

# Medical Termination of Pregnancy and Number of Births Averted : A Methodology for Estimating the Short-Term Impact

The central law relating to abortion, called the Medical Termination of Pregnancy Act came into force in 1972 in India. It is conceived mainly as a health and social measure but it is expected that the liberalisation of abortion law will also have some impact on fertility levels. This expectation rests on the experience of induced abortions in countries like Japan and those of Eastern Europe, where such liberalization had led to dramatic reduction in fertility. Several recent studies have thrown light on the role of abortion in preventing live births\* but they tend to take long-term view and hence are of little value to policy makers whose interest lies in speedy reduction in birth rate.

One induced abortion cannot be considered to prevent one live birth. Firstly, because the effect of particular abortion depends on outcome of the pregnancy if it had not been terminated, the termination could be a miscarriage or a still-birth in which case the effect would be marginal, if any. Only when, but for induced abortion, the pregnancy would have resulted in a live birth, there would be an appreciable delay in the occurrence of the next birth. Secondly, the period of gestation and resumption of ovulation associated with abortion are much

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\*See Potter (1972), Pathak (1975), and Venkatacharya (1972).

less than those associated with a live birth and a woman acquires fecundability status much earlier after an abortion than after a live birth.

In the light of these facts the present paper attempts to study how the short-term impact of abortion varies according to the age and fecundity of the woman and the efficiency of her use of contraception after abortion. For this purpose, we follow two cohorts similar in all respects except in the practice of contraception after abortion. One of the cohorts is assumed not to practise contraception after abortion, while a part of the other is assumed to practise contraception in some form or other after abortion.

### Assumptions and Notations

1. All women have equal values of age specific monthly chance of conception, but m.c.c. is assumed to change by age.

2. The probability of a conception terminating in a live birth or a stillbirth or a spontaneous abortion, is assumed to vary by age. Duration of a pregnancy terminating in a live birth, a still birth or a spontaneous abortion is assumed to be constant for all ages and parities. Similarly post-partum amenorrhoea periods (PPAs) are assumed to be constant.

$e_k$  : Probability of conception leading to  $k$ -th type of pregnancy

$h_k$  : The rest period associated with the  $k$ -th type of pregnancy, i.e.,

$h_k$  :  $g_k + m_k$ , where  $g_k$ ,  $m_k$  are respectively the gestation and post-partum period associated with  $k$ -th type of pregnancy.

3. It is assumed that all the spontaneous abortions occur before the end of the third month of pregnancy.

4. All the abortions are performed in the third month of pregnancy.

5.  $p$  : Monthly chance of conception for women

$e_s$  : Effectiveness of the  $s$ -th type of contraception, where  $s = 1, 2, \dots, 3$ ;

$p_s = p(1 - e_s)$  : Monthly risk of conception during a fecundable month while practising  $s$ -th type of contraception.

6.  $a_i$  : Number of abortions performed in the  $i$ -th month.

By assuming that one hundred abortions are performed every month for each age group, a relationship has been worked out separately for each age group

between the number of births saved in the current and subsequent years and induced abortions performed in the current year. A detailed methodology has been worked out for one age group and for the rest only the values of monthly chance of conception and spontaneous abortion differ from one to another age group.

The methodology has been worked out in two steps.

1. Calculation of hypothetical births which could have occurred to the women in the current year and in subsequent years, had they not undergone for abortion during the current year.

2. Calculation of the number of births with and without contraception that would occur during both current and subsequent years to the women having induced abortions in the current year.

### Step 1

In this section we estimate the total number of births that would have occurred to  $\sum_{i=1}^{12} a_i$  women in the current year and in the subsequent year assuming that these  $\sum_{i=1}^{12} a_i$  women had not undergone for induced abortions during the current year. In the absence of induced abortions these  $a_i$  women who are in the third month of pregnancy would have terminated their pregnancies in  $a_i \theta_1$  live births and  $a_i \theta_2$  still births after the completion of  $g_1 - 3$  and  $g_2 - 3$  months respectively, where  $\theta_1 (\theta_2 = 1 - \theta_1$  according to the assumption) is the probability that a pregnancy which is 3 months old will terminate in live birth. The live birth for  $a_i \theta_1$  women will occur in 7-th month from the origin, whereas for  $a_i \theta_2$  women, still birth will occur in 6-th month from the origin.

The number of births occurring to the women  $\sum_{i=1}^6 a_i$  during the current year, had they not gone for abortion in the current year, is

$$\sum_{i=1}^6 a_i \theta_1 = \alpha_1. \quad (1)$$

Also the number of live births occurring to  $\sum_{i=7}^{12} a_i$  women in the subsequent

year is equal to

$$\sum_{i=7}^{12} a_i \theta'_1.$$

The women who have still birth would conceive from  $(g_2 - 3 + A_2)$  month and these conceptions would terminate into live births, still births and spontaneous abortions. The number of live births likely to occur to these women in the subsequent year are :

$$\theta'_2 \theta_1 \sum_{i=1}^7 \sum_{j=1}^7 a_i p q^{j-i}.$$

The women whose earlier conceptions terminated in still births and spontaneous abortions consecutively, would conceive from  $(g_2 - 3 + A_2 + g_3)$  month and live births given by these women would then be

$$\theta'_2 \theta_3 \theta_1 \sum_{i=1}^3 \sum_{j=1}^3 a_i p q^{j-i} \cdot p q^{j-i}.$$

The total number of live births to  $\sum_{i=1}^{12} a_i$  women in the subsequent year, had they not gone for abortion are :

$$\sum_{i=7}^{12} a_i \theta'_1 + \theta'_2 \theta_1 \sum_{i=1}^7 \sum_{j=1}^7 a_i p q^{j-i} + \theta'_2 \theta_3 \theta_1 \sum_{i=1}^3 \sum_{j=1}^3 a_i p q^{j-i} \cdot p q^{j-i} = \alpha_2. \quad (2)$$

The total number of births occurring  $\sum_{i=1}^{12} a_i$  women during both current and subsequent years, had they not gone for abortions in the current year, are

$$\alpha_1 + \alpha_2 = \alpha. \quad (3)$$

### Step 2

*a. WITHOUT CONTRACEPTION.* In this section, we estimate the total number of births that would have occurred during the current and the subsequent years to  $\sum_{i=1}^{12} a_i$  women having induced abortions in the current year. The live births for women, who had undergone abortions in the first month, will be in the 11th month from the origin. The number of live births to  $\sum_{i=1}^2 a_i$  women during the

current year is

$$\sum_{i=1}^2 \sum_{j=i}^2 a_i pq^{j-t} \theta_1 = \beta_1, \quad (4)$$

and is denoted by  $\beta_1$ .

The number of live births occurring to  $\sum_{i=3}^{12} a_i$  women in the subsequent year is

$$\sum_{i=1}^{12} \sum_{j=3}^{12} a_i pq^{j-t} \theta_1.$$

The number of live births occurring in the subsequent year to the women whose earlier conceptions terminated in still births and in spontaneous abortions are

$$\theta_2 \theta_1 \sum_{i=1}^3 \sum_{j=i}^3 a_i pq^{j-t} \cdot pq^{j-i} + \theta_3 \theta_1 \sum_{i=1}^{10} \sum_{j=i}^{10} a_i pq^{j-t} \cdot pq^{j-i}.$$

Similarly the number of live births occurring to the women whose earlier two conceptions terminated in spontaneous abortions are

$$\theta_3 \theta_3 \theta_1 \sum_{i=1}^6 \sum_{j=i}^6 a_i pq^{j-t} \cdot pq^{j-i} \cdot pq^{j-i}.$$

The total number of live births occurring in the subsequent year to the women having induced abortions in the current year is

$$\begin{aligned} \theta_1 \sum_{i=1}^{12} \sum_{j=3}^{12} a_i pq^{j-t} + \theta_2 \theta_1 \sum_{i=1}^3 \sum_{j=i}^3 a_i pq^{j-t} \cdot pq^{j-i} \\ + \theta_3 \theta_1 \sum_{i=1}^{10} \sum_{j=i}^{10} a_i pq^{j-t} \cdot pq^{j-i} \\ + \theta_3 \theta_3 \theta_1 \sum_{i=1}^6 \sum_{j=i}^6 a_i pq^{j-t} \cdot pq^{j-i} \cdot pq^{j-i} = \beta_2. \end{aligned} \quad (5)$$

Total number of births occurring to  
 $\sum_{i=1}^{12} a_i$  women during both current  
and subsequent years

$$= \beta = \beta_1 + \beta_2. \quad (6)$$

Average number of births saved per  
abortion in the current year

$$= \frac{1}{\sum_{i=1}^{12} a_i} (\alpha_1 - \beta_1).$$

Average number of births saved per  
abortion in the subsequent year

$$= \frac{1}{\sum_{i=1}^{12} a_i} (\alpha_2 - \beta_2). \quad (7)$$

Average number of births saved per  
abortion during two years

$$= \frac{1}{\sum_{i=1}^{12} a_i} (\alpha - \beta).$$

*b. WITH CONTRACEPTION.* The monthly chance of conception for a woman undergoing abortion, who would use family planning methods after abortion, depends upon the efficiency of the contraception. If  $e_{s_1}$ ,  $e_{s_2}$ ,  $e_{s_3}$  represent the contraceptive effectiveness of sterilised persons, IUCD and conventional contraceptive users respectively, then their monthly chance of conceptions would be equal to  $p(1 - e_{s_1})$ ,  $p(1 - e_{s_2})$ , and  $p(1 - e_{s_3})$  respectively. Let  $P_{s_1}$ ,  $P_{s_2}$ ,  $P_{s_3}$  and  $P_{n_c}$  be the proportion of women accepting sterilisations, IUCDs, conventional contraceptives and those not accepting any contraceptive methods after abortion. The average fecundability or monthly chance of conception for the women with the above proportions is

$$p_s = P_{n_c} p + P_{s_1} p(1 - e_{s_1}) + P_{s_2} p(1 - e_{s_2}) + P_{s_3} p(1 - e_{s_3}). \quad (8)$$

For computing the number of births during both current and subsequent years to the women using contraception after abortion, each woman has been assumed to have fecundability equal to the average fecundability or monthly chance of conception, instead of assuming separately for each cohort of contraceptive women. Instead of taking  $p$ , we replace the monthly chance of conception by  $p_s$  and compute the total number of births occurring during the current year, subsequent year and both current and subsequent years taken together to the women using contraception after abortion. Let  $\beta_1$ ,  $\beta_2$  and  $\beta'$  be the total number of births likely to occur during current year, subsequent year and both

current and subsequent years to the women using contraception after abortion.

$$\text{Average number of births saved per abortion in the current year} = \frac{1}{\sum_{i=1}^{12} a_i} (\alpha_1 - \beta'_1);$$

$$\text{Average number of births saved per abortion in the subsequent year} = \frac{1}{\sum_{i=1}^{12} a_i} (\alpha_2 - \beta'_2); \quad (9)$$

$$\text{Average number of births saved per abortion during both current and subsequent years} = \frac{1}{\sum_{i=1}^{12} a_i} (\alpha - \beta').$$

Before applying this model to the Indian data, it is necessary to discuss briefly the Indian situation regarding the socio-demographic characteristics of women undergoing abortion under the Act.

### The Indian Situation

Between April 1972, when the MTP Act came into force and November 1975, over 2,66,000 pregnancies have been terminated in the whole of India[6]. Socio-demographic characteristics and the period of gestation for all these women are not available. Some such data are available from three studies, namely : (1) Induced abortions of Bangalore City 1972-74[7]; (2) An overview of medical termination of pregnancy programme in Gujarat—1973-74[8]; (3) Bombay hospital data performance between 1973-74[9].

Contrary to the expectation that liberalisation of the abortion would lead to increase in the incidence of abortion among unmarried women, these three studies show that this percentage is less than 4.

The distribution of women by age (see Table 1b) indicates that the incidence of abortion was low in the age groups at the extreme of the reproductive span. The women in the age group twenty and less, formed less than 5 per cent and those in the 40-44 age group, 6 per cent of the total. These studies show that the percentage of women undergoing induced abortions was at the highest,

ranging from 27 to 35, for the age group 25-29. Approximately three-fourth of the total abortions related to women in the age group 20-34.

The distribution of women by number of living children shows that the women with three or less living children accounted for 60 to 80 per cent of the total. The percentage was the highest for women with two living children (see Table 1c).

All the three studies reveal that the majority of the abortions were performed in the first trimester (12 or less weeks) and only 6 to 7 per cent of the abortions were performed in the second and third trimesters.

Reliable data regarding the status of contraceptive practice of these women are not available; information in the case cards relates only to contraceptive advice given to them at the time of abortion. No follow-up of women undergoing MTP was undertaken. According to the Gujarat study, approximately forty five per cent of MTP's were followed by sterilisations[10].

### **Application of this Model to Indian Data**

As data for the whole of the country are not available, the data of the Gujarat study were utilised; these covered such items as age distribution of women undergoing abortion, gestation period etc.

We assume that all the women who came for abortion were married. This assumption rests on the finding of these three studies that the proportion of unmarried women undergoing abortion was less than 4 per cent.

The values of monthly chance of conception and probability of conception terminating in live birth, still birth and spontaneous abortion are assumed to be the same as considered by Venkatacharya[11] (see Table 2). The gestation periods for live births, still births and spontaneous abortions are 9, 8 and 3 months respectively and the corresponding figures for post-partum amenorrhea are 10, 3 and 1 months respectively.

On the basis of the Gujarat study it is assumed that 90 per cent of the women undergoing abortion who have three or more living children would go in for permanent methods like sterilisation. It is also assumed that 20 per cent of the women would adopt IUCD and 25 per cent would adopt conventional contraceptives. The women who use IUCD and conventional contraceptives may belong

to the category of women who have one or two living children. Women adopt **IUCD** and conventional contraceptives mainly for spacing. The remaining 10 per cent of the women may not use any contraceptive.

**The** contraceptive practice and type of contraception vary according to age and number of living children. In order to find out the percentage distribution of women by the type of contraception used after abortion in each age group, the assumptions, mentioned earlier (see Table 5) are considered. The gestation period at the time of abortion is assumed to be 3 months.

The monthly chance of conception for the women who would use contraception after termination are estimated for each age group by applying the formula given in equation 8 and the results are shown in Table 4.

By applying different monthly chances of conception for both cohorts, the total number of births saved during both current and subsequent years to the women who had induced abortions during the current year is estimated separately for each age group. In order to estimate the number of births averted per abortion for all age groups, the Gujarat age distribution is considered. The results of the exercise given in Table 5, are : Smaller the value of  $p$ , larger will be the number of births saved per abortion. Hence abortion will be more effective in reducing the fertility in a contracepting than in a non-contracepting group. Among the women assumed not to use any contraceptive method after abortion, the number of births saved per 100 abortions during both current and subsequent years, is 76; the corresponding figure for the women who are assumed to use some contraceptive method is 91.

The difference between the two cohorts of women is substantial, particularly in the age groups 20-24 to 30-34. For a given number of induced abortions, a greater number of live births are saved in age groups 35-39 and 40-44, because at these ages fecundability is low. At these age groups, the occurrence of conception is small. The impact of induced abortions on the number of live births saved is minimum for the age group 20-24 because fecundability for this age group is at the maximum; in this case per 100 abortions, about 68 live births are saved during both current and subsequent years.

Approximately 48 live births in the current and 29 live births in the subsequent years are saved per 100 abortions among the women not using contraception. The corresponding number of births saved for the women using con-

traception are 48 and 43 respectively. Thus a significant difference in the impact of abortion is noted in the second year. This clearly suggests that induced abortion when coupled with effective contraception would bring a significant reduction in fertility.

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10. **Dept. of Family Planning Programme, Gujarat**, *op. cit.*
11. **Venkatacharya, K.**, *op. cit.*, p. 352.

## Appendix

**TABLE 1—SOCIO-DEMOGRAPHIC VARIABLES OF ABORTED WOMEN**

	<i>Bangalore<sup>0</sup></i>	<i>Gujarat<sup>b</sup></i>	<i>Bombay<sup>0</sup></i>
<b>a. Marital Status</b>			
Never Married	3.3		3.2
Currently Married	96.7		95.1
Formerly Married			1.7
Total	100.00		100.00
Samples Size	(996)		(1800)
<b>b. Age Distribution</b>			
15-19	4.6	4.6	1.5
20-24	21.2	21.2	18.3
25-29	33.5	27.4	35.9
30-34	20.5	26.3	28.9
35-39	14.6	14.6	13.1
40-44	3.4	5.9	2.3
45-49	0.6	—	—
N.A.	1.6	—	—
Total	100.00	100.00	100.00
Sample Size	(996)	(2295)	(1800)
<b>c. Number of Living Children</b>			
0	5.5	9.8	5.9
1	17.7	15.7	23.1
2	21.7	22.9	34.0
3	21.2	21.2	16.8
4 and above	33.9	30.4	20.3
Total	100.0	100.0	100.0
Sample size	(996)	(2295)	(1800)
<b>d. Period of Gestation at the Time of Abortion</b>			
Period of gestation			
7 weeks			
7-12	92.5		12.3
13-18	6.5		85.8
18 +	1.0		1.6
Total	100.0		100.0
Sample size	(996)		(2295)

SOURCE : Kanbargi, Ramesh, Induced abortions in Bangalore city—1972-74.

<sup>0</sup>Dept. of Family Planning, Gujarat, "An over-view of medical termination of pregnancy programme in Gujarat, 1973-74".

"Pai D. N., "Abortion by Vaccum Aspiration".

TABLE 2—VALUES OF BIOLOGICAL VARIABLES USED IN THE MODEL :  
MONTHLY CHANCES OF CONCEPTION BY AGE AND PROBABILITY OF  
A LIVE BIRTH, STILL BIRTH AND SPONTANEOUS ABORTION

<i>Age group</i>	<i>Monthly chance of conception</i>	<i>Live birth</i>	<i>Still birth</i>	<i>Spontaneous abortion</i>
15-19	0.0486	0.7888	0.0625	0.1487
20-24	0.0649	0.8667	0.0207	0.1126
25-29	0.0522	0.8841	0.0201	0.0958
30-34	0.0369	0.8618	0.0131	0.1251
35-39	0.0238	0.8110	0.0473	0.1417
40-44	0.0084	0.7349	0.0106	0.2545
All ages	0.0440	0.8507	0.0237	0.1246

Gestation period leading to	Post-partum amenorrhoea follows
Live birth 9 months	10 months
Still birth 8 months	3 months
Abortion 3 months	1 month

SOURCE : Venkatacharya, K. (1972).

TABLE 3—PERCENT DISTRIBUTION OF WOMEN BY THE TYPE OF CONTRACEPTION USED AFTER ABORTION IN EACH AGE GROUP

<i>Age group</i>	<i>Conventional contraceptive users</i>	<i>IUCD Users</i>	<i>Sterilised persons</i>	<i>Non-contraceptive users</i>	<i>Total</i>
15-19	40	—	—	60	100
20-24	50	20	10	20	100
25-29	30	20	40	10	100
30-34	15	20	60	5	100
35-39	—	20	80	—	100
40-44	—	—	100	—	100
Total	25	20	45	10	100

TABLE 4—MONTHLY CHANCE OF CONCEPTION FOR BOTH COHORTS BY AGE

<i>Age group</i>	<i>Without contraception</i>	<i>With contraception</i>
15-19	0.0486	0.0369
20-24	0.0649	0.0273
25-29	0.0522	0.0125
30-34	0.0369	0.0048
35-39	0.0238	0.0012
40-44	0.0084	0
All ages	0.0440	0.0123

TABLE—5 NUMBER OF BIRTHS SAVED IN THE CURRENT YEAR AND IN THE SUBSEQUENT YEAR DUE TO 100 ABORTIONS PERFORMED EVERY MONTH IN THE CURRENT YEAR FOR BOTH COHORTS BY AGE-WOMEN THAT WOULD USE/NOT USE CONTRACEPTIVE METHOD AFTER ABORTIONS

<i>Age group</i>	<i>Women who are assumed not to use any contraceptive method</i>			<i>Women who are assumed to use some contraceptive method</i>		
	<i>Current year</i>	<i>Subsequent year</i>	<i>Total</i>	<i>Current year</i>	<i>Subsequent year</i>	<i>Total</i>
15-19	45.39	26.48	71.87	45.61	39.81	76.42
20-24	46.14	22.06	68.20	47.68	35.84	83.52
25-29	47.78	25.16	72.95	48.61	42.49	91.10
30-34	48.46	31.79	80.25	49.15	46.80	95.95
35-39	46.77	36.38	83.15	47.22	46.88	94.10
40-44	49.14	46.14	95.28	49.29	49.31	98.60
All ages	47.72	28.66	76.38	48.39	42.59	90.98

\*Gujarat age distribution used for all ages.