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Findings on Contraceptive Use Effectiveness from the 1987 Thailand Demographic and Health Survey

John E. Laing
and Kua Wongboonsin

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ABSTRACT Three innovative analytical methods were applied to data from the 1987 Thailand Demographic and Health Survey to study contraceptive continuation and failure. The analysis produced information on program methods that are consistent with data from past studies based on more conventional acceptor follow-up surveys but increase our knowledge about continuation and failure rates in Thailand by extending the life tables beyond the usual year or two, by including users who obtain supplies from nonprogram as well as program sources, by analyzing the effects of method switching, and by producing cross-sectional estimates in addition to the usual duration-specific life-table estimates. The analysis also provided new methodological insights: not only did it demonstrate that demographic surveys employing conventionally structured questionnaires can be used to generate life-table rates and direct cross-sectional rates that appear to be accurate, but it also provided a basis for assessing the validity of the indirect "current status" methods for estimating cross-sectional continuation and failure rates.

INTRODUCTION

In Thailand, the National Family Planning Program (NFPP) has achieved remarkable results in a short period of time. After the start of the program, the contraceptive prevalence rate (CPR) rose from 15 percent of married women of ages 15–44 in 1969–70 to 67.5 percent in 1987 (Chayovan et al. 1988). Nevertheless, since the CPR can reach levels of 80 percent or more, program managers must continue to seek ways of further increasing prevalence. This can be achieved by increasing the rate of acceptance (initiation of contraceptive practice) or the rate of continuation. In addition, the effect of contraceptive practice on fertility can be enhanced by reducing the failure rate—the likelihood of accidental pregnancy occurring among couples while they are using contraception.[1]

To decide how to allocate resources and set priorities, program managers therefore need periodic information on levels and trends of acceptance, continuation, and failure rates. While information on acceptances is routinely produced by program service statistics, continuation and failure rates are much more difficult to measure. In the past, information on continuation and termination of use in Thailand has been obtained through special follow-up surveys of acceptors registered in program clinics. Such surveys have important shortcomings. Because they are expensive and time-consuming, as a rule they are not done frequently. The last surveys in

1. Accidental pregnancies are often divided into two categories—those attributable to failure of the method specifically and those attributable to improper use of the method. When this distinction is made, the term "failure rate" is often reserved solely for method failures, and the term "use-failure" is employed to refer more generally to both types of accidental pregnancy. To simplify presentation here, no distinction is made between accidental pregnancies due to method failure or improper use; the term "failure" is used throughout to refer to all accidental pregnancies.

Thailand were conducted in 1981 (for pill acceptors), 1983 (for injection acceptors), and 1984 (for IUD acceptors). Because the samples are limited to acceptors of methods from program sources, the findings from these surveys cannot provide information about continuation or termination among acceptors of methods they obtain from commercial or private sources or methods that do not require outside assistance (such as withdrawal or periodic abstinence).

The cost of collecting data on contraceptive continuation could be greatly reduced—and the frequency with which such data are collected could be increased—if conventional demographic surveys (which have been conducted every two or three years in Thailand) could be used to generate the necessary data. However, analysis of continuation requires extensive information on past contraceptive use. Since past demographic surveys were designed primarily to measure current contraceptive prevalence, they did not elicit sufficient information to permit analysis of continuation and termination. In an effort to test the feasibility of using a conventional demographic survey to study contraceptive continuation, the 1987 Thailand Demographic and Health Survey (TDHS) was designed to include additional information intended to permit such analysis.

This paper reports the findings from analysis of data on continuation and failure from the 1987 TDHS. (For further information on the TDHS and analyses based on it to date, see Chayovan et al. 1988 and Institute of Population Studies, Chulalongkorn University, 1989.)

FINDINGS FROM PAST STUDIES

Table 1 shows key findings from previous national studies of continuation and failure rates in Thailand. The continuation rates shown here refer to the percentages of acceptors who can be expected to continue using the method specified for 12, 24, and 36 months following acceptance. The 12-month rates for pill acceptors range from 54 to 72 percent, the IUD rates from 64 to 81 percent, and the injection rates from 53 to 57 percent. No clear trend is evident in the observed rates by date of acceptance. The IUD rates tended to be highest and the injection rates lowest. These differentials are consistent with differentials in other countries. The absolute magnitude of the continuation rates is somewhat above average by international standards.

The failure rates from past studies, shown in the last three columns of Table 1, tend to be low by international standards, especially for pills. In other Asian countries, the failure rates for pills are usually at least 2 or 3 percent, and often considerably higher, due to the tendency of many women to forget to take the pills every day, thus increasing the likelihood of accidental pregnancy. The rate of less than 1 percent at 24 months in the one national pill follow-up survey for which failure rate data are avail-

Table 1. First-method life-table cumulative continuation and failure rates from past national surveys of acceptors in Thailand

Method and acceptance dates	Continuation rates			Failure rates		
	CCR12	CCR24	CCR36	CFR12	CFR24	CFR36
Pills						
<1971	69	55	—	—	—	—
1970-73	54	35	—	—	—	—
1974-76	72	56	45	—	—	—
1977-79	64	49	38	0.6	0.9	—
IUD						
<1971	76	65	—	—	—	—
1974-76	75	65	54	1.2	—	—
1979-81[a]	64	47	—	1.8	4.2	—
1982-83[b]	81	—	—	0.7	—	—
Injection						
1976-77	57	39	—	0.3	1.8	1.8
1979-81	53	32	—	1.6	2.3	—

Sources: Anonymous (1982); Narkavonnakit (1982); Thailand NFPP (1985).

CCR*n*—the cumulative continuation rate in the *n*th month following acceptance.

CFR*n*—the cumulative failure rate in the *n*th month following acceptance.

a. Lippes loop.

b. Multiload 250.

able is thus extraordinarily low. Such a low rate may be due to a tendency to underreport failures of this method—possibly owing to a tendency for users of pills to obtain induced (unreported) abortions in the event of failure—but it may also be due to a clearer understanding and more conscientious adherence to the one-a-day pill regimen among Thai women.

The failure rates for the IUD are more consistent with findings elsewhere, but still slightly lower than average. The rates for the Lippes loop are about 2 percent per year, which is at the low end of the typical range for 12-month rates of 2 to 4 percent; the 12-month rate of 0.7 percent for the copper-augmented Multiload 250 is within the expected range of less than 1 percent. The 12-month rate for acceptors in 1974-76, presumably composed of acceptors of both loops and copper-augmented devices, is between these magnitudes. The failure rates for DMPA (the principal injectable used in Thailand) are consistent with rates found in other settings.

Several other studies have been conducted as well, using nonnational samples. Although most of the findings from these studies have been similar to those from the national studies, there have been exceptions. In a study testing the use of midwives to insert IUDs (Sujpluem et al. 1978), for in-

stance, the 12-month continuation rate for the experimental group was an unusually high 82 percent (versus 66 percent for a control group of women whose IUDs were inserted by doctors). A follow-up survey of acceptors at 14 Bangkok Metropolis Health Clinics in the early 1980s showed lower 12-month continuation rates than the national average for all three reversible program methods: 47 percent for pills, 55 percent for the IUD, and 39 percent for DMPA (Chumnijarakij et al. 1984). A recent study of acceptors at the Songklanagarind Hospital in Songkla has revealed slightly higher 12-month failure rates for pill users (2.5 percent) and IUD users (2.2 percent) than those indicated in the national studies (Phandhu-Fung et al. 1988).

Early experience with DMPA in limited areas indicated much higher continuation rates than those subsequently observed in the national program. In the highly successful and well-known McCormick Hospital program in Chiang Mai in the early 1970s, DMPA continuation rates were comparable to those for the IUD in the national program: 74 percent at 12 months, 58 percent at 24 months, and 48 percent at 36 months (Pardthaisong et al. 1975). At about the same time, a clinical trial based in a Bangkok hospital yielded similar rates: 76, 60, and 46 percent (Koetsawang 1975). In the late 1970s, a small-scale study in one province, conducted to test the potential effects of introducing DMPA as a program method, found a similar 12-month continuation rate among DMPA acceptors of 75 percent (Somboonsuk et al. 1978). As Table 1 shows, however, this level was not even approached in the national program after the introduction of DMPA as a program method.

The previous studies of continuation and failure rates have focused primarily on the "first-method" continuation rate—the probability of continuing to use the same method over time following acceptance. One national study in the mid-1970s generated information on the "all-method" rate for pill acceptors—the probability that a person who starts using the pills will continue to use contraception, including methods other than pills (Thailand, NFPP, Research and Evaluation Unit, 1985). This study found 12-, 24-, and 36-month all-method continuation rates of 77, 61, and 48 percent, respectively. These rates exceeded the first-method rates by 5, 5, and 3 percentage points, respectively, the differences reflecting the proportions of acceptors who had switched to and were still using other methods at the end of the specified periods of time. This brief review of the past studies in Thailand reveals several gaps in information on contraceptive continuation and failure that still need to be filled. Among them are the following:

- Three to six years had passed from the dates of the last follow-up surveys of the various program methods to the date of the TDHS. The TDHS can therefore update information on continuation and failure rates that might have changed over time.

- The earlier surveys provided limited information on continuation and failure rates beyond the first year or two after acceptance. The TDHS permits more detailed analysis of longer-term use.
- Earlier surveys provided little information on all-method rates, which can supply important information on the beneficial effect of method switching on contraceptive continuation. The TDHS offers an opportunity to explore all-method continuation rates as well as first-method rates.
- The follow-up surveys were necessarily limited to acceptors of program methods from program clinics. The TDHS is not subject to this restriction and therefore permits calculation of continuation and failure rates of all users, including both program and nonprogram acceptors. Included in the latter category are users of program methods obtained from nonprogram sources as well as users of nonprogram methods such as condoms, periodic abstinence, and withdrawal.

The primary objective of this paper is to contribute to filling these information gaps through analysis of the 1987 TDHS data

METHODOLOGICAL OVERVIEW

The usual approach to analyzing continuation and failure rates is to follow up a representative sample of program acceptors who started use during a defined period of time and ask a set of questions that will permit construction of a "life table." The life table takes into account the fact that current users at the time of the follow-up survey have not yet completed their period of use of the current method; failure to take this into account would result in a substantial downward bias in the continuation rate. The life table also controls for duration of use before the survey, thereby providing more detailed information about the pattern of continuation following acceptance.

The follow-up survey design starts with a representative cohort of acceptors who began contraceptive use during a specified time period. The date of acceptance is usually easily established on the basis of clinic records, which can be verified or adjusted by the respondent at the time of the survey. The respondents are asked about their use following acceptance and are viewed as continuing users until the time they terminate use or until the survey date, whichever comes first. This procedure ensures that short-term and long-term users will all be equally represented.

Use of a conventional demographic survey sample of married women rather than a special sample of a specific cohort of acceptors complicates matters. Since clinic records are not available to the interviewer, it is much more difficult to establish dates of acceptance. As a result, attention tends to be focused on use of the current method or (in the case of current

nonusers) the most recent method. Acceptance of these methods may have occurred within the month preceding the interview or several years before the interview.

If we focus on the current or most recent method, disregarding the date of acceptance, we are likely to obtain continuation rates that are upwardly biased, since we will tend to undersample short segments of use. For instance, in a cohort of women who started to use the IUD two years before the survey, some will still be using the IUD at the time of the survey; others will have terminated use and no longer be using any method at the time of the survey; and still others will have terminated use of the IUD but switched to some other method. The first two groups will not cause any trouble, but the third group—the switchers—will. If we focus on the current or most recent method, we will ignore the short-term use and termination of the IUD and instead classify the switcher as an acceptor of the most recent method, thereby undercounting early IUD terminations.

We can get around this problem by limiting observation to a clearly defined period of time—a fixed "window" of observation—and focusing on the first method used during that window rather than the current or most recent method. We could use a 24-month window, for instance, in which case we would ask about use during the period beginning 24 months before the interview date and ending at the time of interview—identifying the first method used in this period as the reference method for analysis.

This approach demands detailed information on the respondent's recent history of contraceptive practice, which has not usually been available in fertility or contraceptive prevalence surveys. Ideally, the survey should ask about the timing and duration of each method used in the intended window of observation and, if no longer in use, the reason for termination. Most surveys have not attempted to obtain such information at all except, in some cases (such as the World Fertility Surveys), to ask about the duration of use of the current method. In recent years, however, some researchers have tried various approaches to obtaining a detailed recent contraceptive history. (For an excellent overview of such approaches, see Jejeebhoy 1988.)

Most of these approaches have involved construction of a "calendar" in which contraceptive initiation, practice, termination, and nonuse are documented, in varying degrees of detail, on a month-by-month basis for a fixed number of months (ranging from 12 to 60 or more) before the survey. More limited attempts have been made to provide the information for reconstructing recent contraceptive history using a more conventional set of structured questions. An important example is the widely used "Model A Questionnaire" of the Demographic and Health Surveys (DHS), in which information on timing of use and, where applicable, termination is obtained on the current method and last previous method in the open birth interval of current users, the last method in the open birth interval of current

nonusers, and the last method in each closed birth interval. The TDHS began with the DHS Model A Questionnaire and added information on the timing and termination of use of the first method in the open birth interval (if different from any of the methods already specified above). It was hoped that inclusion of this additional information would provide a complete recent history for all but a small minority of respondents who had unusually high method-switching rates.

Assuming that the information in the TDHS on recent contraceptive practice is reasonably complete and accurate, we can use it to construct life tables for analyzing first-method and all-method continuation and failure rates. We can also use it to construct "cross-sectional" rates, which summarize the probability of continuation or failure in a single figure, taking into account the experience of all use during the window of observation, regardless of variations in duration of use since acceptance. In a country like Thailand where a large proportion of couples use contraception and the program is nearly two decades old, many of the current users have been using the same method for several years. Such couples' experience during the window of observation would not be included in life tables limited to the first few years following acceptance but would be included in a cross-sectional analysis. As a rule, long-term users tend to have higher monthly continuation rates and lower monthly failure rates—presumably since those with a greater predisposition to terminate use or become accidentally pregnant are likely to drop out relatively soon after acceptance. As a result, inclusion of large numbers of long-term users can be expected to result in cross-sectional continuation rates that are considerably higher (and failure rates that are considerably lower) than might be expected on the basis of the life-table rates.

In the analysis that follows, two approaches are used to obtain cross-sectional continuation and failure rates. One is the direct approach, which uses the same detailed information on the respondents' recent contraceptive history as the life tables; the other is the indirect "current-status" approach proposed by Bongaarts. Both approaches yield estimates, since they both refer to a sample. The direct approach requires detailed information on the sample and yields results whose accuracy is limited by sampling error and the accuracy and completeness of the input data; the indirect approach requires less detailed information and yields results whose accuracy depends on sampling error and the validity of the assumptions that must be made to compensate for data limitations.

A description of the current-status approach to estimating failure rates has already been published (Bongaarts and Rodriguez 1989). Comparison of failure rates obtained by means of the indirect and direct approaches indicates that indirect estimates tend to be close enough to direct estimates to be useful substitutes in cases where data are insufficient to produce accurate direct estimates (Thapa et al. 1988; Bongaarts and Rodriguez 1989).

Bongaarts has not yet published a description or empirical assessment of his current-status approach to the estimation of continuation rates.[2]

In addition to the primary objective of providing family planning program managers with essential information on continuation and failure, a secondary objective of this paper is to study the following methodological issues:

- How do variations in the information obtained from the survey questionnaire affect the magnitude of the continuation and failure rate estimates?
- What is the optimum window of observation—the one that maximizes the denominators of the rates but minimizes recall error?
- What are the relative advantages and disadvantages of the life-table and cross-sectional approaches to measuring continuation and failure rates?
- How satisfactory are indirect estimates as proxies for direct estimates?

LIFE-TABLE INPUTS

The TDHS questionnaire contained the following information on current users:

- The current method and how long it had been used before the survey
- The last previous method used in the open birth interval (if any), the date the respondent started to use it, the duration of use, and the reason for termination
- The first method used in the open birth interval (if the respondent used more than one previous method), the start date, duration, and reason for termination

From current nonusers, the questionnaire obtained the following relevant information:

- The last method used in the open birth interval (if any), the start date, duration, and reason for termination
- The first method in the open birth interval (if any method was used before the last one) and the date the respondent started to use it

Current nonusers were not asked about the duration of use of the first method in the open birth interval or about the date or reason they terminated use. For the present analysis we have assumed that the method was used continuously from the acceptance date to the date the last method was started and that the reason for termination was always something other

2. Bongaarts orally presented his suggestions for a current status approach to estimating continuation rates at the United Nations Expert Group Meeting on Methodologies for Measuring Contraceptive Use Dynamics, New York, December 1988.

than accidental pregnancy. These assumptions are largely consistent with the conventional procedure in most follow-up surveys but may tend to understate failure rates (and overstate continuation rates) since they overlook the small number of pregnancies during the birth interval that resulted in fetal loss. Information on such pregnancies would ordinarily be at least partially elicited in a follow-up survey. However, since the number of missed episodes of use is probably small and the proportion ending in accidental pregnancies that resulted in fetal loss is also likely to be small, the effect on the failure rate is probably minimal.

All acceptors with at least one live birth were asked, in addition, for each live birth:

- Whether they had used any method before that birth (but after the preceding birth, if any) and, if so, what that method was, how long it was used, and the reason for termination
- Whether they had used any method before that one (in the same birth interval) and, if so, what that method was

No information was elicited on the dates of starting or terminating use of either method or on the reason for terminating the earlier method. For the present analysis, the last method is assumed to have been terminated nine months before the birth if the reason for termination was accidental pregnancy and 17 months before the birth otherwise.[3] The information on the previous method was deemed insufficient for use in the direct methods, though it was used in the indirect method for estimating continuation rates.

In the open birth interval, wherever information was obtained only on date use started and duration of use, the date of termination was calculated by adding the duration to the date use started. Similarly, for the methods preceding live births, where the respondents indicated the duration of use and the date of termination was estimated on the basis of the birth date, the date of starting use was calculated by subtracting the duration of use from the termination date.

The analysis was initially done using a 36-month window of observation, since past studies had indicated that recall problems are not of great importance within the last three years before the interview. The analysis was then replicated with 12-month and 60-month windows. The 12-month window was considered preferable in terms of recall but disadvantageous in terms of reduced couple-months of observation in the denominators of the rates; the 60-month window was considered disadvantageous in terms of recall but advantageous in terms of denominator size. Since the differ-

3. This assumption is based on Irving Sivin's finding in his analysis of post-termination conception rates in the International Postpartum Program (1974), that the mean monthly conception probability following termination of contraceptive practice was .085. With this possibility, it would take eight months for half of the terminators to become pregnant and therefore 17 months to give birth.

ences between the 12-month and 36-month windows tended to be substantial, a fourth analysis was employed, using a 24-month window. No analysis was done with a 48-month window, since there was generally very little difference between the rates based on the 36-month and 60-month windows.

The first step was to identify whether the window began during the open birth interval or before a birth that had already occurred. This step permitted identification of the first method used in the window (either already in use in the first month of the window or, if no method was in use at that time, the first method started thereafter), which became the reference method for both the life-table and cross-sectional analyses.

For life-table analysis of data from follow-up surveys, decrement-only life-table methodology is appropriate since all users are followed from the time of acceptance. With the TDHS, it was preferable to use an increment-decrement life table, which would permit consideration of the experience during the window of observation of those respondents who had started using the reference method before the window began. With a decrement-only life table, the method in use at the beginning of the window would have to be ignored and the reference window would have to be the first method started in the window. This requirement would have greatly reduced the number of woman-months of observation, especially for the analyses using small windows.

The increment-decrement life tables were constructed using four types of information for each respondent:

- For respondents already using a method at the start of the window, the number of months elapsed since acceptance at that time, which indicates the appropriate ordinal month for entering them into the life table
- Whether the respondent terminated use or was still using at the end of observation
- The duration of use from acceptance to termination or to end of observation, whichever comes first
- For those who terminated, whether the termination was due to accidental pregnancy or not

DATA LIMITATIONS

Because of the gaps in the data it is worthwhile considering the question of possible bias before proceeding to the findings. In analyzing data from the DHS in Peru, in which a contraceptive calendar was employed in addition to the DHS Model A Questionnaire approach, Goldman and associates (Goldman et al. 1988, 1989) compared the results from the two approaches. They found that the calendar approach indicated somewhat higher estimates of use more than about six months before the interview, substan-

tially lower estimates of the continuation rate, and slightly higher estimates of the failure rate. Comparing the past prevalence estimates from these two approaches with estimates from previous surveys, they found that the calendar approach yielded more accurate estimates than the questionnaire approach (though it still tended to underestimate past prevalence). The evidence from the Peru DHS thus suggests that the TDHS continuation rates could be slightly underestimated and the failure rates slightly overestimated. The amount of bias may be negligible, however, since, as noted earlier, the TDHS elicited information on recent use not elicited by the DHS Model A Questionnaire. Evidence from the TDHS will be presented in support of this conclusion.

A potentially greater threat to the validity of the failure rate findings is the likelihood that accidental pregnancies resulting in fetal loss—especially induced abortion—were underreported. This underreporting is a pervasive problem, however, and is likely to be nearly as great in follow-up surveys as in the TDHS. In other words, all estimates of the failure rate based on empirical survey data are likely to be downwardly biased to the extent that users who experience accidental pregnancy are likely to obtain abortions and to avoid mentioning aborted pregnancies to interviewers. The abortion rate in Thailand is not known with precision, but a study based on hospital records (Knodel et al. 1982) suggests that there is one abortion for every four live births. The likelihood of abortion is probably greater among women who become pregnant while using contraception.

LIFE-TABLE RATES

A total of 20 first-method life tables were constructed, varying by window size (W = 12, 24, 36, and 60) and reference method (all methods combined, pills, IUD, injection, and less-effective methods). Sample sizes for these life tables are shown in Table 2. For each life table, five sample sizes are given:

- Total *N*: the total number of cases who used the specified method at all during the window of observation, regardless of when the method was accepted. This *N* is larger than the number represented in the life table, since the life tables were carried only to the thirty-sixth month following acceptance and a sizable proportion of users had accepted the reference method more than 36 months before the window began.
- $N^*(1)$, $N^*(12)$, $N^*(24)$, and $N^*(36)$: the number of woman-months of exposure in the first, twelfth, twenty-fourth, and thirty-sixth months of the life table, respectively. These are the denominators of the monthly termination rates for those ordinal months.

Given the large TDHS sample size (6,775 ever-married women of ages 15–49), the high prevalence of contraceptive practice in Thailand, and the

Table 2. Sample sizes in 1987 TDHS for first-method use-effectiveness life tables by method, ordinal month after acceptance, and window size

Method and first sample	Window size			
	$W = 12$	$W = 24$	$W = 36$	$W = 60$
All methods[a]				
Total N	4,512	4,732	4,839	4,993
$N^*(1)$	1,117	1,758	2,113	2,754
$N^*(12)$	702	1,107	1,375	1,806
$N^*(24)$	448	835	1,190	1,563
$N^*(36)$	349	705	1,003	1,455
Pills				
Total N	1,295	1,456	1,650	1,923
$N^*(1)$	444	650	875	1,242
$N^*(12)$	213	347	479	711
$N^*(24)$	131	283	400	615
$N^*(36)$	123	235	337	513
IUD				
Total N	464	467	446	429
$N^*(1)$	136	201	219	252
$N^*(12)$	88	129	173	182
$N^*(24)$	53	110	145	153
$N^*(36)$	52	85	103	137
Injection				
Total N	651	702	718	755
$N^*(1)$	286	416	448	539
$N^*(12)$	137	210	242	295
$N^*(24)$	68	112	162	201
$N^*(36)$	26	70	113	156
LEMs[b]				
Total N	233	284	328	362
$N^*(1)$	103	179	219	270
$N^*(12)$	38	62	81	104
$N^*(24)$	21	46	61	75
$N^*(36)$	12	32	37	56

Note: "Window" refers to the period of observation; for instance, "$W = 12$" refers to the period beginning with the twelfth month preceding the interview and ending with the month of interview. "Total N" refers to the number of cases who used the specified method for at least one month during the specified window of observation. "$N^*(n)$" refers to the number of couple-months of use observed in the nth month following acceptance.

a. Including sterilization.

b. Condoms, periodic abstinence, withdrawal, and combinations among them.

popularity of the three main program methods, it is not surprising that most of the numbers of cases for these methods and for all methods combined are large. The IUD and injection sample sizes fall under 100, but only at long durations and in the 12-month window.

The smallest sample sizes are found for the less-effective methods (LEMs)—condoms, periodic abstinence, withdrawal, and combinations among them. These methods have been combined for the present report because the numbers of cases are small and the significance of each individual method is not as great as all of them taken together. Even when they are combined, and even with the 60-month window, the numbers beyond 12 months' duration following acceptance are small. Nevertheless, with the exception of the numbers of cases beyond the twenty-fourth month in the 12-month window (when they fall below 20), they are great enough to yield useful information for present purposes.

Figure 1 shows the effect of varying the window size on the pattern of first-method cumulative continuation rates for all methods taken together. The most important finding here is that, as noted above, the rates for the 36-month and 60-month windows do not differ much but the continuation rates based on shorter observation periods increase. By the twenty-fifth month, the spread exceeds 10 points. Clearly, the size of the window influences the magnitude of the rates. This finding underscores the importance of trying to identify the best window size. (The explanation for the variation by window size will become apparent as the analysis proceeds.)

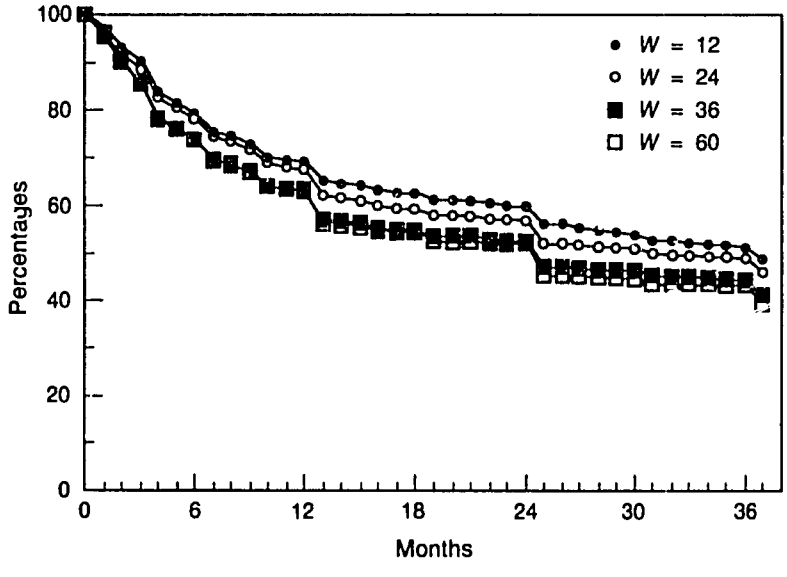

Figure 1. TDHS first-method continuation rates by *W* (all *R*'s)

Another finding shown in Figure 1 is that the continuation rates appear to drop especially sharply after 12 months and multiples thereof. This is clearly a result of response heaping. Dropouts at durations close to one year (give or take a few months) tended to say they stopped using a method 12 months after starting to use it, driving the numerator up in the thirteenth ordinal month of the life table. Current users who had been using for durations close to a year also tended to say they accepted a method 12 months before the interview date. Since they went out of observation in the thirteenth ordinal month, this tendency further inflated the termination rate for that month, thereby depressing the cumulative continuation rate. As a result, the best estimate of the 12-month life-table rate is not the rate obtained for the twelfth month but the average of the 12-month and 13-month rates.[4] The same principle applies to the rates at the twenty-fourth to twenty-fifth and the thirty-sixth to thirty-seventh months as well.

The first-method 12-month continuation and failure rates for each of the method categories and each of the window categories are shown in Table 3.[5] The table shows the tendency, already noted in Figure 1, for the continuation rates to decline with increasing window size. It also shows a systematic tendency for the failure rates to rise with increasing window size. The rates for the three program methods are largely within the ranges of the rates found in previous studies and reported in Table 1, though the pill and injection continuation rates based on the 36-month and 60-month windows are slightly below (and the failure rates above) the corresponding ranges from previous studies. The IUD failure rates based on the 36-month and 60-month windows are unusually high, casting some doubt on their accuracy. The other differences, however, are much less pronounced and therefore do not raise serious questions about the rates based on longer observation periods. Furthermore, it should be borne in mind that the continuation rates may have declined over time and that the inclusion of users who get their supplies from nonprogram sources in the new rates may skew the continuation rates downward.

The method-specific continuation rates in Table 3 are highest for the IUD and lowest for the less-effective methods. The failure rates are by far

4. In fact, the average of the 12th and 13th month rates generated by the life table would be the best estimate of the 12-month rates even without the heaping program, since it has been shown (Laing, 1982, pp. 58–59) that the cumulative life table rate for any given month refers mathematically to the probability of continuing to the middle of the month, whereas the rate conceptually refers to the probability of continuing to the end of the month. Thus the conceptual 12-month continuation rate (the probability of continuing for a full 12 months) is best estimated as the mean of the 12th and 13th month cumulative rates generated by the life table.

5. The life-table failure rates shown in Table 3 and subsequently are all "gross rates," which adjust for competing risks by treating users who terminate use for reasons other than accidental pregnancy as though they were going out of observation while continuing use.

Table 3. First-method 12-month life-table cumulative continuation and failure rates, 1987 TDHS, by first method and window size

First method	Continuation rates				Failure rates			
	$W = 12$	$W = 24$	$W = 36$	$W = 60$	$W = 12$	$W = 24$	$W = 36$	$W = 60$
All methods	67	65	60	60	2	3	4	5
Pills	62	57	52	53	1	2	4	4
IUD	78	76	76	70	2	3	6	6
Injection	56	54	50	50	0	1	2	1
LEMs	41	34	28	29	18	20	26	25

Note: Calculated as the average of the 12th and 13th month rates to correct for the half-month error and response heaping.

highest for the LEMs. Among the program methods they do not differ greatly but are consistently lowest for the injection and highest for the IUD. Since the failure rates are most pronounced for the less-effective methods, Figure 2, showing the differences in failure rates by window size for all durations up to the thirty-seventh month, is limited to the rates of LEM acceptors. The response-heaping pattern for multiples of 12 months is again clearly seen, together with more pronounced evidence of heaping for multiples of 6 months. (The rates for the twenty-fifth to thirty-seventh months in the 12-month window are omitted because the numbers of cases in the denominators for those months are under 20.)

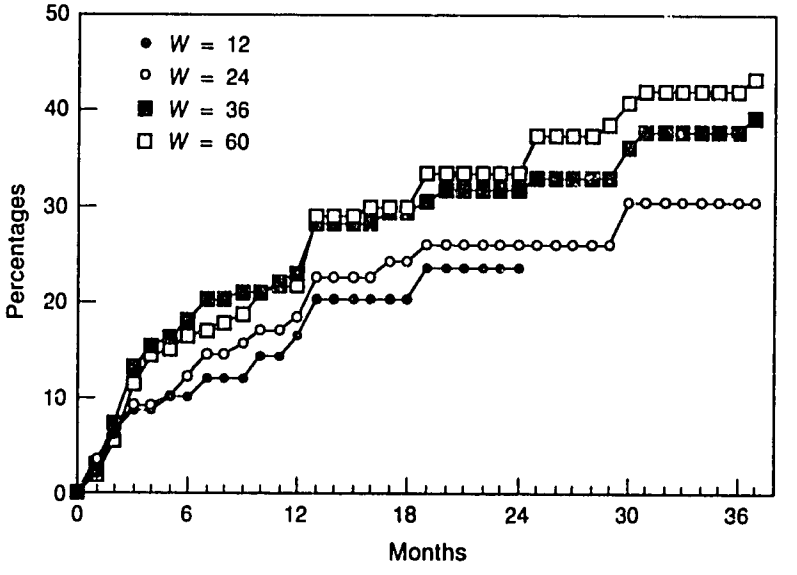

Figure 2. TDHS first-method failure rates by W (all R's)

All the rates reported to this point have been based on data for the entire period indicated by the window size immediately preceding the interview date. A preferable procedure is to omit the last three months before the interview, since many accidental pregnancies that occurred during this period are likely not to have been detected yet by the respondent and omission of these recent failures is likely to result in understatement of the failure rate. Accordingly, the failure rates were recalculated using a cutoff date three months before the interview. (The beginning date of each of the windows remained unchanged so that the use of the three-month cutoff resulted in a reduction of three months in the period of observation.) The continuation rates were recalculated as well, since a downward bias in the failure rate would mean an upward bias (albeit a small one) in the continuation rate.

Table 4. First-method 12-month life-table cumulative continuation and failure rates by method, window size, and cutoff date

First method and window size	Continuation rates			Failure rates		
	C = 0	C = 3	Diff.	C = 0	C = 3	Diff.
Pills						
W = 12	62	55	-7	0.5	0.6	+0.1
W = 24	57	52	-5	2.0	2.3	+0.3
W = 36	52	49	-3	3.7	4.0	+0.3
W = 60	53	51	-2	4.1	4.3	+0.2
IUD						
W = 12	78	73	-5	1.5	1.9	+0.4
W = 24	76	74	-2	3.0	3.4	+0.4
W = 36	76	74	-2	5.7	6.0	+0.3
W = 60	70	68	-2	6.4	6.8	+0.4
Injection						
W = 12	56	48	-6	0	0	0
W = 24	54	50	-4	0.9	1.0	+0.1
W = 36	50	48	-2	1.5	1.6	+0.1
W = 60	50	48	-2	1.3	1.4	+0.1
LEMs						
W = 12	41	32	-9	18.4	23.4	+5.0
W = 24	34	31	-3	20.4	22.3	+2.1
W = 36	28	26	-2	25.5	27.1	+1.6
W = 60	29	28	-1	25.2	22.5	-0.2

Note: "C = 0" means that the cutoff date was the date of interview. "C = 3" means that the last three months of the window of observation were disregarded—that is, the cutoff date was the third month before the interview date and the period of observation was therefore three months less than the window size (nine months instead of 12).

Table 4 shows the results of these recalculations, controlling for method and window size. As expected, the failure rates with the cutoff ($C = 3$) tended to be higher—but not much higher—than the failure rates originally obtained ($C = 0$). The findings for the continuation rates, however, were quite unexpected. Not only were the continuation rates lower with the cutoff than without it, but they were far in excess of the increases in the failure rate—indicating a systematic and pronounced tendency to underreport terminations other than failure in the last three months before the interview. This finding gives us a likely reason for the systematic tendency for the continuation rates to rise with decreasing window size. Underreporting of terminations in the last three months of the window would account for progressively greater overestimation of the continuation rate with decreasing window size, since the three-month period would become an increasingly large proportion of the period of observation.

To permit further study of this possibility, an effort was made to compartmentalize the termination rates by period of observation, dividing the five years before the interview into five subperiods: the last three months; the fourth to twelfth months before the interview; the thirteenth to twenty-fourth months before; the twenty-fifth to thirty-sixth months before; and the thirty-seventh to sixtieth months before. For the second period (the fourth to twelfth months before the interview), the total number of terminations, the number of failures in particular, and the number of woman-months of observation in the denominators of the termination and failure rates were obtained from the analysis of the 12-month window with a three-month cutoff ($W = 12$, $C = 3$). The corresponding figures for the first three months were obtained by subtracting the figures for $W = 12$, $C = 3$ from the figures for $W = 12$, $C = 0$. Corresponding figures for the thirteenth to twenty-fourth months were obtained by subtracting the figures for $W = 12$, $C = 0$ from the figures for $W = 24$, $C = 0$. The figures for the remaining two subperiods were obtained in the same manner.

The results are displayed in the columns labeled F, T, and N^* in Table 5. Average monthly failure and overall termination rates were calculated by dividing F and T, respectively, by N^*; the results are shown in the last two columns of Table 5. It can be seen that both the termination and failure rates are highly consistent with each other for the second, third, and fifth time periods but are much higher in the third year before the interview and near zero during the three months before the interview. The systematic and surprisingly pronounced tendency to underreport terminations (including failures) during the months immediately preceding the interview is thus more than compensated for by a tendency to overreport terminations 25 to 36 months before the interview. This pattern suggests a possible displacement of terminations back in time during the two years immediately preceding the interview. (If all the respondents misstated the dates of termination in the last two years—but not before—by moving them back

Table 5. Incremental values of *F, T, N*, F/N*,* and *T/N** for ordinal months 1–12 resulting from increases in window size (all methods)

Months before interview	*F*	*T*	*N**	*F/N**	*T/N**
Last 3	0	2	2,335	0	0.001
4th–12th	16	330	8,100	0.002	0.041
13th–24th	20	222	6,049	0.003	0.037
25th–36th	32	224	3,134	0.010	0.071
37th–60th	22	231	6,063	0.004	0.038

Note: The values of *F, T,* and *N** for months 4–12 before the interview are the total numbers of failures, terminations, and woman-months of use, respectively, in the first 12 ordinal months of the life table based on $W = 12$, $C = 3$. The values for months 1–3 before the interview are obtained by subtracting the values in that life table from the values in the life table based on $W = 12$, $C = 0$. The values for months 13–24 are obtained by subtracting the corresponding values in the life table based on $W = 12$, $C = 0$ from those in the life table based on $W = 24$, $C = 0$. The values for months 25–36 and 37–60 are obtained in the same manner as the values for months 13–24.

three months, the termination rate for the three months immediately preceding the interview would be zero, the rates for the remainder of the last two years would be unaffected, and the rate for the third year before the interview would be inflated.) The reasons for such a displacement pattern are not immediately apparent, however.

The consistency of the termination rates for the second and third subperiods with each other and with those for the fifth subperiod suggests that the combination of window size and cutoff date that provides the best estimate of continuation and failure rates is the 24-month window with a three-month cutoff, which covers the second and third subperiods, thereby avoiding both the downward bias in terminations of the first subperiod or the upward bias of the fourth subperiod. This conclusion is reinforced by consideration of possible recall error and the likelihood that such error will increase with increasing window size.

Accordingly, Table 6 shows, as best estimates from the TDHS, the first-method life-table cumulative continuation and failure rates and associated 95-percent confidence limits based on these specifications. In this table, the rates are presented for multiples of 12 months up to 96 months. The method-specific continuation rates are also shown in Figure 3, which lets us see the patterns of the rates over time following acceptance in more detail.[6]

The IUD continuation rates are consistently much higher and the LEM rates are consistently lower than the pill or injection rates. The injection rate is close to the pill rate at 12 months but declines more steeply there-

6. Rates are omitted from Figure 3 for months beginning with the first month for which the denominator falls below 20 cases.

Table 6. First-method 12-, 24-, and 36-month life-table cumulative continuation and gross failure rates (±2 SE) based on $W = 24$, $C = 3$, by method

Type of rate and ordinal month	Method				
	All Methods	Pills	IUD	Injection	LEMs
Continuation rates					
12	61.3 (±2.5)	52.2 (±4.2)	73.6 (±6.9)	50.1 (±5.4)	30.9 (±7.2)
24	50.3 (±2.6)	40.2 (±4.1)	62.4 (±7.6)	33.6 (±5.3)	23.0 (±6.6)
36	43.5 (±2.6)	32.8 (±3.9)	51.6 (±8.1)	22.4 (±4.9)	18.8 (±6.2)
48	39.1 (±2.6)	25.6 (±3.7)	48.8 (±8.2)	18.5 (±4.5)	14.7 (±5.8)
60	36.5 (±2.6)	21.9 (±3.5)	44.3 (±9.2)	15.5 (±4.3)	13.1 (±5.5)
72	33.6 (±2.6)	18.2 (±3.3)	38.7 (±9.8)	11.7 (±3.9)	11.8 (±5.2)
84	31.8 (±2.6)	16.0 (±3.2)	32.1 (±9.7)	10.0 (±3.8)	10.9 (±5.0)
96	30.8 (±2.6)	14.3 (±3.2)	28.5 (±9.6)	9.2 (±3.8)	9.7 (±5.0)
Failure rates					
12	3.0 (±0.9)	2.3 (±1.5)	3.4 (±3.0)	1.0 (±1.2)	22.2 (±8.7)
24	4.0 (±1.1)	3.7 (±2.0)	3.8 (±3.2)	1.0 (±1.2)	26.4 (±9.8)
36	5.2 (±1.4)	5.8 (±2.8)	3.8 (±3.2)	1.0 (±1.2)	30.9 (±11.0)
48	5.9 (±1.5)	6.9 (±3.2)	3.8 (±3.2)	3.8 (±3.8)	32.4 (±11.5)
60	6.6 (±1.8)	7.2 (±3.3)	3.8 (±3.2)	8.6 (±7.4)	33.9 (±12.0)
72	6.9 (±1.8)	7.6 (±3.4)	3.8 (±3.2)	8.6 (±7.4)	37.0 (±13.0)
84	6.9 (±1.8)	7.6 (±3.4)	3.8 (±3.2)	8.6 (±7.4)	37.0 (±13.0)
96	6.9 (±1.8)	7.6 (±3.4)	3.8 (±3.2)	8.6 (±7.4)	37.0 (±13.0)

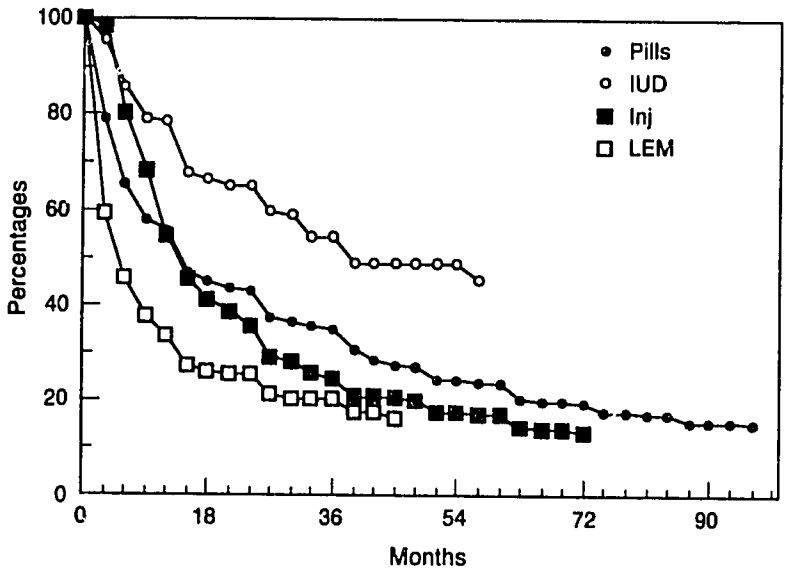

Figure 3. TDHS first-method continuation rates by method (W = 24, C = 3)

after. By the end of the third year after acceptance, the injection rate is closer to the LEM rate than to the pill rate. In the seventy-second to ninety-sixth months, the injection and LEM rates are virtually indistinguishable. The high LEM failure rates in the first year are not matched with comparably high rates thereafter. From the twelfth to ninety-sixth months, the cumulative failure rate rises by only 15 points (from 22 to 37 percent). This pattern may be due to a tendency for the LEM users who do not become pregnant early either to be more effective users of these methods or to be subfecund. The pill and injection failure rates, in contrast, rise substantially from their initial low levels. Though IUD acceptors have marginally higher failure rates than the pill and injection acceptors in the first two years, their rates do not rise after the twenth-fourth month (in spite of relatively large proportions of continuing users). The IUD acceptors have much lower rates than the acceptors of any other method from the sixtieth month on.

Figure 3 clearly shows that the cumulative continuation rate declines most rapidly in the first year following acceptance and much less rapidly thereafter. Similarly, Figure 2 shows that the cumulative failure rate increases much less rapidly after the twelfth month than before. The difference between the rates for successive 12-month periods can be quantified by means of conditional rates for those periods. The conditional continuation rate for a given period of time is, mathematically, the ratio of the cumulative rate for the end of the period to the cumulative rate for the beginning of the period and, conceptually, the likelihood of continuation to the end of the

Table 7. Conditional 12-month continuation and failure rates for selected periods following acceptance, by method (W = 24, C = 3)

Type of rate and months	Method				
	All methods	Pills	IUD	Injection	LEMs
Continuation rates					
1-12	61	52	74	50	31
13-24	82	77	85	65	74
25-36	87	82	83	69	82
37-48	90	78	95	83	(78)
49-60	93	85	91	84	(89)
61-72	92	83	87	76	(90)
73-84	95	88	83	(86)	(92)
85-96	97	90	(39)	(92)	(89)
Failure rates					
1-12	3	2	3	1	22
13-24	1	2	<0.5	0	5
25-36	1	2	0	0	6
37-48	1	1	0	3	(2)
49-60	1	<0.5	0	4	(2)
61-72	<0.5	<0.5	0	0	(5)
73-84	0	0	0	(0)	(0)
85-96	0	0	(0)	(0)	(0)

Note: Parentheses indicate rates with less than 20 cases in the denominator in the last month of the interval.

period for those who were still using at the beginning of the period. For instance, the conditional continuation rate between the twelfth and twenty-fourth months is the ratio of the 24-month rate to the 12-month rate and indicates the probability that an acceptor who completed her first 12 months would go on to complete her second 12 months.

The conditional 12-month continuation and failure rates for the first eight years following acceptance are shown for each method category in Table 7. Only the rates for the 24-month window with the three-month cutoff (W = 24, C = 3) are shown. It can be seen in Table 7 that the conditional continuation rates rise dramatically and the conditional failure rates decline dramatically from the first to second years but change much more gradually in subsequent years. The difference between the rates for the first 12 months after acceptance and subsequent periods will have an important bearing on the cross-sectional rates, in which the amount of time since acceptance is disregarded.

As we have seen, accidental pregnancy accounts for only a small propor-

Table 8. Percentage distribution of terminators (W = 24 and 60, C = 3) by reason for first-method termination, by method, and by ordinal month following acceptance

Subgroup	Weighted N	Reason						
		Accidental pregnancy	Wants pregnancy	Dislikes method[a]	Physical reaction	No need[b]	Method change	Others
All terminators								
W = 24	1,009	7.3	26.4	27.8	8.3	9.8	10.3	10.1
W = 60	2,099	8.8	38.8	19.9	10.5	7.3	7.6	7.0
By method (W = 60)								
Pills	1,172	7.1	41.3	18.7	14.3	7.2	7.2	4.2
IUD	172	12.8	25.8	25.0	1.2	4.2	8.7	22.3
Injection	473	2.7	31.3	26.2	10.2	9.2	10.1	10.3
LEMs	264	23.3	50.4	11.6	0	6.7	4.8	3.2
By ordinal mo. (W = 60)								
1–12	1,160	9.8	37.9	19.1	13.8	5.4	5.6	8.5
13–24	316	8.2	46.8	18.4	8.7	5.3	9.2	3.4
25–36	196	7.9	44.6	15.9	5.3	8.8	10.7	6.7
37+	423	7.3	32.5	25.2	5.4	13.3	10.4	5.8

a. Composed of the following response categories: inconvenient to use, wife disapproves, husband disapproves, health concern, bored with the method.

b. Composed of the following categories: infrequent sex, cannot become pregnant, divorced, separated, had hysterectomy, husband is impotent, menopause, husband is sterilized, do not live together.

tion of first-method terminations. To shed more light on other reasons for termination, Table 8 shows the distribution of terminations by reason. The first panel shows the distribution of terminations in the 24-month and 60-month windows with the three-month cutoff. The results for the 24-month window are shown since that is the window that yields the best estimates of the termination rates. The distribution of terminations in the 60-month window is shown since that is the window that maximizes the denominator. The most common reasons in both cases are desire for pregnancy and dislike of the method. In the 24-month window, these two reasons are of approximately equal importance; in the 60-month window, however, the desire for pregnancy is much more commonly given. Otherwise, there is little difference between the two windows.

In the second and third panels of Table 8, the reasons are shown by method and ordinal month of termination. In both cases the analysis is based on terminations in the 60-month window since the denominators are larger. Users of less-effective methods are, as we have already seen, disproportionately likely to experience accidental pregnancy. The most common reason for termination in this group is desire for pregnancy, which suggests that most acceptors of these methods tend to be primarily interested in deferring pregnancy for only relatively short periods of time. Among the program methods, users of pills are disproportionately likely to terminate in order to become pregnant. They are also disproportionately likely to cite a negative physical reaction to the method. IUD and injection users are disproportionately likely to terminate because of dislike of the method.

Terminations in the first year after acceptance are disproportionately likely to be caused by physical reactions and, to a lesser extent, accidental pregnancy. Terminations after three years are disproportionately likely to be due to a more generalized dislike of the method, including health concerns, and to a perception that contraception is no longer needed. Method change as a reason for termination is less common in the first year than subsequently.

All the findings presented so far refer to first-method rates. Table 9 presents the all-method rates for the 24-month window and three-month cutoff date. The 12-month all-method continuation rates range from 50 percent for less-effective methods to 90 percent for the IUD, with intermediate rates of 67 and 80 percent for the pills and injection, respectively. By the end of 36 months the rates for each of the program methods are at least 50 percent. These rates are all quite high by international standards and indicate the importance of making a variety of methods available.

Figure 4 shows the pattern of all-method continuation rates over time following acceptance. The main difference between Figure 4 and Figure 3 (the corresponding first-method rates), apart from the fact that the all-method rates are appreciably higher, is that the all-method rate for women

Table 9. All-method 12-, 24-, and 36-month life-table cumulative continuation and failure rates based on $W = 24$, $C = 3$, by method

Method and type of rate	Ordinal month 12	24	36
All methods			
CCR	76.8	68.8	62.7
CFR	2.9	3.9	5.1
Pills			
CCR	66.9	57.3	49.5
CFR	2.1	3.4	5.4
IUD			
CCR	89.7	84.5	79.3
CFR	3.3	3.7	3.7
Injection			
CCR	79.9	68.6	52.9
CFR	0.9	0.9	0.9
LEMs			
CCR	49.3	38.7	31.6
CFR	18.7	23.5	28.2

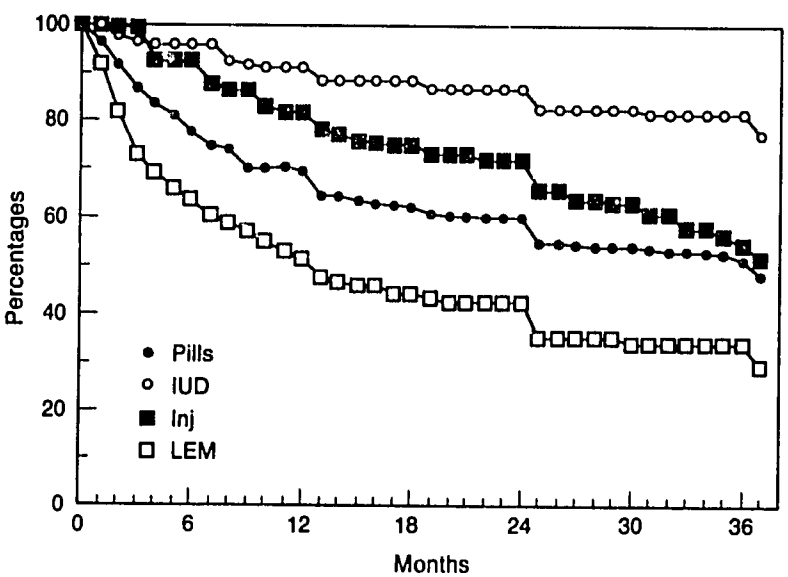

Figure 4. TDHS all-method continuation rates by first method ($W = 24$, $C = 3$)

whose first method is injection is consistently higher for most of the first three years than the all-method rate for pill acceptors. This advantage, however, appears to decline nearly to zero by the end of the third year. Figure 5 permits comparison of the first-method and all-method rates for all methods combined. From this figure it can be seen that taking switching into account substantially increases the continuation rate but has little or no effect on the failure rate.

Table 10 permits more precise comparison of the first-method and all-method rates by method for the twelfth, twenty-fourth and thirty-sixth months following acceptance. First the differences are shown in absolute terms. By the twelfth month the difference ranges from a minimum of nearly 15 points for pills to 30 points for the injection. The pill difference increases slightly to 17 points at 24 and 36 months. The IUD difference increases substantially with increasing duration, from 16 to 28 points. The injection difference goes up to 35 by the twenty-fourth month but drops back to 30 by the end of the thirty-sixth month. The difference for less-effective methods declines from 18 points at 12 months to 13 at 36 months.

The simple differences discussed in the preceding paragraph may be misleading since they do not take into account the opportunity for switching. The number of switchers from the IUD is limited by the fact that, with low first-method termination rates, relatively few IUD users are able to switch methods. In contrast, much larger numbers of LEM acceptors are in a position to switch, since over two-thirds drop out in the first year alone. To adjust for the variations in opportunity to switch, the differences between the all-method and first-method rates are divided by the proportions

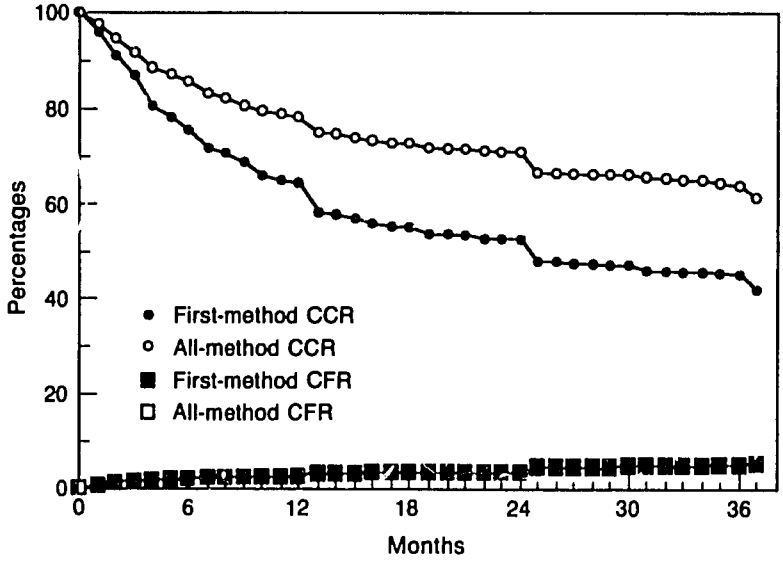

Figure 5. TDHS first-method vs. all-method rates (all *R*'s, $W = 24$, $C = 3$)

Table 10. All-method and first-method continuation rates by first method and ordinal month (W = 24, C = 3)

	All-method rate minus first-method rate by ordinal month			Difference divided by first-method dropouts by ordinal month		
First method	12	24	36	12	24	36
All methods	15.5	18.5	19.2	0.43	0.37	0.34
Pills	14.7	17.1	16.7	0.31	0.29	0.25
IUD	16.1	22.1	27.7	0.61	0.59	0.57
Injection	29.8	35.0	30.5	0.60	0.53	0.39
LEMs	18.4	15.7	12.8	0.27	0.20	0.16

who have dropped out, yielding the probability of using another method among those eligible to do so. These probabilities are shown in the last three columns of Table 10.

In terms of this measure, the IUD has the highest switching rate: approximately 60 percent of the dropouts are consistently using another method at all durations. Injection starts out with a similar rate, but the rate declines with time from 60 percent at 12 months to 39 percent at 36 months. Pills have a more stable rate, but at a much lower level—declining somewhat from 31 percent at 12 months to 25 percent at 36 months. The less-effective methods have the lowest switching rates—partly because users are most likely to become pregnant (and therefore unable to switch methods) and probably partly because they have less exposure or access to other methods since they have not been using the program as a source for contraception.

CROSS-SECTIONAL RATES

Direct Estimates

Direct estimation of cross-sectional rates from survey data has been carried out in the past mostly by using data from all episodes of use in a defined period of time preceding the interview (see Laing 1985; Thapa et al. 1988). In the analysis presented here, cross-sectional rates are calculated only for the first method in the specified window. The decision to ignore other segments of use was made deliberately to simplify analysis, since the inputs have already been calculated in preparation for the life-table analysis. To produce the necessary data for analyzing multiple episodes per respondent would be excessively complicated.

The cross-sectional procedure for measuring continuation rates begins with calculation of a mean monthly termination rate (MTR), which is obtained by dividing the number of first episodes of use in the window that

end in termination by the number of couple-months of use in those episodes that were observed during the window. The MTR is subtracted from 1, yielding the monthly continuation rate (MCR). The MCR is transformed into an implied annual continuation rate (ACR) by means of the formula

$$ACR = MCR^{12}$$

An equivalent annual failure rate (AFR) is obtained by first calculating the monthly failure rate (MFR)—using the number of episodes ending in failure in the numerator and the same denominator as the MTR—and using the formula

$$AFR = 1 - (1 - MFR)^{12}$$

As with the life-table rates, ACR and AFR can be calculated for various window sizes and with or without a cutoff date that precedes the interview date.

Table 11 shows the values of ACR and AFR for the four window sizes and two cutoff specifications employed in the life-table analysis. All these rates are first-method rates. Comparison with the life-table 12-month rates shown in Table 4 reveals that the cross-sectional continuation rates are always higher and the cross-sectional failure rates almost always lower. The reason for the difference is that the life-table 12-month rates are limited to the first 12 months after acceptance, when the likelihood of termination or failure is highest, whereas the cross-sectional rates take into account all use, including use several years after acceptance, when termination rates are very low, as shown in Tables 6 and 7. The differences by window size and cutoff specifications are, as expected, similar to the differences found in the life-table rates. Again, the preferred estimates are the ones based on the 24-month window with the three-month cutoff.

An important advantage of the cross-sectional rates over the life-table rates is that they can be calculated much more quickly. Taking advantage of this feature, we have used the cross-sectional approach to test whether the additional questions employed in the TDHS (on the first method in the open interval) significantly improve on the standard set of questions used in the DHS Model A Questionnaire. This was done by recalculating the life-table inputs on the basis solely of the standard DHS questions and using them to calculate cross-sectional continuation and failure rates. The results are shown in Panel A of Table 12. It can be seen that the continuation rates based on the standard DHS data set are upwardly biased by 5 to 8 percentage points for the program methods. The failure rates, however, are almost the same as the rates based on the extended data set.

We also tested the extent to which the TDHS or DHS improved on an even more limited data set in which information was provided only for the current method, the last method of current nonusers, and the last method in each of the closed birth intervals. The results are shown in Panel B of Table 12. The differences between the continuation rates based on the TDHS

Table 11. Direct estimates of annual continuation rates (ACR) and annual failure rates (AFR), by first method, window size (*W*), and cutoff date (*C*)

Type of rate and first method	C = 0				C = 3			
	W = 12	W = 24	W = 36	W = 60	W = 12	W = 24	W = 36	W = 60
ACR								
All methods	85	85	84	84	82	83	83	84
Pills	75	74	71	71	72	71	70	70
IUD	83	85	86	85	81	83	85	84
Injection	65	66	66	66	60	63	64	65
LEMs	57	54	52	55	49	50	49	53
AFR								
All methods	0.7	1.1	1.3	1.4	0.9	1.2	1.5	1.5
Pills	0.5	1.6	2.1	2.3	0.6	1.7	2.3	2.4
IUD	0.5	1.1	1.5	1.9	0.7	1.2	1.6	2.1
Injection	0.7	0.8	1.2	1.1	0.9	0.9	1.3	1.1
LEMs	10.3	10.7	13.0	12.5	13.5	12.2	14.0	12.6

Table 12. Direct estimates of cross-sectional first-method rates (W = 24, C = 3) based on reduced data sets and difference from corresponding rates based on full TDHS data set

First method	ACR Rate	ACR Difference	AFR Rate	AFR Difference
A. Rates based on usual DHS data set				
All methods	88	+5	1.2	0
Pills	76	+5	1.7	0
IUD	89	+6	1.1	−0.1
Injection	71	+8	1.0	+0.1
LEMs	49	−1	11.7	−0.5
B. Rates based only on most recent method in reference birth interval				
All methods	89	+6	1.0	−0.2
Pills	78	+7	1.7	0
IUD	92	+9	1.1	−0.1
Injection	78	+15	1.1	+0.2
LEMs	62	+12	9.0	−3.2

data and this data set were, as expected, even greater, and the failure rate for the less-effective methods was substantially lower. Clearly the DHS set of questions is an improvement on this more limited data set; but, just as clearly, the downward bias in the continuation rates obtained from the DHS set is too great to be acceptable in light of the improvement that results from adding the information on first method in the open birth interval as in the TDHS. Presumably, the TDHS data set could be improved further by adding more information on the first method in the earlier birth intervals as well.

Indirect Estimates

Bongaarts has proposed the following indirect estimate of the cross-sectional annual continuation rate:

$$\text{ACR} = \exp(Dy/yu)$$

where y is a reference period of y years, Dy is the number of discontinuations in the reference period, and u is the number of current users or (better) the estimated number of users at the midpoint of the reference period (interpolated from prevalence data for two or more points in time).

Bongaarts has also proposed a procedure for indirectly estimating the failure-rate estimate. This procedure is in two parts. First, an average monthly failure (f) is estimated by means of the formula

$$f = (pb)/(120ua)$$

where p is the percentage of live births in the reference period that were conceived while using contraception, b is the period fertility rate (expressed in terms of birth per thousand woman-years of exposure in the reference period), u is the percentage of all person-months of exposure time that is spent using contraception, and a is the proportion of the conceptions occurring while using contraception that result in spontaneous or induced abortion. The monthly rate is then converted into an annual rate (F) by means of the formula

$$F = 100[1 - (1 - f/100)^{12}]$$

Both formulas were applied to the TDHS data set. The estimates that resulted from application of the formula for ACR are shown, together with the estimates and confidence limits of F,[7] by method and window size (in all cases employing the three-month cutoff), in Table 13. As with the direct estimates, the indirect continuation-rate estimates increase with window size. Comparison of the $W = 24$ indirect estimates with the $W = 24$, $C = 3$ direct estimates reveals that the estimates for all methods and IUD are slightly higher than the direct estimates and that the pill, injection, and LEM estimates are all higher by 6 or 7 points. These differences are probably due in part to the apparent underreporting of recent terminations, which probably results in an overestimate of current use. Such an overestimate of current use would bias the indirect estimate of ACR upward while not affecting the direct estimates since the three-month cutoff eliminates the bias. As a result, the direct estimates with the three-month cutoff appear to be preferable to the indirect estimates, at least with the TDHS data set. Since the differences are not great, however, the indirect estimates would be useful substitutes if direct estimates were not available.

Because the failure rates are very low for the program methods, there is little difference between direct and indirect estimates of AFR for these methods. However, the indirect method appears to underestimate the failure rate for the less-effective methods. With the 24-month window, the indirect rate (8.8) is 3.4 points less than the direct estimate. Because of the small sample size, the standard error is still large enough that this difference is not statistically significant. With the 36-month and 60-month windows, however, the difference is significant at the 0.05 level.

The failure-rate estimates in Table 13 are based on Bongaarts' recommendation that induced abortion be ignored in settings where the abortion rate is unknown. Since the proportion of pregnancies expected to result in fetal losses is about 0.17, Bongaarts recommends setting a equal to 0.83.

7. Bongaarts and Rodriguez have proposed and tested a formula for the standard error of F, but no formula has yet been proposed for estimating the standard error of the ACR estimate.

Table 13. Current-status (indirect) estimates of ACR, AFR (Bongaarts' *F*), and confidence limits of *F* (±2 SE), by window size and method

Method and type of rate	$W = 12$	$W = 24$	$W = 36$	$W = 60$
All methods				
ACR	84.0	85.6	84.1	86.9
AFR	1.1 (±.4)	1.3 (±.3)	1.2 (±.2)	1.1 (±.2)
Pills				
ACR	76.7	77.5	75.6	77.4
AFR	1.9 (±.9)	2.4 (±.7)	2.2 (±.5)	2.0 (±.4)
IUD				
ACR	83.8	86.5	87.7	89.2
AFR	0.6 (±.8)	0.4 (±.5)	0.7 (±.5)	0.5 (±.3)
Injection				
ACR	65.0	70.5	72.3	75.6
AFR	0.9 (±.9)	1.2 (±.7)	0.8 (±.5)	0.6 (±.3)
LEMs				
ACR	53.8	55.9	55.9	60.6
AFR	7.8 (±4.4)	8.8 (±3.2)	8.7 (±2.6)	7.5 (±1.9)

In settings where abortion is not negligible, *F* will tend to underestimate the failure rate. Since we know that abortion is not negligible in Thailand, though the exact abortion rate is not known with certainty, we should consider what the values of *F* might be under varying levels of abortion. Table 14 does this. The first column, with $a = 0.83$, reproduces the estimates of *F* given in Table 13. The second column assumes that 10 percent of the pregnancies that do not end in spontaneous fetal loss are terminated by induced abortion ($a = 0.9 \times 0.83 = 0.75$). The succeeding columns assume that 20, 30, and 40 percent, respectively, of the pregnancies that do not end in spontaneous fetal loss are terminated by induced abortion.

The most striking finding in Table 14, given the low levels of *F* in Thailand, is how little difference omission of information on abortion is likely to be in absolute terms. Assumption of a 40 percent abortion level adds only 1 point to the estimated failure rate for all methods combined to the rate obtained under the assumption of no abortion. As noted above, a recent study of hospital records (Knodel et al. 1982) estimated one induced abortion for every four live births, which implies that about 20 percent of pregnancies that do not end in spontaneous fetal loss are terminated by induced abortion and suggests that the third column of Table 14 ($a = 0.8 \times 0.83 = 0.66$) yields the best estimates in the table.

Table 14. Current-status (indirect) estimates of AFR (Bongaarts' *F*), by different abortion assumptions (W = 24)

Method	Abortion assumption				
	a = 0.83	a = 0.75	a = 0.66	a = 0.58	a = 0.50
All methods	1.3	1.5	1.7	1.9	2.2
Pills	2.4	2.7	3.0	3.4	4.0
IUD	0.4	0.5	0.5	0.6	0.7
Injection	1.2	1.4	1.5	1.8	2.1
LEMs	8.8	9.7	10.9	12.3	14.2

Note: "a" refers to the assumed proportion of accidental conceptions (those occurring while contraception is in use) that end in either spontaneous or induced abortion.

Table 15 shows the bivariate differentials in both direct and indirect estimates of ACR and AFR. In this table we have used W = 60 (and C = 3 in the case of the direct estimates) rather than W = 24 in order to maximize sample size. This strategy is acceptable in studying differentials since the absolute magnitudes of the rates are not as important as the differences among them. The first thing to be noted about the differentials in Table 15 is that the direct estimates and indirect estimates show very similar patterns of differentials, although at different levels of magnitude. Substantial differences in the direct estimates are usually reflected in similarly large differences in the indirect estimates, and vice versa. An important exception is found, however, for the youngest women and those with no living children, for whom the indirect estimates appear to overestimate continuation rates by a wide margin and underestimate failure rates. The apparent reason for this is the fact that most such women have not been using contraception for a very long time. With a 60-month window, the basic assumption of the current-status approach (that the percentage currently using contraception has been much the same over the past five years as it is now) is bound to overstate the denominator, which results in an understated termination (or failure) rate and therefore an overstated continuation rate.

With regard to continuation rates, six major sources of variation may be discerned in the differentials shown in Table 15. First, as already noted, the method is a major determinant of ACR, the highest value (for the IUD) being about 30 points higher than the lowest value (for the less-effective methods). Second, older women are much more likely to continue than younger women. The direct estimate of ACR for women under age 20 was 30 points below the estimate for those in their early twenties and nearly 80 points below the estimate for those in their forties. This same factor probably accounts for most of the variation in ACR in relation to number of living children and desire for more children. Third, lower-status women are more likely to continue contraceptive practice than higher-status women.

Table 15. Direct and indirect estimates of ACR and AFR by sociodemographic variables, $W = 60$, all methods

Independent variable and category	Direct		Indirect	
	ACR	AFR	ACR	AFR
All *R*'s	83.8	1.5	86.9	1.1
Reference method				
Pill	70.4	2.4	77.4	2.0
IUD	84.1	2.1	89.2	0.5
Injection	64.9	1.1	75.6	0.6
LEMs	53.2	13.0	60.6	7.5
Age group				
15-19	18.6	1.3	73.6	0.1
20-24	48.4	6.2	68.8	2.4
25-29	72.2	3.0	77.2	1.6
30-34	84.5	1.4	86.1	1.1
35-39	91.6	0.9	91.3	0.9
40-44	96.0	0.3	95.5	0.3
45-49	96.6	0.0	96.3	0.0
Living children				
0	39.7	1.5	67.4	0.0
1-2	76.8	2.1	79.5	1.2
3-4	90.4	1.2	90.1	1.1
5+	93.7	0.6	93.2	0.4
Want more children?				
Yes and sure	59.4	3.1	72.0	1.1
Yes, not sure	70.9	2.7	77.5	0.3
Undecided	61.8	0.0	75.4	0.0
Want no more	80.2	2.0	81.2	1.5
Respondent's education				
0-3 years	89.2	1.0	88.1	0.6
4-7 years	84.1	1.3	84.6	0.9
Secondary	75.3	3.8	77.7	2.5
Beyond secondary	74.7	3.7	77.3	2.7
Husband's education				
0-3 years	86.3	0.9	85.6	0.3
4-7 years	85.1	1.2	85.6	0.8
Secondary	78.2	2.6	79.3	1.9
Beyond secondary	75.2	3.2	77.0	2.6
Respondent's work status				
Agricultural	86.6	1.1	86.6	0.8
Nonagricultural	85.3	1.9	84.7	1.4
Not working	80.0	1.4	81.5	1.0

Table 15. *(continued)*

Independent variable and category	Direct		Indirect	
	ACR	AFR	ACR	AFR
Respondent's wealth				
Poor	83.7	1.3	84.6	0.9
Middle	82.7	1.6	83.2	1.0
Better off	85.3	1.7	84.1	1.5
Residence				
Rural[a]	83.8	1.4	84.3	0.9
Sanitary district	85.2	1.3	84.8	1.5
Provincial urban	84.3	1.2	84.3	1.0
Bangkok	81.6	2.5	82.0	1.9
Region				
Bangkok	81.6	2.5	82.0	1.9
Central[b]	85.0	1.8	83.7	1.2
North	82.7	1.2	83.2	0.9
Northeast	84.9	0.8	85.8	0.5
South	82.4	2.5	83.5	1.9
Ethnicity				
Thai Buddhist	84.4	1.4	84.6	1.0
Thai and Malay Muslim	74.3	5.3	77.3	3.4
Other	76.7	0.7	79.5	0.3
Source of current method				
Government	87.7	1.1	88.4	0.8
Private	81.8	2.4	84.4	1.5
Free pills?[c]				
Not free	88.2	1.3	87.3	1.0
Free	91.4	0.7	88.2	0.5
Duration of previous use				
0	68.3	3.0	76.4	1.5
1-36	87.7	1.3	88.0	1.1
37+	95.6	0.3	96.0	0.2

a. Except sanitary districts.

b. Except Bangkok Metropolis.

c. Pill users only.

This factor is reflected in the relationships between ACR and respondent's education, husband's education, respondent's work status, place of residence, and region of residence. This finding is consistent with past findings in Thailand and appears to be due to the fact that the less-educated women are more likely to use NFPP services and therefore use more effective methods with better guidance from clinic and field personnel working

for the NFPP. Fourth, Thai Buddhists are more likely to continue than Muslims and members of other minority groups. This factor also influences the difference in ACR between the south (where Muslims are most heavily represented) and the other nonmetropolitan regions. Fifth, respondents who receive their supplies from the program have higher continuation rates than those who receive their supplies from private sources.[8] Related to this is a slight tendency for pill users who receive their supplies free of charge (and therefore probably from the program) to have higher continuation rates. And sixth, the probability of continuing is strongly and positively associated with the duration of use of the method before the first month in the 60-month window. This finding simply reflects the tendency, already seen, for the conditional continuation rates to rise over time following acceptance.

With regard to the AFRs in Table 15, there are few major differentials since the average rate for all respondents (1.5 percent) is so low. Apart from the high failure rate already noted for users of less-effective methods, only a few other groups stand out with AFRs (direct estimates) greater than 3 percent: women in their early twenties (6.2 percent), Muslim women (5.3 percent), women with secondary education (3.8 percent) or higher (3.7 percent), and women who are sure they want to have more children (3.1 percent).

CONCLUSIONS

In this paper we have applied three approaches to studying contraceptive continuation and failure, using data from the 1987 Thailand Demographic and Health Survey. The application of these analytical methods and the wealth of data in the TDHS have produced a variety of substantive and methodological findings. The former should be useful for program managers and the latter for researchers interested in studying use effectiveness in Thailand and other settings. Among the most important substantive findings are the following.

First, this analysis bears out past research findings on continuation and failure rates. The continuation rates found in the present study are generally within or only slightly below the ranges of rates found in earlier national studies in Thailand. The tendency for the rates here to be somewhat lower is probably due mostly to the fact that they reflect the experience of both program and nonprogram acceptors; as Table 15 shows, the respondents who cite private supply sources tend to have lower continuation rates than those who cite program sources. The lower TDHS rates could also

8. With the 60-month window, the reference method is less likely to be the current method than an earlier one. In spite of this, the source of the current method is included as an independent variable in Table 15, since the source of current method is likely to be correlated with the source of the reference method. The relationship between ACR and source of the reference method is probably stronger than the relationship seen in Table 15.

reflect a downward trend in continuation rates during the 1980s or a slight downward bias due to gaps in the TDHS data, but there is no clear evidence to support or refute either of these hypotheses.

Second, because the TDHS sample included users of less-effective methods (condoms, rhythm, withdrawal), the analysis reported here was able for the first time to obtain information on continuation and failure rates among users of these methods. As expected, the continuation rates were far lower and the termination rates far higher for these methods than for the program methods.

Third, the TDHS permitted, for the first time, study of very long-term use (beyond the first two or three years after acceptance). The analysis clearly shows that the conditional termination rates decline markedly after the first 12 months and that even the lowest 12-month conditional continuation rates are above 80 (and in some cases above 90) after four years of use.

Fourth, analysis of all-method continuation rates reveals that method switching adds considerably to the continuation of contraceptive use even for methods characterized by low first-method continuation rates. At the end of the twelfth month following acceptance, the all-method continuation rates exceed the first-method rates by 15 to 30 points, depending on the first method.

Fifth, because of the pattern of conditional rates, the cumulative continuation rate for the first 12 months after acceptance—the figure most commonly cited in discussing contraceptive continuation—grossly underestimates the average probability of continuation in a 12-month period among current users. The appropriate estimate for assessing the average likelihood of dropout among current users is the cross-sectional annual continuation rate (ACR), which is 13 to 21 points higher, depending on the method, than the best estimate of the life-table rate for the first 12 months. It is 22 points higher for all methods combined, including sterilization.

This finding and the preceding ones about conditional and all-method rates are probably the most important lessons from the present study for program managers. Since past studies have indicated that about one-fourth of all IUD acceptors, one-third of all pill acceptors, and nearly half of all injection acceptors drop out in their first year of use, program managers have been disturbed by the dropout rate, probably assuming that these high proportions in the first year continue in subsequent years. The TDHS analysis reveals that the average all-method dropout rate for the first year (regardless of method accepted) is only about 25 percent when method switching is taken into account (versus about 40 percent for the first method alone) and that even the first-method conditional dropout rates decline to 18 percent, 13, 10, and less in successive years (reaching only 3 percent in the eighth year). The cross-sectional analysis reveals an average annual termination rate for all current users (including sterilization users) of only 17 percent. Since about one-third of first-method dropouts switch methods (see

Table 10), this means a loss of only about 12 percent of users each year, many of whom drop out because they want to become pregnant or because they no longer need contraception. The message for program managers from these findings is this: When method switching and continuation rates among long-term users are taken into account, continuation rates are not such a source of worry as they may once have seemed.

Sixth, findings from the TDHS regarding differentials generally confirm previous findings, which show that continuation rates tend to be positively associated with age and parity and inversely associated with socioeconomic status and minority status. A new finding is that users of program methods appear to have somewhat higher continuation rates than users of methods from private sources.

Certain methodological findings are particularly noteworthy. First, the TDHS questionnaire design, with more detailed information on use in the open birth interval, substantially improved on the DHS Model A Questionnaire design. Second, the continuation and failure rates derived from the TDHS data varied by window of observation, largely because of a pronounced tendency to underreport terminations in the three months immediately preceding the survey date. It is not clear whether this tendency was unique to the TDHS data set. The findings from this study suggest that future attempts to derive continuation and termination rates from retrospective survey data should experiment with various window sizes and cutoff dates before settling on one set of specifications for detailed analysis. Third, the life-table analysis has yielded a much richer set of findings than the cross-sectional analysis, since it provides information on the patterns of continuation and failure rates following acceptance. Only the life-table results reveal how great the reduction in conditional rates is after the first year, and only the life-table approach permits all-method analysis as well as first-method analysis. On the other hand, the life-table approach does not produce a figure that summarizes the average continuation and failure rates among current users, as does the cross-sectional approach. This study adds to the body of research pointing to the complementarity of the two approaches (see Jejeebhoy 1988).

Finally, the indirect approaches proposed by Bongaarts were much more easily employed than the life-table or direct cross-sectional approaches. One of the two indirect methods for estimating the average continuation rate and the indirect method for estimating the failure rate yielded reasonably close approximations of the corresponding direct estimates. However, they did appear to be subject to some systematic bias. In situations where direct estimates can be obtained with a reasonable degree of confidence about their validity, as in the present case, it is probably better to rely on them than on indirect estimates. Even where direct estimates are obtained, it is probably worthwhile obtaining indirect estimates as well to serve as a check on the direct estimates.

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