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Using Age-Specific Appropriate Method-Mix Strategy to Achieve Replacement Level Fertility in India: A Model for Policy Analysis[1]

Introduction

INDIA is committed to achieving Net Reproduction Rate (NRR) of unity and is trying to gear up its long standing Family Planning Program (FPP), now called Family Welfare Program, whose performance has not been very good but not dismal either, seeing the size of the country, a large number of villages some of which are remote and inaccessible, wide inter-state variations, and slow pace of socio-economic development. The impact of the program has not been very encouraging in terms of reduction in birth rate and total fertility rate (TFR). In 1991, the effective Couple Protection Rate (CPR) was 44.1 and Crude Birth Rate (CBR) 29.5. The TFR in 1991 was 3.6. The decline in birth rate has been very slow; from 36.9 in 1971 to 29.5 in 1991 i.e. decline of 7.6 births per 1000 population in 20 years compared to increase in Couple Protection Rate (CPR) from 10.4 to 44.1 percent during the same period (Planning Commission, India 1985-90; Ministry of Health and Family Welfare, India 1990-91). Because of less-than-desired performance of the program (in terms of coverage as well as impact), the goal of achieving NRR - 1 or replacement level fertility, which was initially set for the year 2000 was shifted to the year 2006-2011 on the recommendations of the Expert Committee on population projections appointed by Governmentof India (PlanningCommission, India 1985-90). Again, seeing the performance of the program during Vllth five year plan, the VHIth plan aims at achieving it during 2011-2016 (Planning Commission, India 1992-97).

The program efforts in the past show that large majority of acceptors of family planning methods have been those of sterilization and among them, large numbers were acceptors at higher parity. The percentage of acceptors of temporary methods has not been large; even in this category acceptors of conventional contraceptives (CC) have been particularly high whereas their use effectiveness taken in only 50% in the program itself (Ministry of Health and Family Welfare, India 1990-91). Further, the continuation rates of temporary methods

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is very low. Due to such reasons, the demographic impact of the program has not been of the desired level.

Till now, the targets worked out and implemented for achievement are in absolute numbers by methods. In the absence of parity-based targets, their monitoring is also not done. As discussed earlier, simply achievement of family planning program acceptor targets has not paid much in the past in terms of reduction in birth rate and fertility.

In a recent study (Rajan *et al.* 1993) have examined the role of family planning in the dynamics of child bearing in India and used to concept of 'extra births' to assess the extent to which targets are being met. To achieve the replacement level fertility, the Indian family planning program has to make effort to delay child bearing through the use of temporary methods and to lower average age at sterilization so as to approximate the average age at which women reach parity two. The study also quotes Zachariah (1980) regarding progress made in this regard. There is need for promotion of spacing methods, though their success in lengthening the birth intervals has not been good in many states—may be because of several reasons including an early age at marriage, a desire to continue child bearing to achieve a specific sex composition because of preference of male child, large family size, and lack of awareness of various spacing methods. Rajan *et al.* (1992) have highlighted the need of targeting women for contraceptive use according to their age and parity. Women in younger age groups may not agree to accept terminal methods at parity two although avoiding births after that should be addressed, greater use of spacing methods should be promoted especially those methods which are more effective. This necessitates covering women with appropriate method mix based on age and parity. This approach will be useful both for health of the mother and child as well as reduction of fertility.

Modeling Approach

The family planning program has to achieve its goal of NRR = 1.0 by 2011-2016. This goal can be achieved by shifting age at marriage, promoting breastfeeding for increasing the birth interval arid/or practice of family planning methods. The impact of the last component is affected by age and parity of acceptors as younger the age at acceptance of family planning methods, larger will be the impact of family planning methods. Therefore, a computer simulation model was developed by using the following parameters:

Proximate determinants of fertility (age at marriage, post-partum infecundability, sterility, abortion)
coverage rates (the proportion of non-users accepting family planning each year) by age and parity
Acceptor method-mix by parity
Method effectiveness and discontinuation

The model is initialised by taking base year number of users from program statistics to achieve the estimated levels of couple protection rate and total fertility rate (TFR). It may be noted that all attempts were made to make the model as realistic as possible.

In each year, we first calculate new acceptors based on the user specified coverage rate. These acceptors are taken from year of acceptance to future years by using attrition rates. This approach helps in computation of couple protection rate in different years and thus changed level of fertility because of use of contraception and other proximate determinants of fertility. These changed levels of fertility and changed levels of mortality (assumed by the Expert Committee on Population Projections of the Planning Commission) gives population projections in different years. This methodology has been implemented in a computer model called FamPlan, developed by Research Triangle Institute, North Carolina, U.S.A.

The model can be used to analyse the effect of changes in the following variables which affect fertility and population growth and design alternate strategies for the family planning programme:

1. Duration of breastfeeding
2. Age at marriage
3. Abortion rates
4. Contraceptive practices

In contraceptive practices, following parameters can be changed:

* Effectiveness rates of methods
* Acceptor method mix by parity
* Coverage rates by age and parity
* Introduction of new methods

Application of the Model to India

For application of the model, the coverage rates (non-users accepting family planning services) by age and parity and acceptor method mix by parity are required for the base year so that appropriate assumptions in their change can be made. Since neither the service statistics nor surveys provide such breakup, these have been generated in the model to approximate the current scenario of acceptors and users. The estimated coverage rates and method mix by parity in the year 1991-1992 are given below :

ESTIMATED COVERAGE RATES BY PARITY—1991-1992

Age	*Parity '0'*	*Parity T*	*Parity '2'*	*Parity '3'*	*Parity '4+'*
15-19	0.09	0.20	0.25	0.35	0.35
20-24	0.09	0.35	0.45	0.42	0.40
25-29	0.09	0.35	0.45	0.45	0.42
30-34	0.00	0.25	0.40	0.45	0.45
35-39	0.00	0.25	0.40	0.40	0.40
40-44	0.00	0.00	0.15	0.15	0.15

ESTIMATED ACCEPTOR METHOD MIX BY PARITY—1991-1992

Method	*Parity '0'*	*Parity T*	*Parity '2'*	*Parity '3'*	*Parity '4+'*
Sterilization	*0%*	1%	15%	23%	23%
IUD	*1%*	20%	19%	18%	18%
Condom	82%	64%	52%	47%	47%
Oral Pill	17%	15%	14%	12%	12%

Base Case—Scenario '0'

This scenario is based on the current situation on age at marriage, breastfeeding practices and on contraception used. Since in India, the average age at marriage has been increasing by about one year every 10 years, this trend of average age at marriage from 1961 to 1991 has been projected in calculating proportion married. Further, with increased socio-economic development, urbanization and more women going for employment, the breastfeeding practices are likely to decline. We have assumed that the average duration of breastfeeding declines from 13 months of 10 months over the next 30 years. The coverage rates and acceptor method mix are assumed to remain unchanged. With these assumptions, the prevalence of contraceptives and TFR remain almost constant. This is expected as the effect of raising age at marriage is offset by the decline in practice of breastfeeding.

Against this background of scenario '0', the effect of non-program and program related factors on fertility has been studied in this paper in different feasible scenarios.

Scenario 1: Breastfeeding Promotion

Government of India has already started the program for promotion of breastfeeding. It is assumed that the breastfeeding promotion program will be able to arrest the declining trend in average duration of breast feeding. Therefore, we have assumed the duration of breastfeeding unchanged in this scenario. Of course, age at marriage increases one year every 10 years (as has been the trend in the past years).

Comparison of the effect of this scenario with Base on total fertility is shown in Table 1 below:

TABLE 1: COMPARISON OF TOTAL FERTILITY RATES

Year	*TFR (Base)*	*TFR (scenario 1)*
1991	3.64	3.64
1996	3.70	3.64
2001	3.76	3.62
2006	3.79	3.60
2011	3.81	3.56
2016	3.80	3.50

The above table shows that 3 months decline in breastfeeding practice alone, over a period of 30 years will increase TFR by about 0.25 to 0.30 by 2011-2016.

Scenario 2: Increased Age at Marriage

Age at marriage has been rising in India by about 1 year every 10 years:

- 1961 = 16.1
- 1971 = 17.2
- 1981 = 18.3

However, it is 3.5 years less than the average for Kerala in 1981 (21.82 years). Based on past trend, the average age at marriage in India and Kerala by 2021 are likely to be

	India	*Kerala*
1991	19.4	22.4
2001	20.5	22.8
2011	21.6	23.1
2021	22.7	23.3

In this scenario, it is assumed that age at marriage in India increases faster than in the past and becomes equal to the average of Kerala in 2001 (22.8) by 2011; i.e., 1.2 years higher than the expected figure of India in 2011. The effect of this faster increase in age at marriage on TFR is shown in Table 2.

TABLE 2 : COMPARISON OF TOTAL FERTILITY RATES

Year	*TFR (Scenario 1)*	*TFR (scenario 2)*
1991	3.64	3.64
1996	3.64	3.58
2001	3.62	3.52
2006	3.60	3.47
2011	3.56	3.41
2016	3.50	3.46

The table shows that the effect of faster increase in age at marriage over the normal trend on TFR is not much.

Scenario 3: Increased Coverage but Constant Met hod Mix

In this scenario, we have assumed that the acceptor method-mix remains unchanged at the current level. The coverage rates by age and parity have been increased in order to achieve replacement level of fertility of 2.15 by 2011-2016.

The model shows that replacement level fertility of 2.15 can be reached in 2016 corresponding of *CPR* of 76.7% and *Effective CPR* of 67.6% (and not 60% as projected in National Health Policy). Table 3 gives the age-specific prevalence which will be achieved by 2016 in this case. Table 4 shows the number of acceptors of methods required to achieve the Effective CPR of 67.6%.

TABLE 3: AGE-SPECIFIC PREVALENCE

Age	*Prevalence 1991*	*Prevalence 2016*_____
15-19	9%	19%
20-24	30%	40%
25-29	61%	72%
30-34	66%	85%
35-39	66%	91%
40-44	55%	92%
Total	50%	76.7%

TABLE 4: REQUIRED ACCEPTORS OF FAMILY PLANNING METHODS : UNCHANGED CURRENT ACCEPTOR METHOD-MIX BUT INCREASED COVERAGE

(in millions)

Year	*Condom*	*Oral Pill*	*IUD*	*Sterilization*	*Total*
1991-92	13.9	3.4	4.4	4.0	25.7
1996-97	19.9	4.2	6.5	5.6	36.2
2001-02	25.4	5.5	8.5	6.9	46.3
2006-07	30.1	6.5	10.0	7.8	54.4
2011-12	34.3	7.4	11.4	8.5	61.6
2015-16	34.1	7.4	11.3	8.3	61.1

From the above table it is seen that very high number of contraceptive acceptors will have to be recruited to reach the replacement level fertility of 2.15. The reason for this is that a large proportion of users are using condoms which is only 50% effective (effectiveness rate used by Government of India) and have low continuation rates. Because of this, CPR of 76.7% is to be achieved to get effective prevalence of 67.6% to reach replacement level fertility. It is therefore, necessary to improve the method mix with more emphasis on effective methods of family planning so as to bring number of acceptors to feasible numbers. This is being done in scenario 4.

Scenario 4: Changed Acceptor Method Mix by Parity

This scenario assumes that improved quality of service is provided for increasing oral pill and IUD users. Therefore, we have modified the acceptor method mix by parity to:

maintain current use of condoms
increase in use of IUD and oral pill similar to Gujarat and Maharashtra, respectively
slight increase in use of sterilization for higher parity to bring it at par with Tamil Nadu

Further, it is assumed that the above method mix by parity is reached by 2011 and then continued.

REVISED METHOD MIX BY PARITY—2011

Method	*Parity '0'*	*Parity '!'*	*Parity '2'*	*Parity '3'*	*Parity '4+'*
Sterilization	0%	1%	20%	37%	40%
IUD	1%	40%	35%	30%	25%
Condom	83%	39%	27%	24%	24%
Oral Pill	16%	20%	18%	10%	10%

From the above table, it will be seen that spacing methods—particularly oral pill and IUD have been emphasised compared to condom, for low parity because effectiveness rates of Oral pill and IUD used by Government of India are 100 and 95 percent, respectively where as condom effectiveness used in the program is only 50 percent. As the parity increases, the couples are more likely to go for long term methods. As such, for parity 3 and 4, sterilization and IUD have been stressed.

With the revised method mix, the age specific prevalence as well as total prevalence have changed as shown in Table 5. The total prevalence has decreased from 76.7% to 70.7% and effective CPR from 67.6% to 66.3% by 2016 from scenario 3 to scenario 4.

TABLE 5: AGE-SPECIFIC PREVALENCE-REVISED ACCEPTOR METHOD MIX BY PARITY

Age	*Prevalence 1991*	*Prevalence 2016*
15-19	9%	19%
20-24	30%	39%
25-29	61%	66%
30-34	66%	82%
35-39	66%	85%
40-44	55%	82%
Total	50%	70.7%

With changed acceptor method mix (scenario 4), replacement fertility of 2.15 will be achieved in 2013 with CPR of 70.7 and Effective CPR of 66.3%. The total fertility rates and acceptors by methods to achieve them are given in Table 6.

TABLE 6: TOTAL FERTILITY RATES AND ACCEPTORS BY METHODS (Scenario 4)

Year	*TFR*	*Acceptors by methods* (in million)				
		CC	*OP*	*IUD*	*Sterilize*	*Total*
1991	3.64	13.9	3.4	4.4	4.0	25.7
1996	3.44	16.5	4.1	6.7	5.5	32.8
2001	2.97	16.8	5.1	9.2	7.0	38.1
2006	2.56	15.4	5.9	11.4	7.9	40.6
2011	2.23	14.6	6.4	12.7	8.6	42.3
2013	2.15	14.4	6.3	12.6	8.4	41.7

This shows that if we modify the method mix and recruit new acceptors of different family planning methods based on parity, we can certainly achieve replacement level fertility by 2013. (If sterilization for parity '2* can be increased further, the goal can be achieved even earlier.) The number of acceptors required is 41.7 million which is much less number than the required acceptors of scenario 3 (61.1 million).

Another question frequently asked is from where all these acceptors will come? The model answers this question by providing the number of non-users in different years and the number of new acceptors to be recruited by parity. This is shown in example in Table 7 below. Such table can be generated every year to realistically decide parity-specific targets. Such table can also give us idea whether numbers of acceptors of different methods are realistic. This is very helpful in deciding from which parity group, the new acceptors of a particular method could come.

TABLE 7: NON-USERS AND ACCEPTORS BY PARITY—2012-2013

(in millions)

Parity	*Non-users*	*Sterilization Acceptors*	*IUD Acceptors*	*OP Acceptors*	*Condom Acceptors*	*Total Acceptors*
0	25.6	0.0	0.04	0.60	3.12	3.76
1	15.5	0.12	4.89	2.45	4.77	12.23
2	11.6	1.76	3.09	1.59	2.38	8.82
3	8.9	2.34	1.90	0.63	1.46	6.33
4+	17.7	4.22	2.64	1.05	2.64	10.55
Total	79.3	8.44	12.56	6.32	14.37	41.69

Justification of Revised Method Mix

Though performance of different family planning methods in the suggested method-mix was taken from the experience of the states of Gujarat, Maharashtra and Tamil Nadu, it is interesting to compare how the performance compared with other states. The comparison of CPR obtained from revised suggested method mix when replacement level fertility will be achieved by India with those of three good performing states in India is shown in Fig. 1.

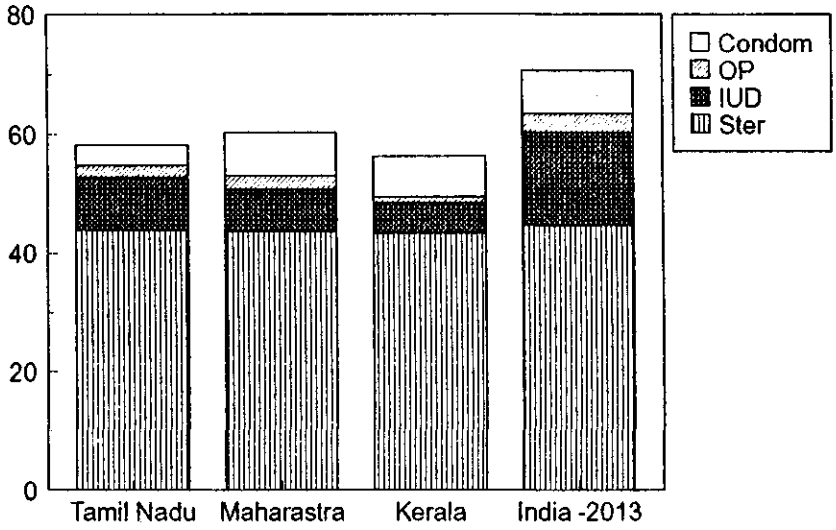

Fig. 1

It may be seen that the suggested method-mix compares quite well with better performing states of the country in sterilization (main method). We have suggested greater prevalence in IUD by shifting emphasis from condoms because of effectiveness consideration.

The comparison of CPR by methods of India and other Asian countries who have achieved replacement level fertility is shown in Fig. 2.

Again, it may be seen that the suggested method-mix fits in the pattern of other Asian countries. India will have sterilization prevalence like Republic of Korea, its IUD prevalence will be like Taiwan.

Conclusion

1. The above analysis shows that use of appropriate method mix based on parity will be crucial in achievement of replacement level fertility by India during 2011-2016. This suggests that it might be useful to investigate how to promote various family planning methods to women of different parities. Also, increase in number of acceptors of OP and IUD shown above is only indicative that more emphasis in the program need to

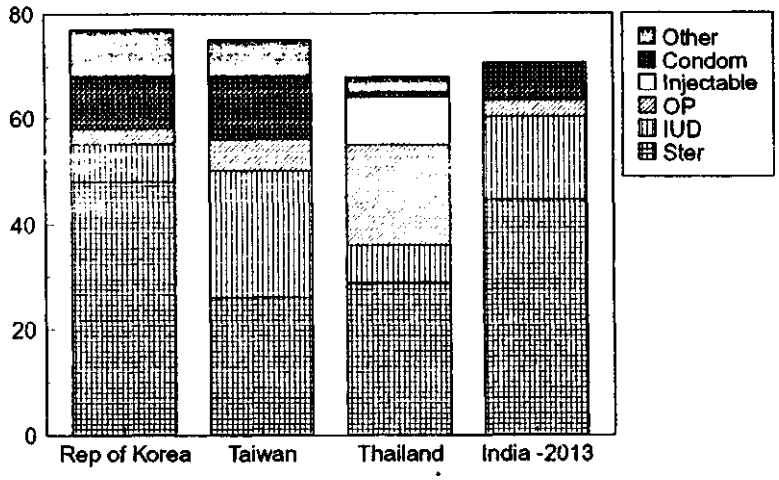

Fig. 2

be given to methods whose effectiveness is higher and have higher continuation rates. Birth spacing methods like once a week pill, injectables etc. in addition to existing method in the programme can achieve this goal.

2. The parity approach provides in each year the pool of non-users and the number of new acceptors to be recruited by parity as shown in Table 6. This is very helpful in deciding from which parity group, the new acceptors of a particular method could come.
3. The age and parity approach also shows that in combination with appropriate method mix (spacing methods for lower parity and terminal methods for higher parity), the goal of replacement level fertility can be achieved with much less number of acceptors compared to the current method mix.

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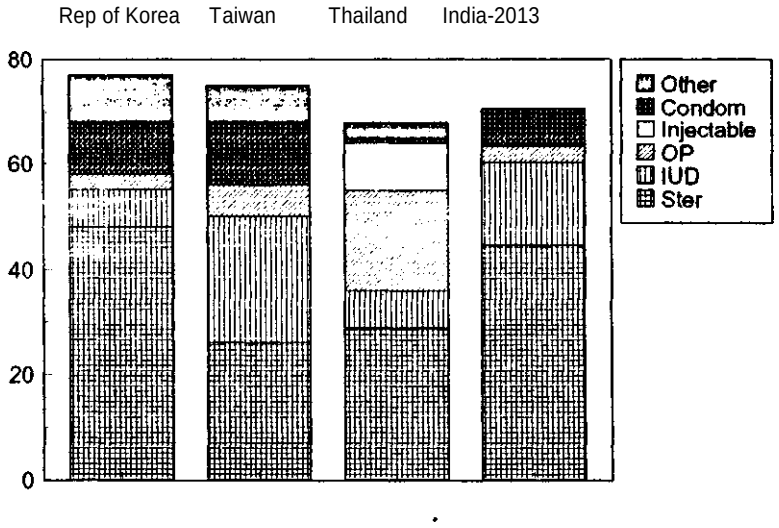

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