods	-0.3978** (0.0163)	-0.4772** (0.0033)	-0.0341 (0.8433)	-0.5238 (0.0010)
Women with no regular exposure to media	0.5966*** (0.0001)	0.4780*** (0.0032)	0.3663** (0.0280)	0.7176 (0.0000)

Source: Authors' estimation based on data from NFHS-5.

Note: * implies $p < 0.1$, ** implies $p < 0.5$ and *** implies $p < 0.01$

4.3 Classification of States/UTs based on Fertility Behaviour Patterns

All states/UTs are classified as per their performance on four fertility indicators- TFR, early marriage, use of modern family planning methods, and preference for a son. The rationale for choosing these parameters is that they reflect several underlying fertility-related processes. The performance on each of the four parameters is classified into three categories. TFR is classified into three ranges-less than 1.5, 1.5 to replacement level, that is, 2.1, and 2.1 and above. The prevalence of early marriage is categorized into low, medium and high, the percentage of women married before the age of 18 being less than 10%, 10-25% and 25% and above respectively. Low, medium and high use of modern family planning methods refer to the percentage of women using these methods being less than 50%, 50-60% and 60% and above respectively. Low, medium and high son preference is defined as the percentage of women preferring more sons than daughters being less than 10%, 10-20%, and 20% and above respectively.

The state of Goa is the best performer with low TFR, low prevalence of early marriages, high levels of

family planning and low preference for a son followed by Himachal Pradesh and Puducherry. In contrast, Bihar and Jharkhand are the worst performers with high TFR, high early marriage, high preference for sons and low levels of family planning. Meghalaya, Manipur, and Uttar Pradesh, with TFR above 2.1 are the states with medium prevalence of early marriage, low incidence of family planning and medium to high son preference. These five states need a policy mix focusing on increased adoption of modern family planning methods, reducing early marriages, and changing the traditional attitudes towards strong preference for a son. Despite low use of modern family planning methods, the state of Lakshadweep exhibits a low TFR that can be attributed, to some extent, to low early marriages and low preference for sons that makes it easier to limit the family size. Assam and Tripura have high fertility less than replacement level but have high early marriage and medium son preference. Although the states of Andhra Pradesh, MP, Telangana, and West Bengal have achieved TFR below replacement level, they cannot be dismissed as ‘doing fine’ even with progress on three parameters in the desired pattern as the issue of early marriage needs to be urgently addressed in these states.

Table 2. Classification of states/UTs in India by TFR, early marriage, use of modern FP practices and son preference

	TFR: Less than 1.5		TFR: 1.5 – 2.1			TFR: 2.1 & above	
	Early Marriage		Early Marriage			Early Marriage	
	Low	Medium	Low	Medium	High	Medium	High
High use of modern family planning methods	Low son preference	Goa		Himachal Pradesh, Puducherry	Maharashtra, Tamil Nadu	Andhra Pradesh	
	Medium son preference				Chhattisgarh, Haryana, Karnataka, Rajasthan	Madhya Pradesh, Telangana, West Bengal	

Medium use of modern family planning methods	Low son preference	Chandigarh	Sikkim, A&N Islands	Kerala, Punjab	Delhi, Uttarakhand	D&N Haveli and Daman & Diu		
	Medium son preference				Gujarat			
	High son preference	Jammu & Kashmir						
Low use of modern family planning methods	Low son preference	Lakshadweep						
	Medium son preference			Nagaland	Odisha	Assam, Tripura	Meghalaya	
	High son preference	Ladakh		Mizoram	Arunachal Pradesh		Manipur, Uttar Pradesh	Bihar, Jharkhand

Source: Authors' classification based on data from NFHS-5.

4.4 Regional Variations in Fertility Behaviour

Next, statistical tests are performed to examine the presence of regional differences in fertility indicators. Table 3, column 2 presents two robust ANOVA statistics-Brown-Forsythe's F test statistic and Welch's F test statistic. None of the two statistics are significant for TFR. Although Welch's F test statistic is significant at 10% for TWFR, Bonferroni pairwise means comparisons test reveals no pairs of regions where the differences in mean TWFR are significant (see Table 3, column 3). While both Brown-Forsythe's F test

statistic and Welch's F test statistics are significant for early childbearing and son preference, each of these behaviours turns out to be significantly different in only two out of fifteen pairs of regions, namely east and northeast regions lagging north region for former, and east and west regions lagging behind south region for the latter. Thus, overall, the presence of overwhelming regional differences in the fertility indicators is not observed.

Table 3. Robust ANOVA-Means Comparisons Test for fertility indicators by regions.

Fertility Indicator	Robust ANOVA Test statistics (Col 2)	Pairwise comparisons of means between regions (Col 3)
TFR	BF: 1.8104 (0.1886) W: 1.7107 (0.2240)	NIL
TWFR	BF: 2.0612 (2.0612) W: 2.8105* (0.0749)	NIL
Higher early childbearing	BF: 4.9241*** (0.0055) W: 4.7787** (0.0168)	East vs North Northeast vs North
Son preference - Women wanting more sons than daughters	BF: 3.5216** (0.0357) W: 4.4991** (0.0229)	East vs South West vs South

Source: Authors' estimation based on data from NFHS-5.

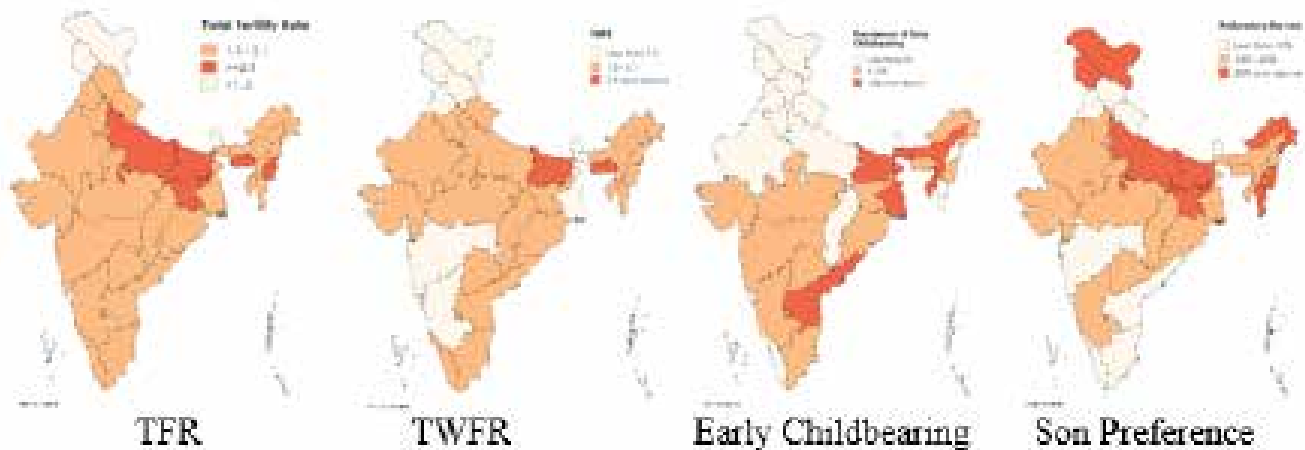
Note: BF: Brown-Forsythe's test statistic, W: Welch's test statistic, values in parentheses are p-values,

* implies $p < 0.1$, ** implies $p < 0.5$ and *** implies $p < 0.01$

The cartographic representations of fertility variations in Fig. 7 confirm our results from Table 3 as there is no evidence of a typical 'North-South divide' often

mentioned in the literature. In each of the four fertility indicators we find no pattern that enables a classification by region.

Fig. 7. TFR, TWFR, early childbearing, and son preference across states/UTs in India.



Source: Authors' construction using <https://www.mapchart.net/india.html>. Maps not to scale

5. Discussion

The analysis of fertility indicators and key related indicators shows spatial heterogeneity at the state level. The study finds a significant correlation between TFR, TWFR, early childbearing, and son preference with wealth, location i.e. rural residence, and women's education. Early marriage and the use of modern family planning are associated with TFR and TWFR. Exposure to media is correlated with TFR, TWFR and early childbearing but does not affect son preference. Religion and percentage of the SC population show no association with fertility indicators while the ST population percentage affects son preference. Women's labour force participation and women's empowerment are also not significantly associated with any of the four fertility indicators. States with high TFR that are not able to translate their wanted fertility rate into actual fertility rate include Bihar, Uttar Pradesh, Jharkhand,

Madhya Pradesh, Gujarat, Rajasthan, and Haryana. Bihar and Uttar Pradesh have high TFR while the remaining states have TFR in the range of 1.5 to 2.1. Again, Bihar and Uttar Pradesh have high son preference and low use of modern family planning methods, but while Bihar has high early marriage, Uttar Pradesh has a medium prevalence of early marriage. Madhya Pradesh has high early marriage and medium son preference but also has a high use of modern family planning. Rajasthan and Haryana have high adoption of family planning but they need to make the transition in terms of early marriage and son preference from medium to low. Gujarat has medium adoption of family planning and needs to perform better in this aspect besides changes in attitudes to improve early marriage and son preference bias. Thus, the multitude of interconnections between various socioeconomic factors results in differential fertility patterns at the state/UT level as evident from Table 2.

The classification of states/UTs in India reveals

the diversity among states in fertility patterns. The experience of states/UTs attaining TFR less than 2.1 is quite diverse and includes the son preference, adoption of family planning, and early marriage ranging from low to high. It demonstrates the significance of socioeconomic differences, cultural attitudes and social norms that influence fertility patterns and can be very useful in policy formulation. Our study confirms that there is an absence of any clear divide based on regions.

There is an indication of well-known persistence in behavioural patterns and gendered social norms as evident in the preference for sons, the widespread prevalence of early marriage and early childbearing, and the fact that women do not want to limit family size. The differences across states call for a closer evaluation of causal factors that can account for differences in fertility patterns and preferences. Socioeconomic factors like income class, female and male education, place of residence or location i.e. rural vs urban, and caste do play a role. But deep-rooted cultural and social attitudes to early marriage, and adoption of modern family planning also influence fertility preferences. Thus, while socioeconomic diversity and heterogeneity influence fertility patterns and preferences, the study does not find evidence of commonality in fertility behaviours region wise.

6. Conclusion

In conclusion, our study uses data from the most recent nationally representative survey in India to examine cross-sectional differences in fertility patterns in states and UTs of India. Our analysis highlights that the prevailing marked diversity in socioeconomic, cultural, and social norms and behaviours is mirrored in the significant heterogeneity in fertility outcome patterns. In particular, fertility levels, son preference, and early childbearing vary significantly across states and are correlated with key proximate socioeconomic determinants. The analysis in the present study provides a useful understanding of fertility behaviours and can help in policy formulation by identifying key correlates of fertility patterns and outcomes. Further,

the study argues that fertility patterns in India do not exhibit region wise differences and that such patterns are best understood at the state-level or further levels of disaggregation. The study argues that successful policy intervention needs to address the specific socioeconomic factors that vary from state to state. The major limitation of the study is that it does not establish the causal factors of fertility patterns through use of cross-sectional regression or panel data analysis. The level of aggregation used for the present study is state-level analysis. Thus, the further scope for study also lies in an analysis at the district, and block/local levels to understand the significance of specific contextual factors.

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