SOCIAL AND DEMOGRAPHIC CORRELATES OF IUCD EFFECTIVENESS: THE TAICHUNG IUCD MEDICAL FOLLOW-UP STUDY

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Introduction

High hopes have been held for intra-uterine contraception as a method which is effective, inexpensive, and not requiring repeated action at an inconvenient time. The device has been assigned top priority in several national family planning programs. To measure adequately its use-effectiveness in a population, one would ideally like to know the proportions of acceptors still wearing the device at specified intervals after insertion and to have this information if not for a general sample representative of the population, at least for a clinic sample representative of a stage of the particular family planning program. As yet data even of the latter sort are scarce.

The present analysis is based on materials from the Taichung IUCD Medical Follow-up Study, in Taiwan. These data, relating to a sizable clinic sample, were collected during a three-year period 1962-64. Although like almost all IUCD studies the insertions were made in medical clinics, the sample of cases is more representative of the general population than is usually true for clinic studies, which tend to be highly selective even of those interested in family planning. The large number of cases came to the clinic following a large scale family planning program described in detail elsewhere.[1] The 4100 cases coming from the city of Taichung itself constitute about 11 per cent of all the married women in the ages 20-39 in the city. It will be shown later that retention of the intra-uterine device varies widely according to social and demographic characteristics of the wearer and it is a primary interest of this analysis to illustrate some of the differentials.

The present investigation represents a collaboration between the Taiwan Population Studies Center and the University of Michigan Population Studies Center. Special acknowledgement is owed Dr. Ronald Freedman who coordinated the work and to Claudia Ludvigh who wrote the computer programs. The present report is a brief abstract of a larger analytical report to be published next year as part of a monograph on family planning and fertility in Taichung.

Let us now briefly consider sample and follow-up procedures.

Sample

The sample consists of 7295 women, two-thirds of them accepting one size of loop and most of the remainder other sizes of loop. Planned procedure was to follow up the women 6, 12, and 24 months after insertion. Each woman received a postcard to remind her of the scheduled visit to the clinic. If she did not come, a field worker went to her home, interviewed her, and asked her to return to the clinic if she might be still wearing the device. If she had terminated IUD, an attempt was made to ascertain circumstance and time of device loss.

Some women returned to the clinic shortly after an insertion because they had been told to come back at once if they experienced any problems. Roughly 30 per cent of the women came to the clinic without a home visit. For the rest, home visits were necessary and because of the heavy and uneven load of work, these visits were not always made on schedule.

Out of a total sample of 7295 women, 650 were not visited even once, nearly half of them because of the short interval between insertion and cut-off date of the study. Another 388 women were visited once or more but with a scheduled visit missing. It is believed that these missed visits reflect more staff limitations than patient resistance. Indeed, only 54 cases of actual failure of follow-up were reported, indicating a high level of respondent cooperation. No important differences were found between the social and demographic characteristics of women adequately followed up and those for whom one or more scheduled visits were missing.

It is believed, therefore, that bias from inadequacies of follow-up is small.

Attention will be restricted to first segments only, by which is meant the period of use from first insertion of an intra-uterine device to first interruption of its use or end of observation, whichever was earlier. The lengths of these first segments have been defined conservatively. Months of use by any woman classified as a continuing user are counted only up to her last clinic visit when it was certain that the device was still in place.

As time from insertion increases, the number of women exposed rapidly decreases. In the present analysis sample size is large enough to yield fairly stable rates for the first two

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[1] R. Freedman and J. Takeshita, "Studies of Fertility and Family Planning in Taiwan," Eugenics Quarterly, Vol. 12, No. 4, (December, 1965), pp. 233-250.

years. For the third year the number of cases becomes too small for stability.

Methodology

So much for sample and follow-up procedure. As a last preliminary before considering results, let us comment briefly about life table methodology.

In any follow-up study of users of intra-uterine devices, for only some of the women will observation be complete in the sense of observing when and under what circumstance the device was lost. Other women, usually comprising a majority of the sample, will be classified as continuing users at time of last visit. Naturally one wants to be able to use these incomplete histories as well as the more complete ones to derive an unbiased picture of retention and loss of IUD as a function of time from insertion. This is what the life table approach is designed to do.

The useful wearing of an intra-uterine device may terminate for any of several reasons - pregnancy, expulsion, or removal, which reasons themselves may be subdivided. To be fully satisfactory, then, the life table methodology must provide for competing risks of termination. At the University of Michigan Population Studies Center, in collaboration with Dr. Christopher Tietze of the National Committee on Maternal Health, we have been developing such a procedure; more precisely, we have been adapting the multiple decrement life table to the analysis of IUD effectiveness. Recently we have called upon Dr. Bernard Greenberg and his associates at the University of North Carolina to assist us with the derivation of formulas for estimating standard errors. Hence our methodology is still in the process of refinement and figures in the hand-out tables may not be final.

Two types of rate will be used. What Tietze has called "net rates" allow for the presence of competing risks. For example, a net cumulative rate of expulsion allows for and is slightly reduced by some women becoming pregnant or removing the device before they have had a chance to expell. Net cumulative rates are additive. The net rates of pregnancy, expulsion, and removal add to the rate of termination for the three reasons combined. Because of this additivity, net cumulative rates are appropriate for studying the relative frequency of different types of termination in a single sample.

However a problem arises when one uses net cumulative rates for comparing the relative frequency of a particular type of termination such as expulsion in two different samples. For example, suppose that in sample B, the monthly rates of expulsion - that is, the probabilities of expelling during the first, second, and so on month after insertion if retaining the device up to the beginning of that month - are lower in sample B than in sample A. Now if the levels of competing risks are also lower in B than in A so that fewer women in B are lost to pregnancy and removal and therefore are exposed on average longer to the risk of expulsion than in A, then it is possible for sample B to show a higher net cumulative rate of expulsion despite its lower monthly rates of expulsion.

To cope with this problem one may use what Tietze calls "gross rates." Gross rates are predicated on there being only a single cause of device loss and all competing risks eliminated. A gross cumulative rate of expulsion is a pure function of the monthly rates of expulsion and formally independent of the levels of competing risks. Hence in the example above the gross cumulative rate of expulsion of sample B with its lower monthly rates of expulsion would always be lower than in A and in this manner leads to sample comparisons that are more easily interpreted. However gross rates, exceeding net rates, are not additive and therefore not appropriate for studying the frequencies of different types of terminations in a single sample.

To summarize these comments on methodology, we will use the additive net rates to study the frequency of different types of termination in a single sample and gross rates to assess the relative frequency of single risks in different samples.

Results: Total Sample

Turning now to results, consider Table 1 which gives cumulative net termination rates per 100 women at the end of 12 and 24 months by type of termination. Looking at the last column on the right which gives terminations for all causes, we see that about one-third of the women have terminated by the end of one year and about one-half by the end of two years. Even allowing for the fact that many of the women accept reinsertions, these loss rates are high absolutely and disappointing relative to the high expectations entertained by many persons for IUD. Preliminary returns from an island-wide follow-up study indicate that termination rates in this more general Taiwan sample may be even higher with perhaps two-thirds of the first segments terminated within two years. It may also be noted that the termination rates reported in Table 1 are not much higher than those reported by Dr. Tietze in his December, 1965 Sixth Progress Report of the Cooperative Statistical Program for the Evaluation of Intra-Uterine Devices, based on an assemblage of clinic samples predominantly from the United States. While the apparently high termination rates after one or two years in either Taiwan or the United States may be discouraging to some, they should be considered in comparison to experience for other types of contraception in use in large populations. It is doubtful, for example, that anyone can show at present continuation rates as high as fifty per cent after two years for any other contraceptive orcombination of contraceptives in a

TABLE 1

Cumulative Net Termination Rates per 100 Women, at End of 12 Months and 24 Months of Use, by Type of Termination, Based on Data from the Taichung Medical Follow-up Study of Users of Intra-uterine Devices

Months of use	Pregnancies			Total expulsions	Removals				Total terminations
	Device in situ	Device undetermined	Total pregnancies		Medical reasons	Personal reasons	Nonrelevant reasons	Total removals	
12	3.3	1.2	4.5	12.2	15.1	.7	1.9	17.7	34.4
24	5.9	2.3	8.2	14.9	22.0	1.2	5.0	28.2	51.3

large sample for a developing country.

Looking at other columns of Table 1, the following points may be made:

(1) Removals are the predominant cause of device loss and most of these removals are attributed to medical reasons (e.g., cramps, staining, menstrual irregularity, and the like).
(2) Expulsions are the next most common cause and occur mainly in the first year.
(3) Slightly fewer than 10 per cent experience pregnancy during the initial 24 months, usually with the device in situ.

In Graph 1, we consider whether monthly probabilities of pregnancy, expulsion, and removal start at high levels and then progressively decline as time elapses from insertion. What is being graphed are conditional monthly probabilities, that is, the probability of terminating for a specific reason during the next month given that the device has been retained up to the start of this month.

Only expulsions follow the pattern of starting at a high level and then progressively decreasing as time elapses from insertion. Depressed during the first few months by postpartum amenorrhea, the monthly pregnancy rate soon stabilizes at a fairly low level, while after the first three months the removal rate stabilizes at a surprisingly high level. Why women who have worn the device for 12 or 18 months should continue to show such a high rate of removal is puzzling. The most common reasons cited are medical and one would expect physical side-effects to subside after the first few months. Relatively high removal rates after 12 or 18 months also appear in the data for the Tietze samples. Further study of these late removals is planned.

Differentials

Now finally let us turn to Table 2 which offers an illustrative set of differentials. The five column headings NPERT stand respectively for subsample size, pregnancy, expulsion, removal, and total terminations. The rates in the three columns headed PER are gross cumulative rates, representing the cumulative proportions of women terminating IUD for a specific cause under the assumption that the particular cause is the only one operative in the sample and all competing risks are eliminated.

In Table 2 four differentials are especially worthy of notice.

First, cumulative rates of removal and expulsion are strongly negatively correlated with mother's age and number of previous pregnancies before insertion. See variables #1 and #2. Young women or women with few pregnancies have relatively high rates of removal and expulsion. Perhaps their physical systems tolerate the device less well and physical side-effects are more severe. Possibly too, being at an early stage of their family building, they are less willing to accept temporary discomfort from IUD.

Secondly, concerning variable #3, women coming from outside Taichung have similar pregnancy and expulsion rates but lower removal rates than do Taichung residents. The difference

Graph 1 Conditional Net Monthly Probabilities of Termination per 1000 Women by Type of Termination and Time from Insertion

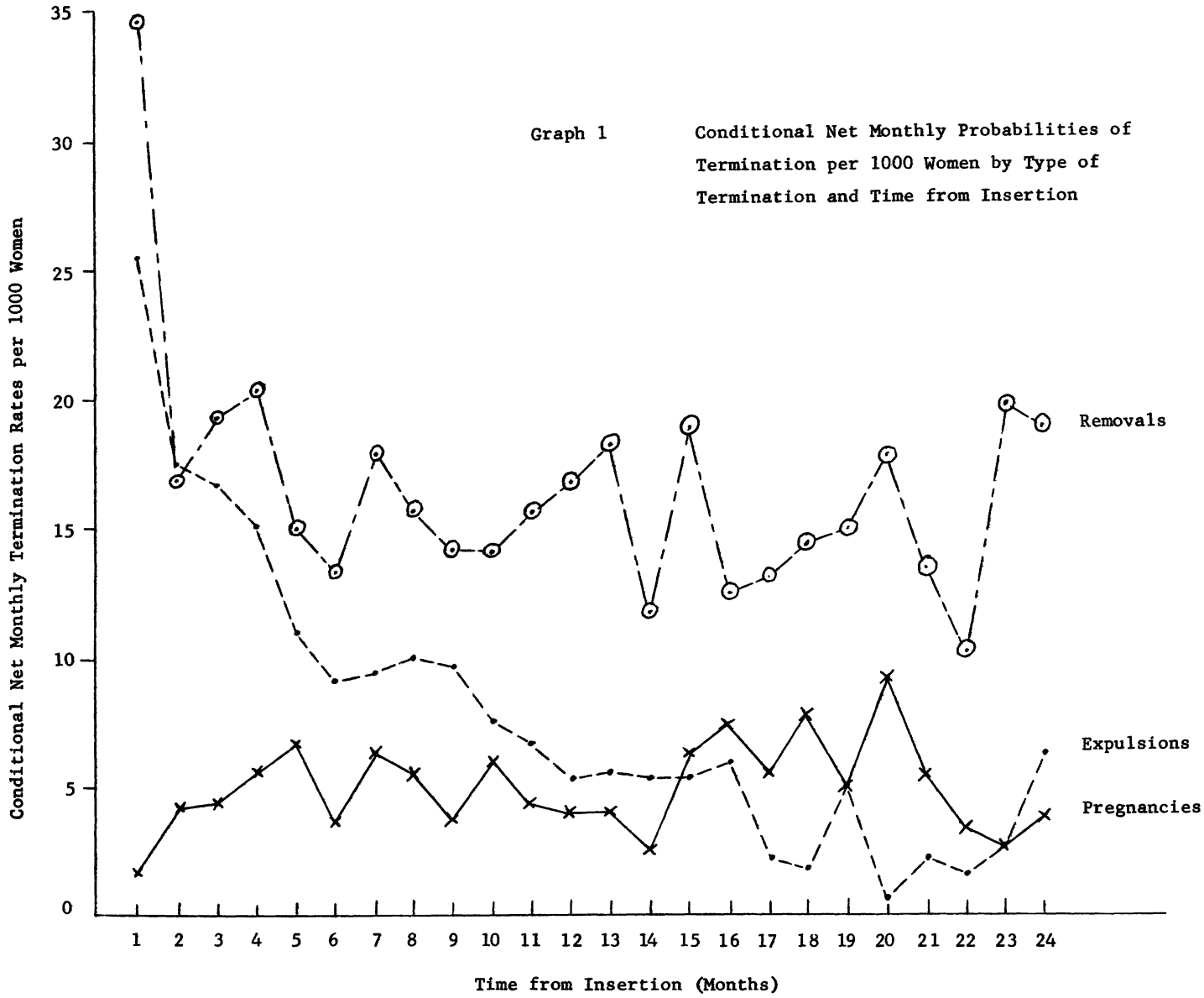

TABLE 2

Cumulative Gross Termination Rates per 100 Women at the End of 12 Months and 24 Months of Use by Type of Termination and Social and Demographic Characteristics

Characteristics		12 months of use				24 months of use			
	N	P	E	R	T	P	E	R	T
1. Age of wife at 1st insertion									
13-24	895	6.6	26.0	34.8	54.9	14.9	32.0	58.1	75.8
25-29	2112	6.7	17.0	22.6	40.1	15.0	22.5	40.1	60.5
30-34	2109	5.7	10.3	15.6	28.6	12.3	13.9	26.5	44.6
35 and over	1521	3.7	7.3	14.1	23.3	6.2	9.5	23.9	35.4
2. No. of pregnancies preceding 1st insertion									
Less than 2	162	3.9	31.8	53.7	69.7	19.9	37.4	89.0	94.5
2	566	7.5	30.0	33.7	57.0	17.3	32.9	58.2	76.8
3	953	6.2	19.4	22.8	41.6	14.2	26.0	40.9	62.5
4	1187	6.4	14.9	22.3	38.2	14.6	20.7	38.2	58.1
5 or more	3774	5.1	9.0	15.3	26.8	9.8	12.0	25.9	41.2
3. Areal location									
Taichung - Urban	2769	6.4	15.2	23.3	39.2	12.4	17.5	38.9	55.9
- Rural	1331	5.3	13.3	20.3	34.6	13.0	17.9	33.4	52.4
Outside Taichung	2456	5.1	11.9	14.6	28.6	8.4	18.0	24.2	43.1
4. Outcome of pregnancy preceding 1st insertion									
Live birth	4994	5.6	15.2	19.7	35.7	12.5	19.7	34.4	53.9
Induced abortion	1271	5.5	8.3	18.9	29.7	8.4	10.5	29.6	42.3
Other	253	6.6	11.9	21.6	35.5	7.5	14.9	33.1	47.4
5. Interval between last* preceding live birth and 1st insertion									
0-2 months	592	2.8	14.1	19.6	32.8	18.6	20.0	39.6	60.7
3-6 months	856	3.2	14.3	23.4	36.4	12.2	21.0	38.3	57.2
6-12 months	1349	7.5	16.4	20.3	38.3	11.5	21.1	34.7	54.3
12 or more months	2154	6.1	15.1	18.0	34.6	11.7	18.6	31.5	50.8
6. Type of device at 1st insertion									
Loop 1	4351	6.8	12.9	18.1	33.5	13.4	16.7	31.4	50.5
Loop 2-4	922	1.9	11.5	25.1	35.0	1.9	14.1	43.4	52.3
Coil	1372	3.4	17.2	23.6	38.9	7.0	21.2	37.5	54.2

TABLE 2 (CONTINUED)

Characteristics	12 months of use					24 months of use			
	N	P	E	R	T	P	E	R	T
7. Contraceptive methods used prior to 1st insertion									
None	4422	5.6	15.0	19.4	35.4	12.1	19.2	33.3	52.7
Ota Ring	685	5.0	8.5	14.5	25.6	8.8	10.6	28.4	41.6
Other methods	1364	5.3	11.6	22.5	35.2	10.9	15.0	35.2	51.0
8. Husband's education									
No formal education	784	6.1	11.8	11.3	26.5	8.4	15.0	22.8	39.9
Primary education	3213	5.3	12.9	17.7	32.1	12.2	17.8	29.8	49.3
Junior high	748	5.9	15.0	23.1	38.6	11.3	16.5	38.3	54.3
Sr. high or more	1816	5.7	15.6	25.0	40.3	11.9	18.2	41.4	57.8

N = Number of women
P = Cumulative net pregnancy termination rate
E = Cumulative net expulsion termination rate
R = Cumulative net removal termination rate
T = Cumulative net total termination rate

*For women whose last preceding pregnancy ended in a live birth.

persists when examined within strata classified by number of previous pregnancies. We conjecture that the relatively greater distance traveled to the clinic by women from outside Taichung selects for higher motivation which expresses itself in a greater toleration of side-effects.

Third - see variable #6 - users of loop 1, a small size of loop, have a higher pregnancy rate than users of loops 2-4, representing larger sizes of loop. This pregnancy differential, substantiated in other work, has been the reason why in the Taichung program the small loop has been abandoned in favor of larger size loops.

Finally, with respect to variable #8, wives of highly educated husbands show barely higher pregnancy and expulsion rates but substantially higher removal rates than wives of less educated husbands. The same results obtain when classification is by wife's education. Perhaps because well educated persons have more family planning alternatives available to them, they are less disposed to persist with IUD in the face of side-effects. Preliminary results from the island-wide follow-up study indicate that the well educated more often turn to other methods after discontinuing IUD than do the less educated.

To summarize: in the present Taiwan sample, the rate at which first segments of IUD are terminated has proven high in absolute terms though not relative to the results of other follow-up studies. Over half the terminations have taken the form of removals and these removals show important differentials among groups classified by social and demographic characteristics. Presumably underlying these differentials is an interplay of physical and motivational factors which our analysis has only begun to explore.