DHS Demographic and Health Surveys

MODEL FURTHER ANALYSIS PLAN

Contraceptive Use Dynamics

MACRO INTERNATIONAL INC.

The Demographic and Health Surveys (DHS) is a 13-year project to assist government and private agencies in developing countries to conduct national sample surveys on population and maternal and child health. Funded primarily by the United States Agency for International Development (USAID), DHS is administered by Macro International Inc. in Calverton, Maryland.

The main objectives of the DHS program are to: (1) promote widespread dissemination and utilization of DHS data among policymakers, (2) expand the international population and health database, (3) advance survey methodology, and (4) develop in participating countries the skills and resources necessary to conduct high-quality demographic and health surveys.

For information about the Demographic and Health Surveys program, write to DHS, Macro International Inc., 11785 Beltsville Drive, Calverton, MD 20705-3119, U.S.A. (Telephone 301-572-0200; Fax 301-572-0999).

Model Further Analysis Plan: Contraceptive Use Dynamics

Siân L. Curtis
Charles R. Hammerslough

Demographic and Health Surveys
Macro International Inc.

August 1995

The recommended citation for this publication is:

Curtis, Siân L. and Charles R. Hammerslough. 1995. *Model Further Analysis Plan: Contraceptive Use Dynamics*. Calverton, Maryland: Macro International Inc.

Charles R. Hammerslough heads the demographic consulting and market analysis firm DemoMetrics.

TABLE OF CONTENTS

PREFACE

A primary objective of the DHS program is to encourage further analysis of the survey data relating to research issues relevant to the design, management and evaluation of health and family planning programs in countries undertaking a DHS survey. A number of illustrative plans for further analysis on key topics that are of primary concern to policymakers and program managers in the health and family planning field have been prepared to carry out this DHS program mandate. These analysis plans are intended to provide a starting point for understanding how DHS data can be used to address specific research topics.

The DHS model analysis plans are designed to serve as tools for implementing further analyses. They lay out model descriptive tables and graphics, and, when appropriate, examples of multivariate analyses. Sample computer programs are provided to facilitate the analysis process.

The DHS model plans are comprehensive, but it is not expected that they will fully address all of the research questions that may be important in a specific country setting. The process of defining the country-specific data needs should involve a dialogue with program managers and policymakers. Based on this dialogue, the researchers using a DHS further analysis plan are encouraged to adapt its content to meet a country's unique research concerns.

Finally, the DHS model further analysis plans emphasize the importance of widely disseminating the results of the study. In order for the research results to be incorporated into program planning, they must be clearly communicated to their target audiences. Researchers undertaking studies using the DHS model plans are urged to consider using a number of dissemination techniques, including the preparation of fact sheets and briefing packets and special seminars for nontechnical audiences in addition to publication of a technical report.

It is anticipated that the availability of the DHS model further analysis plans will help to foster both the timely production and dissemination of policy-relevant research studies.

Martin Vaessen
Project Director

INTRODUCTION

This document is a model plan for the further analysis of data from the Demographic and Health Surveys (DHS) in the area of contraceptive use dynamics. It is one of a series of such plans prepared by the DHS program that are designed for use by researchers as a resource for developing country-specific further analysis plans. It is arranged in eight sections that cover a number of analyses of contraceptive use dynamics that can be conducted using the calendar data collected in some DHS-II and DHS-III surveys. These data are available only in DHS-II and DHS-III surveys that implemented the A-core questionnaire for high prevalence countries.

The study of contraceptive use dynamics usually encompasses the following topics: prevalence structure of the population, contraceptive discontinuation, contraceptive switching behavior, and contraceptive failure. Contraceptive discontinuation, switching and failure become increasingly important issues as populations reach relatively high levels of contraceptive use. The focus then moves from encouraging couples to adopt contraception to encouraging them to maintain use and to providing them with a range of contraceptive options to suit their needs. Relatively few analyses of contraceptive use dynamics exist for developing countries. However, as more and more countries reach high prevalence levels, such analyses are becoming increasingly important for family planning policy makers. One reason for the lack of such studies is that the data required are not often collected. The calendar section of the DHS-II and DHS-III A-core questionnaire is specifically designed to meet this data need. However, it is more demanding to manipulate and analyze calendar data than many other types of data and the techniques are unfamiliar to many researchers. Hence, a key aim of this analysis plan is to make the calendar data on contraceptive use dynamics more accessible to analysts by providing computing and analysis tools.

The organization of the sections and subsections reflects the goals of the DHS Further Analysis Project: to provide a practical analytic toolkit for conducting policy-relevant research that suggests actionable policies. At numerous points, the potential practical use of the results by family planning policy makers is specially mentioned, e.g., the potential impact of various policies on the pregnancy rate in the population in Section 8.

The eight sections cover a number of analyses of contraceptive use dynamics and introduce the techniques required for each analysis. To some extent, the analyses build on each other but that does not mean that researchers cannot pick one or two topics and focus only on them. The sections are 1) Data Quality, 2) Contraceptive Prevalence, 3) Discontinuation Rates, 4) Discontinuation Rates by Reason for

Discontinuation, 5) Method Switching, 6) Comparison of Contraceptive Failure Rates, 7) Trends in Contraceptive Discontinuation and Failure, and 8) Fertility Effects of Contraceptive Use. Each section is further divided into the following subsections: Description of Analysis, Application and Significance, Background Theory and Analytic Details, Discussion of Results, Conclusions, and Analysis Tools. In addition, Appendix A provides an introduction to the life tables techniques used in many of these analyses and Appendix B provides detailed guidance on setting up an SPSS system file for the analyses presented in Sections 1 and 3-8. Appendices C and D provide some guidance on both report writing and dissemination of the results.

The analyses described in this plan are illustrated through examples based on Country A, a country with relatively high contraceptive prevalence that conducted a DHS-II survey that included the calendar.

Requirements

The following computer hardware and software are required for the analyses presented in this document:

1) An IBM PC-compatible computer with the DOS operating system. A math coprocessor and a fast CPU are recommended.

2) The DHS rectangular file of individual data for the subject country. This must be a DHS-II or DHS-III survey that used the A-core questionnaire (high prevalence). The associated .SPS file generated by ISSA is also required.

3) SPSS/PC+ version 4.0 or higher with the Advanced Statistics Module.

4) Any standard spreadsheet (for Section 8 only).

5) DYNPAK computer program package. This package of programs is designed to be used with this plan. It includes a number of utility programs, e.g., CAL2SPSS which extracts the calendar data from the rectangular file in the form required for the analyses, and SELECT which helps to construct SPSS .INC files to extract other data from the rectangular DHS file. It also includes a number of SPSS programs (.INC files) for the analyses in the plan. To extract the individual programs, copy the file DYNPAK.EXE into the subdirectory that you wish to work from and then type "DYNPAK." Information on the individual programs is given in the file READ.ME and in the programs themselves.

1 DATA QUALITY

Description of Analysis

This section presents some simple analyses of data quality that are relevant to the calendar data collected in DHS-II and DHS-III surveys. In the first analysis, the pattern of contraceptive prevalence in Country A from an earlier survey in 1986 is compared with that obtained for the corresponding point in time from the calendar in the DHS-II survey. The distribution of contraceptive use-durations is examined graphically to detect evidence of heaping in the second analysis. In the final analysis, the reported status in the month following discontinuation of contraceptive use is compared with the reason for discontinuation. This comparison helps to determine the extent of concealment of contraceptive failure.

Application and Significance

All retrospectively reported data are subject to various types of error and the calendar data collected by DHS-II and DHS-III surveys are no exception. Recall errors due to memory lapses, duration heaping, and event omission (both deliberate and accidental) are common problems and can bias the results of even the most careful analysis. Therefore, evaluation of data quality is a crucial stage of the analysis that should not be overlooked. In addition to highlighting potential data problems, such analyses also help the analyst to become familiar with the data before moving on to more complex analyses.

Background Theory and Analytic Details

The calendar supplements the interview questionnaire in several ways. It provides a framework for resolving inconsistencies in birth dates, death dates, breastfeeding durations, and segments of contraceptive use or nonuse. The DHS calendar provides a box for every month in the five calendar years before the start of the survey (see Appendix E). The interviewer fills in each box in the first column of the calendar with a code for the respondent's exposure/prevalence status in that month. The calendar makes it possible to identify precisely the timing of events in relation to one another, for example, contraceptive use and labor force participation, which is believed to improve the quality of reporting.

Despite the fact that calendar data have been shown to be superior to alternative retrospective data collection techniques for longitudinal information (Goldman et al., 1989; Westoff et al., 1990), they are

not immune from data quality problems. The calendar places considerable demands on the respondent to recall detailed information for a relatively long period prior to the survey. Consequently, recall problems are an obvious cause for concern. In particular, respondents may forget short periods of contraceptive use. Such omissions would be expected to become more common further back in time and for certain methods, such as condoms, which may be used only occasionally.

One powerful test for such omissions is to compare the data in the calendar with data from an external source. Many (but not all) of the countries with DHS-II or DHS-III calendar data also have an earlier survey within the period covered by the calendar. The current status data on contraceptive use from the earlier survey can then be compared with the calendar data in the later survey for the corresponding time period. Current status data are believed to be more reliable than retrospectively reported data because they are not subject to recall problems. If omission of short periods of contraceptive use is common in the calendar, the prevalence obtained from the calendar would be expected to be lower than that obtained from the current status data in the earlier survey. This may be more pronounced for some methods than for others, as explained above.

Some caution is necessary to ensure that the samples from the two surveys are as comparable as possible. In particular, women age 15-49 at the time of the later survey would have been younger at the time of the earlier survey. For example, if the first survey is in 1986 and the second survey is in 1991, women age 15-49 in the 1991 survey would have been age 10-44 at the time of the earlier survey. Consequently, the comparison should be based on women age 15-44 at the time of the earlier survey if possible. Further, the comparison should be based on all women, not currently married women, because marital status may also change between the two dates.

Surveys that ask respondents to recall retrospectively events in the past are subject to heaping on significant dates or time durations. In effect, respondents are estimating the dates of past events that were not very memorable. Although the calendar minimizes this type of recall error by forcing some consistency, it is impossible to eliminate, especially given the long recall period. Heaping usually occurs on prominent durations, such as 6, 12, and 24 months and can be detected by graphing the reported durations of segments of use. A one- or two-year failure rate might be biased if failures or exposure durations are heaped on 12 and 24 months. Heaping usually is a concern only if it is extreme, because life-table summary rates are essentially smoothed. One solution to extreme heaping is to calculate life-table quantities on nonstandard intervals, such as failure rates in the first 18 or 30 months of use.

Recall problems may lead to accidental omission of events such as short periods of contraceptive use, but deliberate omission or misreporting of events is also a potential problem. Contraceptive failure that results in an unintended pregnancy is a sensitive and potentially embarrassing topic for many women in many countries. They may perceive that they have failed at planning one of the most important elements of their lives. In some places, women conceal contraceptive failures by misreporting them as wanted pregnancies. To the extent that they do so, estimated contraceptive failure rates will be too low. Such misclassification of contraceptive failures is extremely difficult to detect but one simple approach is to tabulate the status of the woman immediately after discontinuation by the stated reason for discontinuation. High numbers of women who are pregnant in the month after discontinuation but who did not report contraceptive failure as the reason for discontinuation might suggest misreporting of contraceptive failures, particularly if they tend to report that they stopped using in order to become pregnant.

Discussion of Results

Table 1.1 presents the contraceptive prevalence distribution at the time of the DHS-I survey in country A as estimated from the calendar data from the DHS-II survey and the current status data from the DHS-I survey conducted about five years before the DHS-II survey. The DHS-II sample was restricted to exclude women under age 20 at the time of the DHS-II survey because these women would have been under age 15 at the time of the DHS-I survey. The sample therefore corresponds approximately to women age 15-44 at the time of the DHS-I survey.

Table 1.1 Percentage of all women using each method of contraception at the time of the 1986 DHS-I Survey in Country A, based on calendar data from the 1991/92 DHS-II survey and current status data from the DHS-I survey

	DHS-II calendar data	DHS-I current status data	
Method	Ages 15-44	Ages 15-44	Ages 15-49
No method	68.3	71.5	72.0
Pill	4.6	4.2	4.0
IUD	4.9	4.6	4.4
Injectables	1.4	0.9	0.9
Vaginal methods	0.8	0.7	0.7
Condom	1.0	0.5	0.4
Female sterilization	3.7	3.4	3.7
Male sterilization	0.0	0.0	0.0
Periodic abstinence	12.4	11.1	10.8
Withdrawal	1.7	2.3	2.2
Other	1.4	0.9	0.9

The contraceptive prevalence distribution for women age 15-44 from the two surveys is remarkably similar despite the high potential for recall error and omission of segments of use in the calendar data. In fact, the contraceptive prevalence rate estimated from the DHS-II calendar data is slightly higher than that obtained from the DHS-I current status data but the difference is small and both estimates are subject to sampling errors. Agreement is good for individual methods too and there is no evidence that use of any method is significantly under-reported in the calendar data.

The final column of Table 1.1 presents the contraceptive prevalence distribution for all women age 15-49 obtained from the DHS-I survey. In many situations, the contraceptive prevalence distribution is published only for women age 15-49 and it may be difficult to obtain the distribution for the age group corresponding exactly to the sample available from the DHS-II calendar data. However, the difference between the distribution for women age 15-44 and for women age 15-49 is very small because women age 45-49 account for only a small percentage of the total DHS-I sample. Hence, the published distribution could be used for this analysis if that is all that is available.

Figure 1.1 shows the distribution of reported durations of segments of use and nonuse. The lines show only moderate heaping at 6 and 12 months' duration. This level of heaping, which amounts to only a few percent of the segments, does not substantially affect the quality of the estimated contraceptive discontinuation rates. The lower line, which shows the durations for only the uncensored (completed) segments, does not display significant heaping.

For comparison, Figure 1.2 shows the distribution of the reported durations of all segments of use and nonuse in Country A together with the corresponding distribution for a different country, Country B, in which there is significantly more heaping of the segment durations. Heaping is particularly pronounced at 12 months' duration in Country B, which could affect 12-month discontinuation and failure rates. In this situation it might be useful to adjust the estimates of the 12-month discontinuation and failure rates to see what impact the heaping has on the rates, as is frequently done for infant mortality rates when ages at death are heaped on 12 months (e.g., Sullivan et al. 1990). However, it is worth noting that even in Country B, the amount of heaping found in the durations of segments of use and nonuse in the calendar data is less than is often seen in reported ages of women or in the reported durations of practices such as breastfeeding, postpartum abstinence, and postpartum amenorrhea.

Table 1.2 is a cross-tabulation of completed use intervals, by reason for discontinuation and prevalence status in the following month. This table might help detect underreporting of contraceptive failures through retrospective rationalization if a suspiciously large proportion of women who discontinued contraceptive use for reasons other than failure are pregnant in the month following discontinuation. The possibly suspect numbers are seen in bold. Of the 2078 women who were pregnant in the month following the end of an interval, 1972 (95 percent) reported that they had experienced a contraceptive failure. Six percent of women who reported that they discontinued use in order to become pregnant were recorded as pregnant in the month immediately following discontinuation. This figure is not unusually large. Similarly, five percent of women who discontinued use for other reasons and who did not immedi-

Figure 1.1: Distribution of Reported Duration of Segments in the Calendar, Country A

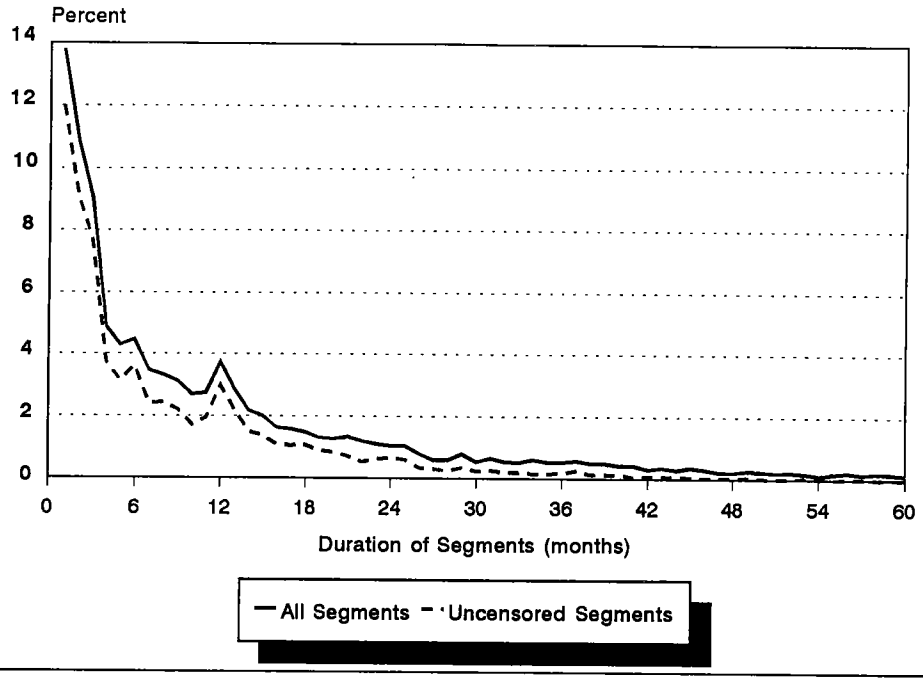


Figure 1.2: Distribution of Reported Duration of All Segments in the Calendar, Country A and Country B

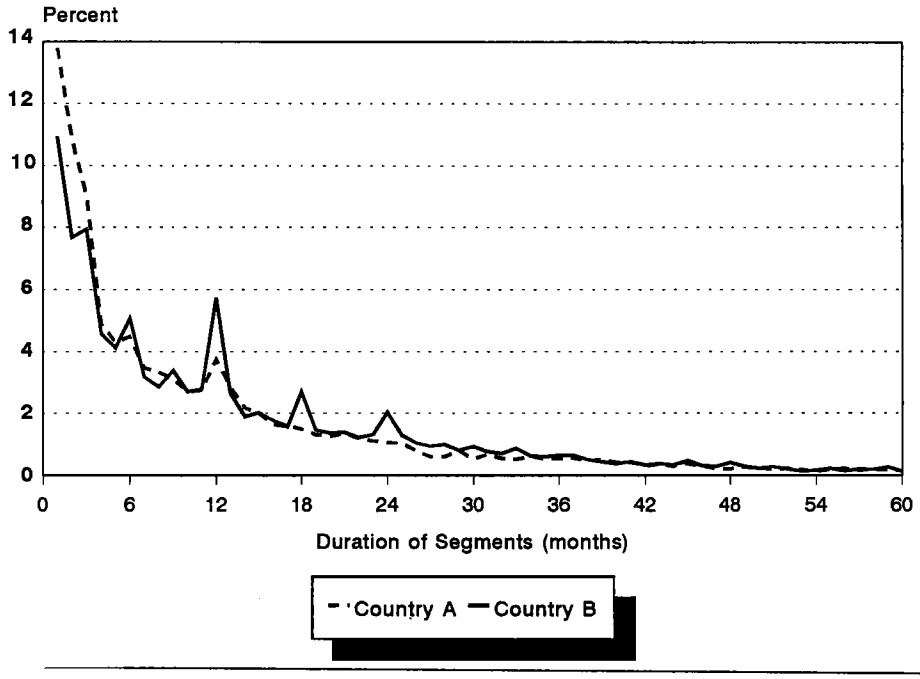


Table 1.2 Distribution of discontinued segments of use by reason for discontinuation and status in the month immediately following discontinuation, Country A.

Reason for discontinuation	Status in the month after discontinuation: Pregnant	Termination	Not using a method	Using another method	Total	Percent of the exposed[1] pregnant
Failure	1972	0	0	0	1972	100.0
To get pregnant	49	0	772	0	821	6.0
Other reason	57	4	1138	2195	3394	5.1
Total	2078	4	1910	2195	6187	52.2

[1] The exposed are defined as those users who are not using another method of contraception in the month following discontinuation of their original method, i.e., the denominator for the percentage includes those women who are pregnant, who experienced a termination, or who are not using any method of contraception.

ately switch to another method were pregnant in the month after discontinuation. Again, this figure does not indicate that failures are misreported as discontinuations for other reasons and both figures are plausible.[1]

Conclusions

Country A's retrospective reproductive calendar appears to provide high quality data for further analysis of contraceptive use dynamics. Table 1.1 suggests that reporting of contraceptive use is complete even in the earliest months of the calendar. The level of heaping shown in Figure 1.1 was moderate, and Table 1.2 showed no evidence for misreporting of contraceptive failures as intended pregnancies.

Although these data quality checks do not detect any serious data quality problems in the calendar data, this does not guarantee that none exist. Data quality checks such as these are not able to detect all problems. In particular, respondents may omit contraceptive failures and the associated pregnancy,

[1] These first-month conception probabilities appear lower than might initially be expected given that fecundability is frequently quoted in the range 0.2-0.3 (Bongaarts and Potter, 1983; Wood and Weinstein, 1988). However, first-month conception probabilities should not be used as an estimate of fecundability because of reporting and sampling errors. There is inherent imprecision in the exact timing of events due to the way in which calendar data are collected and recorded, and the consequences of this imprecision are more serious for events occurring at short durations (Goldman et al., 1984). In addition, in a contracepting population, women who discontinue use for nonpregnancy reasons and do not switch to another method are likely to be self-selected for lower fecundability.

especially if the pregnancy was terminated by an induced abortion. Studies based on U.S. data suggest that abortion reporting in surveys is extremely incomplete and that the omission of contraceptive failures resulting in induced abortion causes a substantial downward bias in estimates of contraceptive failure rates (Grady et al., 1986; Jones and Forrest, 1992). The extent of this bias will vary across countries and will depend on the extent to which women resort to induced abortion if contraceptive failure occurs and the extent to which they report such behavior. Such under-reporting is extremely difficult to detect without reliable external information on induced abortion (which is rarely available). Consequently, no attempts have been made to examine this issue in this section. However, analysts should be aware that this is a potential problem.

Analysis Tools

The analyses presented in this section are all based on simple frequencies and cross tabulations. The program SECT1A.INC produces the contraceptive prevalence distribution at the time of the DHS-I survey. This program uses the raw rectangular data file and the key feature here is to read from the first column of the calendar only the one month corresponding to the average survey date of the earlier survey. This will be country-specific. You will need to create your own version of this program for your particular country using the SELECT program (see Appendix B). Further details are given in the program.

The program SECT1B.INC produces the frequencies and cross tabulations required for Figure 1.1 and Table 1.2. It is based on the segments file obtained using CAL2SPSS (see Appendix B) and can easily be adapted for other countries.

2 CONTRACEPTIVE PREVALENCE

Description of Analysis

This section presents a decomposition of the current status of all surveyed women. They are divided into mutually exclusive and exhaustive exposure/prevalence categories, which are then further analyzed by standard demographic variables. The descriptive analysis should give the analyst a "feel" for the cross-sectional contraceptive prevalence structure of the population.

The cross-sectional nature of the analysis limits interpretation of contraceptive dynamics. It does not capture the dynamics of women shifting in and out of different exposure states through time. Rather it is a "snapshot" in time of a population's contraceptive status. Analyses of unmet need and potential clinic demand usually account for the dynamics of women moving through different exposure states through time.

Application and Significance

Before proceeding to more elaborate analyses of contraceptive dynamics, we define and examine the prevalence structure at the time of the survey. This type of table is the main prevalence result presented by contraceptive surveys. The DHS First Country Reports present contraceptive prevalence distributions that are less detailed than those defined in this section. However, this mutually exclusive and exhaustive categorization is needed later in Section 8.

The decomposition in this section sets up a simple policy-relevant exercise in Section 8. Starting with a static distribution of women across all prevalence categories, the analyst may ask such policy-relevant questions as:

- How much will the birth rate go down if half of all exposed women who want no more births begin to use contraception?
- What if 75 percent of women who are using ineffective methods shift to more effective methods?
- What would the TFR fall to if the failure rate of periodic abstinence were halved?

The answers to these questions can help policymakers weigh the costs and benefits of programming and resource-allocation decisions.

This simple projection technique begins with the prevalence structure presented in this section. The analyst should note that the example presented is for a DHS country where data on all women were collected. If the sample is of ever-married women only, the analyst must decide what assumptions to make about the exposure status of never-married women. If appropriate and realistic, they should be included in the Not Exposed division, within their own category of Never Married. This assumption is warranted only where premarital births are negligible. If premarital births are even slightly prevalent, some never-married women must be allocated to the Exposed categories. In either case, the appropriate analytic assumption must be made upon sources of data external to the DHS survey.

For countries in which only ever-married women were sampled, the static simulation model in Section 8 can be useful in estimating the fertility consequences of

- Extending a family planning program to unmarried women, and
- Increasing sexual exposure among the never-married population.

Background Theory and Analytic Details

It is important to recognize that the current structure of a population's contraceptive prevalence is fully determined by its past history of adoption and discontinuation rates. Adoption rates are influenced by the availability and costs of contraceptive methods, traditions among a country's medical community, cultural factors, and the individual characteristics of women who either need contraception or who are willing to switch. Discontinuation rates depend on method efficacy and quality of use, rumors and mass media, and users' characteristics. The evolution, over time, of heterogeneity in risk among segments of the population adds an additional layer of complexity.

Raising or lowering adoption or discontinuation may affect the prevalence structure in paradoxical ways. For example, a big public campaign to increase use of one method may actually increase overall discontinuation. The mechanism is as follows: the newly recruited women may have lower motivation to contracept and higher fecundability than pre-existing users. The overall prevalence structure is affected by manipulating either adoption or discontinuation, but only a detailed understanding of contraceptive dynamics can help predict in which direction.

The first division of women is by whether or not they are exposed to the risk of pregnancy, and if so, whether they are currently using a contraceptive method. All categorizations are based on respondents' self-reports. The first column of Table 2.1 shows the three primary divisions. Within the category of Not Exposed are 1) Never Had Sex, 2) No Sex in the Last Four Weeks, 3) Currently Pregnant, 4) Post-Partum Amenorrheic, and 5) Non-Contraceptively Sterile. If data on post-partum amenorrhea are not directly available, current breastfeeding status may be used as a proxy. With the exception of 2), these are all current statuses in which it is (theoretically) impossible to become pregnant. Four weeks without coitus is an arbitrary cut-off to classify women as not currently sexually active.

Table 2.1 Decomposition of the population of Country A into exposure/prevalence categories

Prevalence categories and exposure/ prevalence status	Total
Not exposed	
Never had sex	30.4
No sex in last 4 weeks	18.3
Pregnant	4.2
Post-partum amenorrheic	5.4
Non-contraceptively sterile	1.8
Using a method	
Pill	3.4
Injectable	1.0
IUD	7.0
Sterilization	3.8
Condom	1.8
Spermicides	.5
Periodic abstinence	11.7
Withdrawal and other	2.7
Not using a method	
Wants more within 2 yrs	1.7
Wants no more or more in 2+ years	5.0
Intention undetermined	1.3
Column totals	100.0

Within the category of Using a Method are all the familiar methods. In Country A, 7.0 percent of all women 15-49 are using the IUD, and 11.7 percent use some form of periodic abstinence. This analysis follows the convention that if women report using two or more methods simultaneously, they are coded as users of the presumptively higher-efficacy method.

The category of Not Using a Method is divided according to current birth intentions. The survey asked currently married nonusers whether they want more children, and if so, when. The table groups women who want no more with those who want more in the distant future (2+ years). It classifies women as wanting more only if they want more within two years. Their answers are the basis of classifying married women into one of these two categories.

As is standard practice in DHS surveys, Country A's survey asked only currently married women whether they want more children. Women who are not currently married are skipped, so if they are exposed nonusers, their reproductive intentions are undetermined. Into this category fall a small number of women who give ambiguous or uncodable answers. For most subgroups, the Intention Undetermined category is less than two percent of all women.

Discussion of Results

Table 2.1 presents the exposure/prevalence categorization for all women in Country A. As noted above, a large proportion of women use periodic abstinence and the IUD as their contraception. Five percent of the population are exposed, want no more births, and are not using contraception. A large proportion of the unintended pregnancies are likely to come from this group.

Table 2.2 replicates the categorization for five-year age groups. The proportion of women who want no more births, but are not using contraception, rises steadily with age. There appears to be little contraceptive use before the mid-20s, with the exception of periodic abstinence. The patterns of sexual activity and pregnancy are consistent with one another and with the contraceptive prevalences.

Table 2.2 Decomposition of the population of Country A into exposure/prevalence categories by age group

Prevalence categories and exposure/ prevalence status	Age group						
	15-19	20-24	25-29	30-34	35-39	40-44	45-49
Not exposed							
Never had sex	81.4	42.5	16.2	6.5	3.5	2.8	2.5
No sex in last 4 weeks	6.9	17.2	19.9	21.5	22.0	25.5	30.6
Pregnant	2.4	6.2	6.6	6.1	3.6	1.4	0.2
Post-partum amenorrheic	1.9	6.8	10.8	7.0	5.3	2.9	0.8
Non-contraceptively sterile	0.0	0.0	0.3	0.3	0.6	4.9	15.4
Using a method							
Pill	0.5	3.3	5.6	6.9	4.6	1.7	1.2
Injectable	0.1	1.2	1.6	2.0	1.5	0.7	0.1
IUD	0.4	5.4	11.4	13.1	11.1	7.4	2.5
Sterilization	0.0	0.1	1.1	3.9	10.4	11.3	9.6
Condom	0.5	1.5	2.1	3.2	2.6	2.5	1.7
Spermicides	0.1	0.3	0.5	0.9	0.6	1.2	0.6
Periodic abstinence	2.2	8.3	13.6	18.0	19.6	18.4	11.5
Withdrawal and other	0.6	1.9	3.1	3.3	4.2	5.1	3.4
Not using a method							
Wants more within 2 years	0.4	1.0	2.4	2.6	3.0	2.0	1.7
Wants no more or more in 2+ years	1.0	2.7	3.6	3.9	6.5	11.1	17.4
Intention undetermined	1.7	1.6	1.2	0.9	1.0	1.1	0.8
Column totals	100.1	100.0	100.0	100.1	100.1	100.0	100.0
Percentage in column	21.9	19.3	16.1	13.3	12.1	9.7	7.5

Table 2.3 shows prevalence status by parity. There appears to be little contraceptive use before the first birth. However, once women have had children, contraceptive use increases.

Table 2.3 Decomposition of the population of Country A into exposure/ prevalence categories by parity

Prevalence categories and exposure/ prevalence status	Parity			
	None	1-2	3-4	5+
Not exposed				
Never had sex	79.8			
No sex in last 4 weeks	8.1	28.7	20.2	23.3
Pregnant	2.5	5.4	5.1	5.0
Post-partum amenorrheic		7.0	9.7	10.0
Non-contraceptively sterile	0.2	1.4	2.8	4.6
Using a method				
Pill	0.9	6.1	4.5	3.6
Injectable	0.2	1.6	1.8	1.3
IUD	0.1	14.8	12.1	5.1
Sterilization	0.0	1.6	9.0	9.8
Condom	0.9	2.6	2.9	1.6
Spermicides	0.1	0.8	1.0	0.5
Periodic abstinence	2.8	17.3	18.4	15.8
Withdrawal and other	0.4	3.2	4.3	5.3
Not using a method				
Wants more within 2 yrs	1.6	3.0	1.3	0.4
Wants no more or more in 2+ years	0.3	5.3	6.5	13.2
Intention undetermined	2.0	1.2	0.6	0.5
Column totals	99.9	100.0	100.2	100.0
Percentage in column	38.1	25.7	18.5	17.7

The prevalence status for urban versus rural residents in Country A is decomposed in Table 2.4. Urban dwellers are more than twice as likely to be IUD users as rural women. This may be a result of program accessibility. Rural women are more likely to be currently pregnant or amenorrheic and to be in need but not using a method.

Conclusions

These tables portray a country with moderate contraceptive use and strong reliance on periodic abstinence. There is little use of contraception before the first birth. Although a small proportion of women are not using but want no more children, many of the unintended pregnancies will come from their ranks. The categorization presented in this section is the first step to more elaborate analyses, and gives the analyst a feel for the current prevalence structure in Country A. These data are used in Section 8 in a simple model of prevalence and reproduction.

Table 2.4 Decomposition of the population of Country A into exposure/prevalence categories by residence type

Prevalence categories and exposure/ prevalence status	Residence	
	Urban	Rural
Not exposed		
Never had sex	33.9	18.2
No sex in last 4 weeks	17.7	20.6
Pregnant	3.2	7.4
Post-partum amenorrheic	3.2	12.7
Non-contraceptively sterile	1.8	1.8
Using a method		
Pill	3.6	2.6
Injectable	1.1	1.0
IUD	8.1	3.2
Sterilization	4.3	2.1
Condom	2.1	0.9
Spermicides	0.5	0.4
Periodic abstinence	11.2	13.3
Withdrawal and other	2.4	3.6
Not using a method		
Wants more within 2 yrs	1.6	2.1
Wants no more or more in 2+ years	3.9	8.9
Intention undetermined	1.3	1.3
Column totals	99.9	100.1
Percentage in column	77.5	22.5

Analysis Tools

Two SPSSPC programs accompany the analysis presented in this section. The first program, SECT2A.INC, is the output program from the SELECT program that extracts the variables used in the analysis in this section. This program is for illustrative purposes and you will need to use the SELECT program to create your own version of SECT2A.INC containing the corresponding variables that you need to extract from your data file. The second program, SECT2.INC, actually codes the exposure/prevalence status of each woman and produces the cross tabulations presented in the analysis. This program can be adapted to examine the exposure/prevalence status by other background characteristics. You will need to modify this program to match your data set.

HINT: Copy the program SECT2.INC to a new file and edit the new file to suit your needs. A backup copy of all the original programs will still be available if needed.

3 DISCONTINUATION RATES

Description of Analysis

The calculation of contraceptive discontinuation rates at different durations of use using life-table techniques is illustrated in this section. The median duration of use is presented for different methods for Country A, along with 12-month and 24-month discontinuation rates. The percentage of users still using at each duration are plotted for selected methods. Differentials in discontinuation patterns by contraceptive intent and area of residence are also explored for all reversible methods combined and for the pill, and the role of method choice in determining differentials in contraceptive discontinuation is illustrated. It should be stressed at this point that the analyses in this section relate to *method* discontinuation rather than to discontinuation of all contraceptive use, i.e., switching methods is considered as a discontinuation of the original method. Method switching is examined in Section 5.

Application and Significance

The success of a particular method of contraception in preventing unwanted pregnancy and reducing fertility depends not only on the number of women who are using it at a particular moment in time, but also on continuity of use. As levels of contraceptive prevalence rise, contraceptive discontinuation rates become an increasingly important indicator of the success and quality of the family planning program. High levels of discontinuation may suggest either high levels of dissatisfaction among users with particular aspects of a method or high levels of failure. Analysis of discontinuation rates aids understanding of the whole process of contraceptive use in the population. In addition, it indicates which methods women experience difficulties maintaining use of, and which groups of users are most likely to discontinue use of particular methods. This, in turn, can highlight program areas that require development, as well as groups of users who have particular problems that need to be addressed.

Background Theory and Analytic Detail

In DHS surveys, the calendar is used to collect month by month information on all segments of use from a particular date up to the time of the survey. The unit of analysis for the study of discontinuation is a segment of use of a particular method of contraception. However, because many women are still using a method at the time of the survey, the duration of that particular segment of use is unknown. Such segments of use are called *censored*, and they cannot be dropped from the analysis

since this would bias the results. The appropriate methodology for the analysis of data containing censored observations is the *life table* (see Appendix A). Life tables are used to study the transition from one event to another, in this case the transition from initiating use of a particular method of contraception to discontinuing its use, while allowing the information from censored segments of use to be included in the analysis. From the life table, the probability of discontinuing use in each month following initiation can be calculated. Separate life tables can be constructed for different methods or for different subgroups of the population.

The most commonly used summary life-table measure of discontinuation is the 12-month discontinuation rate. This represents the percentage of users who discontinue use of a method within a year.[1] Similar measures can be calculated for other durations, for example the 24-month discontinuation rate represents the percentage of users who discontinue use within two years. Another summary measure that can be obtained from the life table is the median duration of use. The life-table median is defined as the duration by which half the users have discontinued use. As such, it differs from the ordinary statistical median which cannot handle censored data. Graphs of the proportion of users still using the contraceptive method at the start of each month following initiation of use (known as survival curves) are also helpful in presenting discontinuation patterns.

Methods of contraception vary in their convenience, effectiveness, and availability and in the side effects they can cause. Consequently, discontinuation rates are expected to vary by method. The propensity to discontinue use of a contraceptive method is also expected to depend on the characteristics of the user. For example, users who do not wish to have any more children would be expected to be more highly motivated to avoid pregnancy than those who are trying to space their births; hence, they would be expected to discontinue less frequently. Users in rural areas might be expected to discontinue use more frequently because their access to a regular supply of their contraceptive method or to information on how to use a particular method correctly may be less. However, analysis of discontinuation rates by method or by characteristics of the users is complicated by the role of method choice. Highly motivated users are likely to choose long-term methods that are easy to maintain use of, such as IUD, whereas the choices of rural users may be more limited than urban users. Hence, differentials in discontinuation rates by method at least partly reflect characteristics of the users of the method in addition to characteristics of the method.

[1] More accurately, it is the percentage of segments of use that end within a year but in this document we will use the term "user" to represent a woman who is using a particular method at a particular point in time (see Glossary). However, it should be understood that the analysis is based on segments of use of each method. Thus, individual women may contribute several segments of use, i.e., they may represent more than one "user."

Conversely, differentials in the total discontinuation rates by characteristics of users at least partly reflect the choice of methods of those users. Thus, often it is most useful to examine differentials in discontinuation rates by background characteristics for individual methods.

Discussion of Results

The 12-month and 24-month discontinuation rates together with the median duration of use for each method in Country A are shown in Table 3.1. More than half of the segments of use of all methods except IUD and periodic abstinence end within a year. Discontinuation rates are particularly high for condom, injectables, and vaginal methods. In contrast, the discontinuation rate for the IUD is very low, with only 12 percent of users discontinuing within a year of initiating use and a median duration of use of 46 months. The discontinuation rates for the most frequently used method, periodic abstinence, are slightly lower than for other methods (except IUD) with just under half of users discontinuing within a year.

Table 3.1 Life-table discontinuation rates and median durations of use by method: Country A.

Method	12-month discon-tinuation rate (%)	24-month discon-tinuation rate (%)	Median duration of use (months)	Number of segments of use
Pill	55.8	72.1	9.6	1584
IUD	12.0	22.0	45.9	1395
Injectables	67.3	79.5	5.9	661
Vaginal methods	71.5	83.6	5.3	372
Condom	65.6	81.7	4.8	739
Periodic abstinence	48.4	68.3	12.5	3882
Withdrawal	56.8	74.9	9.0	810
Other	52.4	75.0	10.7	312
Total[1]	47.2	63.4	12.9	10043
Total[2]	48.6	65.2	12.5	9755

[1]All methods, including sterilization.
[2]All reversible methods, i.e., excluding sterilization.

Figure 3.1 illustrates the percentage of users still using at each duration following initiation for pill, IUD, and vaginal methods. Discontinuation for both pill and vaginal methods is particularly rapid in the early months following adoption and then levels off somewhat after 18 months of use. This pattern is particularly marked for vaginal methods, which experience very rapid discontinuation in the first six months of use. Discontinuation of the IUD is much more evenly spread over the first three years of use. The much lower IUD discontinuation rates can be seen very clearly from the figure.

Figure 3.1: Percentage of Users Still Using Selected Methods at Each Duration, Country A

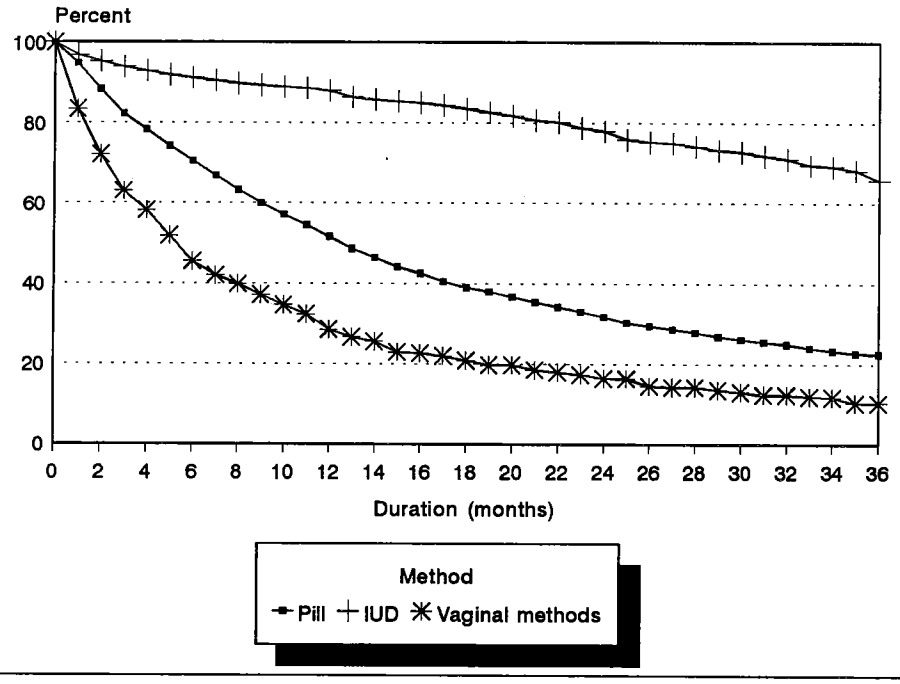


Table 3.2 presents the 12-month and 24-month discontinuation rates and the median duration of use for all reversible methods combined by contraceptive intent and area of residence. Discontinuation rates at both 12 and 24 months of use are higher for users who are trying to delay future births than for users who are trying to prevent any further births. This is consistent with the hypothesis that spacers are likely to be less motivated than limiters. In addition, spacers may discontinue use in order to become pregnant. The urban-rural differentials are much smaller, with urban users experiencing only slightly lower discontinuation rates at each duration than rural users.

As discussed earlier, examination of differentials in discontinuation rates for all methods combined is limited because it does not take into account the fact that different types of women choose different types of method. Consequently, the distribution of segments across methods differs for different subgroups of users. This is illustrated in Table 3.3. Users who are trying to limit childbearing are more likely to use the IUD in a segment of use whereas users who are trying to space births are more likely to choose the pill, periodic abstinence, or a barrier method. Similarly, users in rural areas are more likely to use periodic abstinence and withdrawal and less likely to use the pill, the IUD, and barrier methods than users in urban areas.

Table 3.2 Life-table discontinuation rates and median duration of use for all reversible methods by contraceptive intent and area of residence: Country A.

Method	12-month discon-tinuation rate (%)	24-month discon-tinuation rate (%)	Mediam duration of use (months)	Number of segments of use
Contraceptive Intent[1]				
Spacer	57.0	75.0	9.1	5058
Limiter	39.3	53.9	19.8	4658
Area of Residence				
Urban	47.9	64.1	12.8	7646
Rural	51.3	69.3	11.5	2109
Total	48.6	65.2	12.5	9755

[1]Excludes 39 missing cases

Table 3.3 Distribution of segments of use by method for selected subgroups of users: Country A.

	Characteristics of users				
Method	Spacers	Limiters	Urban	Rural	Total
Pill	16.8	14.7	17.1	11.0	15.8
IUD	11.5	16.4	15.8	7.0	13.9
Injectables	6.5	6.6	6.9	5.4	6.6
Vaginal methods	4.4	3.0	4.0	2.4	3.7
Condom	8.5	6.3	8.3	4.1	7.4
Periodic abstinence	41.9	35.4	35.0	52.1	38.6
Withdrawal	8.1	8.0	7.4	10.4	8.1
Other	2.3	3.9	2.5	5.5	3.1
Sterilization	0.0	5.8	3.1	2.1	2.9
Total	100.0	100.0	100.0	100.0	100.0
No. of segments	5058	4946	7890	2153	10,043

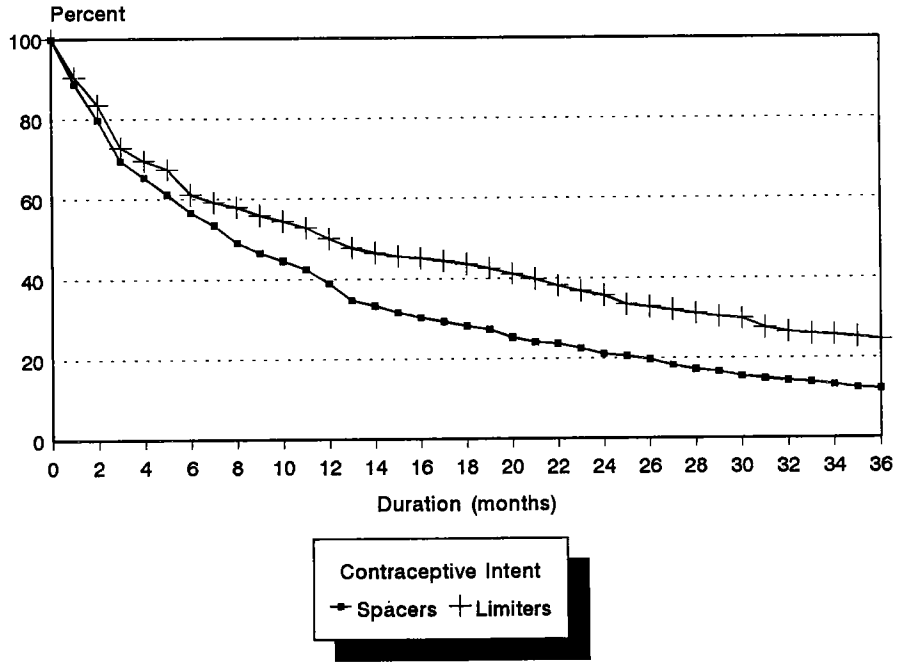
Table 3.4 presents 12-month and 24-month discontinuation rates and the median duration of use for the pill by contraceptive intent and area of residence. The differentials in discontinuation rates for the pill are similar to those observed for all reversible methods but the magnitude is smaller. This reflects the influence of method choice on socioeconomic differentials in discontinuation rates. Users who are using the pill to space births are more likely to discontinue use at each duration than users who are trying to limit childbearing. Even so, half of the segments of pill use by limiters end within a year, although this figure does include discontinuations in order to change to another method. Figure 3.2 shows that discontinuation rates are very similar for spacers and limiters in the first three months of use and it is only after six months of

Table 3.4 Life-table discontinuation rates and median duration of use for the pill by contraceptive intent and area of residence: Country A.

Method	12-month discontinuation rate (%)	24-month discontinuation rate (%)	Mediam duration of use (months)	Number of segments of use
Contraceptive Intent[1]				
Spacer	61.1	79.0	7.8	851
Limiter	49.9	64.4	12.0	727
Area of Residence				
Urban	55.5	71.8	9.9	1348
Rural	57.2	74.2	8.8	236
Total	55.8	72.1	9.6	1584

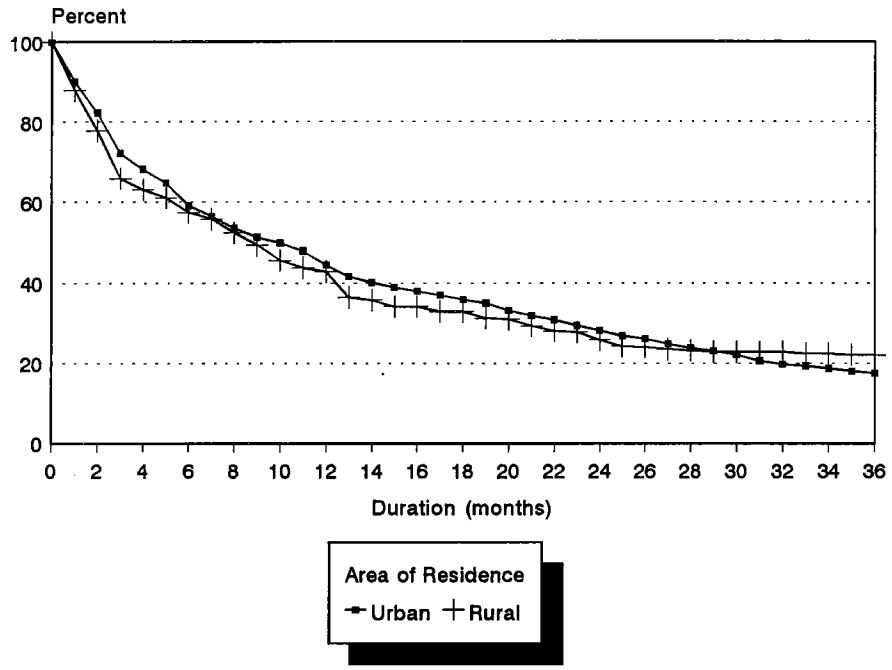
[1] Excludes six missing cases

Figure 3.2: Percentage of Users Still Using the Pill at Each Duration by Contraceptive Intent, Country A



use that a large differential appears. In contrast, there is very little difference in the discontinuation rates of urban and rural pill users (Figure 3.3). The median duration of pill use is about a month higher for urban users than for rural users but the two groups of users present very similar pill discontinuation patterns.

Figure 3.3: Percentage of Users Still Using the Pill at Each Duration by Area of Residence, Country A



Conclusions

Analyses of contraceptive discontinuation rates from calendar data are more technically demanding than many other demographic analyses because life-table techniques are required to handle the problem of censoring. However, life-table analyses of discontinuation rates and patterns are very useful for understanding women's experience with particular methods of contraception. High levels of discontinuation often indicate dissatisfaction with the method and ultimately limit the fertility impact of the method. The analyses of discontinuation rates for individual methods in Country A clearly demonstrate differences between methods in their attractiveness to women for long-term use. In particular, the IUD presents much lower discontinuation rates than other methods, whereas condoms, injectables, and vaginal methods present high discontinuation rates. However, discontinuation rates are relatively high for most methods,

even among users who are expected to be highly motivated, which suggests that discontinuation of contraceptive methods is universally an important issue that should be addressed in the family planning programs.

Analysis Tools

The SPSSPC program that was used to perform the analysis in this section is SECT3.INC. As indicated in the program, it can be modified to suit your needs. The program produces a large amount of output that can be edited and imported into a graphics program or spreadsheet to produce graphs such as Figure 3.1. The median duration of use is printed in the output. The proportion of users still using at the *end* of each duration is in the column of the life-table headed "CUMUL PROPN SURV AT END." The 12-month discontinuation rate is obtained by subtracting the proportion still using at the end of month 11 in the output from 1. This procedure can be repeated for discontinuation rates at other durations.

HINT: Copy the program SECT3.INC to a new file and edit the new file to suit your needs. Thus, a backup copy of all of the original programs will still be available if you need them.

4 DISCONTINUATION RATES BY REASON FOR DISCONTINUATION

Description of Analysis

The analysis introduced in this section derives discontinuation rates at different durations of use, broken down by reason for discontinuation. The cumulative probability of discontinuing use within a year for each reason is presented for each method for Country A. This is followed by an illustrative analysis of differentials in pill discontinuation by contraceptive intent and area of residence, again based on analysis of cumulative discontinuation rates by reason. The relative importance of different reasons is illustrated in both analyses using bar charts of the percentage breakdown of the 12-month discontinuation rate by reason. Again, it should be stressed that switching to another method is considered as a discontinuation of the original method in these analyses.

Application and Significance

The examination of total discontinuation rates, as described in Section 3, provides a useful insight into overall levels of and differentials in contraceptive discontinuation. However, from a policy perspective it is often equally important to understand why users discontinue use of a particular method of contraception since the policies required to address discontinuation for one reason are likely to differ from those required to address discontinuation for other reasons. In addition, analysis of the reasons why different groups of users discontinue different contraceptives can provide valuable insights into the advantages and disadvantages of the different methods, which in turn can result in improved counseling and a greater understanding of contraceptive use dynamics in the population. The analyses described in this section are primarily aimed at describing and understanding the *observed* levels and patterns of discontinuation by reason in different populations. Hence, they are particularly useful for the design of policies aimed at reducing discontinuation rates.

Background Theory and Analytic Details

The analysis of discontinuation rates by reason for discontinuation is basically an extension of the analysis of total discontinuation rates described in Section 3. The issue of censoring of the duration of use for segments of use still in progress at the time of the survey remains, so life-table methodology has to be employed. However, the analysis is complicated by the fact that discontinuations now have to be broken down by the reason for discontinuation. This is done through the use of a *multiple-decrement life*

table (see Appendix A). In this illustrative analysis, the reasons for discontinuation are divided into five mutually exclusive and exhaustive categories: failure, to get pregnant, side effects, other method-related reasons (partner disapproved, health concerns, availability, want a more effective method, inconvenient to use, and cost), and other reasons (infrequent sex, separated/widowed, fatalistic, don't know, subfecund, and other). The multiple-decrement life table is constructed with five modes of decrement corresponding to each of these groups of reasons. Hence, it contains five columns of discontinuation rates, one for each reason. These reason-specific discontinuation rates are calculated by dividing the number of discontinuations for a particular reason at each duration by the exposure at that duration obtained from the ordinary single-decrement life table. Hence, the discontinuation rates for all five reasons add up to the total discontinuation rate at each duration.

In practice, a user may discontinue use for any of a number of reasons. Such a situation is often described as a "competing risks" situation. The multiple-decrement life table models this observed situation as if all risks are present in the life table, e.g., a user may discontinue for any of five reasons. The discontinuation rates calculated from a multiple-decrement life table are called *net* discontinuation rates because they represent the discontinuation rates due to a particular reason *in the presence of other reasons* for discontinuing. Hence, the net discontinuation rates for each reason depend on the discontinuation rates for the other reasons (see Appendix A for further discussion of net rates).

One of the most useful measures obtained from the multiple-decrement life table for contraceptive discontinuation is the cumulative probability of discontinuation for each reason. This represents the probability that a user discontinues use by a given duration for each reason. For example, the 12-month cumulative probability of failure represents the probability that a user discontinues due to failure within the first 12 months of use. Typically, 12-month cumulative discontinuation rates are presented for each reason, but the rates could also be presented for other durations.

It is sometimes difficult to compare cumulative discontinuation rates for different reasons across methods or subgroups of the population because the overall discontinuation rate may vary. Thus, it is difficult to assess the relative importance of different reasons in different groups. One way to reduce this problem is to examine the percentage breakdown of the 12-month discontinuation rate by reason for discontinuation. The breakdown is obtained by dividing the reason-specific discontinuation rate by the total discontinuation rate. Such an approach can be a useful complement to the presentation of the reason-specific discontinuation rates.

Discussion of Results

Table 4.1 presents 12-month (cumulative) discontinuation rates by reason for each method in Country A. Note that, as expected, the discontinuation rates for the individual reasons sum to the total discontinuation rate, which provides a useful check that the rates are correct. The 12-month discontinuation rate due to side effects is particularly high for injectables and pill. In contrast the 12-month discontinuation rate due to failure of the method is particularly high for periodic abstinence, other methods, and withdrawal. Relatively few users of any method except vaginal methods discontinue use within a year in order to get pregnant. This is probably because the majority of women who want a birth within two years are unlikely to initiate contraceptive use. The 12-month discontinuation rate for method-related reasons ranges from 2 percent for the IUD to 32 percent for the condom and is also over 20 percent for withdrawal, injectables, and vaginal methods.

Table 4.1 Life-table 12-month discontinuation rates by reason for discontinuation and method: Country A.

	Reason for discontinuation					
Method	Failure	To get pregnant	Side effects	Method-related reason	Other reasons	Total
Pill	4.1	5.9	22.2	12.5	11.2	55.8
IUD	1.2	0.6	7.2	2.0	1.0	12.0
Injectables	4.2	4.0	28.0	22.4	8.7	67.3
Vaginal methods	14.2	10.9	9.0	25.3	12.1	71.5
Condom	8.7	5.7	5.7	31.8	13.8	65.6
Periodic abstinence	27.3	6.9	0.1	8.3	5.8	48.4
Withdrawal	20.5	6.2	0.8	20.1	9.2	56.8
Other	23.1	5.2	0.6	13.6	9.8	52.4
Total[1]	15.1	5.4	7.3	12.2	7.2	47.2
Total[2]	15.6	5.6	7.5	12.5	7.4	48.6

[1]All methods, including sterilization.
[2]All reversible methods, i.e., excluding sterilization.

Figure 4.1 presents the breakdown of the 12-month discontinuation rates by reason for each method. In large part, this figure confirms the patterns seen in Table 4.1. Side effects are by far the main reason for discontinuation for the IUD, pill, and injectables. However, note that in the case of the IUD only seven percent of users actually discontinue use within 12 months due to side effects because the overall discontinuation rate is so low. Method-related reasons are important for the two male methods, condom and withdrawal, although failure is also an important reason for discontinuing withdrawal. Method-related reasons also account for a significant portion of discontinuation of vaginal methods and injectables. For periodic abstinence, failure is by far the main reason for discontinuing use.

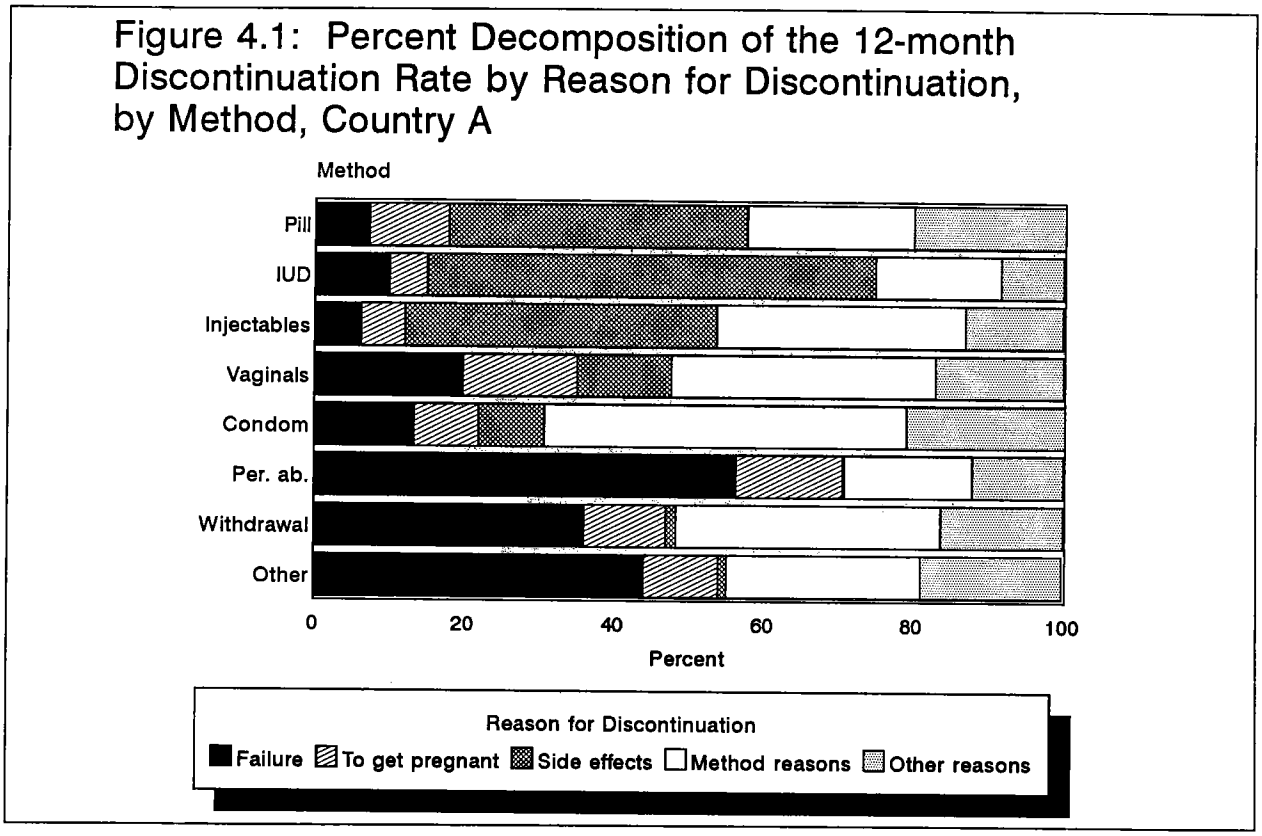


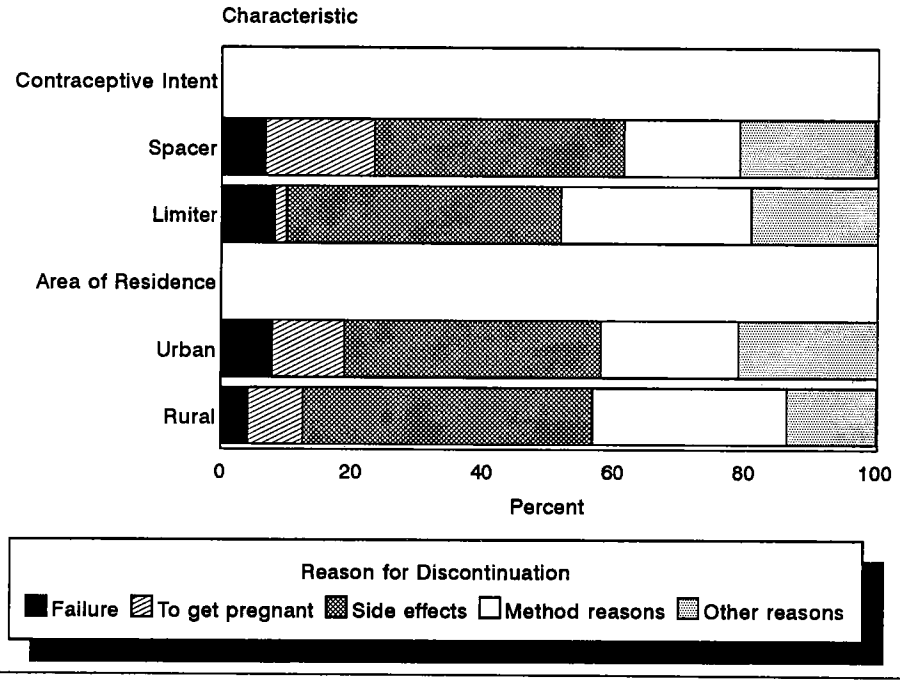
Table 4.2 presents the 12-month reason-specific discontinuation rates for the pill by contraceptive intent and area of residence. Figure 4.2 illustrates the percentage breakdown of the total discontinuation rates by reason. As would be expected, the higher overall discontinuation rate of spacers is due primarily to a much higher discontinuation rate in order to get pregnant. For both limiters and spacers, side effects are the main reason for discontinuation. This reason accounts for a very similar percentage of the total discontinuation rate for both groups although the rate itself is slightly higher for spacers. Other method-related reasons are more important as a reason for discontinuation for limiters than for spacers and this

Table 4.2 Life-table 12-month discontinuation rates for the pill by reason for discontinuation, by contraceptive intent and area of residence: Country A.

Characteristic	Reason for discontinuation: Failure	To get pregnant	Side effects	Method-related reasons	Other reasons	Total
Contraceptive Intent[1]						
Spacer	4.1	10.2	23.3	10.8	12.6	61.1
Limiter	4.1	0.9	20.9	14.5	9.6	49.9
Area of Residence						
Urban	4.4	6.1	21.7	11.7	11.7	55.5
Rural	2.4	4.8	25.3	17.0	7.8	57.2
Total	4.1	5.9	22.2	12.5	11.2	55.8

[1]Excludes six missing cases.

Figure 4.2: Percent Decomposition of the 12-month Pill Discontinuation Rate by Reason for Discontinuation, by Background Characteristics, Country A



may include switching to another method suitable for long-term use, such as sterilization or IUD. The rate of discontinuation due to failure is identical in the two groups.

Although the overall pill discontinuation rate is very similar for urban and rural users, there is some variation in the reason for discontinuation. Side effects are again the main reason for discontinuation in both areas. However, discontinuation due to side effects and other method-related reasons is higher in rural areas than in urban areas, and discontinuations for other reasons, including failure, are correspondingly lower.

Conclusions

This type of analysis is relevant for many policy decisions. For example, policies aimed at reducing pill discontinuation clearly need to focus on reducing discontinuations due to side effects. In contrast, policies aimed at reducing discontinuation of periodic abstinence need to focus on reducing failure rates. The information from this analysis could be utilized effectively in conjunction with other information. For example, data on current use of contraception in Country A show that periodic abstinence is the most widely used method of contraception (Section 2), yet it has very high failure rates. One policy to reduce failure rates in the population of contraceptive users as a whole might be to promote use of more effective methods of contraception. The pill certainly presents much lower failure rates in this analysis, yet any assessment of its suitability as an alternative method must take into account the high discontinuation rate due to side effects.

The analysis can be adapted to answer a range of questions. It is particularly useful in describing the observed patterns of discontinuation in a population. Multiple-decrement life tables can be constructed for subgroups of the population and specific methods of interest, subject to the restriction that there are enough segments of use to enable construction of the life table. The reasons for discontinuation can be grouped in different ways to enable the analysis to focus on particular reasons for discontinuation. The number of modes of decrement can be varied from two upwards, although some grouping of reasons is advisable in most situations because it enables more accurate estimation of discontinuation rates and simplifies interpretation. The disadvantage of the method is that it is quite complex to implement. Also, the results must be carefully interpreted. In particular, it is important to remember that the rates calculated are net rates so they depend on each other. Consequently, reducing the discontinuation rate for one reason will almost inevitably lead to some increase in discontinuations due to other reasons.

Analysis Tools

The program SECT4.INC was used for the analyses in this section. Again, this can be modified to suit your needs as indicated in the program. You need to run this program separately for each subgroup for which you want to construct a life table. The program produces the cumulative discontinuation probabilities for each reason at each duration up to 36 months. Note that these correspond to the cumulative probabilities of discontinuing by the *end* of each month. This information is written to a file named MDLT5.REP in this example to correspond with the five modes of decrement. Because the file will be overwritten the next time the program is run, it must be renamed or printed each time. The 12-month discontinuation rates by reason correspond to the cumulative probabilities of discontinuing by the end of month 11.

HINT: Copy the program SECT4.INC to a new file and edit the new file to suit your needs. Thus, there will be a backup copy of all the original programs if needed.

5 METHOD SWITCHING

Description of Analysis

This section introduces an analysis of contraceptive switching behavior. The contraceptive status in the month immediately following discontinuation is investigated in conjunction with information on the reason for discontinuation, and the cumulative probability of switching to each of three new statuses within 12 months of initiating use is calculated. These 12-month cumulative switching rates are presented for each method in Country A. Differentials in pill switching behavior by contraceptive intent and area of residence are then investigated.

Application and Significance

Contraceptive discontinuation and contraceptive switching behavior are closely related. In particular, the significance of contraceptive discontinuation for both fertility levels and individual women depends on switching behavior. For example, if a woman discontinues use of a method because she experiences side effects and does not start using another method of contraception immediately, she is exposed to the risk of an unwanted pregnancy. Hence, the discontinuation of her original method has implications for the woman's individual welfare and for fertility levels. In addition, the fact that the woman did not switch to another method may suggest that family planning services are not successfully meeting her needs. In contrast, if the woman switched to another method immediately, the fertility implications are much less serious, although there may be an increased risk of unwanted pregnancy if her new method has higher failure rates than her original method. Indeed, the fact that she does switch to another method may indicate that the family planning services are successfully providing her with a range of contraceptive options. Hence, from the perspective of designing and evaluating family planning policies, what women do after discontinuing a contraceptive method is equally as important as why they discontinue.

Again, the analyses described in this section are suitable for describing and understanding the observed switching experience of women after they initiate use of a method of contraception. As such, they are most useful for informing policies aimed at individual users of contraception, but are not appropriate for evaluating the demographic impact of discontinuation and switching on the period fertility levels of the population. Other analyses that are suitable in this situation are described in Section 8 of this model further analysis plan.

Background Theory and Analytic Details

The multiple-decrement life table, described in Section 4, is again used in the analyses in this section. The rate of switching to no method of contraception is of particular interest because it represents the state with the highest risk of pregnancy. However, many users who abandon all use of contraception do so because they no longer have a need for contraception. These need to be distinguished from users who still have a need for contraception but abandon use, consequently exposing themselves to the risk of an unwanted pregnancy. Hence, the contraceptive status of the woman in the month after discontinuation is classified into one of three categories; no longer needs contraception, using another method of contraception (switched), and not using contraception (abandoned). The definition of no longer in need of contraception is based on the reason given for discontinuing use. Users reporting that they discontinued for one of the following reasons are classified as not having a need for contraception; failure, want to get pregnant, infrequent sex, separation/widowhood, and infecund/menopause. Note that users who discontinue due to method failure are classified as no longer in need of contraception. Although this group is something of a special case, it is not considered separately here because discontinuation due to failure has already been examined in Section 4. Users who discontinue for reasons other than those listed above are considered to still be in need of contraception. Those who are using another method in the month after discontinuation are classified as having switched to another method, and those who are not using any method or who are pregnant are classified as having abandoned use.

Discussion of Results

Table 5.1 presents the 12-month cumulative switching rates for each method in Country A. The focus of attention is the behavior of users who discontinue use but still have a need for contraception. For all

Table 5.1: Life-table 12-month discontinuation rates by status after discontinuation and method: Country A.

Method	Status after discontinuation: No need for contra-ception[1]	Switch to another method	Abandon use	Total
Pill	15.1	26.8	13.8	55.8
IUD	2.1	6.7	3.2	12.0
Injectables	10.9	37.9	18.6	67.3
Vaginal methods	28.2	38.0	5.3	71.5
Condom	20.5	36.8	8.2	65.6
Periodic abstinence	38.0	9.3	1.1	48.4
Withdrawal	30.7	23.8	2.4	56.8
Other	31.4	15.1	5.9	52.4
Total[2]	24.1	17.7	5.5	47.2
Total[3]	24.8	18.2	5.6	48.6

[1]Discontinuations for the following reasons: failure, to get pregnant, infecund/menopause, infrequent sex, and separation/widowhood.
[2]All methods, including sterilization.
[3]All reversible methods, i.e., excluding sterilization.

methods, the rate of switching to another method is much higher than the rate of abandoning use. Nevertheless, more than 10 percent of users of pill and injectables abandon all use of contraception within a year of initiating use although they still need contraceptive protection. The high rate of moving to "no need for contraception" for periodic abstinence, withdrawal and other methods largely reflects the very high failure rates of these methods.

Figure 5.1 presents the breakdown of the overall discontinuation rate by status after discontinuation. Again, the figure largely confirms the patterns seen in the table. Abandonment of all contraception represents a much larger percentage of discontinuation for pill, IUD and injectables, which suggests that a significant proportion of users who discontinue use of these methods within a year are unable to find suitable alternative methods of contraception.

Figure 5.1: Percent Decomposition of the 12-month Discontinuation Rate by Status after Discontinuation, by Method, Country A

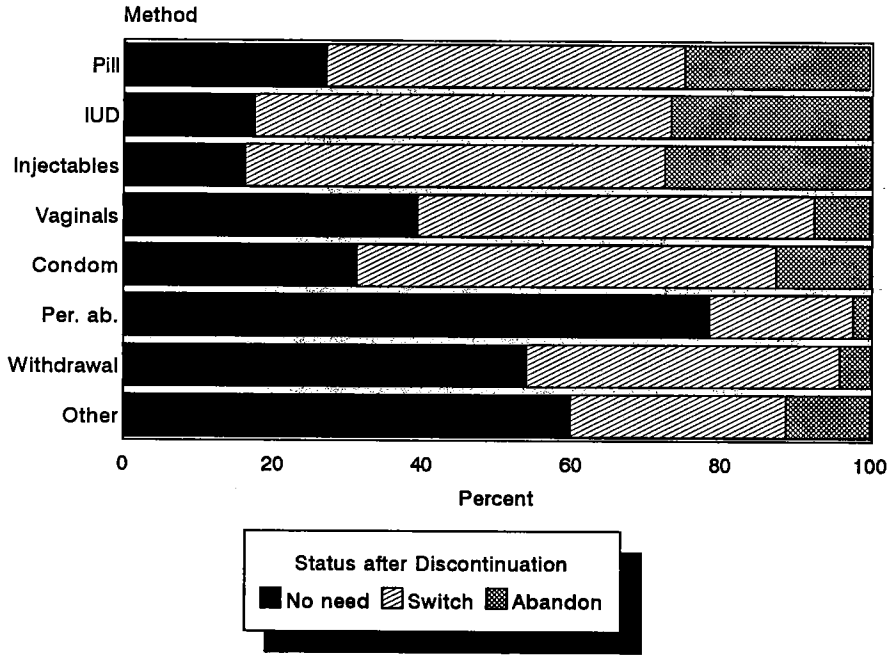


Table 5.2 presents the 12-month cumulative switching rates for the pill by contraceptive intent and area of residence and Figure 5.2 illustrates the breakdown of the total discontinuation rate by status after discontinuation. As expected, users who are using the pill to space births are more likely to have no need for contraception after discontinuation than users who are using the pill to prevent future births because they are more likely to discontinue use in order to get pregnant. However, contrary to expectation, about 25 percent of both spacers and limiters who discontinue the pill within a year abandon contraceptive use after discontinuation (Figure 5.2), although the actual 12-month rate of abandonment is higher for spacers (15 percent) than for limiters (13 percent). Both groups (but particularly limiters) are more likely to switch to another method than abandon use.

There is a marked difference in switching behavior between urban and rural pill users in that rural users are much more likely to abandon use after discontinuation than urban users. Indeed, the 12-month rate of abandonment for rural users is almost equal to the 12-month rate of switching to another method. This contrasts with the behavior of urban users who are much more likely to switch to another method than to abandon use altogether if they still need contraception. This may reflect better access to alternative methods in urban areas or better knowledge of alternative methods, and suggests that the potential for unwanted pregnancy as a consequence of pill discontinuation is higher in rural areas.

Conclusions

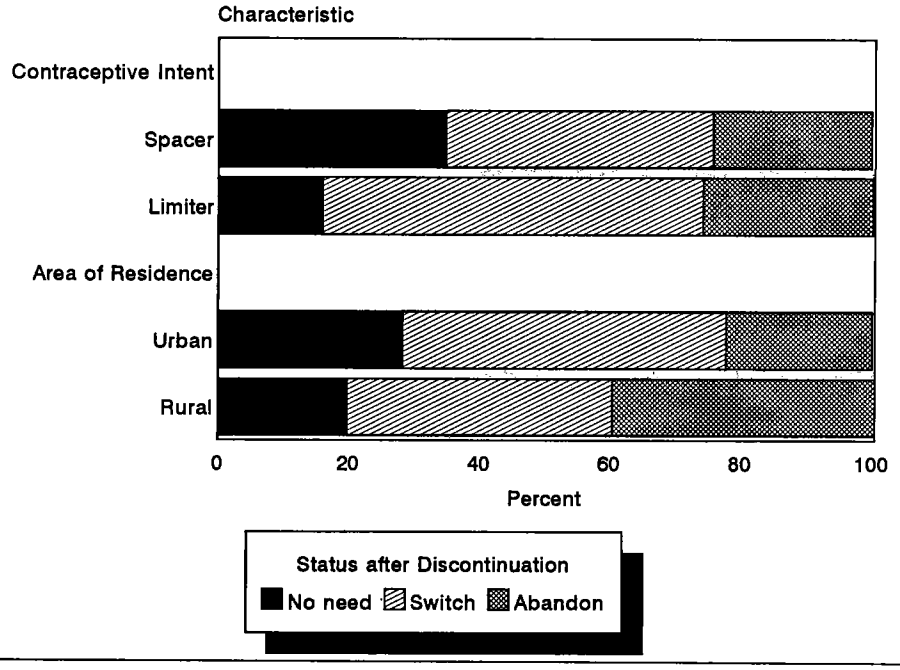
Although technically demanding, this analysis provides interesting insights into contraceptive switching behavior in Country A that have important policy implications. For all methods, users who discontinue use but still have a need for contraception are more likely to switch to another method than to abandon use altogether. However, there are differentials in switching behavior. For example, rural pill users are as likely to abandon use after discontinuation as to switch to another method, whereas urban pill users are more likely to switch to another method. In addition, although users are more likely to switch to another method, many users who discontinue use but still have a need for contraception do not switch to another method immediately, and most of these will be exposed to the risk of unwanted pregnancy. The fact that these women did not switch to another method suggests dissatisfaction with or lack of knowledge about alternative methods of contraception available. Hence, there is potential for family planning services to address these needs.

Table 5.2 Life-table 12-month discontinuation rates for the pill by status after discontinuation, by contraceptive intent and area of residence: Country A.

Method	Status after discontinuation: No need for contra-ception[1]	Switch to another method	Abandon use	Total
Contraceptive Intent[2]				
Spacer	21.3	25.0	14.7	61.1
Limiter	8.0	29.1	12.9	49.9
Area of Residence				
Urban	15.7	27.5	12.3	55.5
Rural	11.3	23.3	22.7	57.2
Total	15.1	26.8	13.8	55.8

[1] Discontinuations for the following reasons: failure, to get pregnant, infecund/menopause, infrequent sex, and separation/ widowhood.
[2] Excludes six missing cases.

Figure 5.2: Percent Decomposition of the 12-month Pill Discontinuation Rate by Status after Discontinuation, by Background Characteristics, Country A



The general comments made at the end of Section 4 also apply to this analysis. Similar analyses can be conducted for other methods of contraception, and for other subgroups of the population, subject to the usual requirement that there are enough segments of use to enable the construction of the life table. The definition of the switching destinations can also be modified to address issues of specific interest; for example, switching could be divided into modern and traditional methods, or failures could be separated from other users who no longer need contraception. However, it is not advisable to construct complex combinations of reason for discontinuation and status after discontinuation because interpretation quickly becomes very complex and confusing. Like all multiple-decrement life tables, the results need to be interpreted carefully.

Analysis Tools

The program SECT5.INC was used for the analyses in this section. Again, this can be modified to suit your needs as indicated in the program. You need to run this program separately for each subgroup for which a life table is needed. The program produces the cumulative discontinuation probabilities for each status after discontinuation at each duration up to 36 months. Note that these correspond to the cumulative probabilities of discontinuing by the *end* of each month. This information is written to a file named MDLT3.REP in this example to correspond with the three modes of decrement. Because the file will be overwritten each time the program is run, it must be renamed or printed every time. The 12-month discontinuation rates by status after discontinuation correspond to the cumulative probabilities of discontinuing by the end of month 11.

HINT: Copy the program SECT5.INC to a new file and edit the new file to suit your needs. A backup copy of all the original programs will still be available if needed.

6 COMPARISON OF CONTRACEPTIVE FAILURE RATES

Description of Analysis

The 12-month failure rates in Country A are compared by method. The 12-month pill and periodic abstinence failure rates are then compared by contraceptive intent and area of residence. The methodology used is particularly suited for analyses that primarily aim to compare levels of failure because it removes the effect of the levels of discontinuation for other reasons, which can distort comparisons. The standard errors of the failure rates are used to construct approximate 95 percent confidence intervals for the estimates, which enables assessment of the statistical significance of the differentials in failure rates observed for each method.

Application and Significance

Contraceptive failure rates often are of particular interest in the study of contraceptive use dynamics and fertility because they result directly in unwanted pregnancies and, unless the pregnancy is aborted, contribute to fertility levels. Indeed, as contraceptive use becomes widespread in a population and desired family sizes fall, contraceptive failures account for an increasing proportion of all pregnancies. Contraceptive failure rates vary considerably by method, but they also vary across subgroups of the population because some women use contraception more effectively than others. High failure rates may indicate weaknesses in the family planning program in providing information about correct use of methods, and examination of differentials in contraceptive failure rates helps to identify groups of users who experience difficulties using particular contraceptive methods effectively.

Background Theory and Analytic Details

Contraceptive failure may occur either because the method itself fails or because the method is used incorrectly or inconsistently. Consequently, different definitions of failure rates are used in the literature to measure different types of contraceptive failure. Method, or clinical, failure rates attempt to measure failure under ideal conditions with perfect use, and are primarily useful for clinical evaluation of contraceptive methods. Use-failure rates attempt to measure contraceptive failure rates in the population under the prevailing conditions of use. This latter measure is more useful from a program perspective and is the type of failure that DHS surveys attempt to measure. All failure rates calculated in this further analysis plan are use-failure rates. The difference between method failure rates and use-failure rates tends

to be large for methods with large potential for user error, e.g., periodic abstinence, but low for methods with low capacity for user error, e.g., IUD. Large differentials in contraceptive failure rates between or within populations usually reflect differentials in quality of use, but can also be partly due to differentials in fecundity levels since any failure of the method or incorrect use is more likely to result in pregnancy among more fecund women.

The observed failure rate in a population is calculated from a multiple-decrement life table as explained in Section 4. However, as was explained in Section 4, the net failure rate obtained from the multiple-decrement life table depends not only on the level of failure but also on the level of discontinuation for other reasons. If discontinuations for reasons other than failure are very high, failure rates will correspondingly be reduced because few women are exposed to the risk of failure for very long. Hence, differentials in net failure rates between methods and populations reflect not only differentials in the level of failure, but also differentials in the level of discontinuation for other reasons. If the levels of discontinuation for other reasons vary a lot between the different populations of interest, the comparison of failure rates will be distorted.

The way to overcome this problem is to calculate failure rates using an *associated single-decrement life table* (see Appendix A). Such a life table assumes that failure is the only risk operating, i.e., women will only discontinue use of a method if they fail while using it. Hence, the effect of other competing reasons for discontinuation is eliminated. The associated single-decrement life table can be constructed by treating all discontinuations for reasons other than failure as censored observations. The failure rates calculated in this way are called *gross failure rates*. They represent the failure rates that would be expected if failure was the only reason for discontinuing use. As such they are *theoretical* failure rates, and represent the underlying risk of failure in the population. Gross failure rates are higher than the corresponding net failure rates because if all other reasons for discontinuing contraception are eliminated, more users will be at risk of failing so the failure rate will be increased.

The measures calculated from the associated single-decrement life table are similar to those calculated from other life tables. The cumulative probability of failing by each duration can be plotted for different populations, and the 12-month failure rates read from the tables. The standard error associated with the 12-month failure rate can be used to construct 95 percent confidence intervals for the estimated failure rates. This enables the statistical significance of observed differentials in failure rates to be assessed; if the confidence intervals overlap, the difference is not statistically significant.

Discussion of Results

Table 6.1 presents the gross 12-month failure rates for each method and for all methods and all reversible methods combined, together with their 95 percent confidence intervals. As expected, failure rates do vary significantly across methods. The 12-month failure rate for the IUD is significantly lower than for any other method. The next most effective methods are the hormonal methods, i.e., pill and injectables, with a 12-month failure rate of around six percent. Users of barrier methods in Country A experience moderately high failure rates. The 12-month failure rate for vaginal methods is higher than that of the condom but the difference is not statistically significant. Finally, the traditional methods, i.e., periodic abstinence, withdrawal, and other, have significantly higher failure rates than all the modern methods (except vaginal methods) but the differences between the failure rates of each traditional method are not significant.

Table 6.1 Life-table 12-month gross failure rates and 95 percent confidence intervals by method: Country A.

Method	Failure rate (%)	95 percent confidence interval: Lower bound	95 percent confidence interval: Upper bound
Pill	6.1	4.5	7.7
IUD	1.2	0.6	1.8
Injectables	6.1	3.7	8.5
Vaginal methods	22.0	16.1	27.9
Condom	15.2	11.3	19.1
Periodic abstinence	31.5	29.7	33.2
Withdrawal	27.3	23.4	31.2
Other	28.6	22.5	34.7
Total[1]	19.2	18.2	20.2
Total[2]	19.9	18.9	20.9

[1] All methods, including sterilization.
[2] All reversible methods, i.e., excluding sterilization.

The total 12-month failure rate in Country A for all methods combined is high at (19 percent). This reflects the fact that periodic abstinence, which has a very high failure rate, is a very popular method in this population. Because sterilization is not very widely used, it accounts for only a small proportion of segments of use. Therefore, excluding sterilization from the total makes little difference to the overall failure rate in this population. Clearly, the method mix in the population will have a large impact on the total failure rate. Differences in the choice of methods by different groups of users will also affect differentials in total failure rates, again illustrating the need to examine differentials in discontinuation patterns for individual methods, as discussed in Section 3.

Table 6.2 presents the 12-month gross failure rates for the pill by contraceptive intent and area of residence together with 95 percent confidence intervals for each estimate. The pill failure rate is slightly higher among users who are using the pill to space births and among urban users, but the differences are very small and not statistically significant. The total pill failure rate is six percent, which is consistent with the levels found in other studies (Moreno and Goldman, 1991). The lack of differentials by contraceptive intent and area of residence suggests that the amount of user error does not vary by these

characteristics. However, the total pill failure rate is still well above the clinical pill failure rate, which is less than one percent, so there is scope to reduce this rate further by improving the quality of use.

Table 6.2 Life-table 12-month gross failure rates and 95 percent confidence intervals for the pill by contraceptive intent and area of residence: Country A.

Method	Failure rate (%)	95 percent confidence interval: Lower bound	95 percent confidence interval: Upper bound
Contraceptive Intent[1]			
Spacer	6.5	4.2	8.9
Limiter	5.7	3.6	7.9
Area of Residence			
Urban	6.4	4.6	8.2
Rural	4.2	0.2	8.1
Total	6.1	4.5	7.7

[1]Excludes six missing cases.

Table 6.3 presents the gross 12-month failure rate for periodic abstinence by contraceptive intent and area of residence. The total periodic abstinence failure rate is 32 percent, which is significantly higher than the pill failure rate and is at the higher end of the range of failure rates generally found for periodic abstinence in other studies (Moreno and Goldman, 1991). This high failure rate for periodic abstinence gives considerable cause for concern since it is the most widely used method in Country A. The periodic abstinence failure rate is significantly higher among users who are using the method to space births and among rural users. This reflects the very high potential for user error with this method, which gives rise to large differentials in failure rates. The higher failure rates among spacers may reflect lower motivation in this group compared to limiters, or may reflect age differentials between the groups in that spacers tend to be younger, on average, than limiters and may therefore be more sexually active, more fecund, and less experienced in using the method. The high failure rate among rural users may again reflect lower motivation in this group or lower knowledge of the correct way to use the method.

Table 6.3 Life-table 12-month gross failure rates and 95 percent confidence intervals for periodic abstinence by contraceptive intent and area of residence: Country A.

Method	Failure rate (%)	95 percent confidence interval: Lower bound	95 percent confidence interval: Upper bound
Contraceptive Intent[1]			
Spacer	35.9	33.6	38.3
Limiter	26.5	24.2	28.9
Area of Residence			
Urban	28.0	26.0	29.9
Rural	39.8	36.2	42.4
Total	31.5	29.7	33.2

[1]Excludes 12 missing cases.

Note that, as expected, the gross failure rates for both pill and periodic abstinence are higher than the net failure rates presented in Table 4.1. This also illustrates the potential distortion that can be introduced into the comparison of failure rates if the influence of discontinuations for other reasons is not controlled by using gross rates instead of net rates.

Conclusions

The analysis presented here is a useful tool for the comparison of failure rates because it controls for the influence of levels of discontinuation for other reasons. It is therefore appropriate when the primary aim of the analysis is to compare failure rates in different groups of users or to estimate the underlying rate of failure. However, interpretation has to be done carefully, and it is important to remember that the rates calculated from an associated single-decrement life table are theoretical failure rates in the absence of other reasons for discontinuation. As such they measure the *underlying* rate of failure rather than the observed rate of failure. The analysis can be adapted to study differentials by any variable of interest, and can also be used to study differentials in the underlying levels of discontinuation due to side effects, or for any other reason.

The results of the analysis presented here demonstrate that failure rates vary substantially across methods. Periodic abstinence failure rates are very high in Country A, whereas pill failure rates are modest. Large differentials exist in periodic abstinence failure by contraceptive intent and area of residence, but there are no significant differentials by these characteristics for pill failure. This reflects the higher potential for user error for periodic abstinence. From a policy perspective such analyses can provide useful information for reducing failure rates. For example, there is a tremendous need to reduce periodic abstinence failure rates, especially among rural users.

Analysis Tools

The SPSSPC program that was used to do the analysis in this section is SECT6.INC. As indicated, this program can be modified to suit your needs. The program produces the same type of output as produced by the program SECT3.INC used in Section 3. The 12-month failure rate is obtained by subtracting the proportion still using at the end of month 11 (in the column labeled "CUMUL PROPN SURV AT END") from 1, and similarly for failure rates at other durations. The standard error for this rate is given in the column entitled "SE OF CUMUL SURVIVING." The 95 percent confidence interval is calculated using the following formulae:

Lower bound = failure rate - 1.96 x SE of failure rate

Upper bound = failure rate + 1.96 x SE of failure rate.

This procedure can also be used to estimate approximate 95 percent confidence intervals for the discontinuation rates presented in Section 3. Calculation of the 95 percent confidence intervals for the net discontinuation rates presented in Sections 4 and 5 is more complex and is beyond the scope of this further analysis plan.[1]

Note that the confidence interval calculated using these formulae is an approximation and is likely to be too narrow because the standard errors are based on the assumption of a simple random sample. In fact, DHS surveys use more complex sample designs and individual women may contribute more than one segment of use to the analysis, which results in correlation between observations. Hence, the true standard errors of the estimates are actually higher than given by the SPSS program.

HINT: Copy the program SECT6.INC to a new file and edit the new file to suit your needs. Thus, a backup copy of all the original programs will be available if needed.

[1] See Namboodiri and Suchindran (1987) for a discussion of the calculation of standard errors for net discontinuation rates.

7 TRENDS IN CONTRACEPTIVE DISCONTINUATION AND FAILURE

Description of Analysis

Three analyses of trends in discontinuation of periodic abstinence are presented in this section. Country A has calendar data from two separate surveys conducted approximately five years apart which can be used for these analyses. In the first analysis, the total discontinuation rates as calculated from ordinary single-decrement life tables are compared. In the second analysis, multiple-decrement life tables are used to compare *observed* patterns of periodic abstinence discontinuation by reason in the period before each survey. The final analysis is an investigation of whether the changes in the observed rates are due to genuine changes in the *underlying* (gross) rates of discontinuation of periodic abstinence for two of the reasons: failure and discontinuation for non-pregnancy reasons. As such, the analysis also illustrates the appropriate use and interpretation of net and gross discontinuation rates.

Application and Significance

Trends in discontinuation patterns are extremely important for family planning policy because they inform policy makers about what has been happening over time in the population, and are useful for evaluation of family planning programs and specific initiatives. Decreases in discontinuation rates may indicate improvements in users' satisfaction with their method of contraception which, in turn, may indicate improved quality of family planning services. In addition, there may be interest in whether underlying discontinuation rates for a particular reason (e.g., failure) have changed, perhaps in response to programs specifically aimed at reducing discontinuations for that particular reason. Consequently, as calendar data suitable for these types of analyses become available from surveys conducted at different points in time, the analysis of trends in discontinuation patterns will become increasingly important.

Background Theory and Analytic Details

The techniques applied in these analyses are the same as those used in the analyses in Sections 3, 4 and 6. Multiple-decrement life tables are used to calculate net discontinuation rates by reason in order to examine trends in observed discontinuation patterns. Reasons for discontinuation are classified into three groups: failure, to get pregnant, and other reasons. These are the only three reasons for discontinuation that were recorded in the earlier survey. Associated single-decrement life tables are used

to calculate gross failure rates in order to investigate trends in the underlying rate of periodic abstinence failure and discontinuation for nonpregnancy reasons.

Discussion of Results

Table 7.1 presents 12-month, 24-month, and 36-month periodic abstinence discontinuation rates, together with 95 percent confidence intervals, for the periods 1981-86 and 1986-91/92 for Country A. The probability of discontinuing periodic abstinence in the first year of use is significantly higher in the later period than in the earlier period. The 24-month and 36-month discontinuation rates are also higher in the later period, but the difference is much smaller and is no longer significant. This narrowing of the difference between the discontinuation rates in the two periods at longer durations shows that, although discontinuation is higher in the first year of use in the period 1986-91/92, it is lower in the second year of use. In the third year of use, discontinuation rates are about the same in the two periods. Hence, it appears that over the first three years of use, the overall level of discontinuation is quite similar in the two periods but the timing has shifted, resulting in a shift in discontinuations from the second year of use to the first year of use.

Table 7.1 Life-table periodic abstinence discontinuation rates and 95 percent confidence intervals for selected durations by period: Country A

	1981 - 1986			1986 - 1991/92		
		95 percent confidence interval			95 percent confidence interval	
Duration (months)	Discontinuation rate (%)	Lower bound	Upper bound	Discontinuation rate (%)	Lower bound	Upper bound
12	38.5	33.6	43.4	48.4	46.8	50.0
24	64.2	58.9	69.4	68.3	66.7	69.9
36	73.6	68.3	78.8	77.5	75.9	79.1

Table 7.2 presents the net 12-month, 24-month, and 36-month discontinuation rates by reason for each period. The observed discontinuation rates for "other reasons" are almost identical in the two periods at all durations so there appears to have been no change in the rate of discontinuation for nonpregnancy reasons during the 1980s. In contrast, the observed rates of discontinuation for "to get pregnant" are con-

Table 7.2 Life-table net periodic abstinence discontinuation rates for selected durations by reason and period: Country A

Duration (months)	1981 - 1986			1986 - 1991/92		
	Failure	To get pregnant	Other	Failure	To get pregnant	Other
12	21.0	3.3	14.3	27.3	6.9	14.2
24	37.5	6.4	20.3	37.9	11.2	19.2
36	42.9	8.7	22.0	42.8	13.5	21.2

sistently higher in the later period than in the earlier period. Discontinuation rates for "failure" present yet another pattern. The 12-month failure rate is higher in the period 1986-91/92 than in the period 1981-86, but thereafter the rates are very similar. Indeed, the net probability of failing within three years of initiating use is almost identical in the two periods. This pattern closely resembles that observed in Table 7.1 for total discontinuation rates, which is to be expected since failure is the main reason for discontinuing use of periodic abstinence. This implies that there has been a shift to more rapid failure, but that the overall level of failure in the first three years of use has remained about the same.

Table 7.3 presents the gross 12-month, 24-month, and 36-month failure rates for each period, together with 95 percent confidence intervals. These gross rates confirm that the trends in the observed failure rates seen in Table 7.2 do indeed reflect genuine trends in the underlying rate of failure. The 12-month gross failure rate is significantly higher in the later period than in the earlier period, but by 24-

Table 7.3 Life-table gross periodic abstinence failure rates and 95 percent confidence intervals for selected durations by period: Country A

Duration (months)	1981 - 1986			1986 - 1991/92		
	Discontinuation rate (%)	95 percent confidence interval		Discontinuation rate (%)	95 percent confidence interval	
		Lower bound	Upper bound		Lower bound	Upper bound
12	23.7	19.0	28.4	31.5	29.7	33.2
24	46.1	39.8	52.4	47.0	44.8	49.2
36	55.0	47.8	62.3	55.7	53.3	58.1

months of use the difference has narrowed and is no longer significant, and by 36 months the cumulative gross failure rate is almost identical in the two periods. Hence, genuine changes appear to have occurred in the underlying pace of periodic abstinence failure during the 1980s.

A final example of the distinction between net and gross rates is seen in Table 7.4. Gross 12-month, 24-month, and 36-month discontinuation rates for nonpregnancy reasons are presented for each period. These underlying rates of nonpregnancy discontinuation are consistently slightly higher in the period 1986-1991/92 than in the period 1981-1986, although the differences are not statistically significant. Note how this pattern contrasts with the pattern in the net nonpregnancy discontinuation rates presented in Table 7.2; the observed (net) nonpregnancy discontinuation rates are slightly *lower* in the more recent period. This is because of the competing risks situation represented by the net rates. The estimates of the underlying (gross) nonpregnancy discontinuation rates are slightly higher in the more recent period, but the underlying discontinuation rates for other reasons (failure and to get pregnant) have increased much more between the surveys so more women are discontinuing use of periodic abstinence for these reasons. Consequently, fewer women are exposed to the risk of discontinuing for nonpregnancy reasons and therefore the observed (net) nonpregnancy discontinuation rates are slightly lower in the more recent period. In this example the differences are very small and both the net and gross nonpregnancy discontinuation rates suggest that there has been no significant change in the rate of discontinuation for nonpregnancy reasons during the 1980s. However, it does illustrate the difference between the two types of rate.

Table 7.4 Life-table gross periodic abstinence discontinuation rates for other reasons for selected durations by period: Country A

Duration (months)	1981-1986	1986-1991/92
12	15.6	16.9
24	25.5	26.7
36	29.4	32.0

Conclusions

Trends in contraceptive discontinuation are likely to be of considerable interest as calendar data become available for more than one point in time. The analysis presented here is very preliminary and primarily descriptive; no attempt has been made to explain why the pace of failure appears to have increased between the two surveys or to examine trends in other methods or for total discontinuation. A range of additional analyses could be developed to investigate issues such as this, based on both analyses of the type presented in this plan and more conventional analyses that are based on trends in other related variables, such as coital frequency or characteristics of users. For example, there may have been a shift towards more users using periodic abstinence for spacing births in Country A. These users experience

higher failure rates and higher rates of discontinuation in order to become pregnant. It is possible to standardize discontinuation rates to control for such changes in the composition of users over time, and clearly, any analysis of trends in total discontinuation would need to standardize for changes in the method mix. However, such analyses are beyond the scope of this document.

These analyses of trends in contraceptive discontinuation also illustrate the use of all three types of life table introduced in this further analysis plan. In particular, the analyses demonstrate the distinction between net and gross rates. In the analysis of trends, both types of rates are likely to be useful so it is very important to be clear about which is being used and how to interpret it.

Analysis Tools

There are no specific analysis tools for the analyses presented in this section. The programs used in Sections 3-6 can be modified and used for the analyses presented here.

8 FERTILITY EFFECTS OF CONTRACEPTIVE USE

Description of Analysis

In this section the contraceptive prevalence results for Country A from Section 2 are integrated with the gross failure rate results from Section 6 in an attempt to understand the fertility effects of contraceptive use in the population. A simple static model of prevalence structure and the fertility rate that results from that structure are used. The first step of the analysis is to calculate average pregnancy rates for different contraceptive use and nonuse groups. The second is to construct policy-relevant scenarios of how the prevalence structure might change, and to use a static model to project their impact on the population's pregnancy rate. The final result is a flexible tool that assists family planning managers and policy-makers to assess the hypothetical demographic effect of policy or program changes.

Application and Significance

This section has the most "applied" orientation of this further analysis plan. The static model assists managers and policy-makers in evaluating the demographic effect of several different kinds of program decisions.

For example, policy programmers may have the choice of building new clinics or upgrading services at existing ones. The analysis in this section can be used to compare the impact on fertility of serving nonusers with increasing the use of medical methods among current users of inefficient methods. The example in this section is drawn from Country A, but it can readily be adapted to other local circumstances.

Another use would be to assist in deciding whether to increase recruitment of new users or to improve clinical quality to decrease program drop-outs. Each alternative can be evaluated for its potential impact on fertility in advance of any actual change.

In addition to decision support for resource allocation, the model helps estimate the fertility-reducing effect of different methods within each country. Such information helps planners decide whether to drop or add particular methods, such as injectables, to a national program. The model provides the baseline data for cost-benefit analyses of any program changes that are likely to change the national

structure of contraceptive prevalence. At the broadest level, this section is designed to assist national-level policy-makers in shaping contraceptive practice in their country.

Background Theory and Analytic Details

The programming requirement for this section is modest, needing only a standard spreadsheet. However, the details are exacting. The model requires *average* pregnancy rates by method and contraceptive prevalence by method. The decomposition of prevalence in Section 2 always adds to 100 percent, so the average pregnancy rates weighted by the method prevalences yield an average pregnancy rate of the population for a given prevalence structure.

In Section 2, the population is divided into mutually exclusive and exhaustive current prevalence categories. The three main divisions are Not Exposed, Exposed/Using, and Exposed/Not Using. Each of these divisions contains several exposure statuses. Those in Not Exposed are either sexually inactive or physiologically incapable of conceiving. The model assumes that the pregnancy rate among non-exposed women is zero. All of the other average pregnancy rates are derived empirically from the life tables in Section 6.

The first step is to examine the life-table conditional probabilities of pregnancy for each duration-month i since the beginning of method use (or unprotected exposure). The relevant column is labeled PROPN TERMINATING on the SPSS SURVIVAL output. In this Section the conditional probability of pregnancy in duration month i is denoted as p_i.

The second step in deriving average pregnancy rates is to find the distribution of current duration in each contraceptive status. SPSS can tabulate the number of women at each monthly duration in each prevalence status, which is then divided by the total number of women in the prevalance status. This quantity, denoted w_i, forms a weight for each of the monthly pregnancy rates. The i indexes duration-month and the weights sum to 1, $\sum w_i=1$. The average monthly failure rate ρ is calculated as $\rho=\sum_i p_i w_i$, which is the monthly failure rates weighted by the proportion of the population in each prevalence status.

Finally, it is easier to use average annual pregnancy rates than monthly ones, so the monthly rate is converted to a 12-month rate with the formula: $P_{12}=12\times\rho$. Table 8.1 contains an example calculation of P_{12} for the pill in Country A. The table illustrates calculations from each equation in this section.

With the annual pregnancy rate by prevalence status in hand, and the prevalence distribution, we are ready to construct the analyses.

Table 8.1 Calculation of average annual pregnancy rates for the pill: Country A

Duration of use in months	Number currently at duration Column (A)	Probability of pregnancy at duration (p_i) Column (B)	Contribution to average pregnancy rate (A) x (B)
0.5	22	0.006131	0.134882
1.5	20	0.006407	0.12814
2.5	17	0.01142	0.19414
3.5	14	0.003668	0.051352
4.5	8	0.002783	0.022264
5.5	13	0.002465	0.032045
6.5	15	0.00155	0.02325
7.5	11	0.003819	0.042009
8.5	13	0.008318	0.108134
9.5	8	0.003124	0.024992
10.5	4	0.00813	0.03252
11.5	15	0.005031	0.075465
12.5	9	0.007819	0.070371
13.5	6	0.010354	0.062124
14.5	10	0.00302	0.0302
15.5	7	0	0
16.5	10	0.00123	0.0123
17.5	3	0	0
18.5	9	0.004559	0.041031
19.5	7	0.007669	0.053683
20.5	6	0.00132	0.00792
21.5	10	0	0
22.5	10	0.003138	0.03138
23.5	5	0.001653	0.008265
24.5	6	0	0
25.5	9	0	0
26.5	6	0	0
27.5	5	0	0
28.5	10	0	0
29.5	3	0.007684	0.023052

Table 8.1—*con't*

Duration of use in months	Number currently at duration Column (A)	Probability of pregnancy at duration (p_i) Column (B)	Contribution to average pregnancy rate (A) x (B)
30.5	11	0	0
31.5	8	0	0
32.5	5	0	0
33.5	6	0.005332	0.031992
34.5	9	0	0
35.5	4	0	0
36.5	6	0	0.0000
37.5	1	0	0.0000
38.5	4	0.004096	0.0164
39.5	2	0	0.0000
40.5	2	0	0.0000
41.5	1	0	0.0000
42.5	2	0	0.0000
43.5	1	0	0.0000
44.5	6	0	0.0000
45.5	5	0	0.0000
46.5	3	0	0.0000
47.5	2	0	0.0000
48.5	2	0	0.0000
49.5	2	0	0.0000
50.5	8	0	0.0000
51.5	4	0	0.0000
52.5	3	0	0.0000
53.5	1	0	0.0000
54.5	4	0	0.0000
55.5	1	0	0.0000
56.5	1	0	0.0000
57.5	2	0	0.0000
58.5	2	0	0.0000
59.5	1	0	0.0000
Sums	400		1.2579

Monthly Failure Rate $\rho = 1.2579/400$
$= 0.003145$

Annual Failure Rate $P_{12} = 12 \times 0.003145$
$= 0.03774$

Discussion of Results

Table 8.2 shows the prevalence/exposure categories in the leftmost column. The next column contains P_{12}, the annual pregnancy rate. The table shows that the annual pregnancy rate is assumed to be zero for non-exposed women. For reversible method users, it ranges from 1.4 percent for the IUD to 27.3 percent for withdrawal and other methods. Among non-contraceptors, those who want no more births have an annual pregnancy rate of 29.6 percent, about equal to those using periodic abstinence or with-

Table 8.2. Scenarios of population contraceptive improvement

Prevalence categories	Annual pregnancy rate,[1] p_{12}	Current prevalence in population (percent)	Prevalence scenario 1: "More efficient limiting"[2] (percent)	Prevalence scenario 2: "Improved reversible methods"[3] (percent)	Prevalence scenario 3: "All users switch to coitus-independent methods"[4] (percent)
Not exposed					
Never had sex	0.0	30.4	30.4	30.4	30.4
No sex in last 4 weeks	0.0	18.3	18.3	18.3	18.3
Pregnant	0.0	4.2	4.2	4.2	4.2
Post-partum amenorrhea	0.0	5.4	5.4	5.4	5.4
Non-contraceptively sterile	0.0	1.8	1.8	1.8	1.8
Exposed, using					
Pill	3.77	3.4	3.4	10.6	7.1
Injectable	4.66	1.0	1.0	1.0	2.1
IUD	1.37	7.0	9.5	7.0	14.7
Sterilization	0.00	3.8	6.3	3.8	8.0
Condom	15.09	1.8	1.8	9.0	0.0
Spermicides	22.03	0.5	0.5	0.5	0.0
Periodic abstinence	26.03	11.7	11.7	0.0	0.0
Withdrawal and other	27.29	2.7	2.7	0.0	0.0
Exposed, not using					
Wants more within 2 years	64.43	1.7	1.7	1.7	1.7
Wants no more	29.64	5.0	0.0	5.0	5.0
Intention undetermined	29.64	1.3	1.3	1.3	1.3
Total population		100.0	100.0	100.0	100.0
Total pregnancy rate	7.40		5.95	4.97	3.53
Pregnancy rate of exposed	18.54		14.91	12.46	8.85

[1]Current pattern
[2]Want no more: half to sterilization, half to IUD
[3]PA and withdrawal: half to condom, half to pill
[4]Condom, spermicides, PA, and withdrawal: distributed over pill, injection, IUD, and sterilization

drawal. Just over half of those women who want more births become pregnant each year. The total annual pregnancy rate is 7.4 percent in Country A. Among exposed women, the pregnancy rate is 18.5 percent per year.[1]

Each scenario in the remaining columns is an alternate prevalence distribution and all posit some increased use of family planning programs. Scenario 1 ("more efficient limiting") is an alternative that switches non-contraceptors who want no more births equally to sterilization and the IUD. Pregnancies fall by 20 percent compared to the baseline. Clearly, a strategy to get nonusers to use contraceptives could have a demographic effect in Country A.

Table 8.2 also shows scenarios that posit increased efficiency of use among women who are current users. Scenario 2 shows the results of using improved reversible methods. In this case, users of periodic abstinence and withdrawal switch equally to the condom and the Pill. The pregnancy rate falls by 33 percent, largely because periodic abstinence users are a major source of unintended pregnancies. Going further, Scenario 3 posits a shift by users of coitus-dependent methods (condom, spermicides, periodic abstinence, and withdrawal) to coitus-independent methods (hormonal, IUD, sterilization) in the proportions in which they are already used. Under the model, this shift in use patterns would result in a pregnancy rate decline of 52 percent.

This simple model incorporates implicit assumptions that limit the validity of the results. The most important is that it is a static model of a dynamic process. For example, the average pregnancy rates are a function of the underlying distribution of use-durations. If a woman changes contraceptive statuses, she begins at duration month 0, not the duration month of her prior status. Similarly, if a method has been recently introduced by á program, failure rates will be relatively high for a time. Another implicit assumption is that women transition from the non-exposed to the exposed statuses equally over time. If there is large-scale secular change underway (for example, declining age at first sex, greater sexual frequency, or declining marriage rates), the balance between non-exposed and exposed may also be changing.

In addition, homogeneity assumptions that may introduce distortions are made in static models such as this one. It is known that women who do not use contraceptives are subfecund relative to women

[1] This rate is in contrast to a rate of about 250/1000 in a natural fertility population (Bongaarts and Potter, 1983). Thus, contraception reduces fertility by about 30 percent of its biosocial maximum in Country A.

who do (Sheps, 1965). This is a result of selection: women who are more fecund achieve their desired fertility faster than subfecund women and thus adopt contraception earlier. Differences in quality of contraceptive use or coital frequency (or male fecundity) may also introduce heterogeneity in conception probabilities.

An alternative modeling strategy would start from the assumption that the contraceptive prevalence structure is endogenous. Family planning programs affect prevalences by changing adoption and discontinuation patterns. Although such a model is conceptually appealing, actually estimating it from the data presented in this Further Analysis Plan would be impossible. Given unknown heterogeneity distributions, it is difficult to estimate population contraceptive prevalences from adoption and discontinuation rates alone. The models presented in this section, though simple, indicate bounds on the result of possible changes in population prevalence structure.

One first step, however, would be to model the proportion pregnant and postpartum infecund as a function of the pregnancy rate. The relations among these variables are well understood.

Conclusions

A model that is an idealized "thought experiment" about the fertility consequences of changing contraceptive prevalence patterns is presented in this section. It integrates the notion of prevalence structure with average population pregnancy rates. Several scenarios of prevalence change indicate a substantial fertility decline for Country A resulting from increasing contraceptive use among nonusers, and an even greater decline resulting from upgrading the efficiency of methods used by current users.

The static nature of the model compromises its accuracy to an unknown extent. In general, it probably overestimates the fertility declines resulting from changes in population prevalence/exposure structure. Nevertheless, a static model can provide a good starting point to understand policy options without paying for the complexity of a more realistic dynamic model.

Analysis Tools

There are no specific analysis tools for this section because the raw data required to set up the analysis can be obtained by adapting programs used elsewhere in this Further Analysis Plan, and the actual

analysis requires only a simple spreadsheet. An example of the spreadsheet used is given in SECT8.WK1 in the DYNPAK package of programs included with this Further Analysis Plan.

The pregnancy rates at each duration can be obtained for each method of interest using the program SECT6.INC. The appropriate column of the SURVIVAL output to use is labelled PROPN TERMINATING. For this analysis, the life table should be constructed for 60 months rather than for 36 months. The program can also be adapted to obtain the gross pregnancy rates for nonusers by their contraceptive intent (i.e., spacers versus limiters). Note that the event of interest in this latter case is pregnancy (or termination) in the month following the end of the segment of nonuse so the STATUS variable in the SURVIVAL command needs to be changed accordingly.

The distribution of current durations of use and nonuse can be obtained by selecting only segments of use and nonuse that are still in progress at the end of the calendar (i.e., censored segments) and adding a simple cross-tabulation to the end of the program SECT6.INC. For users, the tabulation needed is duration by method; for nonusers, it is duration by contraceptive intent. All 60 months should be used for this analysis. Also note that this distribution actually refers to three months prior to the survey date rather than to the time of the survey itself. However, this should be sufficiently close for obtaining the average pregnancy rate for each prevalence group.

The current prevalence/exposure distribution was obtained in Section 2 using the program SECT2.INC. The pregnancy rate of nonusers with undetermined fertility preferences is assumed to be the same as that of women who do not want any more children. This assumption is required because we do not have any empirical information on the pregnancy rate of these women. The remaining calculations are all done using a spreadsheet.

GLOSSARY

Censored observation — an observation for which the event of interest (e.g., contraceptive discontinuation) has not occurred by the end of the observation period (e.g., survey date minus three months); i.e., the woman is using contraception at the end of the observation period.

Confidence interval (95 percent)— a range of values for a given parameter within which one can be 95 percent certain that the true population value of the parameter actually lies.

Contraceptive effectiveness — the degree to which a contraceptive method lowers the monthly probability of conception for a sexually active fecund woman.

Contraceptive failure — unintended pregnancy while using contraception. Can be defined in a number of ways:

> *Method or clinical failure* — unintended pregnancy resulting solely from failure of the method when used perfectly and consistently.
>
> *Use failure* — unintended pregnancy resulting from either failure of the method itself or from user error, i.e., under typical use conditions.
>
> *Extended use failure* — any unintended pregnancy following acceptance of a method even if the method had been discontinued at the time the pregnancy occurred.

Gross discontinuation rate — the discontinuation rate for a particular reason in the absence of other reasons for discontinuation. Gross discontinuation rates are obtained from an associated single-decrement life table and are independent of each other. They are theoretical rates and represent the underlying rate of discontinuation for that reason.

Left-truncated observation — an observation that starts before the observation period covered by the analysis (e.g., more than 62 months before the survey) and continues into it. The duration of the observation at the start of the observation period is known.

Life table — a table of duration-specific probabilities, conditional probabilities, expectations, and conditional expectations. Used in the analysis of prospective follow-up or retrospective data such as calendar data on contraceptive discontinuation and can accommodate censored observations. Several types exist:

> *Single-decrement life table* — only one form of exit from the life table exists, e.g., contraceptive discontinuation. All types of discontinuation are combined together.
>
> *Multiple-decrement life table (MDLT)* — several forms of exit from the life table exist, e.g., discontinuation by reason, discontinuation by status after discontinuation. The number of discontinuations of each type in an MDLT add up to the total number of discontinuations in the corresponding single-decrement life table.
>
> *Associated single-decrement life table (ASDLT)* — only one type of exit event defined in the MDLT exists, e.g., failure. A separate ASDLT can be constructed for each type of exit event in the MDLT. Represents a theoretical situation in which only one type of exit event exists.

Life-table continuation rate — the percentage of contraceptive users who are still using the method (continuously) at a given time following initiation of use. Usually the 12-month continuation rate is presented, which is the percentage of users still using the method 12 months after acceptance.

Life-table discontinuation rate — the percentage of contraceptive users who discontinue use of their method for any reason within a given time following initiation of use. Usually the 12-month discontinuation rate is presented, which is the percentage of users discontinuing use of the method within 12 months. It is the complement of the life-table continuation rate (i.e., 1 - continuation rate).

Life-table failure rate — the percentage of contraceptive users who become pregnant accidently within a given time following initiation of a method. Usually the 12-month failure rate is presented, which is the percentage of users becoming pregnant accidently within 12 months of starting to use the method. Can be defined as a method or clinical failure rate, use failure rate, or extended use failure rate (see definition of contraceptive failure above). Can also be a net rate or a gross rate (see definitions of net and gross rates).

Life-table median duration of use — the duration of use at which half of all users of a particular method have discontinued use.

Limiter — a user who is using contraception in order to prevent any future births. The definition used is based on the woman's stated fertility intentions at the time of use.

Net discontinuation rate — the observed discontinuation rate for a particular reason in the presence of other competing reasons for discontinuation. Net discontinuation rates are calculated from a multiple-decrement life table and are dependent on each other.

Segment of use — an uninterrupted period of use of an individual contraceptive method reported in the calendar. These form the basic unit of analysis for life-table analysis of contraceptive use dynamics in this document.

Segment of nonuse — an uninterrupted period in which the woman is not pregnant and is not using a contraceptive method.

Spacer — a user who is using contraception in order to delay future wanted births. The definition is based on the woman's stated fertility intentions at the time of use.

Survival curve — graph of the proportion of contraceptive users still using their method at each duration following initiation of use (i.e., the life-table continuation rate). Obtained from a single-decrement life table.

Use-interval — see segment of use.

User — a woman who is using a particular method at a particular point in time. A woman may move from being a user of one method at one point in time to being a user of a different method at a different point in time, or to being a nonuser and then back to being a user again. This terminology is meant to convey the dynamic nature of the contraceptive process and the fact that individual women may be users of different methods (or even the same method) at different points in time and hence may contribute more than one segment of use to the analysis.

BIBLIOGRAPHY

REFERENCES CITED IN THE TEXT

Bongaarts, John and Robert G. Potter. 1983. *Fertility, Biology, and Behavior: An Analysis of the Proximate Determinants*. New York: Academic Press.

Goldman, Noreen, Lorenzo Moreno, and Charles F. Westoff. 1989. *Peru Experimental Study: An Evaluation of Fertility and Child Health Information.* Columbia, Maryland: Office of Population Research, Princeton University, Princeton, New Jersey and Institute for Resource Development (IRD)/Macro Systems Inc.

Goldman, Noreen, Anne R. Pebley, and Graham Lord. 1984. Calculation of Life Tables from Survey Data: A Technical Note. *Demography* 21(4):647-653.

Grady, William R., Mark D. Haywood, and Frances A. Florey. 1986. Contraceptive Failure in the United States: Estimates from the 1982 Survey of Family Growth. *Family Planning Perspectives* 18(5):200-209.

Jones, Elise F. and Jacqueline Darroch Forrest. 1992. Contraceptive Failure Rates Based on the 1988 NSFG. *Family Planning Perspectives* 24(1):12-19.

Moreno, Lorenzo and Noreen Goldman. 1991. Contraceptive Failure Rates in Developing Countries: Evidence from the Demographic and Health Surveys. *International Family Planning Perspectives* 17(2):44-49.

Namboodiri, Krishnan and C.M. Suchindran. 1987. *Life Table Techniques and Their Applications*. San Diego, California: Academic Press Inc.

Ryder, Norman B. 1973. Contraceptive Failures in the United States. *Family Planning Perspectives* 5(3):133-142.

Sheps, Mindel C. 1965. An Analysis of Reproductive Patterns in an American Isolate. *Population Studies* XIX (1):65-80.

Sullivan, Jeremiah M., Shea Oscar Rutstein, and George Bicego. 1990. Assessment of the Quality of Data Used for the Direct Estimation of Infant and Child Mortality in the Demographic and Health Surveys. In *An Assessment of DHS-I Data Quality*. DHS Methodological Reports, No. 1. Columbia, Maryland: IRD/Macro Systems, Inc.

Westoff, Charles F., Noreen Goldman, and Lorenzo Moreno. 1990. *Dominican Republic Experimental Study: An Evaluation of Fertility and Child Health Information*. Columbia, Maryland: Office of Population, Princeton University, Princeton, New Jersey and IRD/Macro Systems Inc..

Wood, James W. and Maxine Weinstein. 1988. A Model of Age-Specific Fecundability. *Population Studies* 42:85-113.

GENERAL READING

United Nations. 1991. *Measuring the Dynamics of Contraceptive Use*. ST/ESA/SER.R/106. New York. In particular:

Shireen Jejeebhoy, Measuring Contraceptive Use Failure and Continuation: An Overview of New Approaches, pp. 21-51. (excellent review)

Charles Hammerslough. Overview, pp. 1-12.

Tsui, Amy Ong and M.A. Herbertson (eds). 1989. Dynamics of Contraceptive Use. *Journal of Biosocial Science*, Supplement No.11: 1-148.

METHODOLOGY

Introduction to Life Tables:

Newell, Colin. 1988. *Methods and Models in Demography*. Chapter 6. London: Belhaven Press.

Palmore, James A. and Robert W. Gardner. 1983. *Measuring Mortality, Fertility and Natural Increase*. Chapter 2. Honolulu: East-West Center.

Pollard, A.H., F. Yusuf and G.N. Pollard. 1983. *Demographic Techniques 2nd ed.* Chapters 3, 4 & 10. New York: Pergamon Press.

Sinquefield, Jeanne Cairns. 1973. *Single and Multiple-decrement Life Table Procedures for the Analysis of the Use-Effectiveness of Contraception.* Family Planning Research and Evaluation Manual Number 8. University of Chicago: Community and Family Study Center.

SPSS Inc. *SPSS/PC+ Advanced Statistics Manual.* Sections on Survival Analysis and SURVIVAL procedure (version 4.1 or higher). Chicago, Illinois.

More Advanced Topics:

Trussell, James and Jane Menken. 1980. Life Table Analysis of Contraceptive Failure. In *The Role of Surveys in the Analysis of Family Planning Programs,* Albert I. Hermalin and Barbara Entwisle (eds). Liege, Belgium: IUSSP, Ordina Editions.

LITERATURE REVIEWS

Trussell, James and Kathryn Kost. 1987. Contraceptive Failure in the United States; A Critical Review of the Literature. *Studies in Family Planning* 18(5):237-283.

EXAMPLES OF ANALYSES

Grady, William R., Marilyn B. Hirsch, Nelma Keen, and Barbara Vaughan. 1983. Contraceptive Failure and Discontinuation among Married Women in the United States, 1970-75. *Studies in Family Planning* 14(1):109-119.

Kost, Kathryn. 1993. The Dynamics of Contraceptive Use in Peru. *Studies in Family Planning* 24(2):109-119.

Moreno, Lorenzo. 1993. Differences by Residence and Education in Contraceptive Failure Rates in Developing Countries. *International Family Planning Perspectives* 19(2):54-60.

Moreno, Lorenzo, Noreen Goldman and Ozer Babakol. 1990. Collection of Survey Data on Contraception: Experimental Field Studies in Peru and the Dominican Republic, Paper presented at the 1990 Annual Meeting of the Population Association of America, Toronto, Canada.

APPENDICES

APPENDIX A
INTRODUCTION TO LIFE TABLES

Single-Decrement Life Tables

Life tables were originally developed to study mortality and length of life, but they can be adapted to study a range of problems involving the interval between two events, including contraceptive discontinuation. The basic idea of the life table is that the duration of use is broken down into monthly intervals, and for every duration the number of users who have been using contraception for at least that long is tabulated, together with both the number of discontinuations at that duration and the number of censored observations at that duration (i.e., the number of users who are observed to be still using at that duration at the time of the survey). This information is used to calculate the probability of discontinuing use at each duration.

A simple example will help to illustrate the construction of a life table for contraceptive discontinuation. Suppose we collect information on 100 recent segments of contraceptive use and obtain the following data:

Duration of use observed	Number still using	Number discontinuing
1	3	7
2	5	17
3	8	25
4	2	15
5	9	9

Of the 100 segments of use observed, 10 were of one month's duration. Of these 10 segments of use, 3 were still in progress at the time of observation (i.e., censored) and 7 were complete segments of use. Similarly, 22 of the 100 segments of use were of two month's duration, of which 5 were still in progress at the time of observation and 17 were complete segments of use etc. These data can be rearranged into the form of a life table and from this information the number *at risk* of discontinuing at each duration can be calculated. This is done by assuming that, on average, the segments of use that are continuing at the time of observation are observed in the middle of the month, and consequently they only contribute half a month of exposure in the last month. Hence, the number *at risk* is calculated by taking

the number using at the start of the interval and subtracting half of the number censored during the interval.

For example:

Start of interval (months)	Number using at least this long	Number discontinuing	Number still using	At risk
0	100	7	3	98.5
1	90	17	5	87.5
2	68	25	8	64.0
3	35	15	2	34.0
4	18	9	9	13.5
5	0			

From these data, the probability of discontinuing use at each duration, conditional on the fact that discontinuation has not occurred at an earlier duration, is calculated by dividing the number of discontinuations at each duration by the number at risk at that duration. The probability of continuing use at each duration is simply one minus the probability of discontinuing use at that duration.

For example, consider the first month of use in the above example.

Probability discontinue use = 7/98.5 = 0.0711
Probability continue use = 1 - 0.0711 = 0.9289.

For the second month, assuming that discontinuation did not occur in the first month:

Probability discontinue use = 17/87.5 = 0.1943
Probability continue use = 1 - 0.1943 = 0.8057.

and so on for each duration.

The next stage is to calculate the cumulative probability that a user is still using the contraceptive method at different durations. To do this the conditional probabilities just calculated have to be multiplied together. For example, for the second month in our example:

Probability still using at the end of the 2nd month = (prob. still using at the end of the 1st month) x (prob. still using at the end of the 2nd month given that the user is still using at the end of the 1st month) = 0.9289 x 0.8057 = 0.7484.

The cumulative probability of discontinuing use by the end of the second month is one minus the probability that the user is still using at the end of the second month, i.e., 1 - 0.7484 = 0.2516.

Similar calculations can be done for each duration, giving the final life table as:

Start of interval	Cond. prob. discontinue use	Cond. prob. continue use	Cum. prob. still using at the end of the month	Cum. prob. discontinue by the end of the month
0	0.0711	0.9289	0.9289	0.0711
1	0.1943	0.8057	0.7484	0.2516
2	0.3906	0.6094	0.4561	0.5439
3	0.4412	0.5588	0.2549	0.7451
4	0.6666	0.3333	0.0849	0.9151
5				

It is worth noting that a number of refinements can be made to the calculation of the *at risk* component of the life table for contraceptive discontinuation. These refinements are related to the fact that contraceptive information is usually collected using a calendar that collects information on use in calendar months, whereas the life table refers to actual months of use. In addition, it is common practice to ignore the most recent three months of the calendar to enable women to recognize that they are pregnant. One consequence of this approach is that censored observations actually contribute a full month of exposure in the last month of observation included in the analysis rather than half a month of exposure. However, these refinements generally have very little impact on the rates calculated, so for simplicity they are not used in this further analysis plan.

Multiple-Decrement Life Tables

It is often useful to classify discontinuations into different groups, e.g., by reason for discontinuation or status after discontinuation. In this situation a multiple-decrement life table is a

convenient way of analyzing the risks of different types of discontinuation. Multiple-decrement life tables were originally used to study mortality by cause of death, and are a simple extension of the single-decrement life table outlined in the preceding section.

Suppose that in the simple example described we knew whether each discontinuation resulted from a contraceptive failure or some other reason. We could break down the column containing the number of discontinuations at each duration into two columns, one containing the number of discontinuations due to failure and one containing the number of discontinuations due to other reasons. For example:

Start of interval	Number using at least this long	Number failing	Number discontinuing for other reasons	Number still using	At risk
0	100	2	5	3	98.5
1	90	7	10	5	87.5
2	68	9	16	8	64.0
3	35	4	11	2	34.0
4	18	2	7	9	13.5
5	0				

The number of discontinuations at each duration is still the same, but they are now classified by reason for discontinuation. For example, in the first month there are still seven discontinuations, but two are due to failure and five are due to other reasons. From this table, the probability of discontinuing for each reason at each duration can be calculated, again conditional on the fact that the user is still using at the start of the interval.

Hence, for the first month we have:

Prob. discontinuing due to failure = 2/98.5 = 0.0203

Prob. discontinuing due to other reasons = 5/98.5 = 0.0508

and for the second month, assuming the user does not discontinue in the first month, we have:

Prob. discontinuing due to failure = 7/87.5 = 0.0800

Prob. discontinuing due to other reasons = 10/87.5 = 0.1143

and so on for each duration.

Note that the overall probability of discontinuing (for either reason) remains exactly the same as in the single-decrement life table because the total number of discontinuations remains the same. Consequently, the probability of continuing use at each duration also remains the same. Also note that the overall probability of discontinuing at each duration equals the sum of the probabilities of discontinuation for each reason. For example, in the first month:

Prob. discontinuing = 7/98.5 = (2/98.5) + (5/98.5) = 0.0203 + 0.0508 = 0.0711.

The calculation of the cumulative probability that a user discontinues for a particular reason by the end of each month is a little complicated. It can be illustrated by the following example. In the first month:

Probability discontinue by the end of the 1st month due to failure = Probability discontinue during the 1st month due to failure = 0.0203

and similarly,

Probability discontinue by the end of the 1st month due to other reasons = Probability discontinue during the 1st month due to other reasons = 0.0508.

In the second month:

Probability discontinue by the end of the 2nd month due to failure = Prob. discontinue by the end of the 1st month due to failure + (prob. still using at the end of the 1st month) x (prob. discontinue during the 2nd month due to failure given that the user is still using at the end of the 1st month) = 0.0203 + 0.9289 x 0.0800 = 0.0946

and similarly,

Probability discontinue by the end of the 2nd month due to other reasons = Prob. discontinue by the end of the 1st month due to other reasons + (prob. still using at the end of the 1st month) x (prob.

discontinue during the 2nd month due to other reasons given that the user is still using at the end of the 1st month) = 0.0508 + 0.9289 x 0.1143 = 0.1570.

Similar calculations can be done for each duration, giving the final multiple-decrement life table as:

Start of interval	Cond. prob. continue use	Cond. prob. discontinue due to failure	Cond. prob. discontinue due to other reasons	Cum. prob. still using at the end of the month	Cum. prob. discontinue by the end of the month, failure	Cum. prob. discontinue by the end of the month, other reasons
0	0.9289	0.0203	0.0508	0.9289	0.0203	0.0508
1	0.8057	0.0800	0.1143	0.7484	0.0946	0.1570
2	0.6094	0.1406	0.2500	0.4561	0.1998	0.3441
3	0.5588	0.1176	0.3235	0.2549	0.2534	0.4916
4	0.3333	0.1481	0.5185	0.0849	0.2912	0.6238
5						

The probabilities calculated from the multiple-decrement life table are called net discontinuation probabilities because they represent the probability of discontinuing for each reason in the presence of other competing reasons for discontinuation. Further discussion of the interpretation and use of net discontinuation rates is given below, in Sections 4, 5, 6 and 7 of this further analysis plan, and in a later section of this Appendix.

Associated Single-Decrement Life Tables

One other type of life table that is useful in the analysis of contraceptive discontinuation is the associated single-decrement life table. These are used to calculate underlying rates of discontinuation for a particular reason in the absence of other reasons for discontinuation. These underlying rates of discontinuation for a specific reason are called gross discontinuation rates. They are theoretical rates because they represent the rate of discontinuation for a particular reason if that was the only reason for discontinuing use. As such, they are unaffected by the rate of discontinuation for other reasons and are therefore particularly useful for comparisons of the risk of discontinuing for a particular reason in different populations.

The simplest way to calculate an associated single-decrement life table is to treat all discontinuations for reasons other than the one of interest as censored observations. The gross discontinuation rates calculated in this way are actually approximations of the true gross discontinuation rates, but the approximation is usually very close to the true value. Thus, for the simple example used earlier, the associated single-decrement life table for discontinuation due to failure would be constructed as follows:

Start of interval	Number using at least this long	Number failing	Number censored	At risk
0	100	2	8	96.0
1	90	7	15	82.5
2	68	9	24	56.0
3	35	4	13	28.5
4	18	2	16	10.0
5	0			

Notice that the difference between this life table and the first single-decrement life table is that the number of censored cases is higher at each duration because all discontinuations for reasons other than failure are treated as censored. Consequently, the number *at risk* at each duration is lower because all the discontinuations for reasons other than failure now only contribute half a month of exposure instead of a full month in the last month of observation.

The gross probability of discontinuing due to failure at each duration (assuming that failure has not occurred at an earlier duration) is calculated by dividing the number of failures by the number at risk. For example, in the first month:

Gross prob. of failing = 2/96.0 = 0.0208

Gross prob. of continuing use (i.e., not failing) = 1 - 0.0208 = 0.9792

and for the second month, assuming that failure did not occur in the first month:

Gross prob. of failing = 7/82.5 = 0.0848

Gross prob. of continuing use = 1 - 0.0848 = 0.9152

and so on for each duration.

The cumulative probability that a failure has not occurred at each duration is calculated in the same way as in a single-decrement life table. For example,

Cumulative prob. that failure has not occurred by the end of the second month = 0.9792 x 0.9152
= 0.8962

and correspondingly, the cumulative probability that failure has occurred by the end of the second month is 1 - 0.8962 = 0.1038.

Comments on the Use of Net and Gross Discontinuation Rates

The distinction between the net discontinuation rates calculated using a multiple-decrement life table and the gross discontinuation rates calculated using an associated single-decrement life table is a subtle one, and it can sometimes be difficult to know which one is the most appropriate for a particular analysis. The analyses in Sections 4-7 of this further analysis plan provide some discussion and examples of the use of each type of rate, but some additional comments may be useful.

In order to decide which discontinuation rate is the most appropriate for an analysis it is important to be clear about the difference between the two types. The *net* discontinuation rate for a particular reason is the rate that is *observed* in the population *in the presence of other reasons* for discontinuation. It is affected *both* by the underlying risk of discontinuing for that particular reason *and* the underlying risks of discontinuing for other reasons. As such, the net discontinuation rates are *dependent* on each other and changes in the underlying risk of discontinuing for one reason will affect the net discontinuation rates for other reasons. In contrast, the *gross* discontinuation rate for a particular reason represents the discontinuation rate that would be experienced *if* that reason for discontinuation was the only reason for contraceptive discontinuation. Therefore, it is a *theoretical* rate (since in real populations users are always simultaneously at risk of discontinuing use for a number of reasons) and represents the *"underlying" rate of discontinuation* for that reason. As such, gross discontinuation rates for a particular reason are unaffected by the level of discontinuation for other reasons so the gross discontinuation rates for different reasons are *independent* of each other.

In many policy-related analyses, interest is primarily focused on describing the observed discontinuation patterns in a particular population or comparing the discontinuation patterns actually experienced in different groups of the population. Net discontinuation rates should be used in these

situations since they represent the discontinuation rates actually experienced. The analyses presented in Sections 4 and 5 and in the first part of Section 7 all illustrate the use of net discontinuation and switching rates. These types of analyses answer questions such as:

- If I give a woman with no education the pill, what is the probability that she will still be using it in six months time?
- What is the probability that she will fail within the first year?
- What would be the corresponding probabilities if I give the pill to a woman with primary education?

Sometimes, interest may be in the underlying rate of a particular reason for discontinuing, e.g., failure, in which case the gross rates should be used. The most common applications of gross rates are for comparisons of failure rates in different populations or in the same population over time. The types of questions that can be addressed by studying gross failure rates include:

- Has the rate of pill failure changed in this population in the last five years?
- Are there educational differentials in failure rates?

The analyses in Section 6 and the second part of Section 7 provide specific examples of the use of gross rates.

APPENDIX B:
SETTING UP THE DATA FOR SECTIONS 3-7

Although it is possible to create the variables you want to use every time you run an analysis, you are strongly advised to spend some time at the start of your analysis setting up an SPSSPC system file containing all the variables that you want to use in the form that you want to use them. You may need to experiment a little initially before you have the variables in the form that you need them. However, a little time spent at this stage makes the analysis much more efficient and helps to avoid confusion and inconsistencies in the definition of variables. Indeed, all the programs prepared for this further analysis plan assume that you have such a system file. The following steps are required to create the final system file.

Step 1. Extract the Segments of Use from the Calendar

The analyses in Sections 1 and 3-8 are based on segments of contraceptive use (and nonuse). The information on segments of use is extracted from the calendar data in the DHS rectangular data files using the CAL2SPSS program. Segments of nonuse during which the woman is not pregnant are also extracted. This program writes out the data so that each record represents a segment of contraceptive use or a segment of nonuse. The information included on each record is the woman's ID information (varies across countries), the woman's sample weight, the method used in that segment (including no method), the reason for discontinuing use (not applicable for segments of nonuse), the woman's reproductive status in the month immediately following discontinuation of the segment, the duration of the segment, the woman's reproductive status in the month immediately before initiation of the segment, the number of births the woman had following the segment, and the date of the first month of the segment as a century month code (CMC). Note that the codes used in the calendar vary across surveys.

The default option in CAL2SPSS uses a 60-month period before the survey. The program ignores the last three months of the calendar, i.e., immediately before the survey. This is conventional practice to enable women who get pregnant to recognize that they are pregnant and hence to reduce bias in estimated failure rates due to unidentified failures. Therefore, the period covered by the data on segments of use is 3-62 months before the survey date for each woman. In addition, the program ignores any segments that began before this 60-month period. Such segments are called *left-truncated* and their inclusion complicates the analysis. Omission of these segments of use has little effect on discontinuation rates at short durations (under two years). However, very few segments in the data will continue for long

durations because many of these will have begun prior to the 60-month window. Hence, estimated discontinuation rates at long durations will be subject to larger standard errors. This should be kept in mind when conducting analyses of discontinuation rates.

To run the CAL2SPSS program with the default option simply type:

CAL2SPSS "name of rectangular data file"

at the DOS prompt. The program will produce a new data file with a name based on the name of the rectangular file. For example, if the rectangular data file is called AIQ22RT.DAT, the calendar file will be called AIQ22CL.DAT. Note that for this program to work you MUST NOT change the name of the rectangular data file supplied to you by DHS because it uses information contained in the filename.

In most cases the default option will be the one that you will want to use. However, there may be a situation in which you need to extract segments for a different period from the calendar. For example, in some DHS surveys (e.g., Bolivia, DHS-III) the calendar did not cover a full five-year period for all women so you would need to use a shorter period than the default of 60 months. CAL2SPSS allows you to specify the number of months at the end of the calendar to be ignored and the total number of months that you want to go back from that point. To run the CAL2SPSS program with these options type:

CAL2SPSS "name of rectangular data file" n m

where n is the number of months you want to skip at the end of the calendar and m is the number of months that you want to go back from that point. Note that the default option corresponds to n=3 and m=60. Again, left-truncated segments, i.e., those beginning before the start of the period you have specified, will not be included in the data.

Step 2. Create an SPSSPC System File Containing the Segments of Use Data

The next stage is to write an SPSSPC program to read in the new data file and save it as an SPSSPC system file. An example of the program to read in the segments of use data file for Country A is given in the program AIQ22CL.INC. Note that the file is sorted on the basis of the ID variables before it is saved. This is to enable covariates of interest to be added from the rectangular data file later. The

DYNPAK package of programs includes the appropriate SPSS program to read in the extracted calendar data for your survey. You will need to modify the DOS paths used in the DATA LIST and SAVE commands to those that you are using and then run the program in SPSSPC using the data file you created in Step 1.

Step 3. Extract and Save the Covariates You Want to Use from the Rectangular Data File

The background covariates of interest need to be extracted from the rectangular data file using the SELECT program, and then saved as an SPSSPC system file. The SELECT program requires two input files: the SPSSPC command file created by ISSA that defines all the variables in the rectangular file, e.g., AIQ22RT.SPS, and a file that you must create listing the variables that you want to extract. This file must have each variable name on a separate line and must have the extension DAT (see AIQ22BK.DAT for an example). You can use any editor to create this file. The ID variables must be included to enable the background variables to be matched to the segments of use. To use the SELECT program, just type SELECT at the DOS prompt and follow the instructions. The file produced by the SELECT program will have the extension .INC and the same name as the .DAT file that you created, e.g., AIQ22BK.INC. This file is an SPSSPC command file that will read in the specified variables from the rectangular file. You will need to add some commands to this program so that it will sort the data by the ID variables and then save the data as an SPSSPC system file. The program AIQ22BK.INC gives an example of a final edited version of this file. Finally, you have to run this program in SPSSPC to create the system file that contains the background characteristics in which you are interested, e.g., AIQ22BK.SYS.

It is worth spending some time thinking about exactly which variables you want to use in the analysis. If you do not have standard recode data files you will need to check the skip patterns in the questionnaire very carefully for the questions you want to use. Be sure to extract all the variables you need to create your final working variables. For example, if you want to include "level of education" as a background variable you will have to extract the variable for "ever attended school" as well as the variable for "level of education" because women who have never attended school have no information on level of education. Even if you do have the standard recode file for your country, it is important to check the questionnaire carefully before extracting the variables you want to use.

Another very important point when selecting variables for the analysis is that many variables refer to the time of the survey, but the calendar data cover a five-year period prior to the survey. Consequently, the value of a particular variable recorded at the time of the survey may not be relevant to the segment

of use that you are analyzing. For example, you may know the source of the current method of contraception, but that is not relevant for an earlier segment of use which may have been obtained from an entirely different source. Therefore, it is very important to think about whether a particular variable you are interested in makes sense and will answer your questions.

In some cases it is possible to create a variable that refers to the time of use. For example, in the illustrative analyses in Sections 4-6, contraceptive intent is used as an explanatory variable. This variable is constructed from information on whether a birth was wanted at that time, wanted later, or not wanted at all which is collected for births in the calendar period. The information on the number of births following use, extracted from the calendar in Step 1, is used to identify the birth following a segment of use. If that birth was classified as wanted then or wanted later, the segment is classified as "spacer." If the birth was reported as not wanted at all, the segment is classified as "limiter." For segments of use that are not followed by any births, the woman's current stated fertility intentions are used to define whether the segment was for spacing or limiting. Women who are sterilized or whose partner is sterilized are classified as being limiters at the time of the survey, and women who are not in union at the time of the survey are classified as being unsure about their fertility intentions. These assumptions are necessary because these women are not asked their fertility intentions in the survey. Hence, in order to create this one variable for the analysis, several variables have to be extracted from the original file.

Note that the other variable used in the analyses in Sections 4-6, "area of residence," also refers to the time of the survey and not necessarily to the time of the segment of use. It is possible (but complicated) to adapt this variable to refer to the time the segment of use began but, in general, relatively few segments of use will be misclassified, so the variable can be used as it stands. However, the problem should be kept in mind when interpreting the findings. Such an approach is not recommended for variables that are very likely to change over time and whose interpretation is likely to be very sensitive to misclassification problems, such as source of contraceptive supply.

Step 4. Create the Final System File

The SPSSPC program FINAL.INC illustrates the final steps of the data management process. The program matches the two system files you have previously created, i.e., AIQ22CL.SYS and AIQ22BK.-SYS, on the basis of the ID variables using the JOIN MATCH command. It then recodes and/or creates all the background variables needed for the analyses and saves everything as an SPSSPC system file (FINAL.SYS). This program will need to be extensively modified to suit your analysis and country as

indicated in the program although some variables MUST NOT be changed (e.g., DUR and DISC). These variables are clearly labelled in the program. You will need to check the recoded and created variables carefully with some cross-tabulations and frequencies to ensure that they are correct. You will also probably need to experiment with several different codings of the variables before you settle on the most appropriate, i.e., one that provides you with enough segments for the analyses. As a rough guide, you need a minimum of 125 segments and preferably more, to calculate each life table. Hence, you will probably need to restrict your analyses to certain specific methods and fairly broad subgroups of the population. Grouping of methods should be done cautiously because discontinuation patterns often vary considerably across methods. Thus, the results for very different methods grouped together can be misleading and of little policy relevance. You are advised to drop segments of use missing information on reason for discontinuation from the final system file unless you intend to examine only total discontinuation rates (Section 3). This helps to avoid inconsistencies in the later analyses. The final system file for the analysis can then be created.

APPENDIX C
REPORT WRITING

Once the data gathering is over, you will be faced with the task of deciding how best to present the results to the research community. Writing the report, the logical next step, can be made easier if a little time is spent planning what will be included and what the format will be. Some suggestions are presented below:

Organization

- Make an outline. Once all headings and subheadings are in place, the framework will ensure that nothing is left out. Further, if additional ideas come to mind, they could be inserted easily at this point.

- Make decisions about the supporting data at this time too. Although all reports must have words, some information is transmitted more effectively by visual presentations. Therefore, maximize the effectiveness of tables and figures. Carefully choose formats for each. Equally carefully, place the visuals as close to the relevant text as possible. Have overall coherency in style, size, and units of measurement.

Tables

Tables usually contain vertical and horizontal headings, both of which control what data will be included. Accurately but briefly state the table's contents in the heading. Present the contents neatly in the columns and leave adequate white space. Whenever possible, place the table so that it can be read straight on, i.e., without turning the page.

Figures

Unlike tables, which present specific, or direct, data, other visuals, for example, graphs and charts, present data indirectly. Graphs allow the reader to observe change. Some guidelines for good graphs include:

Label each line either in the graph or in a separate key or legend (see Fig. 3.1)

Make each line different in appearance

Use color to differentiate (this may not always be desirable)

Use the same format from one graph to another (see Figs. 4.1 and 4.2).

Examples of charts include pie, bar, and organization. The pie chart is an excellent vehicle for displaying the distribution of parts to the whole. In the bar chart, the data are broken down into several categories and subcategories, thereby illustrating relative proportions. Organization charts help show the hierarchical relationships in an organization or program.

As a writer, you must decide whether a certain type of visual suits your material best or whether you want to rely solely on the written word.

Mechanical Details

- Do not use long, "run-on" sentences. Clearly define subjects and verbs and follow a logical sequence for ease of reading.

- Do not use personal pronouns (I, we, us); if need be, refer to "the author(s)."

- Supply references that contain all the necessary facts, such as complete names of all authors; correct year of publication, volume, number, and page number; and publishers information.

- Appendices, which offer the opportunity to provide additional, more detailed information to supplement the text, should be cited in the text and also be formatted to look good.

Fine Points

- Avoid the tendency to use a variety of words for the same thing. It is better to see the word "test" mentioned five times in one paragraph, than read about an "experiment," an "analysis," a "program," etc., which could just confuse the reader. Instead, use variety to

add interest to the document with different types of figures and levels of headings, bulleted lists, and action verbs.

- If acronyms or abbreviations are used, insert them immediately after the word to which they refer is first mentioned and use them exclusively thereafter (see Glossary, MDLT). Listing the acronyms on a separate sheet of paper as you write ensures consistency in usage and their orderly introduction

- Consistency also is desired in voice (use the active as much as possible), tense (present or past), agreement of subject and verb, and mood.

In summary, a well written and organized report will help ensure that your information is well received by your intended reading audience.

APPENDIX D:
REPORT DISSEMINATION

Few tools are more helpful to decision-makers in designing, enhancing, and evaluating family planning policies and programs than DHS data. Effective research dissemination will increase the probability that the results will be used in decision-making processes. In its research dissemination activities, the DHS program seeks to 1) provide policy-makers with information useful for decision-making and 2) employ communication formats that will enhance understanding and use of the results among key audiences.

The following ideas might prove useful in effectively disseminating the results from the research papers produced using DHS Model Further Analysis Plans.

Distribution

- Report distribution is an important step in reaching key audiences for the research. Effective distribution requires a good distribution list. *To make a good list, include the individuals or organizations in a position to use the research results, especially those involved in relevant policy areas and research.* For any given report, key audiences might range from family planning or health program managers to journal or newsletter editors.

- After developing your distribution list of key audiences, identify different avenues for distributing the reports. For many of you, distributing the reports via the mail will be easiest and most efficient. *When sending reports through the mail, enclose some sort of supplementary materials, such as a cover letter introducing the report or a short abstract of the main findings.* Because report recipients may have questions or want more information, any items accompanying the report should identify how to reach the author.

- Identify other distribution strategies to reach key audiences. These may be meetings, workshops, or publications that would provide an opportunity to disseminate results. *Use*

electronic networks to announce the availability of reports and provide an abstract of the main findings.

Presentations

- Schedule an informal presentation to more effectively heighten awareness and understanding of the results among important groups. Shape the length and emphasis of the presentation by the needs and interests of a given audience. In most cases, *visual aids, such as transparencies or hand-outs that summarize main points, are extremely helpful.*

- Select other options for reaching key audiences, including *presentations of the results at relevant conferences or workshops.* Various conferences take place during the year and provide a good opportunity to reach academic and research audiences. Additionally, a number of workshops take place on related topics; these might prove to be useful venues for in-depth discussion of the results and their implications. As with informal meetings, the use of transparencies or hand-outs is recommended.

Supplementary Materials

- When disseminating results, use various formats to encourage review and use of findings by key audiences. Present results on transparencies, slides, or computers. Summarize the findings in abstracts, fact sheets, and executive summaries.

To ensure a minimal degree of awareness about the report, you should undertake at least one dissemination activity. At the bare minimum, all researchers need to distribute the report.

APPENDIX E

THE CALENDAR FROM THE DHS-II A-CORE QUESTIONNAIRE

INSTRUCTIONS: ONLY ONE CODE SHOULD APPEAR IN ANY BOX. FOR COLUMNS 1, 6, 7, AND 8 ALL MONTHS SHOULD BE FILLED IN.

INFORMATION TO BE CODED FOR EACH COLUMN

COL.1: Births, Pregnancies, Contraceptive Use
- B BIRTHS
- P PREGNANCIES
- T TERMINATIONS

- 0 NO METHOD
- 1 PILL
- 2 IUD
- 3 INJECTIONS
- 4 DIAPHRAGM/FOAM/JELLY
- 5 CONDOM
- 6 FEMALE STERILIZATION
- 7 MALE STERILIZATION
- 8 PERIODIC ABSTINENCE
- 9 WITHDRAWAL
- W OTHER_____ (SPECIFY)

COL.2: Discontinuation of Contraceptive Use
- 1 BECAME PREGNANT WHILE USING
- 2 WANTED TO BECOME PREGNANT
- 3 HUSBAND DISAPPROVED
- 4 SIDE EFFECTS
- 5 HEALTH CONCERNS
- 6 ACCESS/AVAILABILITY
- 7 WANTED MORE EFFECTIVE METHOD
- 8 INCONVENIENT TO USE
- 9 INFREQUENT SEX/HUSBAND AWAY
- C COST
- F FATALISTIC
- A DIFFICULT TO GET PREGNANT/MENOPAUSE
- D MARITAL DISSOLUTION/SEPARATION
- W OTHER_____ (SPECIFY)
- K DON'T KNOW

COL.3: Post-Partum Amenorrhea
- X PERIOD DID NOT RETURN
- 0 LESS THAN ONE MONTH

COL.4: Post-Partum Abstinence
- X NO SEXUAL RELATIONS
- 0 LESS THAN ONE MONTH

COL.5: Breastfeeding
- X BREASTFEEDING
- 0 LESS THAN ONE MONTH
- N NEVER BREASTFED

COL.6: Marriage/Union
- X IN UNION (MARRIED OR LIVING TOGETHER)
- 0 NOT IN UNION

COL.7: Moves and Types of Communities
- X CHANGE OF COMMUNITY
- 1 CITY
- 2 TOWN
- 3 COUNTRYSIDE

COL.8: Type of Employment
- 0 DID NOT WORK
- 1 PAID EMPLOYEE, AWAY FROM HOME
- 2 PAID EMPLOYEE, AT HOME
- 3 SELF-EMPLOYED, AWAY FROM HOME
- 4 SELF-EMPLOYED, AT HOME
- 5 UNPAID WORKER, AWAY FROM HOME
- 6 UNPAID WORKER, AT HOME

	1	2	3	4	5	6	7	8	
12 DEC 01									01 DEC
11 NOV 02									02 NOV
10 OCT 03									03 OCT
09 SEP 04									04 SEP
1 08 AUG 05									05 AUG 1
9 07 JUL 06									06 JUL 9
9 06 JUN 07									07 JUN 9
0 05 MAY 08									08 MAY 0
* 04 APR 09									09 APR *
03 MAR 10									10 MAR
02 FEB 11									11 FEB
01 JAN 12									12 JAN
12 DEC 13									13 DEC
11 NOV 14									14 NOV
10 OCT 15									15 OCT
09 SEP 16									16 SEP
1 08 AUG 17									17 AUG 1
9 07 JUL 18									18 JUL 9
8 06 JUN 19									19 JUN 8
9 05 MAY 20									20 MAY 9
04 APR 21									21 APR
03 MAR 22									22 MAR
02 FEB 23									23 FEB
01 JAN 24									24 JAN
12 DEC 25									25 DEC
11 NOV 26									26 NOV
10 OCT 27									27 OCT
09 SEP 28									28 SEP
1 08 AUG 29									29 AUG 1
9 07 JUL 30									30 JUL 9
8 06 JUN 31									31 JUN 8
8 05 MAY 32									32 MAY 8
04 APR 33									33 APR
03 MAR 34									34 MAR
02 FEB 35									35 FEB
01 JAN 36									36 JAN
12 DEC 37									37 DEC
11 NOV 38									38 NOV
10 OCT 39									39 OCT
09 SEP 40									40 SEP
1 08 AUG 41									41 AUG 1
9 07 JUL 42									42 JUL 9
8 06 JUN 43									43 JUN 8
7 05 MAY 44									44 MAY 7
04 APR 45									45 APR
03 MAR 46									46 MAR
02 FEB 47									47 FEB
01 JAN 48									48 JAN
12 DEC 49									49 DEC
11 NOV 50									50 NOV
10 OCT 51									51 OCT
09 SEP 52									52 SEP
1 08 AUG 53									53 AUG 1
9 07 JUL 54									54 JUL 9
8 06 JUN 55									55 JUN 8
6 05 MAY 56									56 MAY 6
04 APR 57									57 APR
03 MAR 58									58 MAR
02 FEB 59									59 FEB
01 JAN 60									60 JAN
12 DEC 61									61 DEC
11 NOV 62									62 NOV
10 OCT 63									63 OCT
09 SEP 64									64 SEP
1 08 AUG 65									65 AUG 1
9 07 JUL 66									66 JUL 9
8 06 JUN 67									67 JUN 8
5 05 MAY 68									68 MAY 5
04 APR 69									69 APR
03 MAR 70									70 MAR
02 FEB 71									71 FEB
01 JAN 72									72 JAN

LAST CHILD BORN PRIOR TO JAN. 1985**

NAME: _____ MONTH.. ☐☐

YEAR... ☐☐

* For fieldwork beginning in 1991, 1992, or 1993, the years should be adjusted.
** For fieldwork beginning in 1991, 1992, or 1993, the year should be changed to 1986, 1987, or 1988, respectively.