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Statistical Analysis of Fertility Control Measures in Diverse Group of Females

Brijesh Pratap Singh[1], *Sonam Maheshwari* [2] *and Puneet Kumar Gupta* [3,*]

[1]Department of Statistics, Institute of Science, Banaras Hindu University, Varanasi, India
[2]Department of Community Medicine, Govt. Doon Medical College, Dehradun, India
[3]ICFAI Business School, The ICFAI University, Dehradun, India

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Abstract: Fertility in India will continue to decline steadily to below-replacement levels towards the end of the century, and then recover early next century. Averages aggregated at the national level however, mask the considerable economic, cultural and spatial heterogeneity at the regional level, which in turn, have a profound influence on the level and pace of fertility decline. Conventional fertility theories highlight the influence of modernization, social and economic development and diffusion of changing ideas and individualistic values on the desired number of children. In this study estimation of fertility pattern is analyzed by two fertility control measure. First measure is based on the birth interval treated as non–homogenous Poisson Process and second measure is based on ASFR. The results indicate fertility after age 35 is decreasing; it may be due to use of contraception or curtailing fertility after age 35 years.
Keywords: Fertility, NFHS, ASFR, Birth Interval, Stochastic Process.

1. Introduction

India, as a country of striking demographic diversity, with enormous variations in the conditions and mechanisms of fertility transition, offers a rich ground for these analyses. The TFR has declined noticeably in India over time. Between 1992-93 and 2015-16, the TFR has declined by 1.2 children (from a TFR of 3.4 children in 1992-93 to 2.2 children in 2015-16) [1-2]. The decline in fertility in India is perceived as part of the innovation phenomena that is taking place according to diffusion mechanisms. In addition to the influence of several socioeconomic factors reflecting structural changes, the decline in fertility also seems to proceed by contagion for which any form of proximity, spatial or social, is an important factor of diffusion mechanism. Estimates of fertility are among the most widely used demographic statistics. In many developing countries, policy makers, program managers and demographers to determine whether and how fertility is moving in the desired downward direction avidly watch recent levels and trends in fertility.

The conventional approach to the studies on fertility decline had been based on the strong premise that the decision on the number of children is taken purely privately within the household decision making framework. Hence the question has been on how the individual decision on number of children is shaped in different settings. The demand theories brought out the relative importance of various factors, viz., income, education, social status, women's autonomy, etc. in influencing such individual decisions. It was, therefore, thought that decision on number of children could be altered by individual capacity building through improving income, educational level, mass media exposure, women's emancipation, etc. [3].

However, recent evidences suggest that the individual and household level factors are unable to explain the full course of fertility transition taking place in many developing countries including some of the states in India. The studies observed a geographical regularity in Indian fertility transition [4, 5]. The fertility transition in some regions cut across socio-economic and cultural boundaries. For instance, contraceptive use, in states like Andhra Pradesh, was predominantly by those with low economic and social background. Hence as a natural recourse to demand theories, supply side argument (diffusion theories) emerged as a compelling explanation for the fertility transition. The geographical spread in fertility decline was explained in terms of better provision of family planning than individual capacity building process.

In public debates, rapid population growth on account of high fertility was frequently cited as the principal

*Corresponding author e-mail: puneetstat999@gmail.com

hindrance to improving levels of living and overall development. High fertility is associated with childbearing starting early and continuing until the late reproductive years. However, since women in high-fertility populations typically keep bearing children as long as they remain fecund, the age pattern of fertility is relatively flat. Fertility transition occurs through decreases of fertility at both ends of the reproductive life span, resulting in a more convex age pattern. The decrease of fertility at younger ages is often the result of rising ages at marriage, whereas fertility declines at the older ages primarily because of an increasing propensity to limit family size. Also it is observed that contraceptive prevalence rate in this region is also found to be low. The strong relationship between contraceptive prevalence and the overall level of childbearing Contraception is the most important of the proximate determinants of cross-national differences in fertility. Hence there is an earnest need to develop and evolve a suitable model for examining the tempo of fertility for different states of India.

In recent scenario, fertility control is the most important way to check high population growth. Fertility is directly influenced by a set of social and biological factors. Some intermediate variables, which are influenced by various socio-cultural, economic and environmental factors, are woman's age, education level, age at marriage, economic status and religious attitudes. Among the factors responsible for fertility variation, maternal education, mother's age at marriage and use of contraceptives were found to play a significant role in fertility reduction. The fact that Women's education has a positive impact on fertility regulation has been established by many others [6-12]. Several authors [11, 13] reported that religion plays an important role in determining the attitude of the people in limiting the fertility. Religious disparities also play an important role in declining or increasing fertility, like high fertility rate found in the Muslim population compare to the Hindu population [14]. With the rising level of education and socio economic development, there has been a change in these intermediate variables and fertility indicators. In this paper an attempt has been made to analyze the effect of education, place of residence, age and religion on fertility.

In lieu of the above, the present study considers the estimation of fertility pattern by two fertility control measure. First measure is based on the birth interval treated as non–homogenous Poisson Process while second measure is based on ASFR. For the first measure, reproductive information (birth interval) have been used; that is obtained from data collected in NFHS-I and NFHS-IV which provide the birth history in a five or six year window period prior to the survey date in different states of India and used this measure in an age segment of women. This measure in fact derived from a model suggested by Lawless [15] and later on used by Singh et al. [16]. On the other hand, second measure is based on ASFR, this measure suggested by Suchindran [17] and further modified by Singh [18] and Singh et al. [19]. The above mentioned two measures are used to know the excess fertility in the various segments of the society as well as over the time in the society.

2. Data and Methodology

2.1. Fertility Control Measure-I

The Proposed measure is taken to analyze the effects of socio cultural factors on human reproduction in three fertility National Family Health surveys conducted in 1992-93 and 2015-16 respectively. Here we take only those women whose marital duration are greater than seven years and have children of age maximum up to seven years. The methodology is discussed below.

The methods in the article are based on the proportional intensity Poisson process model. Assume that the birth events in the age interval follow non homogenous Poisson process. Assume further that the data records the birth history of a woman in the age interval (T_0, T_1), $(T_1 > T_0)$. Here we assume $T_0 = 0$ without any loss of generality for changing age interval to duration interval. Intensity function can be described as

$$\omega = \int_0^t \delta(u)du \tag{1}$$

Let the data set collected for the birth history of N women in a particular age interval and out of which m women is of at least parity one in this interval whereas n women has not a single birth in this particular interval, i.e., N=m+n

For the i[th] women (who has a birth in this interval), let there be n_i births occur at times tij, j= 1, 2, ….n_i ;i =1,2,3…..m and $\sum_{i=1}^{m} B_i$. Then the assumption that the individuals act independently, the log likelihood of the number of events (births) data can be written as

$$\log L = \sum_{i=1}^{m}\sum_{j=1}^{n}\log\delta(t_{ij}) - \sum\omega(t_i) \tag{2}$$

Again assume that

$$\delta(t) = \alpha\varphi t^{\varphi-1} \tag{3}$$

Here α represents the level of intensity and φ represents the shape of fertility pattern in this interval. If $\varphi > 1$ and $\varphi < 1$ then fertility level is increasing and decreasing respectively and if equal to 1 then level is constant. The estimate of shape parameter is obtained by substituting equation (3) in equation (2) and maximizing the log likelihood. By assuming that, all women are observed for an equal period of time (i.e. T_i=T for all i), the maximum likelihood estimate $\hat{\varphi}$ of φ is

$$\hat{\varphi} = -\frac{B}{\sum_{i=1}^{m}\sum_{j=1}^{n}\log\frac{t_{ij}}{T_i}} \tag{4}$$

With approximate standard error $S.E.(\varphi) = \frac{\varphi}{\sqrt{B}}$

Here, we illustrate the application of the above mentioned measures using data from three rounds of NFHS. The objective is to study socio economic, cultural and behavioral factors affecting fertility and estimation of the bio-cultural parameters of reproduction. In order to illustrate the fertility differentials and change in any age segment of reproductive life span, we construct the aforesaid proposed measure for several subgroups of population from both surveys. These subgroups are constructed on the basis of women's education, religion and caste. Further to obtain a reasonable number of women in each subclass of the population; we have grouped women in each subclass of the population by their age at the time of survey as 25-29, 30-34, 35-39 and 40-44. Thus the measure of fertility pattern of women in the age group 25-29 describes approximately the shape of their fertility in the seven year window from age 20.5 to 27.5 .The other age groups may also be interpreted accordingly. The tables present here the estimated value of measure and their standard errors for various age groups in different sub-populations in 1992 and 2005 surveys. This table presents the estimated measure for women who were in the age group 25-29 at the time of survey. The result indicates that the proposed measure works well in showing differentials and trends in fertility level in the study population.

2.2. Fertility Control Measure-II

The age-specific fertility curves normalized by total fertility can be considered as the density of the age at childbearing distribution. Coale and Demeney [20] proposed a measure of mean age of fertility schedule to characterize the age-specific fertility schedules. Anderson and Silver [21] proposed a measure of fertility control and it is interpreted as the proportion bearing children before age 35. They have shown that this measure has several advantages over the most commonly used measure of fertility control estimated by other model. This measure does not consider the right tail of age-specific fertility schedule. As in Anderson and Silver [21], the fertility control can be detected by assuming the shape of the right hand side (the cut off age is 35) of the age specific fertility rate, the shape of age specific fertility rate changes from convex to concave after it reaches its maximum value generally. A combined measure of these three components was proposed by Sen [22] and further used by Suchindran [17] as an alternative measure of fertility control. This measure has three components:

1. The proportion bearing children after age 35 (compliment of Anderson & Silver measure).
2. The mean age at childbearing among women who bear children after age 35.
3. The dispersion measure (Gini coefficient) of age at childbearing after age 35.

If the cut off age 35 is considered then the higher the proportion of the births that occur after age 35 results, the higher total fertility and if the proportion of births that occurs after age 35 is lower, than the total fertility is controlled to some extent. Low value of all three components indicates high fertility control. When all the three components changes move in same direction, any one of the components may be used as a measure of fertility control but when the components changes move in different direction then the combined measure is the better measure of fertility control. Detail discussion on the proposed modified method and other methods to estimate the fertility control measure are given as follows:

First we will describe the three components of the fertility control measure.

1) α **-Measure (proportion bearing children after age 35):-** Let m(a) denotes the age specific fertility rate at age 'a' then the total fertility rate will be

$$TFR = \int_{15}^{50} m(a)da \tag{5}$$

and

$$\alpha = \int_{35}^{50} m(a)da \Big/ TFR \tag{6}$$

Lower value of α indicates higher fertility control.

2) β **-Measure (age gap ratio):-** The density of age at childbearing is f*(a)= m(a)/TFR and the density of age at childbearing for women who bear children after age 35 is

$$f(a) = \frac{f^*(a)}{\alpha} \quad ; a > 35 \tag{7}$$

The mean age at childbearing among women who bear children after age 35 is

$$\mu = \int_{35}^{50} af(a)da \tag{8}$$

then the second component of fertility control is the age gap ratio (β) which is the scaled deviation of mean age at childbearing is defined as

$$\beta = \frac{(\mu - 35)}{\mu} \tag{9}$$

This is clear that when mean age at childbearing is closer to the age 35, the value of β will be low and the fertility control will be high. For very low fertility level β seems to be a good estimate of fertility control.

3) **Gini Coefficient (Measure of Dispersion):-** Sen [22] showed that Gini coefficient in terms of the survival function can be written as

$$G = \frac{1}{\mu} \int_{35}^{50} S(a)\left[1 - S(a)\right] da \tag{10}$$

where S(a)= 1-F*(a), here F*(a) is the cumulative distribution function of age at childbearing density. The Gini coefficient is a scaled measure of average years of child bearing exposure after age 35 in the population. Like β-measure, this is also a good measure of fertility control for low level of fertility. A combined measure of the above three components is defined as a weighted geometric mean of the proportion bearing children after age 35 (α) and its product with scaled deviation of the mean age at childbearing for the entire synthetic cohort (β). The weight being, dispersion measure G and its complement is 1-G respectively.

$$I = \alpha^{G} (\alpha\beta)^{1-G} = \alpha\beta^{1-G} \tag{11}$$

Higher proportions of the births that occur after age 35 results in higher fertility and vice versa. Low value of the measure indicates low risky fertility.

3. Proposed Modified Method

Although, the methods discussed so far gives good estimate for published data in Suchindran [17] but still have complicated mathematical calculation. Here, a simple procedure has been proposed to estimate the measure of fertility control. Very high correlation (0.9996) is obtained between β 1-G and β from published data in Suchindran [17]. Thus a coefficient β* is used instead of β^{1-G}. Here, the following equation has been considered

$$\hat{I} = \alpha\beta^* \quad (12)$$

where, β*=1.1744β-0.0107 is obtained using linear regression technique. In this method, there is no need of Gini coefficient. For the justification of the above equation, the method is used on the data published in Suchindran [17].

4. Applications and Discussion

In this section, both the fertility control measures have been estimated for the data of NFHS-I and NFHS-IV for some major states of India and India itself. The percent change in the fertility control measures is obtained using percentage change method defined as

$$\text{\% change in fertility control measures} = \frac{(A-B)}{A} \times 100$$

Where A and B are the estimates of fertility control measure for NFHA-I and NFHS-IV respectively.

A positive change indicates the fertility is under better control. Table 1 represents fertility control measure based on ASFR and birth interval beyond age 35 years taking NFHS-I and NFHS-IV data for two states of India (Uttar Pradesh and Tamil Nadu). Both the measures are decreasing in nature, however, TFR shows that fertility declines rapidly as compared to indexes. Because fertility measures calculated the tempo of fertility after age 35, while TFR shows the tempo of fertility of reproductive period.

Table1: Fertility Control Measures based on ASFR and birth interval beyond age 35 years.

States	Fertility measure based on birth interval (Measure-I)		% Change	Fertility measure based on ASFR (Measure-II)		% Change	Total Fertility Rate		% Change
	NFHS-I	NFHS-IV		NFHS-I	NFHS-IV		NFHS-I	NFHS-IV	
Haryana	0.7785	0.6958	10.62	0.00824	0.00617	25.12	3.99	2.14	46.37
Himachal Pradesh	0.5885	0.5014	14.80	0.00634	0.00510	19.56	2.97	1.92	35.35
Punjab	0.6815	0.5821	14.59	0.00539	0.00420	22.08	2.92	1.65	43.49
Rajasthan	0.6990	0.5914	15.39	0.01382	0.00770	44.28	3.63	2.41	33.61
Madhya Pradesh	0.7982	0.6514	18.39	0.01317	0.00459	65.15	3.90	2.34	40.00
Uttar Pradesh	0.8018	0.7584	5.41	0.01946	0.00978	49.74	4.82	2.71	43.78
Bihar	0.8215	0.7214	12.19	0.01509	0.00997	33.93	4.00	3.42	14.50
Orissa	0.6319	0.5001	20.86	0.00717	0.00721	-0.56	2.92	2.11	27.74
West Bengal	0.6014	0.5214	13.30	0.00936	0.00192	79.49	2.92	1.82	37.67
Assam	0.6547	0.5114	21.89	0.01146	0.00870	24.08	3.53	2.23	36.83
Gujarat	0.5960	0.4978	16.48	0.00640	0.00423	33.91	2.99	2.01	32.78
Maharashtra	0.6110	0.5314	13.03	0.00360	0.00218	39.44	2.86	1.91	33.22
Andhra Pradesh	0.5893	0.4781	18.87	0.00450	0.00073	83.78	2.59	1.83	29.34
Karnataka	0.5312	0.4325	18.58	0.00802	0.00207	74.19	2.85	1.81	36.49
Kerala	0.5012	0.4211	15.98	0.00686	0.00462	32.65	2.00	1.64	18.00
Tamil Nadu	0.5347	0.4321	19.19	0.00429	0.00160	62.70	2.48	1.74	29.84
India	**0.6485**	**0.4789**	**26.15**	**0.01154**	**0.00535**	**53.64**	**3.39**	**2.21**	**34.81**

According to control measure-I, which is based on birth intervals Assam perform well and shows about 21% decline from NFHS-I to NFHS-IV, followed by Orissa and then by Tamil Nadu about 20% and 19% respectively, for Maharashtra, Haryana and Uttar Pradesh it is only about 13, 11% and 5% respectively. By the Measure-II, Andhra Pradesh ranked as highest fertility control state in India and shows about 84% decline. Behind Andhra Pradesh, West Bengal shows about 80% decline. NFHS-IV reported that in all states the numbers of contraceptive users are increased in comparison of NFHS-I. Uttar Pradesh shows a decline of 50% in this measure. However, decline for Madhya Pradesh and Rajasthan is about 65% and 44% respectively proves the enhancement of contraceptive users. Haryana, Punjab, West Bengal, Assam with southern states of India performs well and shows a remarkable decline in the index. According to this measure, the fertility performance for Orissa remains the same. TFR shows Haryana has the first rank in fertility decrement with about 47 percent which is followed by Punjab and Uttar Pradesh with about 43 percent decrement while it is the lowest for Bihar.

Tables 2 to 9 present the estimated value of measure-I for women whose age's lies in different age groups between age 25-50. The estimated value of measure in NFHS-I is greater than in each sub group. It shows that fertility has been steeper decrement among urban, Hindu and literate women while in rural, Muslim and illiterate subgroups moderately decrement in all age groups. It is obvious that fertility has being on decrement as women reproductive age is increasing. The results present that the differential and trend in fertility level is well defined by purposed measure in the present study. Among literate woman, fertility decrement is remarkable in younger group; in age group 25-29 of this category has about 38 and 24 percent highest decrement in Uttar Pradesh and Tamil Nadu state respectively. For both states, fertility decrement is on slow pace but it is extremely slow in highest age groups; therefore, here we conclude that youngest age group is aware about fertility decrement. In Uttar Pradesh fertility decrement is observed among urban women as well as among rural women except higher age group, on the other hand, fertility decrement is high in literate female as counter part of illiterate in older age group women. For instance, in Uttar Pradesh, only in age group 40-50 of Muslim female fertility is almost stable or less than one percent decrement.

Table 2: Estimates of fertility control measure-I and their standard errors by sub-groups and year of survey for age group 25-29 in Uttar Pradesh.

Sub-group	Year of survey				% Change in φ
	NFHS-I (1992-93)		NFHS-IV (2015-I6)		
	N%	φ [S.E.(φ)]	N%	φ [S.E.(φ)]	
Place of Residence					
Urban	22.2	0.9983 (0.0341)	36.1	0.7537 (0.0208)	24.50
Rural	77.8	0.9991(0.0171)	63.9	0.8109 (0.0199)	18.84
Religion					
Hindu	84.5	1.009 (0.0169)	75.3	0.8102 (0.0120)	19.70
Muslim	13.8	0.9475 (0.0369)	18.4	0.9213 (0.0115)	2.77
Education					
Illiterate	72.1	0.9954 (0.0176)	60.1	0.8807 (0.0129)	11.52
literate	27.8	1.0094 (0.0309)	39.9	0.6217 (0.0098)	38.41

Rapid decline in fertility is one of the important social and economic changes, taking place in developing countries. The fertility decline observed in many states in India, thus, still remains to reach the replacement level. The decline, in this region, had taken place in extremely difficult conditions, like low standard of living, low literacy level, lack of modernization, etc. But there is a need of improvement in education urbanization as compared to the previous decade. Woman education can be expected to reduce desired family size for a number of reasons. First, education raises the opportunity cost of women's time and, generally, opens up greater opportunities for women that often conflict with repeated child-bearing. This may lead educated women to want fewer children. Second, in a state such as Uttar Pradesh where there is a son preference prevails, the education of women may reduce their dependence on sons for social recognition or support in old age. This too may lead to some reduction in desired family size, to the extent that large families are the consequence of a desire for an adequate number of surviving sons. Third, educated women may have higher aspirations for their children, combined with lower expectations of them in terms of labour services. This may also reduce desired family size, especially if there is a trade-off between the number of children and the time available for each child. Fourth, educated women may be more receptive to modern social norms and family planning campaigns. Finally, woman education may assist in achieving the planned number of births, especially by facilitating knowledge of and access to contraception and by enhancing women's bargaining power within the family.

There has been a consistently higher rural fertility rate, even though, urban population has been expanding. The analyses indicate that urban areas play a key role in the process of fertility decrement as compared to rural areas. Increased age at marriage, greater contraceptive use, declining infant and child mortality, and economic crisis are additional factors that have been identified as contributing variables to changes in reproductive behavior of urban women. Urbanization is believed to reduce fertility because children are less likely to contribute to household production and are more difficult to supervise in an urban setting. In so far as fertility decline is in part a 'diffusion process', it is also likely to proceed at an accelerated pace in urban areas where people have greater exposure to mass media as well as wider opportunities to observe and discuss the lifestyles of other social groups.

According to religion, results provide considerable evidence that fertility is higher among Muslims than among Hindus. These two religions differ in regard to their beliefs concerning marriage, reproductive behavior, and fertility control, and these differences may have a different impact on the intermediate variables which influence fertility. These intermediate variables include age at marriage, marriage stability, and contraceptive use. For example, Muslim beliefs, in contrast to Hindu beliefs, support polygamy, allow for easy divorce in case of infertility, and allow widows to remarry. These beliefs tend to increase exposure to the risk of pregnancy for Muslim women. Muslim women are also less receptive to family planning than Hindu women. As the modernization process unfolds in India, the impact of religious beliefs on the intermediate variables will decrease, and religious differentials in fertility will decline.

Table 3: Estimates of fertility control measure-I and their standard errors by sub-groups and year of survey for age group 30-34 in Uttar Pradesh.

Sub-group	**Year of survey**				**% Change in φ**
	NFHS-I (1992-93)		**NFHS-IV (2015-I6)**		
	N%	**φ [S.E.(φ)]**	**N%**	**φ [S.E.(φ)]**	
Place of Residence					
Urban	24.3	0.8488 (0.0352)	38.7	0.8312 (0.0118)	2.07
Rural	75.7	0.8843 (0.0182)	61.3	0.9012 (0.0129)	-1.91
Religion					
Hindu	82.9	0.8695 (0.1784)	80.1	0.8001 (0.0096)	7.98
Muslim	15.1	0.9187 (0.0369)	15.7	0.9019 (0.0162)	1.83
Education					
Illiterate	74.0	0.8937 (0.0185)	58.2	0.9582 (0.0120)	-7.22
literate	26.0	0.8189 (0.0331)	31.8	0.7981 (0.0106)	2.54

Table 4: Estimates of fertility control measure-I and their standard errors by sub-groups and year of survey for age group 35-39 in Uttar Pradesh.

Sub-group	**Year of survey**				**% Change in φ**
	NFHS-I (1992-93)		**NFHS-IV (2015-I6)**		
	N%	**φ [S.E.(φ)]**	**N%**	**φ [S.E.(φ)]**	
Place of Residence					
Urban	25.2	0.7344 (0.0431)	37.8	0.6831 (0.0158)	6.99
Rural	74.8	0.8083 (0.2220)	62.2	0.6458 (0.0256)	20.10
Religion					
Hindu	82.5	0.7930 (0.0221)	76.8	0.7258 (0.0358)	8.47
Muslim	15.1	0.7982 (0.0434)	22.0	0.7353 (0.0093)	7.88
Education					
Illiterate	74.2	0.8064 (0.0216)	76.5	0.6881 (0.0181)	14.67
literate	25.8	0.7318 (0.0466)	23.5	0.6651 (0.0302)	9.11

Table 5: Estimates of fertility control measure-I and their standard errors by sub-groups and year of survey for age group 40-50 in Uttar Pradesh.

Sub-group	Year of survey				% Change in φ
	NFHS-I (1992-93)		NFHS-IV (2015-I6)		
	N%	φ [S.E.(φ)]	N%	φ [S.E.(φ)]	
Place of Residence					
Urban	21.1	0.6737 (0.0625)	32.5	0.6956 (0.0082)	-3.25
Rural	78.9	0.7227 (0.0259)	67.5	0.7493 (0.0056)	-3.68
Religion					
Hindu	85.8	0.7245 (0.0267)	81.9	0.6583 (0.0125)	9.14
Muslim	12.2	0.6869 (0.0550)	15.2	0.6857 (0.0198)	0.17
Education					
Illiterate	83.0	0.7133 (0.0246)	78.9	0.7352 (0.0129)	-3.07
literate	17.0	0.7576 (0.0995)	21.1	0.4539 (0.0182)	40.09

Table 6: Estimates of fertility pattern Index and their standard errors by sub-groups and year of survey (Age group 25-29) in Tamil Nadu.

Sub-group	Year of survey				% Change in φ
	NFHS-I (1992-93)		NFHS-IV (2015-I6)		
	N%	φ [S.E.(φ)]	N%	φ [S.E.(φ)]	
Place of Residence					
Urban	20.8	0.8719 (0.0201)	32.8	0.6386 (0.0133)	26.76
Rural	79.2	0.9991 (0.0210)	67.2	0.7259 (0.0099)	27.34
Religion					
Hindu	83.5	0.8358 (0.0432)	78.2	0.6853 (0.0078)	18.01
Muslim	13.7	1.0060 (0.0478)	11.8	0.8012 (0.0201)	20.36
Education					
Illiterate	88.8	0.9381 (0.0321)	76.4	0.7215 (0.0047)	23.09
literate	11.2	0.8392 (0.0333)	23.6	0.6358 (0.0124)	24.24

Table 7: Estimates of fertility pattern Index and their standard errors by sub-groups and year of survey (Age group 30-34) in Tamil Nadu.

Sub-group	Year of survey				% Change in φ
	NFHS-I (1992-93)		NFHS-IV (2015-I6)		
	N%	φ [S.E.(φ)]	N%	φ [S.E.(φ)]	
Place of Residence					
Urban	23.6	0.8753 (0.0345)	39.2	0.6919 (0.0213)	20.95
Rural	76.4	0.9358 (0.0231)	60.8	0.7312 (0.0321)	21.86
Religion					
Hindu	82.3	0.8609 (0.0521)	70.1	0.8011 (0.0211)	6.95
Muslim	12.6	0.9990 (0.0201)	16.9	0.8332 (0.0347)	16.60
Education					
Illiterate	84.3	0.8853 (0.0371)	72.9	0.7109 (0.0211)	19.70
literate	15.7	0.7061 (0.0679)	27.1	0.5501 (0.0201)	22.09

Table 8: Estimates of fertility pattern Index and their standard errors by sub-groups and year of survey (Age group 35-39) in Tamil Nadu.

Sub-group	Year of survey				% Change in φ
	NFHS-I (1992-93)		NFHS-IV (2015-I6)		
	N%	φ [S.E.(φ)]	N%	φ [S.E.(φ)]	
Place of Residence					
Urban	25.6	0.7219 (0.0321)	35.8	0.6954 (0.0456)	3.67

Rural	74.4	0.8310 (0.0479)	64.2	0.6013 (0.0203)	27.64
Religion					
Hindu	79.8	0.8013 (0.0255)	70.9	0.5881 (0.765)	26.61
Muslim	15.0	0.7037 (0.0389)	21.2	0.5913 (0.0437)	15.97
Education					
Illiterate	79.0	0.7010 (0.0268)	73.8	0.7221 (0.0278)	-3.01
literate	21.0	0.6001 (0.0380)	26.2	0.6319 (0.0321)	-5.30

Table 9: Estimates of fertility pattern Index and their standard errors by sub-groups and year of survey (Age group 40-50) in Tamil Nadu.

Sub-group	**Year of survey**				**% Change in φ**
	NFHS-I (1992-93)		**NFHS-IV (2015-I6)**		
	N%	**φ [S.E.(φ)]**	**N%**	**φ [S.E.(φ)]**	
Place of Residence					
Urban	23.0	0.6101 (0.0218)	30.6	0.5352 (0.0278)	12.28
Rural	77.0	0.6219 (0.0291)	69.4	0.5667 (0.0202)	8.88
Religion					
Hindu	72.6	0.6001 (0.0390)	73.6	0.5219 (0.0167)	13.03
Muslim	18.5	0.6119 (0.0788)	19.9	0.6032 (0.0214)	1.42
Education					
Illiterate	73.5	0.6235 (0.0098)	59.6	0.5901 (0.0203)	5.36
literate	26.5	0.5119 (0.0798)	40.4	0.4912 (0.0125)	4.04

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Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this article.

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Brijesh P. Singh is currently working as Associate Professor in the Department of Statistics, Institute of Science, Banaras Hindu University, Varanasi, India. He has obtained Ph. D. degree in Statistics form Banaras Hindu University, Varanasi and has more than 16 years' experience of teaching and research in the area of Statistical Demography. He has published 120 research papers in the refereed journals and books of national and international repute and edited 2 books containing research papers and presently supervising four students for their research work.

His research interests are in statistical modelling and analysis of demographic data specially fertility, mortality, reproductive health and domestic violence with its reason and consequences.

Sonam Maheshwari received his Ph.D. degree in Statistics from Banaras Hindu University, Varanasi, India. Currently, Serving as Assistant Professor in the Department of Community Medicine, Govt. Doon Medical College, Dehradun, India. She has published more than 25 research articles in various journals of international repute.

Her research interests include Health Statistics, Applied Statistics, Analysis of demographic data etc.

Puneet Kumar Gupta is currently working as an Assistant Professor in ICFAI Business School, The ICFAI University, Dehradun. Dr. Gupta received his D. Phil. degree in Statistics from the University of Allahabad, Prayagraj, India. He has published more than 20 research papers in various National and International Journals.

His research interests include Quantitative Techniques, Business Research Methods, Applied Statistics, Bayesian inference, load-sharing models, distribution theory, and reliability analysis.