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Estimation of Potential Fertility of Programme Acceptors in Korea

Abstracts

The estimation of potential fertility of program acceptors is very difficult but those data are indispensable for both the program evaluator and the policy maker to assess the impact of the family planning programme on fertility. For this purpose Lee & Isbister had made an assumption that the potential fertility of programme acceptor is 20 percent higher than that of non-acceptors. Therefore an attempt has been made to examine Lee & Isbister's assumption using Korean data.

I. INTRODUCTION

Most of the Asian countries have adopted the family planning programme as a means of controlling their population growth rate. It is important for both the programme evaluator and the policy maker to assess the impact of the family planning programme on fertility.

There are different methods available to estimate the impact of a family planning programme on fertility. Component projection method is one of the methods which has

been used widely in many countries. In this method, the effect of the family planning programme is assessed by comparing the observed fertility of the population under study and its potential fertility. The potential fertility is the fertility that the population would have experienced in the absence of the programme. Even in the absence of programme, the fertility of Korean population in 1962 would have been different from natural fertility since some forms of fertility control might have exercised by the population. In this sense potential fertility is different from natural fertility.

Estimation of potential fertility of the acceptors is a rather complex problem. In their pioneering work in this directions, Lee & Isbister[1] tried to measure the impact of birth control programme on fertility assuming that the potential fertility of acceptors to be 20 percent higher than that of the non-acceptors in the context of Korean family planning programme. After this publication such an assumption has been used in a number of publications, such as by Koh & Nichols.[2]

The validity of the assumption of 20 percent higher potential fertility for a programme acceptor compared to a non-acceptor has been discussed by several authors. However, there is no conclusive evidence available so far to justify or discard this assumption.

In this study an attempt has been made to examine the Lee & Isbister's assumption and at the same time to estimate the potential fertility of programme acceptors in Korea for the period 1960—1976.

II. DATA SOURCES AND LIMITATIONS

First, the data on number of women and number of married women by age group were taken from the "Population and Housing Census Report" 1960, 1966, 1970 and 1975. Secondly, programme acceptors by method and Age Specific Fertility Rate were

1) Lee, B.M. and Isbister, J., Impact of Birth Control Programme on Fertility·· Bernard Berelson et al. (ed.). *Family Planning and Population Programme: A Review of World Development,* Chicago University, Chicago Press, 1966.
2) Koh, K.S. and Douglas, J. Nichols, *Measurement of the Impact of the National Family Planning on Fertility in Korea; 1960—1975,* Korean Institute for Family Planning, 1977 (mimeographed)

taken from the "Statistics on Population and Family Planning in Korea."

Since the data on non-programme acceptors were not available, this factor is not taken into consideration in this study for calculating the number of surviving users at specified points of time. The results of this study are thus relevant only for the programme acceptors.

III. METHODOLOGY

Assuming that the age specific marital ferility rate (ASMFR) for the period 1960—65 represent the ASMFR of women in Korea in the absence of the programe an attempt has been made to get the ratio of potential fertility of programme acceptors to that of non-acceptors ($K_{i,t}$; t = 1967, 1972 and 1976) specific for age group i using the following formula.

$$K_{i,t} = \frac{M_{i,t}(f_i - F_{i,t})}{U_{i,t} \cdot f_i}$$

where $M_{i,t}$: Number of married women in the ith age group in year t

f_i : ASMFR for the period 1960—65 for age group i

$F_{i,t}$: ASMFR in the ith age group in year t

$U_{i,t}$: Total number of surviving contraceptive users in the ith age group in year t.

Many steps are involved in order to get the data on $F_{i,t}$ and $U_{i,t}$. Only the steps that are absolutely necessary for getting $K_{i,t}$ have been discussed here and the details are furnished in the Appendix.

Table 1. ASMFR for the Selected Years

Age Group	1960—65	1965—70	1970—75	1976
20—24	434	372	351	415
25—29	382	346	344	318
30—34	296	237	233	150
35—39	214	148	95	52
40—44	112	70	22	20
45—49	23	13	4	1

1. Age Specific Marital Fertility Rate ($F_{i,t}$)

See the Appended Table A and Table B for the detailed steps.

Table 1 clearly shows that the ASMFRs were decreased in all age groups through year except in the age group 20—24 in 1976. Since the ASFR in that age group for the period 1970—75 is same as that in 1976, it must be due to decrease in proportion married.

2. Number of Married Women ($M_{i,t}$)

The number of married women for the year 1967 and 1972 was obtained through linear interpolation from the censuses of 1966, 1970 and 1975. However, the number of married women for the year 1976 has been obtained through extrapolation assuming that the rate of decrease or increase in the number of married women will be same as in the period 1970—1975.

Table 2.   Number of Married Women by Age Group for the Selected Years ($M_{i,t}$)

Age Group	Jan. 1. 1967	Jan. 1. 1972	Jan. 1. 1976
20—24	521,730	529,040	564,799
25—29	1,011,017	1,002,223	1,077,101
30—34	930,069	1,027,061	1,032,147
35—39	738,457	898,807	1,011,636
40—44	574,147	692,085	661,408
45—49	424,140	525,960	596,650

3. Total Number of Surviving Users ($U_{i,t}$)

The total number of surving users on January 1st 1967, 1972 and 1976 was obtained by summing the number of surviving users of different contracptive method as follows:

$$U_{i,t} = \overset{(I)}{U_{i,t}} + \overset{(S)}{U_{i,t}} + \overset{(C)}{U_{i,t}} + \overset{(O)}{U_{i,t}}$$

Where $U_{i,t}$: The number of surviving users in the ith age group in year t and the symbols in brackets defined as:

I : IUD

S : Sterilization

C : Condom

O : Oral Pill

For the detailed procedures to get $U_{i,t}^{(I)}$, $U_{i,t}^{(S)}$, $U_{i,t}^{(C)}$ and $U_{i,t}^{(O)}$ see the Appendix (Table C — K and Methodology).

Table 3. Total Number of Surviving Users by Age Group for the Selected Years. ($U_{i,t}$)

Age Group	Jan. 1. 1967	Jan. 1. 1972	Jan. 1. 1976
20—24	18,383	32,793	41,642
25—29	83,248	127,372	165,463
30—34	157,561	236,665	294,512
35—39	159,912	243,157	298,907
40—44	85,937	139,825	173,437
45—49	21,158	37,398	51,580

IV. RESULTS

Using the methodology discussed earlier, the values of $K_{i,t}$ estimated from the above data are given in Table 4.

When the results are plotted in a graph (refer Fig. 1) it has been found that the curve of K values in relation to age is "U" shaped for the periods 1967 and 1972 and it is "J" shaped for the period 1976. This indicates, for the two periods, that the potential fertility of acceptors (in relation to non-acceptors) is higher in the younger age group and older age groups than in the middle age groups 25—34. Whereas for the period 1976, the potential fertility of younger age group (20—24) is much lower than that of non-acceptors. When we look at the average value (averaged at the three time points), in the

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Table 4. Ratio of Potential Fertility of Programme Acceptors to that of Nonacceptors by Age Group for the Selected Years

Age Group	1967	1972	1976	Average
20—24	4.054	3.085	0.594	2.399
25—29	1.144	0.783	1.091	1.006
30—34	1.176	0.924	1.729	1.276
35—39	1.424	2.055	2.562	2.014
40—44	2.505	3.977	3.132	3.205
45—49	8.716	11.618	11.064	10.466

age group 25—29 the potential fertility is almost same as that of non-acceptors, while for all other age groups the potential fertility is much higher, particularly so in younger and older age groups.

Table 4 clearly shows that the potential fertility rate of programme acceptors varies with age and over the years.

Figure 1. Ratio of Potential Fertility of Programme Acceptors to that of Non-acceptors by Age Group for the Selected Years
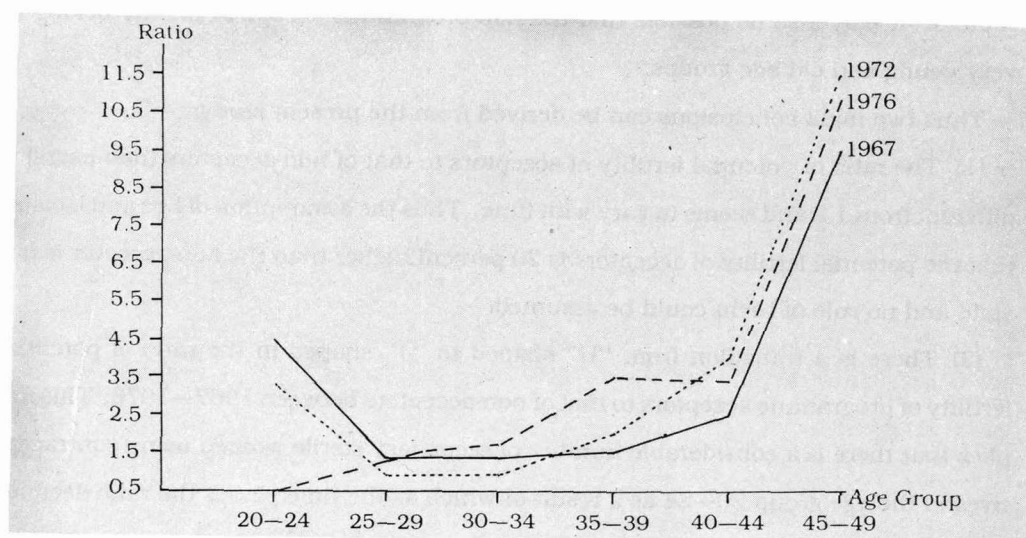
V. DISCUSSION AND CONCLUSIONS

From the above study, we can conclude that the assumption of a uniform 20 percent higher potential fertility for the acceptors over all the age groups first made by Lee and Isbister and used widely by others is not valid on empirical considerations even for Korean data. Some of the factors which might vitiate the results regarding the potential fertility of the acceptors in the present study are briefly discussed:

(i) reliability of the estimates of ASMFR obtained in different periods of time

(ii) secular changes in the proportion of acceptors who accepted the methods from non-programme sources, and

(iii) secular changes in the age distribution of the women who accepted the methods from non-programme sources

Since the estimates of potential fertility of acceptors at all three points of time show similar age patterns, it can be inferred that the assumed estimtes of ASMFR in the absence of the programme are correct or the pattern of under or over estimation is same at all the points of time. Higher the proportion of acceptors from non-programme sources, higher would be the value of the estimate of potential fertility and consequently the "K" values. However, its impact can be assumed to be uniform over different ages, unless the age distribution of such women is very much different from programme acceptors. It may also be possible that the non-programme acceptors mainly belong to very young and old age groups.

Thus two main conclusions can be derived from the present study:

(1) The ratio of potential fertility of acceptors to that of non-acceptors (non-users) is different from 1.2 and seems to vary with time. Thus the assumption of Lee and Isbister that the potential fertility of acceptors is 20 percent higher than the non-acceptor is not valid and no rule of them could be assumed.

(2) There is a transition from "U" shaped to "J" shaped in the ratio of potential fertility of programme acceptors to that of non-acceptors between 1967—1976. This implies that there is a considerable number of secondary sterile women using contraceptives in the age group 20—24 as a result of which as the time passes the ratio declines considerably.

APPENDIX

Table A. Proportion of Married Women by Age Group for the Selected Years

Age Group	1960*			1966*			1965**
	Total No. of Women	No. of Married Women	Prop. Married	Total No. of Women	No. of Married Women	Prop. Married	Prop. Married
20—24	107391	713021	.6661	1095362	521988	.4765	.5081
25—29	959986	894580	.9319	1128214	1013163	.8980	.9036
30—34	788247	722156	.9162	983780	923709	.9389	.9351
35—39	714078	628384	.8800	818450	730118	.8921	.8901
40—44	560085	458390	.8184	687495	568841	.8274	.8259
45—49	503668	375290	.7451	556646	418825	.7524	.7512

Age Group	1970*			1975*			1976**
	Total No. of Women	No. of Married Women	Prop. Married	Total No. of Women	No. of Married Women	Prop. Married	Prop. Married
20—24	1124483	517865	.4605	1511359	562564	.3722	.3545
25—29	1107474	978824	.8838	1235707	1072421	.8679	.8647
30—34	1084426	1025472	.9456	1092752	1031829	.9442	.9439
35—39	939131	863548	.9195	1077695	1004584	.9322	.9347
40—44	770841	653736	.8481	914903	807131	.8822	.8890
45—49	655694	503870	.7684	748859	592232	.7908	7953

Source: * Economic Planning Board, National Bureau of Statistics, 1960, 1966, 1970, 1975, Population and Housing Census Report, Vol. I, Complete Enumeration.
** Since the data on ASFR were available for the period 1960—65, 1965—70, 1970—75 and 1976, the data on proportion of married women also need for those period therefore, proportion of married women for 1965 and 1976 have been obtained by interpolation and extrapolation respectively assuming linear decrease or increase.

Table B. ASMFR by Age Group for the Selected Years

| Age Group | 1960—65 | | | 1965—70 | | |
	ASFR[1]	Average[2] Prop. Married	ASMFR[3]	ASFR	Average Prop. Married	ASMFR
20—24	255	.5871	434	180	.4843	372
25—29	351	.9178	382	309	.8937	346
30—34	274	.9256	296	223	.9404	237
35—39	189	.8850	214	134	.9048	148
40—44	92	.8222	112	59	.8370	70
45—49	17	.7482	23	10	.7598	13

| Age Group | 1970—75 | | | 1976 | | |
	ASFR	Average Prop. Married	ASMFR	ASFR	Average Prop. Married	ASMFR
20—24	146	.4164	351	147	.3545	415
25—29	301	.8758	344	275	.8647	318
30—34	220	.9449	233	142	.9439	150
35—39	88	.9258	95	49	.9347	52
40—44	19	.8652	22	18	.8890	20
45—49	3	.7796	4	1	.7953	1

Source : 1) Korean Institute for Family Planning, Statistics on Population and Family Planning in Korea, Vol. I, Korean Institute for Family Planning.
2) Calculated from Table A.
3) ASMFR = (1) ÷ (2)

Methodology to get the number of surviving users by different methods

1. The Number of Surviving IUD Users $(U^I_{i,t})$

At first, the data on IUD acceptors by age group were taken from the Statistics on Population and Family Planning in Korea (Table C). Secondly, many studies have shown that the mean duration of use for IUD in Korea is about 2 years and the continuation rates by ordinal months were available only upto 36 months.[3] (Table D)

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3) Cho, N.H. and Lee, H.Y., *Report on Follow-up Survey for IUD Acceptors*, Korean Institute for Family Planning, Dec. 1980.

Therefore on the basis of these two reasons th umber of surviving IUD users at the 3 point of time have been obtained as follow:

$$U_{i,t}^{\prime} = A_{i,t-3} \cdot R_i^{30} \frac{30}{60} + A_{i-1,t-3} \cdot R_{i-1}^{30} \frac{30}{60} + A_{i,t-2} \cdot R_i^{42} \frac{42}{60} + A_{i-1,t-2} \cdot R_{i-1}^{18} \frac{18}{60}$$
$$+ A_{i,t-1} \cdot R_i^{54} \frac{54}{60} + A_{i-1,t-1} R_{i-1}^6 \frac{6}{60}$$

Where $A_{i,t}$: IUD acceptors in the ith age group in year t.

R_i^x : Continuation rate at x^{th} ordinal month after insertion in the

i^{th} age group.

Table C: The Number of IUD Acceptors by Age Group and Years

Age Group	1964	1965	1966	1967	1968	1969
20—24	4974	12257	21785	18113	14735	15772
25—29	20875	51435	91421	76011	61836	66186
30—34	29225	72010	127990	106416	86571	92660
35—39	23717	58440	103870	86362	70256	75198
40—44	9594	32639	42015	34933	28418	30417
45—49	444	1094	1945	1617	1316	1409

Age Group	1970	1971	1972	1973	1974	1975
20—24	16526	16452	16817	18252	19643	22676
25—29	69348	69041	70573	76595	82430	89308
30—34	97088	96658	98802	107233	115401	108146
35—39	78792	78443	80183	87024	93654	88959
40—44	31871	31729	32433	34201	37882	35932
45—49	1475	1469	1501	1630	1754	3837

It is assumed that the use-effectiveness if 100 percent. The number of surviving IUD users at the specified of time are shown in Table E.

Table D: Contination Rate of IUD Acceptors

Ordinal Month	Below 30	Above 30
6 months	.5417	.6753
18 months	.3088	.4667
30 months	.1931	.3841

Source : N.H. Cho and H.Y. Lee. *Report on Follow-up Survey for IUD Acceptors, Korean Institute for Family Planning,* Dec. 1980.

Table E: Number of Surviving IUD Users by Age Group for the Selected Years

Age Group	1967	1972	1976
20—24	12851	13116	17064
25—29	60501	58985	73564
30—34	118659	124814	143892
35—39	111114	125774	145430
40—44	54853	66308	76808
45—49	9614	14091	17709

2. The Number of Surviving Sterilization Users ($U_{i,t}^s$)

At first, to correct for over-reporting and falsification, I multiplied the reported vasectomy performance by .94 and the reported tubaligation performance by .98.[4] The adjusted sterilization acceptors by age group and year are shown in Table F.

Secondly, the probability of surviving through the next year is computed as the fifth root of the joint 5 year survival ratio of male and female.

$$P_{i-i+5} = (P'_{i-i+5} \cdot P^*_{i+5-i+10})^{\frac{1}{5}}$$

The data on expectation of life at birth (e_0^0) were available only for the year 1961 and 1966 (Table G). The survival ratio for male and female have been obtained by using Coale & Demeny model life table, and then using the above equation the joint survival ratios have been calculated. The joint survival ratios obtained corresponding to e_0^0 of 1961 have been assumed to remain constant for the period 1961—65. Similarly, the

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4) Koh, K.S., Foreit, K.G. and Lee, H.Y., *Births and Induced Abortions Averted by the Sterilization Achievement of the Korean National Family Planning Program,* Korean Institute for Family Planning, March 1979.

joint survival ratios corresponding to 1966 were kept constant for the period 1966—75.

The number of surviving sterilization users have been calculated using the below formula:

$$U^s_{i,t} = (\tfrac{4}{5} S_{i,t-1} \cdot P_i + \tfrac{1}{5} S_{i-1,t-1} \cdot P_{i-1}) + A_{i,t}$$

where $t = 1962-75$

and

$$U^*_{i,1976} = \tfrac{4}{5} S_{i,1975} P_i + \tfrac{1}{5} S_{i-1,1975} P_{i-1}$$

Where $S_{i,t}$: Cumulative sterilization users in the ith age group by January 1st year t.

$A_{i,t}$: New acceptors in the ith age group in year t.

Results are shown in Table I.

Table F: Adjusted Sterilization Acceptors by Age Group and Years

Age Group	1962 Vas.	1963 Vas.	1964 Vas.	1965 Vas.	1966 Vas.	1967 Vas.	1968 Vas.	1969 Vas.	1970 Vas.	1971 Vas.
20—24	3	19	24	97	149	148	256	274	161	154
25—29	164	953	1214	1272	1969	1944	2389	2893	1289	1698
30—34	744	4337	5519	3586	5533	5462	5425	6075	5157	5403
35—39	1216	7066	9016	4493	6957	6870	5259	4031	6447	5711
40—44	808	4710	5995	2059	3189	3147	1488	1065	2418	1853
45—49	273	1589	2022	605	938	926	211	57	807	618

Age Group	1972 Vas.	1972 Tub.	1973 Vas.	1973 Tub.	1974 Vas.	1974 Tub.	1975 Vas.	1975 Tub.
20—24	309	31	185	47	704	111	924	189
25—29	2629	381	2777	517	6839	765	9765	2397
30—34	5878	921	7405	1457	11624	1867	16113	5419
35—39	4949	1113	6294	1598	7233	1663	10567	4678
40—44	1392	635	1667	940	1661	792	2330	1642
45—49	309	95	185	141	56	53	482	218

Vas.: Vasectomy   Tub.: Tuballigation

Table G. Expectation of Life at Birth

	1961	1966
Male[1]	54.48	59.74
Level in the Model[2]	16 & 17	18 & 19
Female[1]	60.61	64.07
Level in the Model[2]	17 & 18	18 & 19

Source : 1) *Statistics on Population and Family Planning in Korea,* Vol. I. Korean Institute for Family Planning. Dec. 1978.
   2) Coale & Demeny. *Regional Model Life Tables & Stable Populations.* Princeton University Press. Princeton, New Jersey. 1966.

Table H. Joint Survival Ratio by Age Group

Age Group	1961	1966
20—24	.99151	.99376
25—29	.99007	.99265
30—34	.98794	.99088
35—39	.98485	.98810
40—44	.98010	.98368
45—49	.97263	.97670

3. The Number of Surviving Condom $U(^c_{i,t})$ and Oral Pill $(U^o_{i,t})$ Users

In Korea every health center should report their achievement by method every month to Ministry of Health and Social Affairs and Korean Institute for Family Planning.

For condom and oral pill, they report the number of acceptors as well as number of the packets or cycles distributed regardless of new acceptors and continuing users. Therefore, to get the number of surviving users at the specified point of time only those persons who were reported as acceptors in previous year were considered as users to get rid of double counting. Use-effectiveness of condom and oral pill taken as .50 and .95 respectively for calculating the number of surviving users. Table J and K represent the number of surviving users for condom and oral pill respectively.

Table I. The Number of Surviving Sterilization Users by Age Group for the Selected Years

Age Group	1967	1972	1976
20—24	348	915	1882
25—29	5417	9705	20893
30—34	18446	30310	52013
35—39	29266	43706	64362
40—44	22561	36208	51511
45—49	11544	23307	33871

Table J. The Number of Surviving Condom Users by Age Group for the Selected Years

Age Group	1967	1972	1976
20—24	5184	5889	7181
25—29	17330	19684	24002
30—34	20456	23233	28330
35—39	19532	22184	27051
40—44	8523	9680	11804

Foot note: $U^c_{i,t} = A^c_{i,t-1} * .50$

Where $A^c_{i,t-1}$: Condom acceptors in the ith age group in year t-1
    .50 : Use-effectiveness

Table K. The Number of Surviving Oral Pill Users by the Age Group for the Selected Years

Age Group	1972	1976
20—24	12873	15515
25—29	38998	47004
30—34	58308	70277
35—39	51493	62064
40—44	27639	33314

Foot note: $U^o_{i,t} = A^o_{i,t-1} * .95$

Where $A^o_{i,t-1}$ = Oral pill acceptors in the ith age group in year t-1
    .95 = Use-effectiveness

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