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A Computer Model for Simulation of Women of Reproductive Age

There have been several projects involving the Mont Carlo simulation of fertility and family planning, in India as well as in other countries having medium-size or large computers. Probably the most, important of such projects in India is the COMPSIM model being developed at the International Institute for Population Studies, a highly complex model whose results may not be available for some time.

I have undertaken to construct a computer simulation model which is relatively simple and yet gives a fairly comprehensive set of results. It has bsen programmed for and run on the IBM 360/44 at the Delhi School of Economics and should, therefore, work on other 360/44 systems in India and with some modifications may possibly be adapted to some other Indian computer systems.

Nature of Output

Perhaps the most direct way to illustrate the model is to present portions of its actual ontput. This is done in Tables 1 arid 2. For the purpose of these tables the output portions shown are for women born in the year 1945. As the sample size was chosen as one per 10,000 female population, the number for 1945 was 721 out of an estimated 7,210,000 women born in India in the year.

Table 1 shows the distributions as of January 1, 1972, of the 434 women still surviving out of the Monte Carlo sample of the 721 women born in 1945, these distributions being by marital status, parity, number of living children and (in the case of married women) number of living sons. The attained age of the surviving women is 26 (last birthday). 392 out of the 434 women in the sample are shown to be married, 24 widowed and 18 single (never married). From the group of 392 married women, 20 are classified as 'Sterilized Married', i.e. a woman or whose husband had accepted sterilization.

The various rows of Table 1 subdivide women by both parity and number of living children (the rows designated 6-f- indicating 6 or more). In addition, the columns in the right-hand portion of the table further subdivide both the total married and the sterilized married according to number of living sons (the columns headed 4+ indicating 4 or more). In effect

married women are cross-classified by (a) acceptance of sterilization, (b) parity, (c) numer of living children; (d) number of living sons and (e) number of living daughters.

While Table 1 merely shows the status of women born in 1945 at the beginning of 1972, the computer program permits corresponding output at the beginning of each calendar year 1961 through 1975 (excluding years before attained age 12) for women born in each year from 1925 to 1957.

Looking, for example, in Table 1 at the lines representing women of parity 4, we find a total of 106 such women, 1 of whom is widowed and 105:married. Of the 105 married, 41 have all four of their children still living, 43 have three living, 18 have two and 4 have only one. Married women accepting their own or their husband's sterilization number 3 in the first three of these four parity groups. 4 of the 41 women with 4 living children, have four daughters (and no son), 9 have one son and three daughters, 15 have two sons and two daughters, 9 have three sons and one daughter and 4 have four sons (and no daughter). Of the 3 sterilized cases, .1 has a son and three daughters, 1 has two of each and 1 has three sons and one daughter. Corresponding breakdowns are included in the other output rows.

The other type of program .output is illustrated in Table 2, again for women born in 1945. This table shows (a) certain additional statuses relating to the beginning of each calendar year and (b) the frequencies of certain events for each calendar year, as shown below:

(a) Statuses

MWLC:	Married women's living children
MWLB	" sons
MWLG	" daughters
MWDC	,, deceased children
WWLC	Widowed ,, living children
WWLB	" " sons
WWLG	,, daughters
WWDC	,, deceased children
NEW	Deceased women to end of year (excluding deaths before age 12)
DWLC	Deceased women's living children
DWDC	,, ,, deceased children

(b) Events

WMAR	Women marrying (including first marriages only)
WDIE :	Women dying
WWID	Women becoming widowed (excluding those who later remarry)
STER	Women accepting (or whose husbands accept) sterilization
lUCDs	Women accepting IUCDs
BIRTH	Total births
NBCE3	Births where the current birth is parity 4 or more
NLCE3	Births where the mother already had at least 3 living children
NBIC2	Births where the mother already had at least 2 living children including at least one living son

We find in Table 2 that as of the beginning of 1972, the 392 married women born in 1945 had a total 978 living children (518 sons, 460 daughters) and 212 deceased children, a mean of 2.89 living children and mean parity 3.04. The 24 widowed women had a total of 38 living and 4 deceased children and the deceased women, a total of 36 living and 7 deceased children, so that in all the cohort of women had a total of 1275 children. During the year 1971, 3 additional women had married, 1 died, 5 became widowed, 11 accepted (or their husbands accepted) sterilization, 1 had accepted an IUCD, and a total of 107 children were born to the cohort. Of the 107 births, 60 were above parity 3, but in only 47 cases were the number of living children above 3. In 58 cases, the births occurred where there were already at least two living children and at least one living son.

Nature of Input

An essential feature of this model is that all demographic assumptions used as input can be, and in my actual application are, dynamic. Thus mortality rates are specific not only by age and sex but also by calendar year. Age-specific conditional probabilities of marriage vary from one year-of-birth cohort to the next. Probabilities of acceptance of a family planning method (sterilization, IUCD or conventional contraception) vary according to calendar year as well as by other factors (in the ease of sterilization, these are age and number of living sons and total number of living children). The input assumptions were chosen after some trial and error to give approximately reasonable results, but there is probably ample room to improve them.

Methodological Features

Basically, what the model does is to project women in each individual year-of-birth cohort from birth to the cohort's attainment of age 48 (the assumed termination of fertility). Except prior to attained age 12, the Monte Carlo method is used for each individual woman at every attained age, testing whether the woman had each of the possible events which could befall her, viz death, natural sterility, marriage, widowhood, childbirth, acceptance of an IUDC or of a "programmed" sterilization; and also testing on the sex of each child born and on the survival of each child year by year. The Monte Carlo method here employed consists of the generation of a long sequence of random numbers (in a uniform distribution between O .and 1), comparison of each random number with the approprite probability of an event's occurrence (depending on age, sex, calendar year, etc.) and treating the event as having occurred if the random number is less than the probability, and as not having occurred otherwise. Prior to attained age 12, since the only probability to which the cohort members arc exposed is death, Monte Carlo is not used, and the number living at age 12 in the cohort is directly obtained by multiplying the number of births by I_{12}/lo using female life-table functions generated for the particular year-of-birth cohort.

A special feature which distinguishes this model from most other Monte Carlo models involving fertility is that for all events, including fertility, the probability time unit is a year. In most fertility models, specific account is taken not only for the months of pregnancy but also for the number of months of post-partum amenorrhea when a women Cannot conceive; this number is a random variable which in India has a mean estimated in 'the neighbourhood of 12 and a substantial variance. Some other fertility models take into account the proba-

bility of fetal wastage and the numbers of months of fetal wastage, pregnancy and subsequent amenorrhea, which are also random variables. In the present model a much simpler procedure is attempted with rates given and applied by year of age rather than monthly. Obviously it would have been incorrect in this model, as reasonable distributions according to parity and number of living children are desired, simply to apply marital age-specific fertility rates every year to each woman, since this would mean a woman's probability of having a child in any year would be independent of whether she had a child the previous year, which is obviously fallacious. This would also make it possible for some women to have a very large number of children (say 25 or 30) and it would also increase the probability of having no children.

Taking G (i) to be the age-specific marital fertility rate for age experiments were made with the expression H (i) = G (i)/l-aG (i-l)-bG (i-2) to find effective fertility rates H (i) conditioned upon a woman's having had a child in the preceding or second preceding calendar year, with a and b having values in the range O to 1, Strictly speaking, a and b could themselves vary with i. Nevertheless, it was found that setting a = 1 and b = o for all values of i did produce reasonable distributions by parity when measured against a detailed fertility model which took into account probabilities of fetal wastage and durations of post-partum amenorrhea expressed in months. Accordingly it was decided, once a set of basic fertility rates G (i) was chosen to write the program so that whenever a women had a child in a given year she could not have a child in the next year, but in all other cases her basic fertility rate G (i) would be replaced by an effective fertility rate H (i)/l-G (i-1),

Another special arrangement had to be made for widowhood and remarriage of widows in order to avoid handling probabilities of women going back and forth between married and widowed statuses. It was assumed that all married women had husbands five years older than themselves; admittedly this was a low differential, but it was initially chosen in order to prevent the proportion of widows from being too high, as the probability of widowhood was a function of the husband's attained age. Even with only n 5-year differential, it was seen that the proportion of widows became too high when measured by census results, and it is known that widow remarriage is not infrequent.[1] Accordingly, the program was modified so that if a woman's husband died, and if she had not more than one living daughter and not more than three living children, she was subjected to probabilities of remarriage immediately following widowhood equal to the conditional probability of first marriage for that attained age. If the random number drawn was less than this marriage probability, she was kept in the married state rather than transferred to widowed state, but a special one-year period of non-fertility was imposed to represent the lapse of time before remarriage (perhaps a longer period might have been assumed).

The program has been run both with and without allowance for the three main methods of family planning, namely sterilization, IUCD and conventional contraception. A function PAPS is defined as PSS [.005 (XNLC — 1) + .015 (XNLB —1)] and represents the probability of a non-sterilized married couple accepting sterilization in a year, where XNLB is the number of living sons and XNLC the number of living children (sons or daughters). PSS is a scale factor chosen to reflect approximately the relative acceptance of sterilization in various calendar years: for 1971, the value 1.15 was chosen for PSS to reproduce approximately 2.0 million sterilizations. Obviously the probability is heavily weighted in favour of

living sons, particularly those in excess of one. An age factor was initially introduced in the PAPS function, but .it was found to have relatively little effect; however, the program pre cludes sterilizations except where the wife is in the 20 to 45 range. Sons in excess of 5 and total children in excess of 8 are disregarded in the PAPS function.

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Simpler methods, based largely on calendar year scale factors, were used for acceptance of lUCD's and conventional contraceptives.

The program makes allowances for the probability ; of both primary and secondary sterility In the actual runs, primary sterility was assumed to affect 4% of all women beginning at age 12. A probability of secondary sterility was presumed to exist after each child birth, the probability actually used being 3 per 1000 multiplied by the parity.

The program also contained special codes and instructions which permitted detailed printouts for testing program operations woman by woman and age by age. The print statements for such testing were deleted after the program was satisfactorily tested.*

Assumption

As stated earlier, no claim is made as to the accuracy of the assumptions made. The main purpose has been to develop and present a workable model. At the same time, there was considerable trial-and-error with the inputs in the hope that they would come reasonably close to reproducing results released by the Registrar General's Office and the Department of Family Planning. ,.

Mortality assumptions were made in the form of period qx values for years 1925, 1950, and 1975, for each sex separately. The 1925 and 1950 values were found by interpolation and the 1975 by extrapolation from a recent paper on Indian Vital Rates by Prithwis Das Gupta.[2] Numbers of female births in each year 1925 through 1957 were also approximated from this paper, though with some modification. Death rates were interpolated to produce separate geometric progressions for each age and sex for years between 1925 and 1950 and similarly^ for years between 1950 and 1975. The 1925, 1950 and 1975 period values of qx and also some, cohort life tables derived from the array of interpolated values are shown in Table 3.

Conditional age-specific probabilities of first marriage for several female year-of-birth cohort* are shown in Table 4. For year-of-birth cohorts 1925 though 1935 the probabilities produce mean age marriage 15.7,for the 1955 year-of-birth cohort mean age 17.1. Rate for other cohorts were developed on the computer by interpolation, assuming geometric progression of the complements of the rates for the 1935 and 1955 cohorts.

Basic age-specific marital fertility rates were drawn from various studies and represent fertility without contraception and also before allowance for primary or secondary sterility ; consequently they were adjusted to be somewhat higher than the studies from which they are drawn. Both the basic and the derived "effective rates" are shown in Table 5. Family planning scale factors are shown in Table. 10.

Major Items of Output

Table 1 shows output for status of woman from a single year-of-birth cohort as of January 1. 1972. Table 6 shows some corresponding results as of the same data for all years of birth,

1927 through 1956, representing attained ages last birth day, 15 through 44, and subdivided into 5-year age groups. All figures of actual output can be blown up to the represented population totals by multiplying them by 10,000. The fact that there appear to be only 96.6 million couples with wife aged 15-44 instead of the generally assumed 100 million may result .from the assumption of some deferment of marriage in recent yaers.

Some of the percentages and averages, derived from the table are : 67.7 per cent married at ages 15-19 increasing to 92.24 per cent at ages 20^24and decreasing to 72.9 per cent at 40-44, the over-all percentage married for ages 15-44 being 81.5 per cent. The over-all percentage of sterilized couples is 8.3 per cent of the married, but 16.3 per cent at ages 40-44. Attained age 45 is also shown following the age 15-44 total : it shows completed fertility for still-married couples to be approximately seven.

Table 7 shows the total events for the calendar year 1971, corresponding to Table 2 which showed events for year-of-birth 1945 only. Some details of this table are of particularly interest. The 21,42 million births indicated for the total population, when divided by an assumed mean 1971 population of 551 million would yield a crude birth rate of 38.9 per 1000. The highest age-specific fertility rates would appear to be at ages 20-24. The total living women 20-24 in the model at the beginning of 1971 was 2,368, of whom 2.181 were married. Dividing 692 births by the mean number of women 20-24 in 1971 (3401) gives an age specific fertility rate of .288. Dividing by the mean number of married women 20-24 (2,213) gives age-specific marital fertility of .313.

This table shows that the fourth and higher order births account for 41.9 per cent of total births. The fourth order births alone account for 33.6per cent of total ; elimination of these births would thus reduce the crude birth rate from 38.9 to 25.8 per 1000. Births where there were already at least two living children with at least one living son account for 36.9 per cent of total, and their elimination would reduce the crude birth rate to 24.5 per 1000.

Relationship Derived from the Simulation Model ^

Besides the directly valuable information, the model of this type yields several important quantitative relationships which are either difficult or almost impossible to derive from actual census or survey tabulations. -,

One of these is the relationship between parity *and number of living children.* The following figures, for example, are a sample, of this relationship as of January 1, 1972, for childrens of married women at ages 25-29 last birthday (i.e., women born during 1942-46).

Married women by number of living children

	0	1	2	3	4	5	6 or more	Total
Parity								
0	110							110
1	11	42						53
2	12	69	190					271
3	4	35	182	311				532
4	2	17	73	188	297			527
5	1	1	12	58	112	108		292
6 or more	0	0	0	4	15	29	21	69
Total	140	164	457	561	374	137	21	1,854

This table yields a mean parity of 3.33 for this age group, with mean number of living children 2.73, assuming no more than six children for any woman.*

Another important variable is that of *mean age of first marriage.* The usual practice in India has been to obtain average marriage ages from individual census, using methods such as Hajnal's. This model permits two additional methods, one using actual year-of-birth cohorts, the other, the tabulation of marriages taking place in a given calendar year. The latter method will not be possible from actual data until there is compulsory registration and siatistical tabulation of marriages in India. The run of the simulation model shows that the mean age of marriages taking place in 1971 was 16.3 (Table 7). On the other hand, the mean age of marriage assumed for the cohort of women born in 1955 can be calculated at *1 1'* 1 from the age-specific conditional probabilities shown in Table 4, and Hajnal's method gives a mean age of 16.7 (ignoringmortality).

A more important relationship obtained from the model is the determination of *births prevented by family planning methods.* For this purpose, the model was run separately with out any reduction from family planning. This time the number of births in 1971 produced by the model was 2,372 instead of 2,142. This would indicate (subject to the accuracy of the input assumptions) that on a national basis 2.30 additional million births would have occured in 1971 were it not for the family planning programme, or in other words 2.30 million births were prevented in the year as the result of the programme.

It would also have been possible to run the model with some, but not all, of the family planning inputs to analyze how many births were prevented by each method. While this has not been done, it has been possible by means of expected value methods to estimate the effect of lUCD's and conventional contraceptives separately. The births prevented by these methods are so estimated to be 0.25 million and 0.55 million respectively. By subtraction, it would appear that 1.50 million births were prevented in 1971 by cummulative sterilizations upto the end of that year ; sterilizations may thus account for 65 per cent of the births prevented.

Still another relationship indicated by the model are the distributions, by age of women, number of living children and number of living sons, of those *couples who have and those who have not accepted sterilization.* These distributions are set forth in Table 8 and 9. In each table the left hand section shows total married couples, by age of women and number of living children or number of living sons as the case may be. The middle section of the table shows the cases where sterilization has been accepted up to the begining of 1972. The right-hand section shows the residue where sterilization has not been accepted.

The figures speak for themselves ; they show how large a potential market for future sterilization still exists. Blowing up the figures in Table 8 to the national level and excluding couples where the wife has reached age 40, we still find 10 million couples with five or more living children in this postential market, another 10 million with exactly four living children and another 12.4 million with exactly three,

Turning to Table 9 we see, as expected, that couples accepting sterilization include practically none having no livingsons. This is due to the nature of the acceptance probability function used in the model, Perhaps some of the five cases in the model without a living son may have had a son at the time of sterlization who later died. Similarly only a very small proportion (111 out of 2682) or 4 per cent with only one living son had accepted

sterilization. But here again in the blown-up figures show a very large potential market for future sterilization. Ignoring couples where the wife has reached 40, there thus appear to be 10'5 million cases with three or more living sons who have not accepted sterilization and another 15.4 million with two living sons.

Naturally, only the results of the model up to January 1972 can be said to approximate the national situation. However, it is possible to make *projections of what might happen in the near future* if acceptance of family planning is stepped up. It is said that a total of 5.0 million sterilizations a year are hored for in the near future. In order to test the effect of this on future births, the PSS scale factor which had been 1.15 in 1971 was increased to 1.50 in 1972, to 2.00 in 1973 and to 2.75 in 1974 and 1975, corresponding respectively to about 2.6 million sterilization in 1972, 3.5 million in 1973 and 4.8 million in 1974 and again in 1975. With these inputs, the number of births in 1972, 1973, 1974 and 1975 would be approximately 23.1 million, 23.8 million, 24.0 million and 23.4 million respectively. These figures include estimation for children of women born in 1958 and later. It would thus appear that if a level of 5.0 million sterilizations a year is quickly reached. India can expect not only a continued reduction in birth rate but even a reduction in absolute number of annual births, a remarkable achievement.

* Staff Demographer, USAID Mission, New Delhi. Any views expressed in the paper are those of the author and not necessarily those of USAID.
* The actual program together with comment statements will be made available from the author or the office of Demography—India.
* Actually the mean parity was 3-35 (obtained from data of the type of Table 2) as some 7-child cases were present.

1 S. N. Agarwala, "India's Population/Problems"; 1972, Chapter 8' 2. "Estimations of Demographic Measures for India," Population Studies, November 1971. pp. 395-414.

Table 1: Copy of portion of computer output showing January 1972 status of women born in 1945 (actual computer output format differs slightly from the format of this table)

721 WOMEN BORN IN 1945 467 LIVING AT AGE 12

1972 STATUS

No. of living children	Parity	Total living women	Single women	Widowed women	Total married women	Sterilized married	Total married by no. of living sons					Sterilized married by no. of living sons				
							0	1	2	3	4 +	0	1	2	3	4 +
0	0	51	18	2	31	0	31	0	0	0	0	0	0	0	0	0
1	0	2	0	0	2	0	2	0	0	0	0	0	0	0	0	0
1	1	16	0	11	5	0	2	3	0	0	0	0	0	0	0	0
2	0	4	0	0	4	0	4	0	0	0	0	0	0	0	0	0
2	1	24	0	2	22	I 0	10	12	0	0	0	0	0	0	0	0
2	2	51	0	3	48	2	13	21	14	0	0	0	0	2	0	0
3	1	7	0	0	7	0	3	4	0	0	0	0	0	0	0	0
3	2	38	0	2	36	1	8	19	9	0	0	0	0	1	0	0
3	3	89	0	2	87	.5	10	30	35	12	0	0	0	2	3	0
4	1	4	0	0	4	0	2	2	0	0	0	0	0	0	0	0
4	2	18	0	0	18	3	3	10	5	0	0	1	1	1	0	0
4	3	43	0	0	43	3	3	13	21	6	0	0	1	2	0	0
4	4	42	0	1	41	3	4	9	15	9	4	0	1	1	1	0
5	1	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0
5	2	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0
5	3	6	0	0	6	0	0	2	2	2	0	0	0	0	0	0
5	4	19	0	0	19	1	1	5	4	9	0	0	0	0	1	0
5	5	17	0	1	16	2	0	1	5	8	2	0	0	0	1	1
6+	5	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0
TOTALS		434	18	24	392	20	96	132	112	46	6	1	3	9	6	1

Table 2: **Copy of portion of computer output showing** various statuses **and events for** wotnen **born in 1945 (actual computer output format differs** somewhat **from the format of this table)**

Statuses (at beginning of indicated year)	1967	1968	1969	1970	1971	1972*	1973*	1974*	1975*
MWLC (married women's living children)	521	624	715	792	908	978	1069	1126	1176
MWLB (. „ „ „ sons)	284	334	381	415	480	518	563	594	625
MWLG(„ „ „ daughters)	237	290	334	377	428	460	506	532	551
MWDC („ „ deceased children)	107	131	152	170	195	212	221	238	255
WWLC (widowed whmen's living children)	15	17	23	24	24	38	44	45	51
WWLB(„ „ „ sons)	8	9	13	13	13	24	29	29	32
WWLG(„ , „ „ danghters)	7	8	10	10	11	14	15	16	19
WWDC („ deceased children)	1	2	2	2	2	4	5	7	10
NDW (total women died since age 12))	18	20	24	28	32	33	37	41	47
DWLD (deceased women's living children)	10	10	14	24	33	36	48	63	82
DWDC („ „ deceased „)	2	2	5	6	6	7	14	17	18
Events (during year)									
WMAR (women marrying in year)	2	0	3	0	3	1	0	3	0
WDIE („ dying „ „)	2	4	4	4	1	4	4	6	4
WWJD („ widowed „ „)	2	4	1	0	5	2	1	2	1
STER (sterlizations accepted in year)	3	2	2	4	11	9	18	18	30
IUCD (lUCD's accepted in year)	5	1	2	3	1	1	1	3	4
, BRTH (total births in year)	130	125	107	150	107	126	97	96	87
NBCE3) These are births during year which	10	22	30	77	60	91	73	80	73
NLCE3) result in certain statuses. See	3	13	15	53	35	68	52	65	55
NBIC2) text for description of symbols	18	36	35	69	56	69	52	64	60

* 1972-75 events and 1973-75 statuses are projected on the assumption of significantly increased rates of acceptance of sterilization.

Table 3: Mortality assumptions used in model, shown for selected ages

		Age 0	1	2	3	4	5	10	15	20	30	40	50
Part 1: qx values per 1000 assumed for calendar years 1925, 1950 and 1975													
'Males:	1925	275	90	55	33	20	16	9	9	12	17	25	43
	1950	204	58	33	17	10	9	5	6	8	12	14	27
	1975	100	18	8	5	3	3	2	2	4	6	11	23
Females	1925	262	97	60	38	25	20	10	9	17	18	27	41
	1950	199	63	36	22	15	12	5	6	11	13	15	25
	1975	98	25	10	6	4	4	3	3	5	8	12	21
Part 2: Survivors (to indicated age) per 1000 born, in selected year-of-birth cohorts													
Males born in	1925	1000	725	661	626	607	596	565	547	526	476	428	367
	1935	1000	756	700	670	654	645	618	602	583	540	494	
	1945	1000	783	735	709	696	689	667	654	640	605		
	1955	1000	823	787	770	761	756	741	731	719			
Females born in:	1925	1000	738	668	629	607	593	556	539	513	457	403	345
	1235	1000	765	704	671	652	639	607	592	569	518	464	
	1945	1000	790	736	708	692	681	654	641	623	578		
	1955	1000	827	786	766	755	748	726	715	700			

Table 4: Conditional probabilities of first marriage, by year of birth and attained age.

Age	1925-35	1940	1945	1950	1955
13	0.100	0.082	0.063	0.044	0.025
14	0.320	0.271	0.218	0.161	0.100
15	0.510	0.458	0.400	0.336	0.265
16	0.480	0.453	0.425	0.396	0.365
17	0.410	0.403	0.395	0.388	0.380
18	0.330	0.338	0.345	0.353	0.360
19	0.225	0.244	0.263	0.282	0.300
20	0.165	0.186	0.206	0.226	0.245
21	0.130	0.147	0.163	0.179	0.195
22	0.108	0.121	0.133	0.145	0.157
23	0.091	0.102	0.113	0.124	0.135
24	0.078	0.089	0.099	0.110	0.120
25	0.066	0.076	0.087	0.097	0.107
26	0.055	0.065	0.076	0.086	0.096
27	0.045	0.055	0.066	0.076	0.086
28	0.036	0.046	0.057	0.067	0.077
29	0.028	0.038	0.048	0.058	0.068
30	0.021	0.030	0.040	0.049	0.058
31	0.015	0.023	0.032	0.040	0.045
32	0.010	0.017	0.024	0.032	0.038
33	0.006	0.012	0.017	0.023	0.028
34	0.003	0.007	0.011	0.014	0.018
35	0.001	0.003	0.005	0.006	0.008

Table 5: Basic and effective marital fertility rates by age.

Age	Basic	Effective	Age	Basic	Effective
13	0. 000	0.000	31	0.280	0.397
14	0 .075	0.075	32	0.265	0.368
15	0 .140	0.151	33	0.250	0.340
16	0 .200	0.233	34	0.235	0.313
17	0 .260	0.325	35	0.220	0.288
18	0 .310	0.419	36	0.200	0.256
19	0 .340	0.493	37	0.180	0.225
20	0 .350	0.530	38	0.160	0.195
21	0 .360	0.554	39	0.140	0.167
22	0 .360	0.562	40	0.120	0.140
23	0 .355	0.555	41	0.100	0.114
24	0 .350	0.543	42	0.081	0.090
25	0 .345	0.531	43	0.063	0.069
26	0 .335	0.511	44	0.046	0.049
27	0 .325	0.489	45	0.030	0.031
28	0 .315	0.467	46	0.015	0.015
29	0 .305	0.445	47	0.006	0.006
30	0 .295	0.424	48:	0.002	0.002

Table 6: Age and marital status of women in model as of January 1972 and total children of married women

Years of birth 1/1/72	Age last birthday	Total living women	Currently married	Steri-lized married	Single	Widowed	Children of currently married women Living	Deceased	Total	Currently married women's Mean living	Mean parity
							ch.	ch.	ch.		
1952-56	15-19	2848	1927	0	903	18	461	63	524	0.24	0.27
1947-51	20-24	2434	2245	35	116	73	2940	580	3520	1.31	1.57
1942-46	25-29	2060	1854	127	69	137	4799	1025	5824	2.59	3.14
1937-41	30-34	1762	1546	213	35	181	5628	1505	7133	3.64	4.61
1932-36	35-39	1494	1178	226	33	283	5284	1643	6927	4.49	5.88
1927-31	40-44	1252	913	204	27	312	4382	1437.	5819	4.80	6:37
Total 1927-56	15-44	11850	9663	805	1183	1004	23494	6253	29,747	2.43	3.08
1926	45	218	148	38	4	66	758	278	1,036	5.12	7.00

Tabie 7: Totals of various events shown in model occurring in 1971

Years of birth of women	Age last birthday 31/12/71	Events occurring in 1971 Marriages	Sterilization	IUCD insertions	Total births	Births where current birth results in Parity 4 or more	4 or more liv. ch.	3 or more liv. ch. and 2 or more liv. sons
1957	14	37	0	0	0	0	0	0
1956	15	137	0	0	10	0	0	0
1955	16	121	0	1	44	0	0	0
1954	17	100	0	0	100	0	0	0
1953	18	48	0	1	135	0	0	0
1952	19	19	0	4	160	0	0	2
1947-51	20-24	19	17	11	692	69	40	138
1942-46	25-29	7	45	8	499	345	244	278
1937-41	30-34	1	43	6	298	283	247	202
1932-36	35-39	0	44	3	342	139	131	120
1927-31	40-44	0	42	1	57	57	54	47
1925-26	45-46	0	6	0	5	5	3	4
Total 1952-57	13-46	501*	198	. 35.	2142	898	719	791
Mean age of woman at occurrence of event		16.3	33.7	26.3	25.2	30.8	31.2	29.9

* Includes an estimated 12 births at age 13 (years of birth 1958)

Table 8: Married couples in model, by age of woman, number of living children, and acceptance of sterilization as of January 1972

All couples by no. of living ch.							Sterilized, by no. of living ch.						Non-sterilized, by no. of living ch.					
Age of wife	Total	O or 1	2	3	4	5+	Total	O or 1	2	3	4	5+	Total	O or 1	2	3	4	5+
15-19	1927	1836	89	2	0	0	0	0	0	0	0	0	1927	1836	89	2	0	0
20-24	2245	1096	782	320	46	1	35	1	19	14	1	0	2210	1095	763	306	45	1
25-29	1854	304	457	561	374	158	127	0	35	44	35	13	1727	304	422	517	339	145
30-34	1546	146	164	315	439	482	213	4	19	51	61	78	1333	142	145	264	378	404
35-39	1178	56	69	188	274	591	226	0	11	38	44	133	952	56	58	150	230	458
40-44	913	52	56	113	182	510	204	0	6	16	47	135	709	52	50	97	135	375
Total 15-44	9663	3490	1617	1499	1315	1742	805	5	90	163	188	359	8858	3485	1527	1336	1127	1383
% sterilized							8.3	0.1	5.6	10.9	14.3	20.6						

Table 9: Married couples in model, by age of woman, number of living sons, and acceptance of sterilization as of January 1972

All couples, by no. of living sons						Sterilized by no of living sons					Non-sterilized , by no of living sons				
Age of wife	Total	0	1	2	3+	Total	0	1	2	3+	Total	0	1	2	3+'
15-19	1,927	1508	391	27	1	0	0	0	0	0	1,927	1508	391	27	1
20-24	2,245	927	889	369	60	35	0	7	22	6	2,210	927	882	347	54
25-29	1,854	402	605	554	293	127	1	24	57	45	1,727	401	581	497	248
30-34	1,546	202	402	469	473	213	4	37	84	88	1.333	198	365	385	385
35-39	1,178	89	242	347	500	226	0	27	63	136	952	89	215	284	364
40-44	913	82	153	270	408	204	0	16	55	133	709	82	137	215	275
Total 15-44	9,663	3210	2682	2036	1735	805	5	111	281	408	8,858	3205	2571	1755	1327
% sterilized						8.3	0.1	4.1	13.8	23.5					

Table 10: Input scale factors for family planning acceptance

Calendar	PSS (sterilization)	CDA (IUCD)	RED (conventionals)
1957	.01	–	–
58	.01	–	—
59	.02	—	—
1960	.04	—	—
61	.06	—	—
62	.08	—	—
63	.10	—	—
64	.15	.010	.004
65	.30	.042	.004
66	.50	.047	.005
67	.90	.035	.006
68	.97	.018	.010
69	.15	.024	.015
1970	.80	.021	.020
71	1.15	.020	.023
72	1.50	.020	.026
73	2.00	.020	.029
74	2.75	.020	.032
75	2.75	.020	.035