

Ghasuria, N.D.; Thakar, P.H.; Pandya, P.S.: Fertility Trends in Gujarat. The Journal of Family Welfare. Dec 1996. 42(4).p.55-63.

Fertility Trends in Gujarat

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Introduction

The success of a good planning strategy for the overall development of any society (population) depends upon two main factors. First, the measures incorporated in it should be such that they can be efficiently implemented to bring about the desired changes, and second, that they are based upon the key socioeconomic and demographic characteristics of the population and the level to which these indicators are to be improved by the introduction of the new measures or schemes.

The latter prerequisite requires the most recent information about the location of the population in question preferably by districts and a break-up by rural-urban residence, sex, age and social groups, as also reliable fertility, mortality and migration rates. Mathematically, population growth depends upon the "increase in population" and "shift in population". The former is related to fertility and mortality, while the latter is related to "net-migration" which is the difference between in-migration and out-migration. Considering the importance of fertility data in estimating population and their use in assessing the impact of family planning programmes, this paper aims to (a) study the fertility trend in Gujarat; (b) compare the fertility rates of Gujarat and India between 1981 and 1993; and (c) project key fertility indicators namely, the crude birth rate, general fertility rate, and total fertility rate for Gujarat for the eighth and ninth Five-Year Plan periods.

Results and Discussion

Before studying the fertility trends in Gujarat, it would be in order to look at the important demographic characteristics of the State, which have a direct bearing on fertility. Table 1 which presents this information for the census years 1971, 1981 and 1991 shows that the population of Gujarat increased from 26.7 million in 1971 to 34.1 million in 1981 and further to 41.3 million in 1991. However, the decadal growth rate, which was 29.39 in 1971 declined steadily to reach 21.19 in 1991. During this period, the urban population increased from 28.8 per cent of the total in 1971 to 34.38 per cent in 1991 to give Gujarat the distinction of being the fourth most urbanized state of India. The rural population also increased from 19.20 million persons in 1971 to 27.06 million in 1991.

Table 1: Population of Gujarat by area and sex

Census year	Population (millions)	% of urban population to total	Decadal growth rate	+/- decadal GR over previous census
1971	26.7	28.8	+ 29.39 (1961-71)	2.51
1981	34.1	31.08	+ 27.67 (1971-81)	-1.72
1991	41.3	34.38	+ 21.19 (1981-91)	-6.48

Crude Birth Rate

Since there is a one-to-one correspondence between the fertility rate and the birth rate, it was considered of interest to study the trend in the birth rate of Gujarat vis-a-vis that of India. Thus, state-wise data of rural and urban crude birth rates (CBRS) were obtained from the Sample Registration System (SRS) bulletins published by the Office of the Registrar General, Government of India, New Delhi. Figure 1 (Figure 1 is missing) illustrates the trends in birth rate for Gujarat and the country as a whole separately for rural and urban areas as well as both combined for the period 1971-1994 using three-year moving averages, to reduce sampling and non-sampling errors in the SRS data after examining the original pattern.

Figure 1A (Figure 1A is missing) indicates that in 1971, the combined (rural and urban) CBR of Gujarat was higher than the national CBR, but after 1979, the gap between the two narrowed and in 1984, they coincided with each other. Thereafter, the CBR of the state fell steadily and at the end of 1994, it remained lower than the all-India figure. Figures 1, B and C give a comparative view of the CBRs for rural and urban areas respectively of Gujarat and India across 1971-1994.

Figure 1B (Figure 1B is missing) shows that the rural CBR followed a similar pattern beginning with a state CBR (42.1) higher than the national (38.9) in 1971. Both CBRs coincided in 1983, and as a result of the further gearing up of rural family planning activities in Gujarat the state's CBR remained substantially lower than that of rural India thereafter. On the other hand, as Figure 1C (Figure 1C is missing) shows, the decline in the urban CBR of Gujarat paralleled that of urban India over 1971-94 and remained higher than the national figure throughout, though there was an appreciable narrowing of the gap between the two CBRs in 1987 and thereafter.

General and Total Fertility Rates

The general fertility rate (GFR) gives the number of live births occurring to 1000 females during their reproductive span (15-49 years) in a given year. The GFR thus indicates the reduction in fertility due to family planning activities or socioeconomic changes. Table 2 compares the general and total fertility and gross reproduction rates of Gujarat and India as a whole during 1981-1993.

As the top panel of Table 2 indicates, during 1981-93, the GFR of the state declined at a faster rate than that of the country. The rural GFR followed a similar pattern, which was reversed in the case of the urban GFR in that the national urban GFR decreased at a faster rate than that of Gujarat. The TFR, which gives the average number of children a woman can produce during her childbearing years (i.e. 15-49 years) indicated a trend similar to the GFR (middle panel, Table 2).

Table 2: General and total fertility rates and gross reproduction rate for selected years, Gujarat and India

Year	Combined		Rural		Urban	
	Gujarat	India	Gujarat	India	Gujarat	India
GFR	140.6	140.9	148.4	149.4	118.3	107.2
1981	130.5	136.5	133.9	145.6	122.9	108.1
1986	110.4	116.6	115.7	125.2	100.4	93.5
1993						
TFR	4.3	4.5	4.6	4.8	3.4	3.3
1981	3.8	4.2	4.0	4.5	3.3	3.1
1986	3.2	3.5	3.3	3.8	3.0	2.8
1993						
GRR	2.0	2.2	2.2	2.3	1.7	1.6
1981	1.8	2.0	1.9	2.2	1.6	1.5
1986	1.5	1.7	1.6	1.8	1.3	1.3
1993						

Gross reproduction rate

The bottom panel of Table 2 looks at the rural, urban and combined gross reproduction rates (GRR) of Gujarat and all-India in 1981, 1986 and 1993. The GRR gives an idea of the capacity of a woman to produce female children during her fertile period. As seen from Table 2, Gujarat had a lower GRR than India for all the three years and both declined by 0.5 points between 1981 and 1993 (Gujarat: from 2.0 to 1.5; India: from 2.2 to 1.7). The rural-urban comparison showed that the rural GRR was lower for Gujarat than for India for all the three years, but the urban GRR was lower than the all-India rate only in 1993.

Age specific fertility rate

Table 3 presents the age specific fertility rate (ASFR) of Gujarat and India for the years 1981, 1986 and 1993.

Table 3: Age-specific fertility rate, Gujarat and India

Age group (in years)	Gujarat			India		
	1981	1986	1993	1981	1986	1993
15-19	56.6	43.9	26.3	90.4	91.1	69.9
20-24	294.4	277.9	248.2	246.9	252.8	234.4
25-29	239.5	231.9	211.5	232.1	216.4	189.7
30-34	153.2	120.4	100.1	167.7	139.2	114.3
35-39	76.1	49.3	39.7	102.5	78.6	61.1
40-44	29.2	20.7	13.8	44.0	37.9	28.5
45-49	12.0	7.2	5.0	19.6	14.9	10.1

Table 3 shows air ASFR of 56.6 for women aged 15-19 years in Gujarat in 1981; this means that 1000 women in this age group had produced, on average, 57 children in that year. In the same year, women in the next higher age group (20-24 years) had produced 294 children, which was the highest. Thereafter, the ASFR decreased as age increased and was 12 for women who were 45-49 years of age. A similar trend with the ASFR peaking in the 20-24 age group and declining thereafter was observed in 1986 and 1993 for Gujarat, as also for the country as a whole for all the three years.

A comparison of ASFRs across 1981-93 in Gujarat showed a reduction from 56.6 in 1981 to 26.3 in 1993 among women aged 15-19 years. For almost all age groups, the ASFR displayed a similar declining pattern. This was so in the case of India as well, except in the age groups 15-19 and 20-24 years where the ASFR increased slightly. The data also showed that except for the peak childbearing years of 20-29, the ASFRs of Gujarat were lower than the national ASFRs for all the three years. This suggests that the state family welfare planners should direct their efforts to these age groups for lowering the birth rate of the state.

Table 4: Age-specific fertility rate of Gujarat

Age group (in years)	1981		1986		1993	
	Rural	Urban	Rural	Urban	Rural	Urban
15-19	58.8	50.2	43.4	45.3	31.4	16.1
20-24	313.0	244.7	283.9	265.2	266.1	209.4
25-29	256.2	198.4	243.2	209.3	207.8	218.1
30-34	165.2	117.3	131.6	97.7	102.6	95.9

35-39	84.4	50.1	58.3	31.0	40.8	37.8
40-44	31.4	22.7	22.1	17.0	16.0	9.5
45-49	14.0	5.9	9.3	2.1	4.1	6.8

Table 4 gives the rural and urban ASFRs for Gujarat for the three selected years. The data shows that in 1981, the rural ASFR was higher than the urban ASFR irrespective of the age group. This was so in 1986 and 1993 as well with the exception of the 15-19 age group in 1986 where the rural ASFR was slightly lower than the urban ASFR.

Couple protection rate

Table 5 looks at the proportion of couples protected by sterilisation, IUD and conventional contraceptives between 1981 and 1993. The data indicates that the percentage of couples protected by sterilisation to all protected couples decreased from 90.2 per cent in 1980-81 to 66.1 per cent in 1993-94 thereby indicating a decrease in the adoption of sterilisation. Concomitantly, the acceptance of the IUD increased from five per cent of all acceptors to 20.3 per cent, and the proportion of conventional contraceptive users increased from five per cent to about 16 per cent indicating that a greater number of couples were spacing births. The trend in contraceptive use suggests that though the birth rate may show a decline during one or two years, the growth rate may not decline substantially over the next decade. This is an alarming situation.

Table 5: Distribution (%) of couples currently protected by various methods of family planning, Gujarat

Year	Sterilisation	IUD	C.C. users	Total
1980-81	90.2	4.9	4.9	100(92064)
1982-83	89.3	5.1	5.6	100(123283)
1983-84	85.2	6.5	8.3	100(205978)
1984-85	80.8	9.0	10.2	100(291013)
1985-86	77.8	11.9	10.2	100(327710)
1986-87	74.9	13.5	11.6	100(403408)
1987-88	73.9	15.2	10.8	100(398409)
1988-89	71.7	16.6	11.6	100(450758)
1989-90	70.2	17.4	12.4	100(502984)
1990-91	68.4	19.4	12.3	100(519375)
1991-92	69.1	19.2	11.8	100(502386)
1992-93	68.4	20.2	11.3	100(465132)
1993-94	66.1	18.1	15.7	100(684708)

Table 6 looks at the percentage of couples in Gujarat who accepted sterilisation and the IUD, the two most accepted and effective methods in 1994-95, by the age of the wife.

Table 6: Distribution (%) of sterilisation and IUD acceptors by age, 1994-95

Age (years)	Sterilisation	IUD	Total
15-19	3.9	86.1	100(34050)
20-24	20.6	79.4	100(238239)
25-29	40.9	59.1	100(290394)
30-34	58.6	41.4	100(152685)
35-39	66.6	33.4	100(52831)
40 and above	54.6	45.4	100(6750)
Total	38.8	61.2	100(774949)

Figures in the brackets indicate the actual number of acceptors.

The table shows that in 1994-95, the percentage of couples protected by sterilisation among all couples protected by sterilisation or the IUD was the lowest in the 15-19 age group (3.34 per cent). This proportion increased with age and was 67 per cent for the 35-39 age group, and for obvious reasons, declined to 55 per cent in the next age group of 40+ years. In the case of the IUD, the 15-19 age group showed the highest acceptance (86 per cent) which decreased with age to about 33 per cent in the 35-39 age group and again increased in the 40+ age group. That women between 20-29 years of age who usually had two or more children (table not given) are more inclined to use a spacing rather than a terminal method is probably due to the fear of child loss. Thus, if the desired replacement level fertility is to be achieved by the end of 2001, an effective family planning strategy which attracts more and more younger women to space as also to limit births to not more than two children will have to be designed. This may be possible if a social environment can be created to ensure that (a) parents do not marry their daughters before the age of 21 years; (b) women are encouraged to plan to have their first child not between the age of 25-29 years; and to have the second after an interval of five years during which she should again be protected by the IUD or any other suitable method, and the children should be immunised so that they do not succumb to disease. Besides changing sociocultural attitudes this also calls for the creation of facilities for educating women and providing them with suitable options for self-development and employment so that early marriage, childbearing and childrearing can be delayed.

Projections of CBR, GFR, TFR

In order to predict the key fertility indicators namely the CBR, GFR and TFR, a hypothetical model with a one year lagging variable was developed with the following mathematical form:

$$Y_{it} = A_{it} + B_{i1}x_{it} + B_{i2}x_{i2(t-1)} + B_{i3}x_{i3t} + B_{i4}x_{i4t} + B_{i5}x_{i5t}$$

Where $i = 1,2,3$ and suffix 1 stands for CBR, 2 stands for GFR and 3 stands for TFR

X_1 = Female population (15-49 years) (in 100,000s)

X_2 = Couples protected by sterilisation in the previous year in 100,000 (since these couples will not contribute to future births and are negatively correlated to fertility)

X_3 = Per capita health expenditure in Rs. (in the absence of data on the expenditure per pregnant woman (on delivery) which would have been a better choice as a variable).

X_4 = Literate female population (15-49 years) in 100,000 (this has been recognised as an essential component of fertility analysis)

X_5 = Infant mortality rate (in the presence of an efficient immunisation programme, child loss will be reduced thereby encouraging couples, especially literate couples to end childbearing).

Applying the above model to 1971-91 data, the CBR, GFR and TFR have been projected as given below.

CBR, GFR and TFR

The fitted regression model using the method of least squares books the following form for CBR:

$$Y(\text{CBR})_t = 55.607854 + 0.02698998 * x_1 - 0.0651067 * x_2(t-1) + 0.093567 * 3t - 0.559672 * x_4t - 0.047929 * 5t \text{ (Model - 1)}$$

The regression model had an R-square (0.94), SESS(CBR) as 0.136286 suggesting a good fit.

In the case of GFR, the fitted regression model was as follows-

$$Y(\text{GFR})_T = 194.542933 - 0.0065911 * X_{1t} - 0.301791 * X_{2t-1} + 0.117614 * X_{3t} - 1.48649 * X_{4t} - 0.00679 * X_{5t} \text{ (Model - 2)}$$

This model had an R-square (0.93) and SESS(GFR) = 0.670629 and also indicated a good fit.

The fitted regression model for TFR was

$$Y(\text{TFR})_t = 3.956491 + 0.007881492 * X_{1t} - 0.0633392 * X_{2t-1} - 0.021017 * X_{3t} + 0.02117075 * X_{4t} + 0.004842 * X_{5t} \text{ (Model - 3)}$$

It had an R-square 0.96 and SESS(TFR) as 0.1794435 indicating a good fit.

Using the regression model given by (1), (2) and (3) and regressing the number of couples protected by sterilisation, per capita health expenditure and infant mortality rate on time (t) for each year of the Eighth and Ninth Five Year Plans, the CBR, GFR and TFR were projected. These values are presented in Table 7.

Table 7: Yearwise projected CBR, GFR and TFR for the Eighth and Ninth Five-Year Plans of Gujarat

Year	CBR	GFR	TFR
1992-93	27.42	107.95	3.14
1993-94	25.72	102.57	3.05
1994-95	24.46	97.83	2.96
1995-96	23.20	92.83	2.88
1996-97	21.72	87.55	2.80
1997-98	20.08	81.86	2.73
1998-99	18.37	75.97	2.66
1999-00	16.59	69.76	2.58
2000-01	14.06	62.48	2.64
2001-02	12.06	56.25	2.46

In order to visualise the efficiency of the hypothesised lagged model in predicting the CBR, GFR and TFR, graphs of the actual values of these fertility indicators and their predicted values versus time (year) are depicted in Figures 2A, 2B and 2C respectively (Figures 2A, 2B and 2C are missing).

Summary and Conclusion

The above analysis indicates that the rural CBR of Gujarat was higher than the national average in 1971 but declined steadily to coincide with the latter in 1983

and remained low thereafter, whereas the urban CBR though on the decline, remained higher than the national urban CBR throughout the 1971-94 period.

The rural GFR and TFR of the state were also lower than the corresponding rates for rural India while the urban GFR and TFR were higher than the corresponding urban values for India for all the three years studied. The ASFRs of the state appeared to be significantly higher than those of the country during the peak childbearing years of 20-24 and 25-29 in 1981, 1986 and 1993, while they were lower than the national average for all other age groups. However, the rural rates were higher than the corresponding urban rates irrespective of age.

Contraceptive acceptance over this period indicated a decline in the acceptance of permanent methods and a concomitant increase in the use of spacing methods - the IUD and conventional methods. That a large percentage of the acceptors in the 20-24 and 35-39 age groups who are likely to have two or more children opted for the IUD as opposed to a terminal method, suggests that the couples were more inclined to use a reversible than an irreversible method. This tendency will have to be changed if the birth and growth rates of Gujarat have to be lowered and their respective goals attained by the turn of the century. Our projections show that the CBR of the state will decline to 22 by the end of the Eighth Five-Year Plan (1996-97) and will further decline to 12 by the end of the Ninth Five-Year Plan (2001-02). The GFR and TFR are expected to be around 88 and 2.8 respectively by 1996-97, the last year of the Eighth Five-Year Plan.

Thus, in order to reach replacement level fertility, the state will have to gear up its immunisation programme to improve child survival on the one hand, and intensify its family planning activities to recruit younger couples to delay the first child, space the second and to stop after two children. Simultaneously, programme planners and managers should work towards creating a social climate conducive to planned childbearing and at the same time provide women with options to delay marriage till they are 21 years of age as also to delay their first child and plan for two children.

Acknowledgements

The authors express their deep gratitude to Mrs. Sudha Anchalia (IAS), Commissionerate of Health, Medical Services and Medical Education for her encouragement. Thanks are also due to Mr. P.H. Shah S.A. (V.S. Branch) of the Commissionerate for his computer assistance, and to Mr. Jignashu Yagnik, Programmer for GIDR, Ahmedabad for his statistical assistance.

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