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Demographic Implications of Compulsory Sterilization

Introduction

OF late, there has been an upsurge of enthusiasm among politicians and administrators alike for making family planning compulsory for all the couples after a certain number of children as a radical measure for arresting the spiralling growth of population. The National Population Policy[1] announced in the Parliament by Dr. Karan Singh, Union Minister of Health and Family Planning in April 1976 states, "We are of the view that where a State legislature in the exercise of its own powers, decides that the time is ripe and it is necessary to pass legislation for compulsory sterilization, it may do so. Our advice to the States in such cases will be to bring in the limitation after three children, and to make it uniformly applicable to all Indian citizens resident in that State without distinction of caste, creed or community."

The State of Maharashtra has passed the bill for compulsory sterilization of all eligible couples after 3 living children and this bill is with the Central Government for approval. A notable allowance made in the bill is that if the three living children are of the same sex, the couple may have one more child; after that sterilization would be compulsory, irrespective of the sex of

1. National Population Policy Statement by Dr. Karan Singh, Minister of Health and Family Planning, Government of India on April 16, 1976.

the fourth child. Further, if there is evidence to show that a couple has been practising some other method of family planning effectively and has no births during the previous five years it would be exempt from sterilization. Exemption from sterilization would also be permissible on specific health grounds as certified by a board of specialists. It is likely that once the Maharashtra Bill, after approval by the Central Government, becomes a law, many other states might come forward to introduce legislation for compulsory sterilization and it might become a common pattern throughout the country in the course of the next few years.

Under these circumstances it appears worthwhile to study the demographic and other implications of compulsory sterilization. Accordingly, we here attempt a study of the demographic and specific programme implications of such a compulsory sterilization programme (CSP) for the Karnataka State. Following the Maharashtra pattern it has been assumed that sterilization is made compulsory for every couple in reproductive age group, after one year of the birth of the third child and that for those cases where all the three living children are of the same sex, one more child is allowed and sterilization becomes obligatory one year after the birth of the fourth child. It is assumed that all couples initially eligible for sterilization will be sterilized within a period of two years since the commencement of the programme, after which the couples newly becoming eligible would be sterilized. The demographic effects of CSP are studied under the following heads:

1. Its immediate, intermediate and ultimate impact on the birth and growth rates of the population;
2. The changes in the size of the population over next 30 years;
3. Changes in sex-ratio of the population;
4. Changes in age-distribution of population and their implications; and
5. Resources needed for its implementation.

Analysis in each of the above five sections has been made under very simplistic assumptions for Karnataka State. This has been done mainly with a view to capturing the trends and magnitudes of the results rather than their accurate and precise measurement. It is to be hoped that an understanding of these trends and magnitudes of the results might help policy makers and

administrators in redesigning their programme or reshaping their policies, if need be.

Methodology and Data

The procedure adopted is the technique of component projection. The population of Karnataka State is first projected to July 1977 by age and sex on the basis of best of available estimates of fertility and mortality. The smoothened 1971 census population[2] is taken as the starting point and the age specific fertility rates estimated by the Sample Registration Scheme (SRS) for 1971[3] are used. On the basis of the best available estimates, the average levels of mortality during 1971-76 have been assumed to be at levels 13 and 15 of West Model Life Tables for females and males respectively. These correspond to an expectation of life of 50.0 for females and 51.8 for males.

From 1.7.1977 onwards, the population is projected under two sets of assumptions regarding fertility. The first assumption is that the age specific fertility rates would continue at the 1972 levels without any change upto 2007. In the second case, estimates of age specific fertility rates are modified to allow for the introduction of CSP as explained above. In the latter case, it is assumed that the backlog of all sterilizations of eligible couples would be cleared during the two year period, 1.4.1977 to 31.3.1979, and thereafter it would be confined to new crop of eligibles. The effects of such a sterilization programme on the birth rates would be recorded from the calendar year 1978 onwards.

The common assumption on mortality is that mortality level will increase for females at a steady rate from level 13 to 17 and for males from level 15 to 18 of West Model Life Tables during 1977-1987, the levels remaining unchanged thereafter. These assumptions imply that at the end of the period 1977-87, the expectation of life for males would be slightly lower than that for females. This pattern is assumed in the light of empirical evidence that in all countries with high expectation of life, females live longer than males. These assump-

2. K. Srinivasan, "Methods of Measuring the Impact of Family Planning Programmes on Fertility : The case of Karnataka State, India", Expert Group Meeting on Methods of Measuring the Impact of Family Planning Programmes on Fertility, Geneva, 1976.

3. Combined (Rural and Urban) rates obtained from Srinivasan, *op. at.* Figures are based on Rural and Urban rate given in SRS-Report Series No. 1, Bureau of Economics and Statistics, Government of Karnataka, Bangalore, 1974.

tions imply an increase in expectation of life of almost 10 years during the decade 1977-1987. The ground for this rapid change is that a sudden drop in the birth rate caused by the CSP would contribute to a dramatic decline in the maternal mortality rate and also in the infant and child mortality rates because of the removal of high parity births, and thanks to the implied increased attention on child health care activities for the children already born. It can be expected, further, that these effects on mortality of a rapid decrease in birth rate will become visible even in the course of the first few years of the programme. Further decline in mortality after 1987 is not anticipated as the available empirical evidence from other countries shows that increases in expectation of life beyond 60 years could be achieved only through fundamental changes in the social and economic structure of the society. Here, our concern is with the effects of CSP within the present social and economic framework over a reasonably short duration of time and so the consideration of long-term changes in mortality is not taken up.

For estimating post-CSP age specific fertility rates we have used the information on the parity distribution of births, and assumed birth intervals and applied a simple combinatorial probability theory. Since it is not possible to specify exactly the age specific fertility patterns that would emerge under a CSP, we assume two alternative patterns providing a range for the impact of the programme. In the first variant, CSP (A), it is assumed that the fertility impact of CSP is distributed in all the groups, in such a way that the age specific fertility rate at each age group is uniformly reduced in such a manner that the required births of para 3 and above are averted. In the second variant, CSP (B), it is assumed that the impact of CSP on the age specific fertility schedules is borne mainly by the women of older ages, cutting down drastically their fertility almost to zero. Assumption CSP (A) is more conservative and assumption CSP (B), more radical in the sense that in the latter case there are no changes in spacing patterns even in the presence of a compulsory sterilisation programme. CSP(B) is found to give a greater impact on fertility than CSP(A). The likely impact of the CSP programme would be somewhere between these two results.

Thus three streams of projections were involved: one with constant fertility; Assumption I, the second with a conservative pattern of age specific fertility rates under the CSP, Assumption CSP (A), and the third with a radical pattern of age specific fertility rates, Assumption CSP (B). All the three streams have the same mortality assumption.

Appendix-1 gives the parametric values with regard to initial age distribu tion, fertility levels and distribution of births by birth order. Appendix-2 gives the procedure adopted in the derivation of the age specific fertility rates under assumptions CSP (A) and CSP (B) of the CSP,

Results

Appendix-3(a, *b), 4(a, b)* and 5(a, *b)* provide results of component projection under assumptions I, CSP(A), and CSP (B) respectively. Appendix 3(a), 4(a) and 5(a) give the results of the three streams of projections for the total population of Karnataka State. Appendix 3 (6), 4(6) and 5(6) provide the results of the female population. In Figure 1 we present a graphic representation of

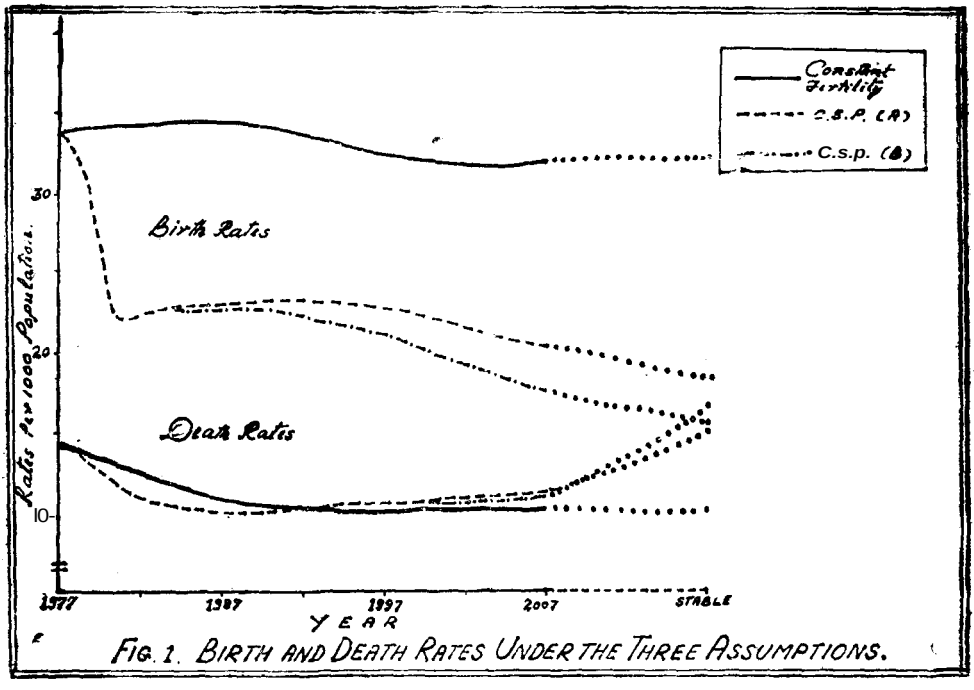

FIG. 1. BIRTH AND DEATH RATES UNDER THE THREE ASSUMPTIONS.

the birth and death rates for the population of Karnataka under assumptions I, CSP (A) and CSP (B) with the data given in Appendix 3(a), 4(a) and 5(a). Figure 2 presents a graphic description of the sizes of the population of Karnataka State projected upto 2007 under the three assumptions of constant

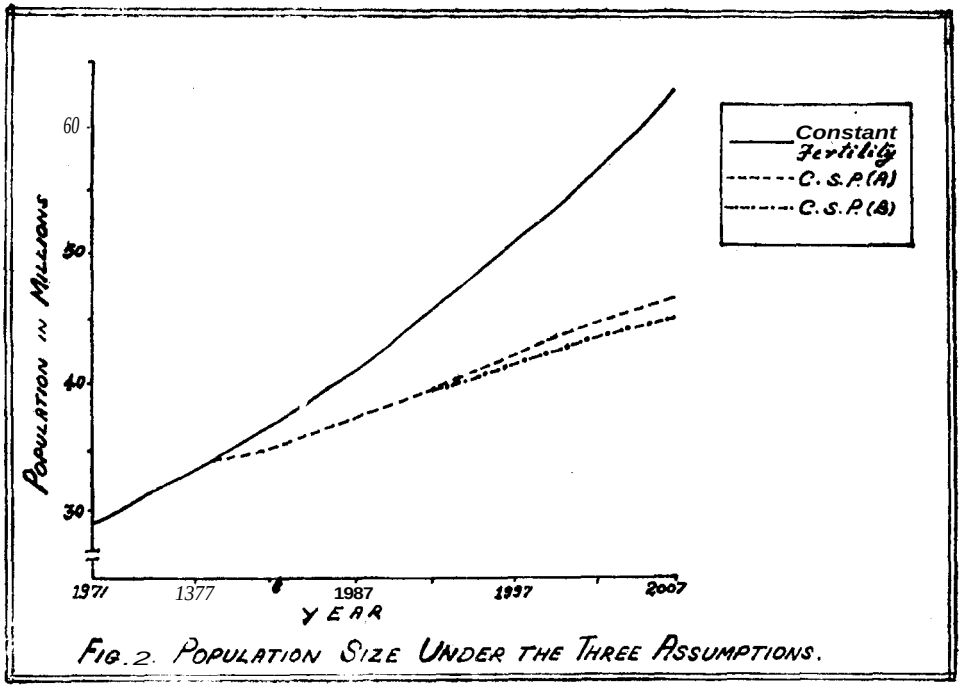

FIG. 2. POPULATION SIZE UNDER THE THREE ASSUMPTIONS.

fertility, CSP(A), and CSP(B). We now proceed to discuss these results under five separate heads noted earlier :

1. Impact on the Birth and Growth Rates of the Population :

(i) From appendix 3(a), giving data based on assumption of the 1971 fertility pattern remaining constant, it can be seen that changes in the age distribution of the population cause slight changes in the birth rates at different points of time ranging from 34.37 in 1982 to 31.90 in 2002 and 32.05 in 2007. The stable birth rate that will become operative in the long run is found to be 32.05. Thus the present population distribution is very close to stable age distribution despite the fact that the birth rate is comparatively low. The growth rate of the population varies from 19.33 in 1977 to 23.10 in 1992 with a stable rate of 21.05. The death rates decline steadily from a level of 14.32 in 1977 to 10.55 in 2007.

(ii) Appendix 4(a) gives corresponding data based on assumption CSP (A). This shows that the birth rate decreases from 33.65 in 1977 to 22.36 in

1982 and fluctuates marginally thereafter to reach a level of 20.06 in 2007. The stable level of the birth rate is 18.46. A steep dip of 34 percent in the birth rate (from 33.7 to 22.0) occurs during the three-year period 1977 to 1980 because of almost the total absence of births of para 4 and above. During the period 1980 to 1992 the rate increases slightly as a result of two opposing factors. First, owing to a sudden decline in the birth rate prior to 1980, the proportion of women in the reproductive ages as a percentage of the total population records a significant increase after 1980, and with the same age specific fertility rates, the birth rate tends to rise. In contrast, the decline in mortality increases the survivorship of children, which in turn tends to increase the rate of sterilization for any given age group. This second factor tends to decrease the age specific fertility rate of the population which in turn reduces the birth rate. However, the projections reveal that the effects of the increase in the proportion of women in the reproductive ages fail to offset fully the effects of the decline in the age specific fertility rates, causing a slight increase in the birth rate during the period 1980-1992. The table also shows that the death rate of the population decline steadily from a level of 14.32 in 1977 to 11.40 in 2007 which is close to that of Assumption I of unchanged fertility. Thus the impact of the CSP on the death rates of the population is not different from what it would be under conditions of unchanging fertility. The stable level of the population growth rate under this assumption, CSP (A), is found to be positive but quite low, + 0.0027, which is about 3 per thousand population per year. In effect, Assumption CSP (A) gives rise to an almost stationary population in spite of the fact that the rules for the compulsory sterilization programme are rough and ready, as explained in the earlier section.

(iii) Appendix 5(a) provides the projection figures under assumption CSP (B), under which fertility rates of women above 30 are reduced more drastically, than of those in the earlier ages, in order to avert the births of para 4 and above. The effects of this assumption on the birth rate are shown to be more radical than assumption CSP (A). The birth rate of the population here decreases from 33.65 in 1977 to 22.40 in 1982, which is almost the same as in Assumption CSP (A). However, by the year 2007 the birth rate falls here to 17.30 as against the corresponding level of 20.06 under assumption CSP (A) and the stable level

of the birth rate is 15.51 compared to 18.46. Thus, CSP (B) has got a greater long-term impact on the birth rate of the population. It may be noted, however, that the actual age pattern of fertility that will emerge under the regime of compulsory sterilization cannot be fully predicted. It will depend on age at marriage and spacing of births within marriage. The stable growth rate under assumption CSP (B) is found to be negative but small, - 0.0023. Since the rate of decline is very small, it can be said that both assumptions CSP (A) and CSP (B), lead ultimately to a stationary population.

(iv) Thus, by comparing the projected result of the sets of assumptions, CSP (A) and CSP (B), it can be said that there will be a dramatic decline in the birth rate under compulsory sterilization programme from a level of 33.65 in 1977 to 22.08 in 1980. Thereafter it tends to rise slightly till 1992 because of increase in the proportion of women in the reproductive ages. From 1992 onwards, it continues to decline steadily. The pace of this decline is faster under CSP (B) as compared to that under CSP (A). The ultimate level of birth rates when the age distribution of the population stabilises lies between 18.46 in CSP (A) and 15.51 in CSP (B). The size of population would then be changing at a very small level of less than 3 per thousand population per year.

The projected figures of population and vital rates given in Appendix *3(b), 4(b)* and 5(*b*) refer to the female population. A comparison of the vital rates given in these tables with those for the population indicates that there are no significant differences between the vital rates calculated for female population separately and those for the total population. However, generally the birth rates for the female population under each of three assumptions are lower than the birth rates for the total population. This is because of the assumption of the sex ratio at birth of 105 males to 100 females, favouring a slightly higher male specific birth rate.

2. Changes in the Size of the Population :

The growth of population of the State during the years 1971 to 2007 under the three assumptions is indicated by Figure 2 and appendices 3, 4 and 5. It will be seen that if the present pattern of age specific fertility rates continue, the population will double itself in the next 33 years or before 2010. It will increase at a geometric rate of 2.1 per cent per year even without any further reductions in mortality after 1987. This is an alarming picture and lends

Support to the emphasis placed by the National Population Policy to the intensive family planning drive. Significantly, the closeness of the present age distribution to its stable form implies that the fertility rates have not undergone in the past serious changes. This fact warrants further enquiry in the light of the family planning programme, which has been in operation for over two decades recruiting a number of acceptors, especially for sterilization in the programme. The birth rate of the state appears to have declined only by about 8 points during 1951-71 from about 40 to 32 per thousand. Apparently, two sets of opposing forces have been at work; one set tending to increase the age specific fertility rates through such factors as modernization, eradication of certain diseases and improvement of the health of the population and the other set, including the family planning programme tending to decrease the age specific fertility rates. On balance the age specific fertility schedule seems to have remained almost unchanged.

Appendix 4(a), based on assumption CSP (A), reveals an increase in population from 33.03 million in 1977 to 47.31 million in 2007; an increase of only 43.23 percent compared to an increase of 94.73 percent under assumption I. The increase slows down dramatically after 1980, reaching an annual rate of 0.009 by 2007 and an ultimate stable growth rate of 0.003. Here, the doubling of the population would take almost 130 years as compared to 33 years under assumption I.

The projections of appendix *5(a),* under assumption CSP (B), present a more dramatic impact of CSP. In this case the population grows only by 38.31 percent compared to 43.23 percent under assumption CSP (A), and 94.73 percent under assumption I. The ultimate size of the population remains below the 66 million mark which is double the 1977 figure. The population increases to a level of 51 million by 2035 and thereafter decreases at a very slow rate of about 2.3 per thousand per year. If the same holds true at the national level, the population of the country will never reach the billion mark dreaded by demographers; and it will reach a level of 930 million by the year 2035 and will thereafter start declining slowly.

Thus, under the compulsory sterilization programme a forceful brake will be applied on the population growth almost immediately. Under any of the assumed age specific fertility patterns becoming operative with a CSP, the population will be checked well below the level of 900 million by the year 2007.

3. *Effects on the Sex Ratio of the Population :*

There is a general fear that a programme of compulsory sterilization could alter the population sex ratio especially in a society where there is a preference for male children. The sex ratio of the population is influenced by two factors : *(a)* the sex ratio at birth, and *(b)* the differential rates of mortality of males and females. The first factor is generally assumed to be biological and is independent of the parity or the sex composition of the existing family. This assumption of independence has, however, not yet been empirically verified in a large sample of births. The second factor is not expected to be significant in situations where the mortality differential is not acute.

The common mortality assumption underlying the three projections imply that the mortality differential between male and female narrows down during the decade 1977-87. As a consequence, the sex ratio of the population changes slightly in favour of females. From 953 in 1977, it improves in 2007 to 959 under assumption I, to 963 under assumption CSP (A) and to 965 under assumption CSP (B).

The most crucial assumption underlying the sex ratio is the constant probability of birth of a male child for all mothers irrespective of parity or sex distribution of the children already born. Since it is very difficult to verify the validity of this basic assumption, it is assumed to hold good for the purposes of these projections. Keyfitz[4] has proved that even under a regime of sterilization, wherein a couple takes to sterilization at the birth of the first male child, the sex ratio of the population will not be affected as long as the above assumption holds good.

4. Effects on Population Age Distribution :

The effects of a sudden decline in birth rate on the population structure has been a subject of lively debate among demographers. Such changes have serious implications for both economic planning and social welfare programmes. The changes in age structure under the three assumptions are reflected in the distribution of population into five broad age groups, namely, 0-4, 5-14, 15-44, 45-59 and 60+, given in appendices 3(a), 4(a), and *5(a).*

Appendix *3(a)* shows that the age distribution of the population remains

4. Keyfitz, N., Introduction to the Mathematics of Population. Reading, Massachusetts: Addison-Wesley.

almost unchanged during the regime of constant age specific fertility schedule and a declining mortality from 1977 to 1987. The proportions in the groups of 45-59, and 60+ record a slight but steady increase during the years 1977-2007. However, the population remains essentially stable with the population below 15 years of age declining marginally from 38.91 in 1977 to 37.26 percent in 2007.

Assumption CSP (A) implies decline in the proportion of children below 5 years from 14.0 percent in 1977, to 10.9 percent in 1982 and to 9.3 percent in 2007, despite the assumption of a substantial decline in child mortality during 1977-87. This reduction of almost 33 percent in the age group 0-4 should help the maternal and child health personnel to give more attention and care to children born and to increase their expectation of life and quality of life in general.

The proportion of the age group 5-14 representing the school going population, declines from 24.95 percent in 1977 to 18.05 in 2007, implying a substantial reduction in child dependency. This, in turn, can be expected to increase the levels of consumption of each child even in the absence of any major socio-economic changes, facilitating better health and growth. With this decrease in the proportion of children of school going age, the teacher-pupil ratio will improve and result in saving of additional investments needed in the construction of schools and training of teachers. This may, in turn, have a healthy impact on the quality of education imparted.

Assumption CSP (B) implies a decrease of 40 percent in pre-school children in the age group 0-5, from 14.0 percent in 1977 to 8.1 percent in 2007. Similarly, in the age group 5-14 of school-going population, the decrease is of 30 percent from 24.9 percent in 1977 to 17.0 percent in 2007. The improvements in the quality of education and the per capita consumption of the children mentioned will be even more significant under assumption CSP(B).

In both the assumptions, the proportion of population in the age group 15-44 remains almost unchanged, there is only a slight increase in the proportion during the years 1982 to 1997. There is, on the other hand, a steady increase in the proportion of the population in the age groups 45-59 and 60+ in the two projections. Significantly, over the 30 year period, the size of the labour force, relative to the total population does not undergo any significant change even under conditions of drastic reduction in fertility assumed in CSP(A) and CSP (B); there is only a slight but steady increase in labour force upto the

year 2007. However, the ratio of persons 60 and above in age, to those in the 15-59 age group increases by as much as 50 percent by the year 2007 under the two CSP projections.

In the long run under stable state this proportion is three times its present level in both the projections. Thus while child dependency decreases rapidly under the CSP programme, the dependency of the older population increases, due to decline in the mortality and growth of population.

5. *Resources for Implementation of the CSP:*

The CSP involves a large number of sterilization operations to be done in the first two years of the programme in order to clear the backlog of eligible couples with three or more living children followed by a maintenance programme for the fresh crop of couples becoming eligible. The present distribution of the married women in the reproductive ages by number of living children indicates the number of those with three or more living children is around 2.24 million. Those, among them, who are already sterilized number around 0.84 million. The balance of eligible couples is thus 1.40 million. Among them, about 0.15 million are with three living children all of the same sex, who may be permitted to have one more child. We are thus left with a balance of 1.25 million, as on 1.7.1977, and an annual addition of 0.2 million couples moving from the second to the third parity. This calls for sterilization of 1.65 million couples within a period of two years 1977-79. Thereafter, the average annual load would only be of the order of 0.2 million for a few years.

The present pattern of expenditure on family planning involves the following expenditure per sterilization in the state :

(i)	Compensation to acceptors (for three living children) given by Government of India	Rs. 100
(ii)	Additional funds given by the State Government and local bodies for each sterilization	Rs. 50
(iii)	Salaries of personnel on family planning and MCH deployed for the programme (Proportionate cost per case)	Rs. 100
	Total expenditure	Rs. 250

Assuming this kind of expenditure per sterilization, the table given below gives an estimate of the expenditure for the implementation of the CSP in the state.

TABLE 1-ESTIMATE OF EXPENDITURE ON CSP

in crores

	Year					
	1977	1978	1979	1980	1981	1982
Approximate expenditure on the C.S.P.	20.6	20.6	5.0	5.0	5.0	5.0

The per capita expenditure involved in the implementation of the CSP is about Rs. 6/- per year in the first two'years and Rs. 1.50 thereafter. If the same scale can be adopted for the nation as a whole, this would involve an expenditure of Rs. 372 crores for the first two years and Rs. 93 crores thereafter.

APPENDIX 1

Data Used for the Study

The 1971 age distribution of Karnataka smoothed by moving average method separately for males and females was used. The distribution is given in Table 2.

TABLE 2-SMOOTHED AGE DISTRIBUTION FOR KARNATAKA, 1971

Age group	*Female Population (in 000s)*	*Male Population (in 000s)*	*Total Population (in 000s)*
0- 4½ 0- 9	4,201.8	4,249.2	8,451.0
10-14	1,806.3	1,834.3	3,640.6
15-19	1,483.5	1,526.9	3,010.4
20-24	1,253.6	1,265.4	2,519.0
25-29	1,081.6	1,092.3	2,173.9
30-34	933.4	969.7	1,903.1
35-39	787.9	874.1	1,662.0
40-44	657.3	768.1	1,425.4
45-49	539.7	647.3	1,187.0
50-54	441.9	523.6	965.5
55-59	356.4	409.8	766.2
60-64	282.3	308.6	590.9
65-69	202.0	213.2	415.2
70+	299.4	289.4	588.8
Total	14,327.1	14,971.9	29,299.0

SOURCE : *K. Srinivasan, Methods of Measuring the Impact of Family Planning Programme on Fertility '. The case of Karnataka State, India.* Expert Group Meeting on Methods of Measuring the Impact of Family Planning Programmes on Fertility, Geneva, 1976.

The distribution of live births by birth order for India, 1971-72 (Rural) is given in Table 3.

TABLE 3 DISTRIBUTION OF LIVE BIRTHS BY BIRTH ORDER

Birth Order	*1*	*2*	*3*	*4*	*5*	*6+*	*Total*
Percentage of Live Births	19.48	17.25	15.53	13.86	11.31	22.57	100.00

SOURCE : India, Registrar General, Ministry of Home Affairs, New Delhi: *Sample Registration Bulletin,* Vol. IX, No. 3, 1975.

The age specific fertility rates were obtained for Karnataka from SRS data. Rates for the year 1971 for the combined Rural and Urban population age are given in Table 5 in Appendix 2 alongwith the reduced ASFR's under CSP.

APPENDIX 2

Derivation of Age Specific Fertility Rates (ASFR) under the Compulsory Sterilization Programme (CSP)

The derivation of age specific fertility rates under the CSP involves, essentially, the following three steps:

(i) Translation of the programme implications into cumulative rates of sterilization among eligible couples by parity.

(ii) Translation of the probability of sterilization by birth order into probability of sterilization by age, and

(iii) Estimation of the modified age specific schedules of fertility taking into account the age specific sterilization rates.

Following are the details of the procedure that were followed in each of the three steps.

(i) The decision to sterilize a person is taken on the basis of the number and sex of living children at a point in time. For all eligible couples with four or more living children sterilization is obligatory at the end of one year of the birth of the last child. For those with three living children sterilization is obligatory for those who have at least a boy and a girl. For couples with three living children of the same sex, the CSP allows for one more child after which sterilization becomes obligatory.

Since sterilization is to be done on the basis of living children, the probabilities of sterilization on the basis of parity requires data on mortality of children and average interval between successive births. With regard to mortality the assumptions made were Levels 13 and 15 in the year 1977 and Level 17 and 18 in the year 1987 of West Model Life Tables for men and women. For the sake of simplicity the average birth interval between successive live births was taken to be three years. With these assumptions on mortality and birth interval it is possible to estimate the probability $p(x)$ that a couple with X number of live births will be sterilized within the first two years of the programme. For example, the probability that a couple with three live births in 1977 will be sterilised is equal to the probability that all the three children will be alive in 1977 and will not be of the same sex. This can be worked out by simple probability theory. For couples with four live births the probability of sterilization is the sum of two probabilities, namely, the probability that all the four children will be alive in 1977 plus the probability that only three will survive and all the three are not of the same sex. In this manner the probabilities of sterilization of women with higher parities were worked out. It was assumed that the backlog of all eligible couples would be sterilized during the period 1.4.1977 to 31.3.1979 by an intensive crash programme and thereafter only those couples newly coming up to parity 3 would be considered for sterilization. The probabilities computed in this manner are given in Table 4.

(ii) The conversion of the rates of sterilization by parity of women into rates of sterilization by age of the women was carried out assuming certain birth order distribution for each age group. In this context two assumptions were made which led to two different age specific steriliza-

TABLE 4-PROBABILITIES OF STERILIZATION BY PARITY OF WOMEN

Live Birth Order	*Probability of Sterilization after a live birth*	
	Under 1977 MortaliTy	*Under 1987 Mortality*
3	0.46201	0.56409
4	0.62321	0.74107
5+	0.75334	0.77851

NOTE : The sterilization rate for each year by parity for the year 1977 to 1980 were on the basis of mortality levels for 1977 and thereafter as a linear interpolation of the rates obtained by the two mortality levels.

tion rates. It was, first, assumed that the birth order distributions of women in all age groups were identical and equal to the birth order distribution of all women in the population. This implies that the proportion of sterilization in each age group is the same and equal to the proportion of sterilization in the whole population of eligible couples. It is to be admitted that this assumption, CSP (A), is unrealistic and will under-estimate the impact of programme on fertility and as such could be considered as a conservative assumption.

In the second procedure, CSP(B), it was assumed that the births in the age group 15-16 are all of first order; in the age group 20-24 are of first, second and third order in certain proportion; in the age group 25-29 are of third, fourth and fifth order in certain proportion; and 30 and above are of fifth or higher order. This assumption was made so that the birth order distribution obtained for the country as a whole and the age specific fertility rates of Karnataka State will be mutually consistent. It would have been ideal if the data on the age parity distribution of married women in Karnataka State were available in which case this could have been used to convert the parity specific sterilization rates to age specific rates without resort to the approximating procedure mentioned above.

(iii) After obtaining the age specific sterilization rates by the procedures outlined above for CSP(A) and CSP(B), the problem of obtaining the age specific fertility schedules under the programme is quite simple. It was

assumed that the initial age specific fertility schedule for the State in 1977 was the same as the rates derived in the Sample Registration Scheme in 1971. The age specific fertility rates under CSP were obtained by direct multiplication of the rates in each age group by the rates of sterilization. The age specific fertility schedules obtained for CSP(A) and CSP(B) are given, in Table 5 below:

TABLE 5-AGE SPECIFIC FERTILITY SCHEDULES UNDER THE COMPULSORY STERILIZATION PROGRAMME

Age Group		*Projection II*			
		CSP (A)		*CSP (B)*	
	1971[a]	*1980*	*1992*	*1980*	*1992*
15-19	101.0	63.8	60.7	101.0	101.0
20-24	211.1	133.3	126.9	211.1	211.1
25-29	223.8	141.3	134.6	140.7	125.3
30-34	157.8	99.6	94.9	19.0	10.4
35-39	118.0	74.5	71.0	5.9	3.0
40-44	46.2	29.2	27.8	2.3	1.2
45-49	16.5	10.4	9.9	0.8	0.4
Total Fertility Rate	4.4	2.7	2.6	2.4	2.3

a : SOURCE : Government of Karnataka, Bureau of Economics and Statistics, SRS Report, Series No. 1 (1974).

APPENDIX 3a

PROJECTIONS FOR TOTAL POPULATION UNDER THE ASSUMPTION OF CONSTANT FERTILITY (PROJECTION I), KARNATAKA

Year		*1977*	*1982*	*1987*	*1992*	*1997*	*2002*	2007	*Stable*
Population (in OOO's)		33,032.9	36,633.5	41,128.5	46,289.4	51,823.2	57,776.8	64,324.1	—
Percent Growth over 1977		0.00	10.90	24.51	40.13	56.88	74.91	94.73	—
Crude rates (per 1000)	*b*	33.65	34.37	34.30	33.41	32.36	31.90	32.05	32.05
	d	14.32	12.48	10.91	10.31	10.20	10.30	10.55	11.00
	r	19.33	21.89	23.39	23.10	22.16	21.60	21.50	21.05
Births (in OOO's)		1,111.6	1,259.0	1,410.9	1,546.4	1,677.0	1,843.2	2,061.7	—
Age distribution	0- 4	13.96	14.20	14.67	14.64	14.25	13.96	13.91	14.05
	5-14	24.95	23.57	22.92	23.53	24.02	23.82	23.35	23.17
	15-44	45.25	45.97	45.83	44.89	44.35	44.29	44.23	43.83
	45-59	8.35	10.61	10.73	10.84	11.06	11.43	11.84	11.54
	60+	5.49	5.65	5.85	6.10	6.32	6.50	6.67	7.41
Sex Ratio (Females per 1000 males)		953.1	951.0	952.5	955.0	957.0	958.4	959.4	958.7

APPENDIX 3b

PROJECTIONS FOR FEMALE POPULATION UNDER THE ASSUMPTION OF CONSTANT FERTILITY (PROJECTION I), KARNATAKA

Year		*1977*	*1982*	*1987*	*1992*	*1997*	2002	2007	*Stable*
Population (in OOO's)		16,119.8	17,856.6	20,063.7	22,612.0	25,341.7	28,275.3	31,495.9	—
Percentage growth over 77		0.00	10.77	24.47	40.28	57.21	75.41	95.39	—
Crude Rates :	*b*	33.64	34.39	34.30	33.36	32.28	31.80	31.93	31.94
	d	14.65	12.45	10.69	10.02	9.94	10.07	10.47	10.89
	r	18.99	21.84	23.61	23.34	22.34	21.73	21.46	21.05
Age distribution	0- 4	13.94	14.13	14.65	14.62	14.23	13.92	13.86	14.01
	5-14	25.17	23.56	22.72	23.36	23.91	23.71	23.22	23.05
	15-44	45.57	46.43	46.20	45.02	44.25	44.07	43.94 *	43.56
	45-59	9.87	10.31	10.64	10.91	11.21	11.60	12.01	11.57
	60+	5.45	5.57	5.79	6.09	6.40	6.70	6.97	7.81

APPENDIX 4a

PROJECTIONS FOR TOTAL POPULATION UNDER THE ASSUMPTION OF COMPULSORY STERILIZATION PROGRAMME (PROJECTION II-A), KARNATAKA

Year		*1977*	*1982*	*1987*	*1992*	*1997*	*2002*	2007	*Stable*
Population (in OOO's)		33,032.9	35,261.8	37,504.4	40,072.9	42,671.9	45,130.5	47,314.0	—
Percent Growth over 1977		0.00	6.75	13.54	21.31	29.18	36.62	43.23	—
Crude rates (per 1000)	*b*	33.65	22.36	23.09	23.21	22.73	21.38	20.06	18.46
	d	14.32	10.60	10.30	10.30	10.86	11.09	11.40	15.76
	r	19.33	11.76	12.78	12.91	11.87	10.29	8.66	+ 2.70
Births (in OOO's)		1,111.6	788.6	866.1	929.9	970.0	964.7	948.9	—
Age distribution	0- 4	13.96	10.87	9.98	10.27	10.20	9.82	9.27	8.47
	5-14	24.95	24.48	21.58	18.30	17.90	18.88	18.05	16.02
	15-44	45.25	47.77	50.24	51.86	50.80	48.99	47.51	42.92
	45-59	8.35	11.02	11.77	12.52	13.43	14.63	16.11	17.32
	60+	5.49	5.86	6.43	7.05	7.67	8.32	9.06	15.27
Sex Ratio (Females per 1000 Males)		953.1	951.4	953.2	956.2	958.9	961.3	963.3	969.1

APPENDIX 4b

PROJECTIONS FOR FEMALE POPULATION UNDER THE ASSUMPTION OF COMPULSORY STERILIZATION PROGRAMME (PROJECTION II-A), KARNATAKA

Year		*1977*	*1982*	*1987*	*1992*	*1997*	*2002*	*2007*	*Stable*
Population (in OOO's)		16,119.8	17,191.6	18,303.1	19,588.3	20,888.7	22,120.0	23.212.9	---
Percent Growth over 1977		0.00	6.65	13.54	21.52	29.58	37.22	44.00	—
Crude rates :	*b*	33.64	22.38	23.08	23.16	22.65	21.28	19.94	18.32
	d	14.65	10.90	10.04	9.95	10.52	10.77	11.10	15.62
	r	18.99	11.48	13.04	13.21	12.13	10.51	8.84	+2.70
Age distribution	0- 4	13.94	10.81	9.96	10.25	10.17	9.78	9.22	8.41
	5-14	24.16	24.47	21.57	18.16	17.79	18.12	17.91	15.86
	15-44	45.57	48.24	50.63	51.97	50.69	48.71	47.11	42.41
	45-59	9.87	10.71	11.67	12.60	13.59	14.83	16.30	17.26
	60+	5.45	5.77	6.35	7.02	7.76	8.56	9.46	16.07

APPENDIX 5a

PROJECTIONS FOR TOTAL POPULATION UNDER THE ASSUMPTION OF COMPULSORY STERILIZATION PROGRAMME (PROJECTION II-B), KARNATAKA

Year		*1977*	*1982*	*1987*	*1992*	*1997*	2002	2007	*Stable*
Population (in OOO's)		33,032.9	35,238.3	37,448.3	39,903.4	42,225.9	44,176.6	45,688.4	—
Percentage Growth over 1977		0.00	6.68	13.37	20.80	27.83	33.74	38.31	—
Crude rates : (per 1000)	*b*	33.65	22.40	22.79	22.33	21.00	18.63	17.30	15.51
	d	14.32	10.62	10.36	10.35	10.89	10.83	11.23	17.77
	r	19.33	11.78	12.43	11.98	10.11	7.80	6.07	-2.26
Births (in OOO's)		1,111.6	789.5	853.4	891.2	886.7	823.0	790.3	—
Age distribution	0- 4	13.96	10.81	9.92	10.02	9.65	8.87	8.09	7.20
	5-14	24.95	24.50	21.53	18.26	17.74	17.74	17.00	14.12
	15-44	45.25	47.80	50.34	52.08	51.28	49.93	48.84	41.71
	45-59	8.35	11.03	11.78	12.56	13.57	14.96	16.68	18.83
	60+	5.49	5.86	6.43	7.08	7.76	8.50	9.39	18.14
Sex Ratio (Females per 1000 Males)		953.1	952.7	954.2	957.4	960.0	962.5	964.5	973.1

APPENDIX 5b

PROJECTIONS FOR FEMALE POPULATION UNDER THE ASSUMPTION OF COMPULSORY STERILIZATION PROGRAMME (PROJECTION II-B), KARNATAKA

Year		*1977*	*1982*	*1987*	*1992*	*1997*	*2002*	*2007*	*Stable*
Population (in OOO's)		16,119.8	17,192.2	18,284.9	19,517.2	20,682.6	21,668.2	22,431.6	—
Percentage Growth over 1977		0.00	6.65	13.43	21.08	28.31	34.41	39.10	—
Crude rates : (per 1000)	*b*	33.64	22.40	22.27	22.27	20.91	18.53	17.19	15.34
	d	14.65	10.92	10.10	9.97	10.53	10.50	11.32	17.60
	r	18.99	11.48	12.67	12.30	10.38	8.03	5.87	– 2.26
Age distribution	0- 4	13.94	10.81	9.90	10.00	9.61	8.82	8.04	7.13
	5-14	25.17	24.46	21.39	18.16	17.64	17.63	16.86	13.95
	15-44	45.57	48.24	50.67	52.16	51.18	49.67	48.45	41.15
	45-59	9.87	10.72	11.68	12.63	13.73	15.14	16.86	18.73
	60+	5.45	5.77	6.36	7.05	7.84	8.76	9.79	19.04