A Study on Regional Variation in Son Preference in India

R.C. Yadava [1], A. K. Tiwari[2], Mahima[3*]

[1.] Former Senior Professor at Department of Statistics, Banaras Hindu University, Varanasi, Uttar Pradesh, India
rcyadava66@yahoo.ac.in
[2.] Professor at Department of Statistics, Banaras Hindu University, Varanasi, Uttar Pradesh, India
abhay.tiwari@bhu.ac.in
[3.] Senior Research Scholar at Department of Statistics, Banaras Hindu University, Varanasi, Uttar Pradesh, India
Corresponding Author:
Mahima
Banaras Hindu University
mahima9999kumari@gmail.com or mahima@bhu.ac.in

Key Words: Sex composition, Son preference, Parity Progression Ratio (PPR), Parity Progression Infecundity (PPI), Sex composition of children based on stopping behaviors, Major states and India

Abstract

Background: Son preference is a widespread phenomenon observed in many countries, including India and other South Asian nations. An extensive and populous country, India exhibits substantial variations in its geographic, economic, and cultural environment. There is little evidence of measurement of son preferences at the quantitative state level.
Objective: To measure son preferences quantitatively for major states of India and examine regional variation or heterogeneity in stopping behaviors of couples across the states of India.
Methods: We applied our proposed methodology to real data from the National Family Health Survey of different rounds.
Results Measures confirm that the methodology-based values are robust enough to provide reliable estimates of son preference at the state level. Son preference is highest in the eastern and central states, followed by northern states, and lowest in the southern states.
Conclusions: There is considerable variation in son preference across Indian states, often masked by National-level average measurements. Our findings warrant urgent policy interventions targeting specific districts in India to tackle the ongoing son preference attitudes and practices.

1.Introduction

Son preference is a widespread phenomenon observed in many countries, including India and other South Asian nations (Arnold et al.,1998 ; Gaudin, 2011). This preference reflects the belief that sons are more important and valuable than daughters, often resulting in families continuing to have children until a desired number of male offspring is reached (Kim & Lee, 2020). Initially, it was thought that son preference would skew the sex ratio at birth towards males, but later studies showed that this would only happen with deliberate practices such as sex-selective abortions (Aksan 2021; Saikia et al. 2021; Kashyap and Villavicencio 2016; Robitaille and Chatterjee 2018) which remain illegal but prevalent in India (Das Gupta, 2005; Bongaarts, 2013).

Sex preference impacts family composition, population demographics, fertility trends, and mortality rates (Bhattacharya 2006; Guilmoto et al. 2018). It influences fertility behavior, with son preference being a strong cultural factor driving higher fertility rates.

For much of the past century, India has exhibited a well-documented and deeply ingrained preference for sons over daughters (Das Gupta & Mari Bhat 1997; Poston 2002; Guilmoto 2009; Jayachandran, 2015). This strong

son preference has significantly influenced family planning decisions and fertility patterns throughout the country (Chaudhuri 2012).

It should be mentioned that in the majority of previous research on son preference, the son preference was evaluated by asking the female (spouse) for her view on the desired family size for a couple (Bharati et al. 2011; Clark 2000).

On the desire for family size for stopping behaviors of fertility, a great number of researches have been undertaken to estimate Parity Progression Ratios (Chiang & Van Den Berg, 1982; Sapienza, 1997; Hill, 2015; Spoorenberg, 2010; Feeney & Yu, 1986-87; Yadava et al., 1992 and 2011) .The Parity Progression Ratios (PPR) for a parity says *i* is the probability that a female giving i^{th} birth at a time will ever proceed to the next birth i.e. $(i+1)^{th}$ birth. Conversely, we can examine the opposite scenario: the probability that a female who has had i^{th} birth will not proceed to her next birth. We may refer to this probability as Parity Progression Infecundity (PPI) for parity i.

It should be noted that the stopping behavior of couples is influenced not solely by parity but also by the sex composition of children (Clark, 2000). In India, understanding how couples' decisions to stop childbearing are influenced by the sex composition of their children is essential, as it provides insight into underlying son preference and associated demographic patterns (Aksan 2021). Accurately measuring this behavior can reveal region-specific trends and help identify the role of sex composition in family planning decisions, contributing to the broader analysis of fertility and population dynamics in the country.

Parity progression, especially influenced by son preference, has traditionally shaped fertility patterns in India. With declining fertility rates, there is a pressing need for research examining the impact of son preference on fertility decisions to inform policies that promote gender balance and equitable family planning practices.

In previous studies, the measurement of son preference was primarily conducted using qualitative approaches and focused on family size. However, recently Shukla et al., (2018) attempted a relative assessment of son preference. Shukla et al.,(2018) published a paper titled "*Measuring Son Preference through Number of Children Born*," which explored the sex composition of children among women who had stopped childbearing after their second and third births, utilizing data from the National Family Health Survey. According to Shukla et al., (2018) , the sex composition of children can be represented as combinations of male (M) and female (F) based on birth order. For two children, the possible combinations are MM, MF, FM, & FF and for three children, these are MMM, MMF, MFM, MFF, FMM, FMF, FFM, and FFF.

Hesketh et al., (2011) found that in human communities without prenatal intervention, the ratio of men to women at birth remains constant. If parents have no gender preference, children within a family are anticipated to have a binomial distribution.

Further, when assuming $p = q = ½$ (where p is the probability of male birth and q is the probability of female births), the expected proportions for the two-child scenario would be 25% for each combination. If observed proportions deviate from 25%, it indicates a preference for a specific sex composition, often male in the Indian context. Shukla et al., (2018) found that the proportion of MM was 34.2%, significantly higher than the 13.8% for FF, based on NFHS-2 data, suggesting a strong preference for male children.

However, Shukla et al., (2018) did not propose any methodology for measuring son preference in quantitative terms.

To tackle the issue of quantitatively measuring sex composition preferences, Yadava et al. (2025) published a paper entitled "*On the Measurement of Son Preference in Quantitative Terms*," in which a methodology was proposed for the computation of Probability of Progression Infecundity (PPI) values at different parities for various sex compositions at each parity.

The study was presented at the IASP Conference and later published in *Demography India* (2025); therefore, a concise description of the proposed methodology for measuring varying preferences for different sex compositions is presented here for completeness. The methodology is essentially based on the concept of what the proportions for different sex compositions would be for females who stop childbearing at a specific parity if there is equal preference for each sex composition, and comparing this with observed proportions.

Measuring Son Preference

The detailed methodology was previously presented in our India-level study published in Yadava et al.,2025. Therefore, only a brief description of the methodological framework is provided here to support the regional

analysis. The proposed methodology is based on a concept that involves the following steps:

1. Suppose we want to find the levels of preference for different sex compositions for females who stop childbearing after parity *i,* (*i* = 1, 2, 3…). For this purpose, we consider a cohort of females who give at least *i* births and have sufficient exposure periods to give at least *i*+1 birth. The condition of a sufficient exposure period to give at least (*i*+1) births has been imposed to ensure that if a female has only *i* births, then it will imply that she has stopped childbearing after *i* births.
2. Out of these females, we consider only those females who stop childbearing after their i^{th} birth. Then we compute the proportions of females among females stopping at i^{th} birth with different sex compositions for *i* births. In fact, for *i* births, there will be 2^i possible sex compositions. For example, if *i*=1, then there will be only two possible sex compositions viz male (M) and female (F). If *i*=2, then there will be four possible sex compositions viz MM, MF, FM and FF. Similarly for other parities.
3. We denote these proportions as p_{11} and p_{12} for parity one, as $p_{21,}$ $p_{22,}$ p_{23}, and p_{24} for parity two, p_{31}, p_{32}, p_{33}, p_{34}, p_{35}, p_{36}, p_{37} and p_{38} for parity three and so on where the first subscript denotes parity and the second subscript denotes different sex compositions.
4. We compute the corresponding expected proportions for parity i, given the probability that a birth will be male (at each parity) as p and stopping behaviors at parities 1, 2…*i*-1, and assuming no preference for any sex composition at parity *i*. Let these be denoted as p_{11}* and p_{12}* for parity one, p_{21}*, p_{22}*, p_{23}*, and p_{24}* for parity two, and so on. Theoretically, if $p = 1/2$ and there are no sex composition preferences at parities 1, 2…, *i,* then all the 2^i possible sex composition proportions for stopping at i^{th} birth will be equal, i.e. $1/2^i$. However, if there are sex composition preferences or $p \neq ½$, then these expected proportions may deviate from $1/2^i$.
5. Whatever be the case, we compute the relative magnitudes of preferences for different sex compositions as $R_{11} = p_{11}/p_{11}$*, $R_{12} = p_{12}/p_{12}$* for parity one, $R_{21} = p_{21}/p_{21}$*, $R_{22} = p_{22}/p_{22}$*, $R_{23} = p_{23}/p_{23}$* and $R_{24} = p_{24}/p_{24}$* for parity two and so on for different parities. These R_{11}, R_{12}... values give the relative magnitudes of preferences for stopping after different sex compositions at any parity. Although the R_{ij} (*i* = 1, 2, 3...*j* = 1,2,3) values give the relative magnitudes of stopping for different sex compositions, these do not provide the actual values of PPI for different sex compositions at different parities.

However, we have mentioned earlier that if from any other source, we have the value of PPI for parity *i*, then we can compute PPI values for all possible sex compositions for parity *i.* For example, if the PPI value for parity *i* is *Pi*, then $Pi \times Rij$ will give the PPI value *(*$Pi \times Rij$*= PPI)* for the j^{th} sex composition of parity *i.*

The proposed methodology was intended to demonstrate an analysis of son preference at the national level in India. The current study aims to apply the methodology to major states of the country to explore regional variations in India, particularly examining the influence of sex composition and parity on couples' stopping behavior. Building on that foundation, this study provides a regional examination, focusing on major states across India.

By analyzing PPR and quantitatively measuring son preference across different regions, this study aims to identify where sex composition bias was more or less pronounced, highlighting significant regional disparities in son preference.

A large and populous country, India exhibits substantial variations in its geographic, economic, and cultural environment. Not surprisingly, large differentials in the degree of son preference and demographic behavior have also been noted among India's regions (Arnold et al., 1998; Yadava et al. 2020).

Studying son preference and sex composition biases at the regional or state level in India is important because of the country's wide cultural, demographic, social, and religious diversity. Each area has its own beliefs and values that shape attitudes toward gender, so analyzing these differences locally is essential. Studies have highlighted the wider demographic, economic, and social consequences of the traditionally held son-preference practices in India (Kashyap and Villavicencio 2016; Ebenstein and Leung 2010; Chaudhuri 2012; Chao et al. 2020; Kashyap and Behrman 2020; Robitaille and Chatterjee 2018; Saikia et al. 2021; Singh et al. 2021).

Additionally, economic conditions differ significantly from one state to another impacting family planning choices and son preference. This variation highlights the need for targeted interventions that address these specific issues in different regions. By examining these trends and measuring them regionally, we can gain a clearer understanding of the overall situation, which is vital for conducting thorough research in this area.

Guilmoto (2009) have demonstrated that northern India consistently exhibits higher rates of sex-selective practices, resulting in skewed sex ratios. Conversely, in southern states such as Kerala and Tamil Nadu, the trends show a declining preference for sons due to improved education, urbanization, and progressive family planning policies.

Bongaarts's (Bongaarts 2013) studies used the desired sex ratio at birth and sex-selective abortions to examine regional variations in son preference. No quantitative measurements or preferences for regional variances were provided. Aksan (Aksan 2021) also studied son preferences and sex selection, focusing on regional heterogeneity using mixed-effects logit regression analysis (used NFHS-5). However, the study did not provide a model-based approach to analyse variations in son preferences.

Now, with this much discussion on the matter , numerous studies have explored the variation in son preferences (not model-based) Arnold, Choe, and Roy 1998; Klaus and Tipandjan 2015; Yadav et al. 2020; Bharati et al. 2011; Singh et al 2021) proposed a methodology based on a model approach (stochastic modeling of human fertility) which provides a quantitative measurement of stopping behaviors of childbearing for different sex compositions for different parities (Yadava et al., 2025). The objective of the present paper is to provide the quantitative measurement of son preference utilizing the methodology proposed by Yadava et al. (2025) on a regional basis.

2. Data

Data were sourced from multiple rounds of the National Family Health Survey (NFHS), covering a broad geographical area. Quantitative techniques were used to assess disparities in sex composition bias and desired family size across regions. The proposed methodology was employed to identify levels and patterns across states, with specific indices and measures quantifying son preference.

3. Applications of methodology to real data

Now we apply the proposed methodology to obtain PPI values for different sex compositions (s) for females stopping giving birth after one, two, and three children, using data of 5 rounds of NFHS, viz 1,2,3, 4, and 5. The NFHS is a multistage household survey conducted across the country under the stewardship of the Indian government's Ministry of Health and Family Welfare (MoHFW). The principal aim of this survey is to furnish vital information on health and family welfare at the national, state, and district levels, which is required by the Ministry of Health and Family Welfare and other organizations for policy and program needs. The NFHS is essential to the monitoring and assessment of numerous family planning, reproductive, and child health programs, as well as a few other policies.

There have been five rounds of NFHS conducted completely in India until now. The first survey (NFHS-I) was carried out in 1992-1993, it was followed by NFHS-II in 1998-1999, NFHS-III in 2005-2006, and NFHS-IV in 2015-2016.The NFHS-V (International Institute for Population Sciences (IIPS) and ICF 2021) survey, which was conducted in 2019-21, is the most recent NFHS survey whose data are publicly available. Females of reproductive age are regarded as primary responders in the National Family Health Surveys.

As mentioned in the methodology, firstly, we are required to identify the females who stop childbearing after their first, second, and third births, respectively. To identify such females, we consider only those females whose age is 35 years or more at the time of the survey and who have given only first, second, and third births. (Here it has been assumed that a female who has only two births and her age is more than 35 years has stopped childbearing after one, two, and three births.) For application purposes, we assume that the probability of male birth = the probability of female birth = ½. After identifying such females, we are required to compute the proportions of females with M and F, i.e., p_{11}, p_{12} for one child; MM, MF, FM, and FF combinations among such females, i.e., values of p_{21}, p_{22}, p_{23}, and p_{24}, respectively, for two children, and so on.

The PPI value can be obtained using the formula

$$(N_2^* - N_3^*)/N_2^*$$

where N_2^* is the number of females who have given at least two births, and N_3^* represents the number of females who have given at least three births (this formula is for stopping childbearing after two births and can be applied further).

4. Results

Regional levels and patterns of PPI at various parities in India

Although five rounds of the NFHS have been completed to date (as shown in the appendix table), for simplicity and a better understanding of the time trends, we consider only three rounds of the survey: NFHS-1, NFHS-3, and NFHS-5. The data from NFHS rounds 1 to 5 are provided in the appendix; however, for lengthy tables, we focus only on these three rounds to analyse the level and pattern of PPI values.

This study looks at sex-based preferences and childbearing stopping patterns in 23 major (PPI values for all states are given in appendix) Indian states, divided into the following regions: Northeast (Assam, Arunachal Pradesh, Manipur), Central (Madhya Pradesh, Uttar Pradesh), Eastern (Bihar, Odisha, West Bengal), Western (Gujarat, Maharashtra), North (Haryana, Punjab, Rajasthan, Himachal Pradesh), and Southern (Kerala, Karnataka, Tamil Nadu, Andhra Pradesh). A review of the data from NFHS-1 (1992-93) to NFHS-3(2005-6) and then NFHS-5 (2019-21) highlights key trends in the decision to stop childbearing after one, two, and three children.

Firstly, we focus on the PPI values for couples who choose to stop childbearing after their first birth. Direct-survey-based summary measures of PPI at the state level are presented in Table 1.

4.1 *Parity One*

The total PPI values are categorized into three groups: (i) PPI values below 3%, (ii) PPI values between 3-6%, and (iii) PPI values above 6%. Upon analyzing the data, it is observed that several states, including Bihar and Orissa from the eastern region, Rajasthan, Uttar Pradesh, and Madhya Pradesh from the central region, and Punjab and Haryana from the northern region, as well as Assam, Manipur, and Arunachal Pradesh, exhibit PPI values below 3%.This trend may be attributed to secondary sterility (Conditions such as Polycystic Ovary Syndrome (PCOS), Endometriosis, Primary Ovarian Insufficiency (POI), fallopian tube blockage, uterine fibroids, thyroid disorders, Pelvic Inflammatory Disease (PID), and hyperprolactinemia), where women involuntarily cease childbearing after their first birth. The states with PPI values in the 0-3% range are predominantly located in the central and northern regions.

The PPI value in Maharashtra, which belongs to the western region, was found to be between 3-6%. In contrast, states in the southern region, including Kerala, Karnataka, Tamil Nadu, and Andhra Pradesh, exhibited PPI values greater than 6%. PPI values greater than 6% in the southern region indicate that couples tend to stop childbearing after having one child, likely due to voluntary decisions.

Similarly, at the NFHS-3 round, it seems to be quite an observation there is a marginal increase in states. This may be perhaps because earlier only a smaller proportion of females used to stop childbearing after 1 child. The most significant improvements were seen in West Bengal (15%) which had the highest stopping rates after one child across NFHS rounds 3. Highest 0bserved in Eastern-North and Central regions states as Bihar (2.5%), Haryana (3.4%), Punjab (4.2%) Rajasthan (2.1%), Uttar Pradesh (2.3%) and Madhya Pradesh (3.5) on the other hand, had the lowest during the surveys NFHS-3 (2005-06) was in Kerala (9%) and Tamil Nadu (10%). Since the southern regions have already attained high PPI values, any small increase over time still leads to significantly higher PPI values, which is consistent with the observed trends.

It is important to note that during NFHS-5, the number of states where more women decided to stop having children after having one child increased significantly. States of Eastern-Western and Northeast regions (Orissa, West Bengal, Gujrat, Maharashtra, Arunachal Pradesh, and Manipur) already had percentage rates around 10-12 % in NFHS-5 (2019–21). Southern states Kerala, Karnataka, Tamil Nadu, and Northeast Indian state Assam with percentage rates around 11% (0.11-0.15). Everywhere it has increased over time.

The large gap difference between the stopping percentage of couples after any sex (composition) based preference is called sex preference, if it favors males then called son preference. It was noted, at parity 1, there were apparent very less gap differences in a few states during NFHS-1(there are fewer people who stop childbearing after one child, but still a gap between stopping numbers after male and female children).

A similar pattern for PPI for male and female children for one parity was observed in the NFHS-3 round. At parity1, a large gap difference between females after M and F child (high PPI value after M child shoes son preference) was noted predominantly in West Bengal (M-19%, F-12%), Haryana (M-5%, F-1%). Son preference was also high in the northeast region of Arunachal Pradesh and Manipur where PPI on sex composition (male and female) children were observed as M=11% & F=9%, M=12% & F=8% respectively.

Additionally, in the forwarding time from NFHS-3 to NFHS-5, in these years we saw there is a big gap difference between PPI for M and F children in eastern-central states (except West Bengal). By contrast, the lowest gap difference (not stopping behavior after any specific sex child) was observed only in southern states Kerala (M-11%, F-14%), Tamil Nadu (M-14%, F-12%) and Andra Pradesh (M-10%, F-8%). Figure 1 & 2 illustrates the variations in PPI values, clearly indicating considerable state-level regional heterogeneity in son preference for one parity during 20-year survey rounds (NFHS-1 & NFHS-5) in India.

4.2 *Parity Two*

Table 2 shows the computed total PPI values for parity two an increasing trend over time i.e. more and more females stop childbearing after two births over time.

PPI values represent conditional probabilities. In regions where couples have already voluntarily stopped at parity 1, there is a low chance of progressing to the next parity. Conversely, in regions with lower PPI values (indicating fewer couples stopping at parity 1), there is a higher chance of progressing to the next parity.

In the NFHS-1 round, PPI values were very low in almost every region, including Haryana (9.2%), Uttar Pradesh (5%), Madhya Pradesh (7.8%), Rajasthan (7.4%), Bihar (7.8%), Orissa (9%), Assam (10%), and Manipur (7.6%). In these regions, a large increase was observed from parity one to parity two. As fewer couples stopped childbearing at parity one, there was a significant rise in PPI values from parity one to parity two.

On the other hand, the southern region, which includes the states of Kerala (28%), Karnataka (15%), Tamil Nadu (16.2%), and Andhra Pradesh, had a much lower increase in stopping behavior among couples. The increase in PPI values from parity 1 to 2, was especially high in the western region (Maharashtra (14.9%) and Gujarat (14%), with parity 2 during NFHS-1.

During the NFHS-3 (2005-6) round, PPI values varied very slightly in the North and Central regions, but there were significant variances in the southern states. PPI levels were low in Bihar (9.4%), Uttar Pradesh (11.7%), Rajasthan (12.8%), and Arunachal Pradesh (15%). In contrast, PPI values were high in southern states Kerala (56%), Karnataka (31.8%), Tamil Nadu (40.8%), and eastern state West Bengal (32%). In some states, it was lower than 30%. Andhra Pradesh (34%), Maharashtra (27.3%), Gujarat (23.8%), Haryana (21%), and Punjab (25.7%) are examples of two-parity women.

Similarly, PPI was low in the central-northeast region (Bihar (12%), Uttar Pradesh (19%), Rajasthan (29.5%), Madhya Pradesh (32%), and Arunachal Pradesh and Manipur (32% each) during NFHS-5. While the PPI value was substantially higher in southern states such as Kerala (70%), Karnataka (51%), and Tamil Nadu (62%), among couples having two women, more than 50% stopped having children after two. A very marginal increase in PPI was shown in the southern region from NFHS-3 to NFHS-5, except for West Bengal (Eastern region), Haryana, and Punjab (North region), where more than 40% (42-52%) of respondents stopped after having two children.

From the NFHS-1 to NFHS-5 survey rounds, we looked for regional trends such as how couples stopped having children after a particular sex composition of children, such as MM, MF, FM, and FF. The large gap between PPI for MM and FF children indicates a strong son preference (stopped after MM combination is high, while after FF combination was the least. The preferences for stopping with MF and FM combinations are almost equal. One son and one daughter (either in the form of MF or FM) are equally proposed for stopping after two children.

Table 2 shows the gap difference value PPI for MM and FF combination was high in States in the North-Central and Northeast region including Haryana (10%), Punjab (18.8%), Uttar Pradesh (5.5%), Madhya Pradesh (7.2%), Assam (9.1%), Arunachal Pradesh (11%), and Manipur (10%). Kerala (1%), and Andhra Pradesh (2.7%) all exhibited lower PPI in NFHS-1 (1992-92), which led to minimal variations in MM and FF stopping values. A high gap difference was observed because of son preference.

During NFHS-3, PPI for parity 2 increased, whereas PPI for sex composition of children did not increase, indicating that son preference persisted. The gap difference in PPI for MM children and FF children was high in most states. PPI value for MM combination was high in Punjab (35.2%), Gujrat (30%), Maharashtra (29%), Haryana (28.1%), Madhya Pradesh (22%) Orissa (22%) West Bengal (19%), Tamil Nadu (17%) and in Uttar Pradesh (11%). On the other hand, the lowest son preference (low PPI gap difference) was noted in Kerala (1%).

Similarly, the NFHS-5 survey round found that the high son preference was noted largely in states Haryana (57%), Punjab (53.5), Madhya Pradesh (40%) Orissa (31%), West Bengal (30%), Uttar Pradesh (23.3%), Assam (24%), Arunachal Pradesh (20%) and Bihar (18%) with parity two. On the contrary, Kerala (8.3%), Himachal

Pradesh (10%), and Rajasthan (14.2%) were displayed in Figure 3 (in NFHS-1 round) and Figure 4 (NFHS-5 round). The result is in the expected direction.
For other states also the computed values show a similar pattern as reported although the levels are different for different states.

4.3 *Parity Three*

The analysis of data for stopping childbearing after three children shows that most couples stop after two children, with fewer opting to go after two children.
At parity 3, fewer states exhibit a high preference for sons, as fewer women opt for a third child. The table illustrates that while most couples stop childbearing after parity two, the PPI value remains high in the eastern and central regions. In states like Uttar Pradesh, Bihar, and Madhya Pradesh, which are part of the eastern-central and northern regions with low PPI at parity 2, a higher PPI is observed at parity 3. In the southern region, most couples stop childbearing at parity two. The most preferred combination for stopping births after parity two was the MM combination, while the FF combination was the least favored. Combinations involving one son or one daughter, such as FFM, FFF, FMM, FMF, MFF, and MFM, are almost equally common after having three children.
There is a total of eight combinations of sex compositions after two children (MMM, MMF, MFM, MFF, FMM, FMF, FFM, and FFF). To avoid excessive contrast differences, we have provided only two states for all eight combinations: Uttar Pradesh (U.P.), a highly populated northern state, and Kerala, a southern state, using NFHS-1 (1992) and NFHS-5 (2021) data to observe trends between 1992 and 2021(to ignore lengthy table we focus only two major states). Table 3 reveals that stopping the behavior of couples after three children was less common, Kerala (76%) had made more progress in family planning compared to Uttar Pradesh (44%), which had seen slower changes in fertility patterns. Figure 5 illustrates PPI vales state-wise variation at parity 3 in the NFHS-1 round. From Table 3, U.P. still exhibits a notable bias between the sex composition of children, while there is a very low difference between MMM and other combinations, such as MFM or FMM, or FFM, in Kerala. Figure 6 illustrates the son preference variation in major states during NFHS-5.
In this context, we first compared the pattern and level of the states of different regions.

5. Discussion

This study presents a quantitative evaluation of son preference variances using the proposed methodology (Yadava et al., 2025). The outcomes, which have been obtained using a model-based method, illustrate how son preference varies substantially by state. This study is interesting as it involves quantitative measurements of son preference (using model-based), showing geographical differences and providing a more accurate, region-specific analysis than earlier research. Quantitative measurements confirm state-level variation in son preference, which is frequently overshadowed by national estimates.
A strong son preference within states indicates rigid cultural and social norms related to son preference, and these behaviours are further reflected in poor performance of certain demographic indicators such as fertility and mortality, and policymakers and program managers develop appropriate state-level policies.
The results demonstrate significant geographical diversity in son preference throughout India's 23 states of different regions. Son preference is strongest in the northern and central regions, followed by the western region of India, and lowest in the southern states. Our findings are consistent with prior research that produced evidence at the state level (Bharati et al. 2011; Dyson and Moore 1983; Gaudin 2011; Singh et al. 2021). The states in northern and central India with the highest son preference also have high fertility, newborn and child mortality, poor contraceptive prevalence, high patriarchy, lower female autonomy, and high poverty (Singh et al. 2021).
This study provides new evidence of significant regional variance in son preference in quantitative measurement based on different sex compositions at different parities. For example, at parity 1, total PPI values (PPI) were particularly high in the southern region, while lowest in the eastern-central and northeast regions. As mentioned in the result, son preference (value of PPI for M is quite large in comparison to F) is high in eastern and central states, followed by northern states. We observed that the gap between male and female children is less in the north-central region whereas wider in the southern region. This disparity was present in all states, having a smaller difference in some states and a larger disparity in some, but the gap (prefers) is higher for male children over female children, because of son preference in all parts of India.

Now more and more females are stopping after two births with MM combination and a lesser number of females with FF combination resulting in higher PPI values in recent times. In this, the central-eastern region i.e. Bihar, Uttar Pradesh, and Orissa (exceptional West Bengal) have the highest level of fertility while the southern regions i.e. Kerala, Tamil Nadu, and Karnataka have the lowest level of fertility. We see that even in recent years (NFHS-5), there is strong evidence of son preference as around half of females (29%) stop childbearing with the MM combination while only 6% females stop with the FF combination in Uttar Pradesh (similar in Bihar). Whereas the gap between the MM and FF combination is relatively smaller for the southern states. In southern regions (high PPI value), couples that have an FM or MF combination voluntarily choose to stop after having two children. Again, we notice that there is a PPI value gap between MM and FF combinations in every state; preference for MM combinations is particularly high in the central-east and north regions, while lesser in the south. Stopping behaviours after the MM combination is higher than that after the FF combination in all regions of India because of Son preference.

The percentage of women with and without a son who do not want additional children varies greatly by the sex composition of the child, with the greatest variances occurring between parity two. Due to the increased popularity of the two-child family in India, the vast majority of parity 1 women want another child, regardless of whether they already have a son. Among women with two or more children, those without a son are more likely to desire another child than those with at least one son. Son preference varies among women with one or two children, but not among those with more than two (Singh et al, 2021) .

At parity 3, few people have two or three children. In this context, we first compare the pattern and level for the two states of two regions (Central and Southern), which are Uttar Pradesh (Similar to Bihar) and Kerala. As for the relative magnitude, for concern, MMM and FFF combinations are a concern for Uttar Pradesh; there is a big gap between the maximum and minimum values. Whereas this gap is relatively smaller for Kerala. As far as the level of stopping after three births is concerned, the conditional probability of three births in Uttar Pradesh is substantially lower in comparison to the probability of stopping in Kerala.

These regional variations highlight the influence of regional factors access to family planning services, and the presence of son preference in shaping reproductive choices. The desired family size in India varies by region, with larger families preferred in northern-central-northeast states like Uttar Pradesh, Bihar, Haryana, and Assam due to cultural and economic factors. In contrast, southern states like Kerala, Karnataka, and Tamil Nadu tend to favour smaller families, influenced by higher education levels, better healthcare, and family planning access.

Further, all the results reported here are based on the assumption that females (or couples) have no control over the sex of the born child. Our indicator of son preference might be biased in populations with high rates of sex-selective abortions or female child mortality (Kashyap and Villavicencio 2016; Robitaille and Chatterjee 2018 ; Aksan 2021; Bhattacharya 2006). While male and female disparities in child mortality have diminished considerably, there is evidence of sex-selective abortions in India (Saikia et al. 2021).

We apply the methodology to major states of the country to explore regional variations in India, particularly examining the influence of sex-based couples' stopping behavior. The methodology is essentially based on the concept of what would be the proportions for different sex compositions for females who stop childbearing at a specific parity if there is an equal preference for each sex composition and comparing this with observed proportions.

Even though the Government of India and various state governments have launched several schemes to increase the value of female children, such as *Beti Bachao Beti Padhao* (Save the girl child, Educate the girl child), *Sukanya Samriddhi Yojana* (savings schemes for female children), and Ladli (promoting female births), inter-state variation in son preference highlights variations where a greater push may be needed to enforce policies to uniformly change the norms that propagate and reinforce son preference. For example, at parity1, high son preference was found in the North-Centre and eastern region states Bihar, Haryana, Uttar Pradesh, Rajasthan, Madhya Pradesh, and Assam. Likewise, at parity 2, high son preference was found in only north-central region states such as Bihar, Uttar Pradesh, Rajasthan, Madhya Pradesh and northeast states Assam, Arunachal Pradesh, and Manipur. Additionally, hotspots of heightened son preference were identified in central and eastern states (Uttar Pradesh, Rajasthan, and Bihar). While these states may differ from each other in terms of culture and local norms. Similar findings are reported in a study of child marriage in India (McDougal et al. 2020). These findings highlight the critical need for geographically focused and targeted policy and program initiatives. Policies and programs that consider regional culture and normative values may be more effective than centrally focused

policies and initiatives. Our findings also call for a better knowledge of the local challenges of implementing and promoting programs targeted at combating the societal danger of son preference. The analysis of fertility patterns and stopping behaviors across India reveals significant regional disparities, shaped by cultural norms, son preference, and access to family planning.
However, more investigations are needed to unfold further facts on this issue.

6. Conclusion

The study we conducted demonstrates regional diversity in son preference quantitative measures at the state level. We applied NFHS-1,3 & 5 (a population-based representative household survey) data to evaluate son preference in India's states, allowing us to explore the regional level and pattern of son preference. The indicators of son preference vary substantially between states. Our findings indicate that son preference in India is state-specific rather than national, and they call for a greater understanding of the determinants related to son preference at the state level.

6.1 Implications

The state-level (regional variation) of son preferences serves as crucial for effective and centered programs and initiatives that address state needs rather than performing at the national level.

6.2 Limitation

We must emphasize the fact that the results given here relate to those females whose age was more than 35 years at the time of the survey. Further, all the results reported here are based on the assumption that females (or couples) have no control over the sex of the born child. However, if there is some deliberate control over the sex of the born child (for example, sex-selective abortion), then the methodology will need modifications.

References:

1. Aksan, A. M. (2021). Son preference and the fertility squeeze in India. *Journal of Demographic Economics*, *87*(1), 67-106.
2. Arnold, F., Choe, M. K., & Roy, T. K. (1998). Son preference, the family-building process and child mortality in India. *Population studies*, *52*(3), 301-315.
3. Bharati, S., Shome, S., Pal, M., Chaudhury, P., & Bharati, P. (2011). Is son preference pervasive in India?. *Journal of Gender Studies*, *20*(3), 291-298.
4. Bhattacharya, P. C. (2006). Economic development, gender inequality, and demographic outcomes: Evidence from India. *Population and Development Review*, *32*(2), 263-292.
5. Bongaarts, J. (2013). The implementation of preferences for male offspring. *Population and Development Review*, *39*(2), 185-208.
6. Chao, F., Guilmoto, C. Z., KC, S., & Ombao, H. (2020). Probabilistic projection of the sex ratio at birth and missing female births by State and Union Territory in India. *PloS one*, *15*(8), e0236673.
7. Chaudhuri, S. (2012). The desire for sons and excess fertility: a household-level analysis of parity progression in India. *International perspectives on sexual and reproductive health*, 178-186.
8. Chiang, C. L., & Van Den Berg, B. J. (1982). A fertility table for the analysis of human reproduction. *Mathematical Biosciences*, *62*(2), 237-251.
9. Clark, S. (2000). Son preference and sex composition of children: Evidence from India. *Demography*, *37*(1), 95-108.
10. Das Gupta, M., & Mari Bhat, P. N. (1997). Fertility decline and increased manifestation of sex bias in India. *Population studies*, *51*(3), 307-315.
11. Dyson, T., & Moore, M. (1983). On kinship structure, female autonomy, and demographic behavior in India. *Population and development review*, 35-60.
12. Ebenstein, A., & Leung, S. (2010). Son preference and access to social insurance: evidence from China's rural pension program. *Population and Development Review*, *36*(1), 47-70.
13. Feeney, G., & Yu, J. (1987). Period parity progression measures of fertility in China. *Population Studies*, *41*(1), 77-102.
14. Gaudin, S. (2011). Son preference in Indian families: absolute versus relative wealth effects. *Demography*, *48*(1), 343-370.
15. Guilmoto, C. Z. (2009). The sex ratio transition in Asia. *Population and development review*, *35*(3), 519-549.
16. Guilmoto, C. Z., Saikia, N., Tamrakar, V., & Bora, J. K. (2018). Excess under-5 female mortality across India: a spatial analysis using 2011 census data. *The Lancet Global Health*, *6*(6), e650-e658.
17. Gupta, M. D. (2005). Explaining Asia's "missing women": a new look at the data. *Population and development review*, *31*(3), 529-535.
18. Hesketh, T., Lu, L., & Xing, Z. W. (2011). The consequences of son preference and sex-selective abortion in China and other Asian countries. *Cmaj*, *183*(12), 1374-1377.
19. International Institute for Population Sciences (IIPS) and ICF. 2021. "National Family Health Survey(NFHS-5) India 2019-21." *Demographic and health surveys* Volume I: 1–714. https://dhsprogram.com/methodology/survey/survey-display-541.cfm.
20. Jayachandran, S. (2015). The roots of gender inequality in developing countries. *Annual review of economics*, *7*(1), 63-88.
21. Kashyap, R., & Behrman, J. (2020). Gender discrimination and excess female under-5 mortality in India: A new perspective using mixed-sex twins. *Demography*, *57*(6), 2143-2167.
22. Kashyap, R., & Villavicencio, F. (2016). The dynamics of son preference, technology diffusion, and fertility decline underlying distorted sex ratios at birth: A simulation approach. *Demography*, *53*(5), 1261-1281.
23. Kim, S., & Lee, S. H. (2020). Son preference and fertility decisions: evidence from spatiotemporal variation in Korea. *Demography*, *57*(3), 927-951.
24. Klaus, D., & Tipandjan, A. (2015). Son preference in India: Shedding light on the north-south gradient. *Comparative population studies*, *40*(1).

25. Pandey, A., & Suchindran, C. M. (1997). Estimation of birth intervals and parity progression ratios from vital rates. *Sankhyā: The Indian Journal of Statistics, Series B*, 108-122.
26. Poston Jr, D. L. (2002). Son preference and fertility in China. *Journal of biosocial science*, *34*(3), 333-347.
27. Robitaille, M. C., & Chatterjee, I. (2018). Sex-selective abortions and infant mortality in India: The role of parents' stated son preference. *The Journal of Development Studies*, *54*(1), 47-56.
28. Saikia, N., Meh, C., Ram, U., Bora, J. K., Mishra, B., Chandra, S., & Jha, P. (2021). Trends in missing females at birth in India from 1981 to 2016: analyses of 2· 1 million birth histories in nationally representative surveys. *The Lancet Global Health*, *9*(6), e813-e821.
29. Pandey, A., Saxena, N. C., & Singh, K. K. (1997). Estimation of parity progression ratios from birth order statistics. *Genus*, 177-188.
30. Shukla, A. K., Yadava, R. C., & Tiwari, A. K. (2018). Measuring Son Preference Through Number of Children Born. *Demography India*, *47*(2).
31. Singh, A., Kumar, K., Yadav, A. K., James, K. S., McDougal, L., Atmavilas, Y., & Raj, A. (2021). Factors influencing the sex ratio at birth in India: A new analysis based on births occurring between 2005 and 2016. *Studies in family planning*, *52*(1), 41-58.
32. Spoorenberg, T. (2010). Fertility Transition in India between 1977 and 2004. *Population*, *65*(2), 313-331.
33. Yadav, A. K., Anand, A., Singh, R. A., & Jungari, S. (2020). Sex composition and son preference in India and major states: Evidence from the National Family Health Survey-4 (2015-16). *Clinical Epidemiology and Global Health*, *8*(4), 1140-1146.
34. Yadava, R. C., Pandey, A., & Saxena, N. C. (1992). Estimation of parity progression ratios from the truncated distribution of closed and open birth intervals. *Mathematical biosciences*, *110*(2), 181-190.
35. Yadava, R. C., Kumar, A., & Pratap, M. (2011). On the estimation of parity progression ratios. *Journal of Scientific Research*, *55*, 127-134.
36. Yadava, R. C., Pandey, A., & Saxena, N. C. (1992). Estimation of parity progression ratios from the truncated distribution of closed and open birth intervals. *Mathematical biosciences*, *110*(2), 181-190.
37. Yadava, R. C. (2018). Stochastic modeling of some natural phenomena: a special reference to human fertility. In *Handbook of statistics* (Vol. 39, pp. 187-274). Elsevier.
38. Yadava, R. C., Tiwari, A. K., & Mahima (2025). On the measurement of son preference in quantitative terms. *Demography India*, *54*(1).

Table 1 Changes in PPI values for the three rounds of survey for the states of different regions at parity one

North region states												
	Haryana			*Punjab*			*Rajasthan*			*Himachal Pradesh*		
Survey Round	*Calculated Parity Progression Infecundity*											
M	**NFHS-1**	**NFHS-3**	**NFHS-5**	**NFHS-1**	**NFHS-3**	**NFHS-5**	**NFHS-1**	**NFHS-3**	**NFHS-5**	**NFHS-1**	**NFHS-3**	**NFHS-5**
F	0.028	0.054	0.145	0.028	0.059	0.141	0.036	0.024	0.137	0.043	0.058	0.059
PPI for parity 1	0.014	0.015	0.109	0.021	0.027	0.069	0.038	0.019	0.055	0.013	0.028	0.258
Survey Round	0.021	0.034	0.944	0.024	0.042	0.123	0.03	0.021	0.047	0.028	0.043	0.543

Central Region							**Western Region**					
	Uttar Pradesh			*Madhya Pradesh*			*Gujrat*			*Maharashtra*		
Survey Round	*Calculated Parity Progression Infecundity*											
M	**NFHS-1**	**NFHS-3**	**NFHS-5**	**NFHS-1**	**NFHS-3**	**NFHS-5**	**NFHS-1**	**NFHS-3**	**NFHS-5**	**NFHS-1**	**NFHS-3**	**NFHS-5**
F	0.031	0.026	0.063	0.036	0.044	0.162	0.034	0.079	0.106	0.061	0.089	0.188
PPI for parity 1	0.015	0.021	0.035	0.038	0.026	0.134	0.027	0.038	0.032	0.055	0.056	0.059
Survey Round	0.022	0.023	0.049	0.036	0.035	0.051	0.03	0.058	0.095	0.057	0.072	0.105

Southern Region												
	Kerala			*Karnataka*			*Tamil Nadu*			*Andhra Pradesh*		
Survey Round	*Calculated Parity Progression Infecundity*											
M	**NFHS-1**	**NFHS-3**	**NFHS-5**	**NFHS-1**	**NFHS-3**	**NFHS-5**	**NFHS-1**	**NFHS-3**	**NFHS-5**	**NFHS-1**	**NFHS-3**	**NFHS-5**
F	0.068	0.089	0.115	0.046	0.069	0.073	0.084	0.011	0.148	0.079	0.045	0.107
PPI for parity 1	0.062	0.107	0.042	0.047	0.104	0.029	0.059	0.087	0.121	0.065	0.041	0.084
Survey Round	0.064	0.097	0.148	0.048	0.086	0.134	0.071	0.1	0.132	0.072	0.043	0.096

	Eastern Region						**North-east Region**					
	Bihar			*West Bengal*			*Assam*			*Manipur*		
Survey Round	*Calculated Parity Progression Infecundity*						*Calculated Parity Progression Infecundity*					
M	**NFHS-1**	**NFHS-3**	**NFHS-5**	**NFHS-1**	**NFHS-3**	**NFHS-5**	**NFHS-1**	**NFHS-3**	**NFHS-5**	**NFHS-1**	**NFHS-3**	**NFHS-5**
F	0.04	0.027	0.035	0.073	0.192	0.172	0.045	0.099	0.227	0.047	0.121	0.135
PPI for parity 1	0.022	0.01	0.024	0.059	0.127	0.1	0.043	0.076	0.133	0.031	0.089	0.087
Survey Round	0.031	0.025	0.029	0.066	0.159	0.18	0.044	0.087	0.136	0.039	0.105	0.111

Note: PPI represents the Parity Progression Infecundity values for parity one across different periods and major states of India.
Data Source: National Family Health Surveys India.

Table 2 Changes in PPI values for the three rounds of survey for the states of different regions at parity two

North region states												
States	*Haryana*			*Punjab*			*Rajasthan*			*Himachal Pradesh*		
	Calculated Parity Progression Infecundity						*Calculated Parity Progression Infecundity*					
Survey Round	**NFHS-1**	**NFHS-3**	**NFHS-5**	**NFHS-1**	**NFHS-3**	**NFHS-5**	**NFHS-1**	**NFHS-3**	**NFHS-5**	**NFHS-1**	**NFHS-3**	**NFHS-5**
MM	0.121	0.326	0.65	0.234	0.394	0.687	0.106	0.231	0.253	0.253	0.562	0.811
MF	0.145	0.225	0.402	0.135	0.34	0.742	0.135	0.34	0.742	0.145	0.225	0.402
FM	0.077	0.238	0.576	0.117	0.251	0.506	0.075	0.11	0.13	0.13	0.388	0.806
FF	0.024	0.045	0.076	0.046	0.042	0.148	0.092	0.145	0.111	0.111	0.372	0.711
PPI for parity 2	0.092	0.208	0.426	0.133	0.257	0.52	0.074	0.128	0.295	0.135	0.343	0.625

	Central Region						**Western Region**					
States	*Uttar Pradesh*			*Madhya Pradesh*			*Gujrat*			*Maharashtra*		
	Calculated Parity Progression Infecundity						*Calculated Parity Progression Infecundity*					
Survey Round	**NFHS-1**	**NFHS-3**	**NFHS-5**	**NFHS-1**	**NFHS-3**	**NFHS-5**	**NFHS-1**	**NFHS-3**	**NFHS-5**	**NFHS-1**	**NFHS-3**	**NFHS-5**
MM	0.089	0.183	0.294	0.119	0.306	0.464	0.207	0.362	0.598	0.186	0.396	0.724
MF	0.056	0.105	0.213	0.07	0.244	0.311	0.152	0.288	0.503	0.164	0.266	0.534
FM	0.055	0.11	0.206	0.076	0.167	0.31	0.137	0.236	0.412	0.154	0.34	0.555
FF	0.034	0.071	0.061	0.047	0.085	0.068	0.067	0.067	0.122	0.091	0.104	0.163
PPI for parity 2	0.058	0.117	0.194	0.078	0.20	0.288	0.141	0.238	0.409	0.149	0.276	0.494

Southern Region

States	*Kerala*			*Karnataka*			*Tamil Nadu*			*Andhra Pradesh*		
	Calculated Parity Progression Infecundity											
Survey Round	**NFHS-1**	**NFHS-3**	**NFHS-5**	**NFHS-1**	**NFHS-3**	**NFHS-5**	**NFHS-1**	**NFHS-3**	**NFHS-5**	**NFHS-1**	**NFHS-3**	**NFHS-5**
MM	0.249	0.565	0.702	0.198	0.363	0.629	0.187	0.472	0.669	0.154	0.392	0.726
MF	0.342	0.603	0.745	0.153	0.344	0.548	0.179	0.434	0.683	0.124	0.366	0.639
FM	0.292	0.523	0.698	0.147	0.362	0.582	0.175	0.427	0.699	0.207	0.4	0.64
FF	0.249	0.556	0.619	0.111	0.204	0.286	0.108	0.298	0.428	0.127	0.216	0.411
PPI for parity 2	0.283	0.562	0.691	0.152	0.318	0.511	0.162	0.408	0.62	0.123	0.34	0.60

Eastern Region **North-East Region**

States	*Bihar*			*West Bengal*			*Assam*			*Manipur*		
	Calculated Parity Progression Infecundity											
Survey Rounds	**NFHS-1**	**NFHS-3**	**NFHS-5**	**NFHS-1**	**NFHS-3**	**NFHS-5**	**NFHS-1**	**NFHS-3**	**NFHS-5**	**NFHS-1**	**NFHS-3**	**NFHS-5**
MM	0.115	0.122	0.217	0.175	0.355	0.557	0.164	0.311	0.454	0.015	0.381	0.401
MF	0.062	0.083	0.119	0.143	0.361	0.566	0.117	0.282	0.439	0.110	0.214	0.365
FM	0.089	0.116	0.12	0.098	0.382	0.558	0.069	0.229	0.467	0.106	0.19	0.347
FF	0.046	0.058	0.036	0.105	0.192	0.267	0.073	0.139	0.218	0.094	0.212	0.194
PPI for parity 2	0.078	0.094	0.123	0.13	0.322	0.487	0.105	0.24	0.395	0.076	0.20	0.323

Note: PPI represents the Parity Progression Infecundity values for parity two across different periods two major states of India.

Table 3 Changes in PPI values for the three rounds of survey for the states of different regions at parity three

NFHS-1 (1992-93)		**NFHS-5 (2019-21)**		**NFHS-1 (1992-93)**		**NFHS-5 (2019-21)**	
Sex Compositions	*PPI Values*	*Sex Compositions*	*PPI Values*	*Sex Compositions*	*PPI Values*	*Sex Compositions*	*PPI Values*
MMM	0.5	MMM	0.501	MMM	0.499	MMM	0.757
MMF	0.4	MMF	0.401	MMF	0.401	MMF	0.556
MFM	0.4	MFM	0.401	MFM	0.399	MFM	0.602
MFF	0.2	MFF	0.200	MFF	0.200	MFF	0.867
FMM	0.4	FMM	0.400	FMM	0.401	FMM	0.722
FMF	0.2	FMF	0.201	FMF	0.201	FMF	0.483
FFM	0.2	FFM	0.199	FFM	0.199	FFM	0.471
FFF	0	FFF	0	FFF	0	FFF	0
Total PPI value	0.112	Total PPI value	0.331	Total PPI value	0.440	Total PPI value	0.76

Source: National Family Health Surveys India.

Data Availability Statement: The National Family Health Survey-5 dataset used in the study is publicly available at the official website of the RESEARCH ARTICLE

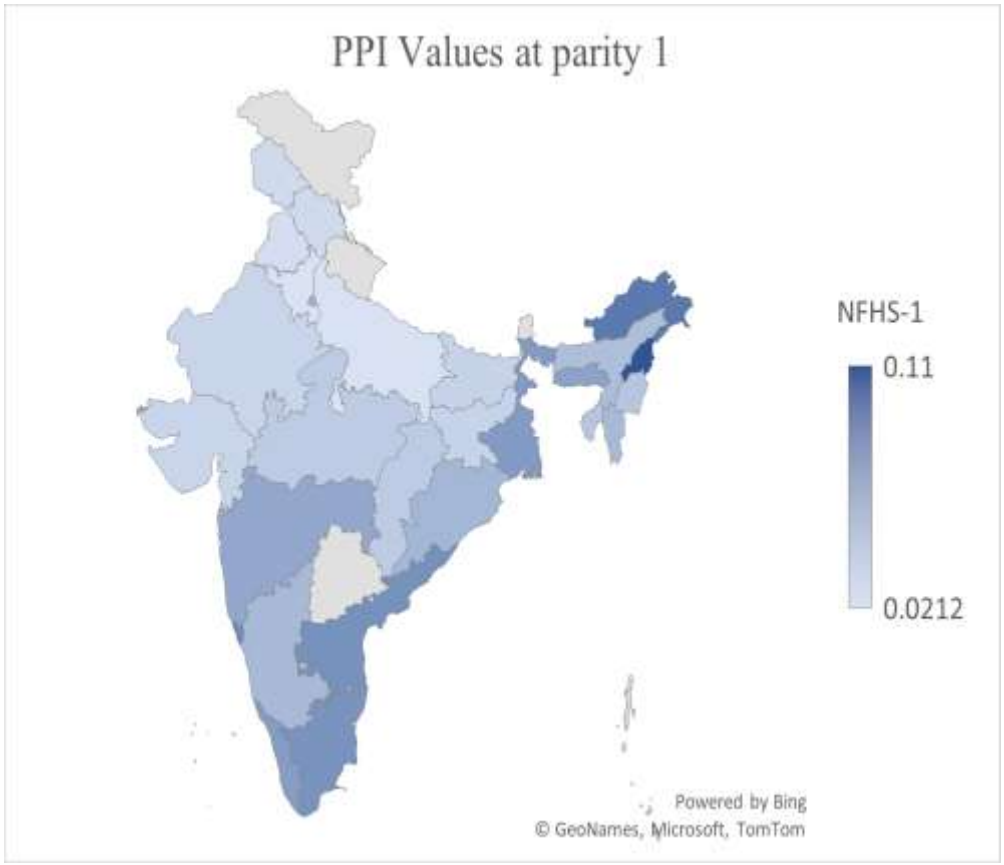


Figure 1 PPI Values at Parity One in Various Regions of India during NFHS-1.

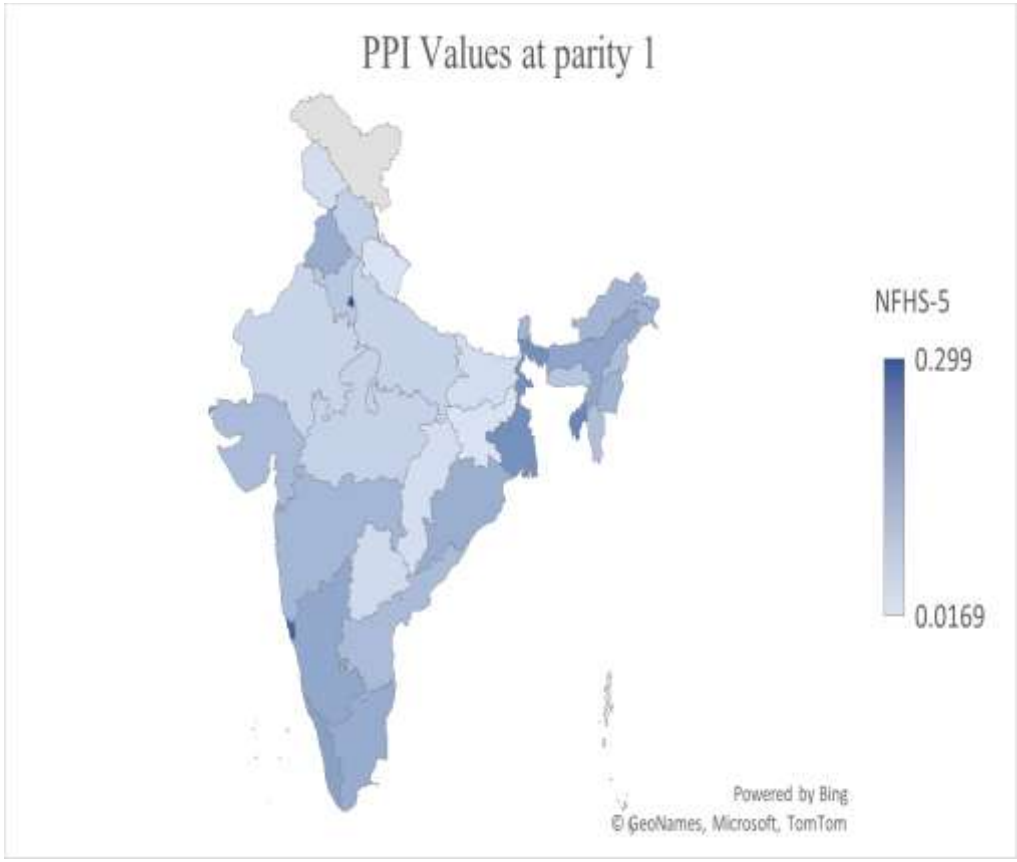
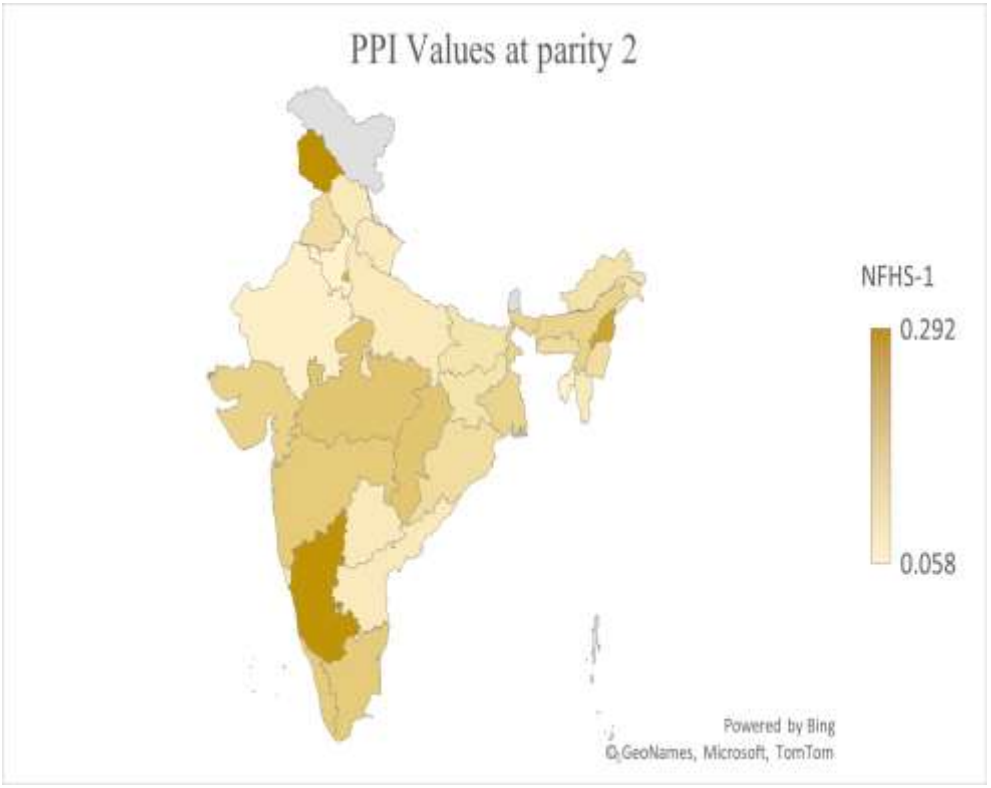


Figure 2 PPI Values at Parity One in Various Regions of India during NFHS-5.



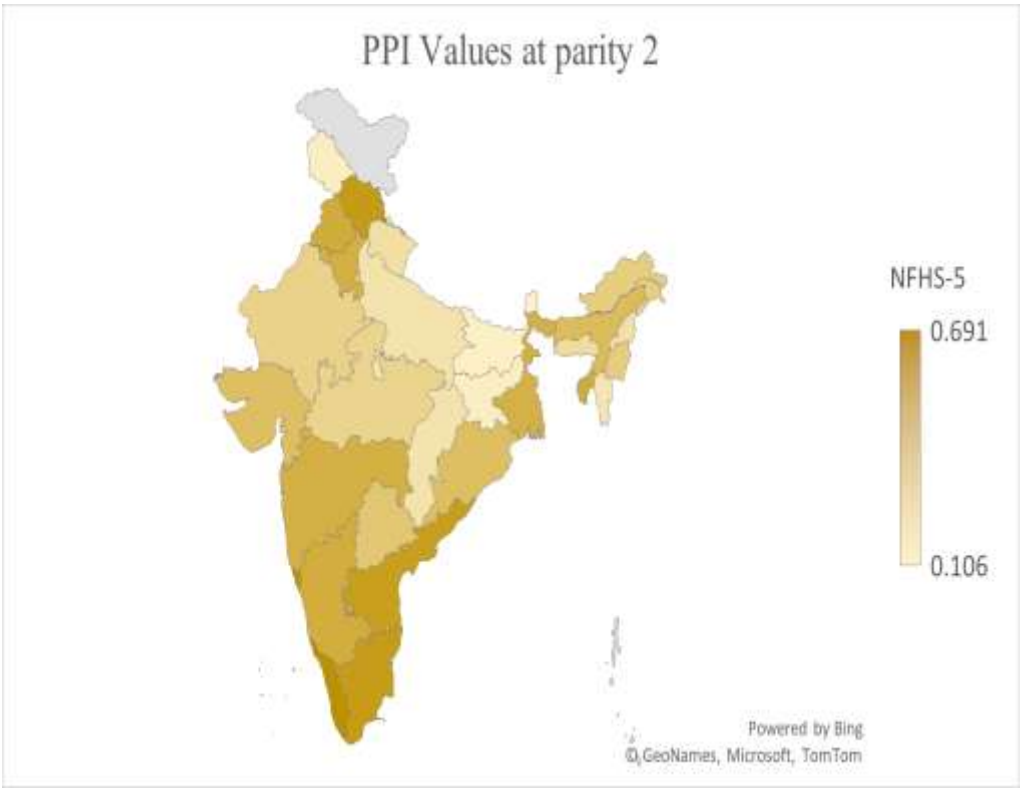


Figure 3 PPI Values at Parity Two in Various Regions of India during NFHS-1. **Figure 4** PPI Values at Parity Two in Various Regions of India during NFHS-5.

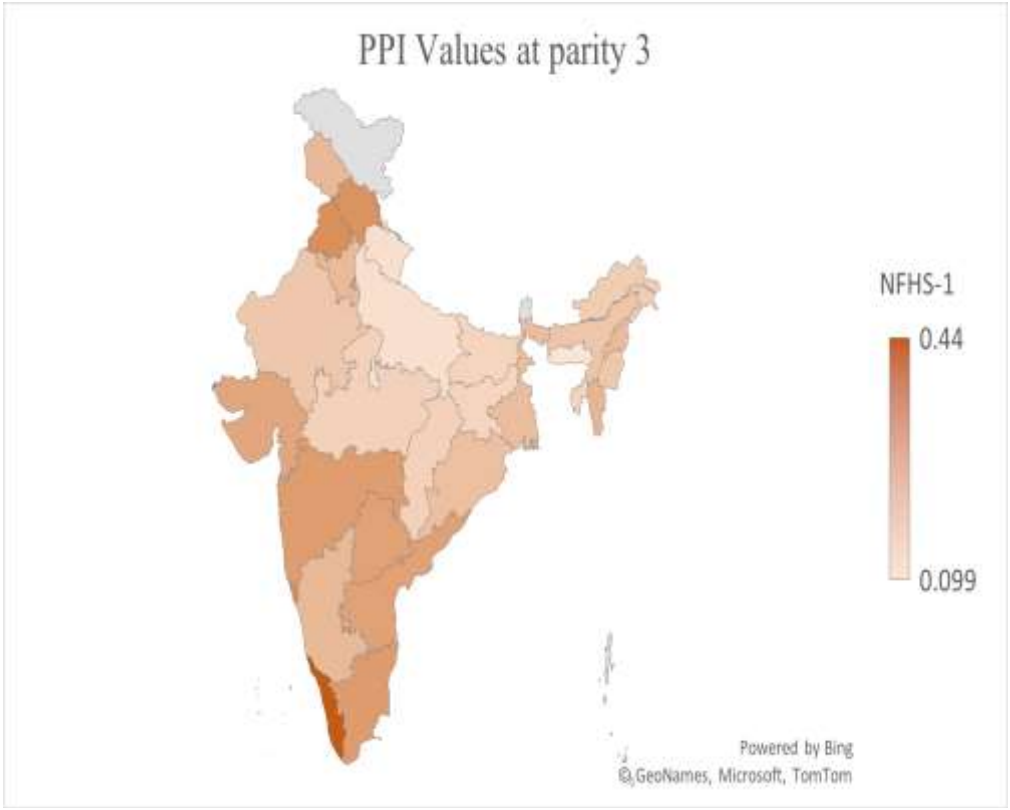


Figure 5 PPI Values at Parity Three in Various Regions of India during NFHS-1.

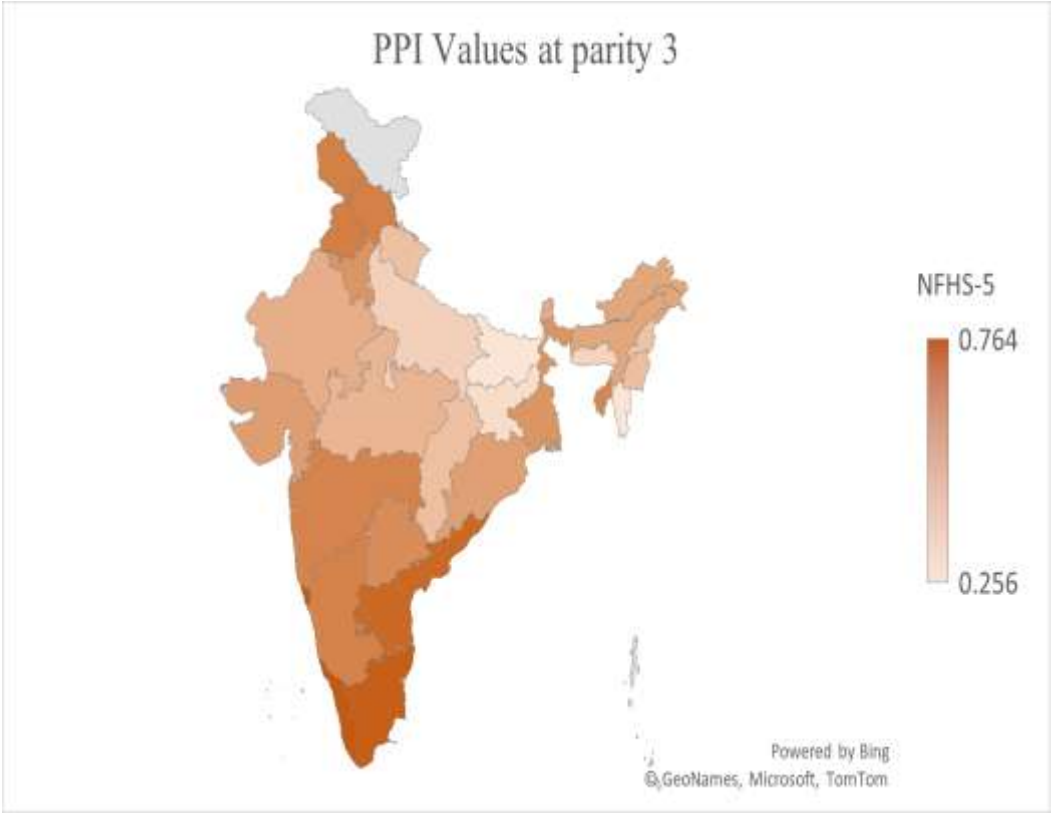


Figure 6 PPI Values at Parity Three in Various Regions of India during NFHS-5.

Appendix

Table 4 Changes in PPI values for all rounds of the survey for the states of different regions at parity one

States	*PPI Values at parity 1*				
	NFHS-1	**NFHS-2**	**NFHS-3**	**NFHS-4**	**NFHS-5**
Andhra Pradesh	0.072	0.05	0.043	0.08	0.095
Arunachal Pradesh	0.087	0.038	0.059	0.107	0.108
Assam	0.044	0.058	0.087	0.106	0.136
Bihar	0.031	0.028	0.0249	0.031	0.029
Chhattisgarh	0.036	0.032	0.032	0.067	0.027
Delhi	0.051	0.051	0.077	0.108	0.299
Goa	0.075	0.110	0.172	0.239	0.269
Gujrat	0.03	0.037	0.059	0.085	0.095
Haryana	0.0212	0.022	0.034	0.070	0.069
Himachal Pradesh	0.027	0.036	0.040	0.071	0.054
Jammu & Kashmir	0.027	0.020	0.036	0.060	0.027
Jharkhand	0.031	0.028	0.045	0.060	0.016
Karnataka	0.047	0.061	0.087	0.133	0.134
Kerala	0.065	0.087	0.097	0.150	0.148
Madhya Pradesh	0.036	0.032	0.035	0.052	0.051
Maharashtra	0.057	0.065	0.072	0.090	0.105
Manipur	0.039	0.067	0.068	0.105	0.111
Meghalaya	0.061	0.067	0.054	0.077	0.073
Mizoram	0.047	0.048	0.071	0.094	0.087
Nagaland	0.110	0.054	0.065	0.087	0.091
Orissa	0.049	0.046	0.073	0.100	0.121
Punjab	0.0242	0.041	0.042	0.097	0.123
Rajasthan	0.03	0.021	0.021	0.042	0.047
Sikkim	*	0.042	0.114	0.170	0.106
Tamil Nadu	0.071	0.091	0.100	0.163	0.127
Telangana	0.072	0.050	0.043	0.081	0.035
Tripura	0.039	0.069	0.100	0.194	0.199
Uttar Pradesh	0.022	0.023	0.023	0.034	0.049
Uttarakhand	0.022	0.023	0.031	0.041	0.017
West Bengal	0.066	0.119	0.159	0.142	0.180

Source: National Family Health Surveys India

Table 5 Changes in PPI values for all rounds of the survey for the states of different regions at parity two

States	*PPI Values at parity 2*				
	NFHS-1	**NFHS-2**	**NFHS-3**	**NFHS-4**	**NFHS-5**
Andhra Pradesh	0.077	0.185	0.094	0.503	0.604
Arunachal Pradesh	0.095	0.163	0.224	0.262	0.321
Assam	0.130	0.144	0.322	0.304	0.426
Bihar	0.091	0.078	0.208	0.114	0.123
Chhattisgarh	0.162	0.075	0.142	0.240	0.193
Goa	0.074	0.308	0.128	0.592	0.682
Gujrat	0.135	0.189	0.343	0.387	0.408
Haryana	0.058	0.155	0.117	0.382	0.494
Himachal Pradesh	0.078	0.224	0.200	0.472	0.625
Jammu & Kashmir	0.292	0.101	0.172	0.257	0.134
Jharkhand	0.091	0.078	0.154	0.206	0.129
Karnataka	0.283	0.205	0.561	0.472	0.511
Kerala	0.152	0.384	0.318	0.721	0.691
Madhya Pradesh	0.162	0.075	0.407	0.224	0.288
Maharashtra	0.152	0.216	0.343	0.400	0.494
Manipur	0.105	0.122	0.24	0.288	0.327
Meghalaya	0.110	0.105	0.158	0.187	0.231
Mizoram	0.076	0.089	0.201	0.207	0.181
Nagaland	0.237	0.061	0.453	0.182	0.215
Orissa	0.108	0.224	0.248	0.472	0.409
Punjab	0.106	0.232	0.158	0.496	0.520
Rajasthan	0.064	0.069	0.167	0.239	0.295
Sikkim	*	0.123	0.114	0.468	0.106
Tamil Nadu	0.152	0.270	0.407	0.582	0.619
Telangana	0.077	0.077	0.094	0.385	0.364
Tripura	0.058	0.205	0.248	0.507	0.519
Uttar Pradesh	0.078	0.068	0.117	0.137	0.193
Uttara Khand	0.078	0.068	0.210	0.268	0.221
West Bengal	0.130	0.251	0.322	0.404	0.487
Delhi	0.208	0.261	0.299	0.407	0.347

Source: National Family Health Surveys India

Table 6 Changes in PPI values for all rounds of the survey for the states of different regions at parity three

States	*PPI Values at parity 3*				
	NFHS-1	**NFHS-2**	**NFHS-3**	**NFHS-4**	**NFHS-5**
Andhra Pradesh	0.263	0.309	0.565	0.667	0.709
Arunachal Pradesh	0.159	0.298	0.176	0.381	0.483
Assam	0.176	0.239	0.351	0.385	0.482
Bihar	0.138	0.146	0.158	0.244	0.257
Chhattisgarh	0.147	0.293	0.267	0.414	0.391
Delhi	0.276	0.363	0.483	0.511	0.452
Goa	0.309	0.422	0.585	0.695	0.761
Gujrat	0.25	0.327	0.392	0.504	0.516
Haryana	0.204	0.302	0.417	0.539	0.546
Himachal Pradesh	0.299	0.399	0.565	0.607	0.625
Jammu & Kashmir	0.208	0.224	0.328	0.416	0.621
Jharkhand	0.138	0.146	0.244	0.341	0.284
Karnataka	0.206	0.325	0.436	0.581	0.615
Kerala	0.44	0.542	0.617	0.741	0.764
Madhya Pradesh	0.147	0.182	0.293	0.367	0.43
Maharashtra	0.275	0.375	0.428	0.575	0.609
Manipur	0.171	0.18	0.321	0.398	0.391
Meghalaya	0.099	0.159	0.203	0.267	0.316
Mizoram	0.214	0.25	0.32	0.399	0.256
Nagaland	0.2	0.144	0.185	0.264	0.375
Orissa	0.19	0.27	0.347	0.44	0.508
Punjab	0.31	0.369	0.44	0.631	0.629
Rajasthan	0.172	0.154	0.211	0.379	0.453
Sikkim	*	0.232	0.382	0.579	0.471
Tamil Nadu	0.277	0.396	0.558	0.703	0.746
Telangana	0.263	0.309	0.565	0.584	0.577
Tripura	0.138	0.307	0.355	0.561	0.599
Uttar Pradesh	0.112	0.141	0.186	0.247	0.331
Uttarakhand	0.112	0.186	0.324	0.423	0.388
West Bengal	0.194	0.305	0.357	0.497	0.548

Source: National Family Health Surveys India