DHS ANALYTICAL REPORTS

6

Determinants of Contraceptive Failure, Switching, and Discontinuation: An Analysis of DHS Contraceptive Histories

DHS

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Demographic and Health Surveys
Analytical Reports No. 6

Determinants of Contraceptive Failure, Switching, and Discontinuation: An Analysis of DHS Contraceptive Histories

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October 1997

Recommended citation:

Curtis, Siân L. and Ann K. Blanc. 1997. *Determinants of contraceptive failure, switching, and discontinuation: An analysis of DHS contraceptive histories.* DHS Analytical Reports No. 6. Calverton, Maryland: Macro International Inc.

Contents

Tables

Figures

Preface

One of the most significant contributions of the DHS project is the creation of an internationally comparable body of data on the demographic and health characteristics of populations in developing countries. The *DHS Analytical Reports* series and the *DHS Comparative Studies* series examine these data across countries in a comparative framework, focusing on specific topics.

The overall objectives of the DHS comparative research are: to describe similarities and differences between countries and regions, to highlight subgroups with specific needs, to provide information for policy formulation at the international level, and to examine individual country results in an international context. While *Comparative Studies* are primarily descriptive, *Analytical Reports* utilize a more analytical approach.

The comparative analysis of DHS data is carried out primarily by staff at the DHS headquarters in Calverton, Maryland. The topics covered are selected by staff in conjunction with the DHS Scientific Advisory Committee and USAID.

The *Analytical Reports* series is comprised of in-depth, focused studies on a variety of substantive topics. The studies employ a range of methodologies, including multivariate statistical techniques, and are based on a variable number of data sets depending on the topic under study.

It is anticipated that the *Analytical Reports* will enhance the understanding of significant issues in the fields of international population and health for analysts and policymakers.

Martin Vaessen
Project Director

Acknowledgments

The authors would like to thank Germán Rodríguez of Princeton University for his invaluable assistance and advice on multilevel modeling. We would also like to thank Fiona Steele of The London School of Economics for her thoughtful review of the manuscript and her suggestions for improvements. We are very grateful to Trevor Croft of DHS for his advice on the programming to set up the data sets for the analysis and to Nicholas Hill, also of DHS, for his assistance in the preparation of the tables and figures. Production assistance was provided by Mary Lane, Tonya Gary, Celia Siebenmann, and Catherine Sansone of DHS.

Executive Summary

While much has been learned about the determinants of current contraceptive use in developing countries over the past 20 years or so, the dynamics of changes in contraceptive status—failure, switching, and abandoning method use—are much less understood. These dynamics are significant because contraceptive effectiveness and duration of use become increasingly important determinants of fertility as desired family size declines and contraceptive prevalence rises. In addition to its demographic impact, the analysis of contraceptive use dynamics is important because it can inform efforts to improve service delivery in various ways.

The purpose of this report is to examine contraceptive discontinuation in six developing countries that conducted DHS surveys between 1991 and 1995—Bangladesh, Colombia, Egypt, Indonesia, Peru, and Zimbabwe. Four types of discontinuation are examined: failure, switching, and abandonment of use subdivided into users who are not 'in need' of contraception following discontinuation of a method and those who remain 'in need.' The first type of abandonment refers to users who abandon contraception because they no longer need to use, either because they want to get pregnant or because their exposure to the risk of pregnancy is reduced. The second type refers to users who abandon contraception for reasons that leave then 'in need' of resuming use to avoid an unwanted pregnancy, such as side effects, health concerns, husband's disapproval, access/availability, and cost. Analyses are based on monthly contraceptive histories collected from all survey respondents. Following an assessment of data quality, both life table and multivariate statistical techniques are used in the analysis. The multivariate analyses of the determinants of contraceptive discontinuation, switching, and failure are based on hazards models. In the analysis, each episode of contraceptive use is divided into three-month intervals and piecewise-constant hazards models with random effects are fitted.

The life tables show that discontinuing use of a contraceptive method is a common event. Within two years of starting an interval of use, almost half the users have discontinued in Egypt, Indonesia, and Zimbabwe. In Bangladesh, Colombia, and Peru, approximately two-thirds discontinue within two years. While much of this discontinuation reflects method switching and abandonment due to reduced need for contraception, contraceptive failure and abandonment while still in need of contraception are also relatively common. Two-year contraceptive failure rates range from 7.6 percent in Indonesia to 29.4 percent in Peru, while two-year rates of abandonment while still in need of contraception range from 11.5 percent in Indonesia to 26.8 percent in Bangladesh.

Multivariate analyses reveal that the method chosen by women is strongly associated with the likelihood of each of the four types of discontinuation examined in all six populations. Users of modern methods have consistently lower rates of failure than users of traditional methods but are more likely to discontinue the method while still in need. The relationship between the type of method used and switching tends to be both duration and method-specific in these six countries. In general, condoms are associated with high rates of switching at early durations. Switching rates for injectables are also high compared to other methods. Further, the abandonment of condoms due to reduced need tends to be relatively higher compared to other methods, especially during the first year of use. In contrast, the risk of contraceptive failure, switching, and abandoning use due to reduced need tends to be lower for the IUD than for other methods. The risk of abandoning use while still in need is also generally lower for the IUD than for other modern methods, although it tends to be higher than for traditional methods.

In contrast to studies of the determinants of current contraceptive use, socioeconomic variables are not consistently related to the outcomes examined here. In particular, women's level of education and socioeconomic status are not significant determinants of the likelihood of contraceptive failure or abandoning due to reduced need. The variables that influence these two outcomes most strongly tend to be more proximate, such as fertility intention, number of living children, and marital status.

The effects of socioeconomic variables are important, however, in the case of switching and abandoning while in need. The risk of switching increases consistently with increasing education and, in some countries, with increasing socioeconomic status. In addition, women's socioeconomic status is negatively

related to abandonment while still in need in every country except Bangladesh. These findings indicate that cost and access factors may contribute to contraceptive outcomes even though they are seldom mentioned as the main reason for discontinuation.

The role of a change in marital status is substantial for both types of abandonment. A change in marital status is significantly positively related to contraceptive abandonment due to reduced need in every country except Bangladesh (where the coefficient is also positive but not significant). These results are not surprising since marital dissolution is likely to be associated with reduced frequency of sex while an initiation of marriage is associated with a desire to get pregnant. A change in marital status strongly increases the likelihood of discontinuing while in need in every country except Peru, where the effect is also positive but not significant. It may be the case that women who tolerate side effects to avoid a premarital pregnancy abandon the method following marriage because their desire to avoid pregnancy diminishes (or perhaps because their husbands disapprove). At the same time, women who have side effects or health concerns about their method may abandon the method if they are divorced or widowed. A change in marital status is also positively associated with the likelihood of contraceptive failure in the three countries in which it was possible to measure this effect. This relationship may be due to increased exposure to sexual intercourse after marriage or to the possibility that a premarital contraceptive failure leads to marriage.

The community-level variables included in the multivariate models—ever use of contraception and discussion of family planning—did not have consistently significant effects in any of the models; the one exception is that cluster-level contraceptive experience is significantly negatively related to the risk of abandonment while in need. The lack of statistical power of the community variables may be due to their inability to capture true community effects because, for example, the sampling cluster is not a relevant social unit or women's discussion of family planning is poorly reported. However, the size and statistical significance of the random effects suggest that there are considerable cluster-level influences on contraceptive outcomes which are unmeasured in this analysis and confirm the utility of including these effects through a multilevel model both from a substantive perspective and because omitting them would potentially bias the estimated effects of the other variables in the model.

The findings of this analysis suggest several areas for future research, much of which can be carried out with DHS contraceptive histories. First, the strong but complex relationship between method choice and contraceptive discontinuation merits further investigation. Other areas to pursue include the relationship between contraceptive discontinuation and other changes in women's lives, particularly changes in marital status and place of residence; the nature of community-level effects; the role of service availability and quality in contraceptive discontinuation; and the subsequent behavior of women who experience a contraceptive failure or who abandon use while still in need of family planning.

1 Introduction

The demographic impact of contraceptive use depends not only on its prevalence but also on the duration and effectiveness of use. As desired family size declines and contraceptive prevalence rises, contraceptive effectiveness becomes an increasingly important determinant of fertility (Wang and Diamond, 1995). For example, if desired fertility is six births per woman, an increase in contraceptive effectiveness from 85 to 90 percent would result in a decline in total fertility of about 0.20 births. In contrast, if desired fertility is two births per woman, then the same increase in contraceptive effectiveness would reduce the total fertility rate by more than one birth (Bongaarts and Rodriguez, 1991).[1]

In addition to its demographic impact, the analysis of contraceptive discontinuation is important because it can inform efforts to improve service delivery in various ways. For instance, the rate at which women discontinue use of a method due to experiencing side effects may indicate that counseling needs improvement and that information about the method needs to be communicated more effectively (Datey et al., 1995; Petta et al., 1994; Amatya et al., 1994). High levels of discontinuation due to access or availability problems suggest that supply and/or distribution mechanisms need examination. Combined with knowledge of the modes of delivery for different methods, discontinuation rates can help identify the inadequacies of particular types of service delivery and the potential effects of contemplated changes in modes of delivery (Hossain and Phillips, 1996; Jensen, 1996).

Settings in which women frequently discontinue one method and switch to another have usually been thought to indicate some level of dissatisfaction with methods or services or responses to actual or feared side effects (Ali and Cleland, 1995). However, this assumption has been questioned by some researchers who suggest that high rates of method switching may indicate expansive method choice and ease of access with women switching frequently as their circumstances change (Kost, 1993; Dixon-Mueller, 1993). At the same time, very low rates of switching can be a reflection of restricted options available to couples (Ping, 1995).

High levels of discontinuation due to contraceptive failure can affect induced abortion rates and, depending on the level of induced abortion, can mean that contraceptive use has a diminished impact on fertility (Henshaw and Kost, 1996; Johansson et al., 1996) . In addition, unplanned pregnancies may have serious implications for women's quality of life and that of their children. Finally, estimates of contraceptive failure rates for particular populations are invaluable for women and men in making an informed choice of method and may help to pinpoint those who are most (or least) likely to use a particular method incorrectly (Beckman and Harvey, 1996; Trottier et al., 1994; Hammerslough, 1991).

The purpose of this report is to examine contraceptive discontinuation and failure in six developing countries that conducted DHS surveys between 1991 and 1995—Bangladesh, Colombia, Egypt, Indonesia, Peru, and Zimbabwe. The first section of the report contains a review of previous research and a conceptual framework for the analysis. In the next section, the data used in the analyses, particularly the contraceptive history calendars, are described. The third section presents measures of data quality. Next, multilevel multivariate models of the determinants of discontinuation are presented. Four types of discontinuation are examined: failure, switching, and abandonment of use subdivided into users who remain 'in need' of contraception following discontinuation of a method and those who are not 'in need.' The final section summarizes the results and provides suggestions for further research in this area. A technical appendix provides details of the multivariate models.

[1] This is primarily because, in a population with low desired fertility, the duration of contraceptive use necessary to achieve the level of desired fertility is longer; thus, the cumulative risk of contraceptive failure is greater.

2 Background

2.1 PREVIOUS RESEARCH

In spite of recent improvements in both the quality and quantity of data for the measurement of contraceptive discontinuation, population-based studies of discontinuation in developing country populations remain relatively rare. Most are based on single countries; only a few comparative studies have been published. Thus, while much has been learned about the determinants of current contraceptive use in developing countries over the past 20 years or so, the dynamics of changes in contraceptive status are much less understood. This lack of information has been due primarily to a lack of data appropriate for studying contraceptive discontinuation. The relatively recent availability of data for numerous countries from the calendar section of the DHS questionnaire makes possible population-based analyses that do not suffer from the problems of selection bias and loss to follow-up associated with studies conducted in clinical populations (Moreno and Goldman, 1991; Moreno, 1993). In addition, the surveys contain data that allow analyses of users of nonclinical methods and of the socioeconomic and demographic determinants of contraceptive discontinuation (Goldman et al., 1983).

Contraceptive failure is probably the most studied of the various types of discontinuation. Numerous clinical studies have been conducted but population-based studies of failure and its determinants are much less common. Virtually all of the population-based studies look at failure rates by method, perhaps the most important factor determining the probability of failure (Jejeebhoy, 1991; Goldman et al., 1983; Steele et al., 1996). For example, in their study of six DHS countries, Ali and Cleland (1995) calculated 12-month cumulative life-table failure rates ranging from 1 percent for injectables to 30 percent for periodic abstinence. A study by Moreno (1993) examined the determinants of contraceptive failure in 15 developing countries by estimating proportional hazards models with DHS survey data. The study showed that the method used is the most important determinant of failure. Age was also a significant factor with younger women being more likely to experience a contraceptive failure than older women. Contraceptive intention (spacing and limiting) was also significantly related to failure in a few countries while neither type of place of residence nor education had any effect on failure rates.

It is also commonly found that failure rates for the same method vary across countries. Ali and Cleland report 12-month failure rates for the pill that vary from 2 percent in Indonesia to 9 percent in Morocco; rates for periodic abstinence range from 12 percent in Indonesia to 29 percent in Morocco. Sambisa (1996) summarizes 12-month pill failure rates across 10 DHS surveys that range from 1.7 in Indonesia to 7.1 in Northeast Brazil. In a review of numerous previous studies from both developed and developing countries, Jejeebhoy (1991) also finds a range of rates reported for the same method. These differences are sometimes attributable to methodological differences across studies, such as how a contraceptive failure is defined and how the rates are computed, but are also influenced by other factors such as service delivery and the characteristics of users.

A series of mostly descriptive studies published by the DHS program demonstrates that a variety of user characteristics are associated with differentials in discontinuation due to failure (El-Tawila, 1995; Enülü and Doğan, 1996; Fathonah, 1996; Ferraz, 1994; Gómez, 1994; Melián, 1994; Mitra and Al-Sabir, 1996; Padilla, 1994; Perez and Tabije, 1996; Polanco, 1994; Sambisa, 1996;). Older users have consistently lower rates of failure than younger users, as has been found in other studies (see for example, Entwisle and Sayed, 1991; Steele et al., 1996). In addition, in most of the DHS studies women who want no more children are less likely to fail than those who are using contraception to space births. The association of type of place of residence with contraceptive failure varies across DHS studies and, within countries, sometimes varies with the method. For example, urban pill users are more likely to experience a contraceptive failure than rural users in a number of countries, especially those in Latin America, while the opposite tends to be the case for users of traditional methods. The woman's level of education rarely appears to be strongly associated with failure rates; in most of the studies, differentials in failure rates by education are relatively small and often are inconsistent in direction.

Although they are far more common events on average, switching of methods and contraceptive discontinuation for reasons other than failure are even less studied than failure (Kost, 1993). This lack of study is also surprising because discontinuation of a method for method-related or service-related reasons (such as supply shortages) may place a woman at high risk of an unintended pregnancy. Even switching immediately to another method may increase the risk of an unintended pregnancy

Table 2.1 Twelve-month net discontinuation rates by reason for discontinuation

Twelve-month net discontinuation rates by reason for discontinuation, all methods except sterilization, selected Demographic and Health Surveys, 1990-1994

	Failure	To get pregnant	Side effects	Method related	Other	Total
Bangladesh 1993/94	3.7	8.3	18.7	12.7	6.0	49.4
Brazil (NE) 1991	10.3	5.6	14.5	15.8	13.4	59.6
Colombia 1990	9.5	6.9	10.0	10.2	8.6	45.2
Dom. Rep. 1991	10.4	13.3	11.7	17.4	12.1	64.9
Indonesia 1994	3.2	6.2	5.6	10.0	1.4	26.5
Paraguay 1990	9.1	5.9	13.0	17.5	13.6	59.1
Peru 1991/92	15.6	5.6	7.5	12.5	7.7	48.9
Philippines 1993	14.0	5.6	6.2	—11.5—		37.2
Turkey 1993	10.4	5.3	5.2	10.9	5.3	37.1
Zimbabwe 1994	3.6	5.2	1.7	6.5	2.6	19.7

Source: Adapted from Enülü and Doğan, 1996; Fathonah, 1996; Ferraz, 1994; Gómez, 1994; Melián, 1994; Mitra and Al-Sabir, 1996; Padilla, 1994; Perez and Tabije, 1996; Polanco, 1994; Sambisa, 1996.

because failure rates tend to be highest in the first few months of use (Kane et al., 1988). The series of studies conducted under the DHS program provides an opportunity to examine discontinuation for reasons other than failure across 10 countries (Table 2.1). The studies are based on data collected using virtually identical questionnaires and are analyzed with the same methodology. The rate of discontinuation due to side effects ranges from less than 2 percent in Zimbabwe to 19 percent in Bangladesh. The rate for other method-related reasons for discontinuation is somewhat less variable with all of the rates except the rate in Zimbabwe falling between 10 and 17 percent. In 7 of the 10 countries, these reasons account for the largest proportion of discontinuations. In Bangladesh, discontinuations due to side effects are by far the largest contributor to the overall discontinuation rate while in Peru and the Philippines, contraceptive failure is the most important reason for discontinuation, reflecting the high prevalence of traditional methods in these two populations. Overall discontinuation rates for all reasons combined are surprisingly variable, ranging from a very low 20 percent in Zimbabwe to 65 percent in the Dominican Republic.

Discontinuation rates from the study by Ali and Cleland are shown in Table 2.2. The data collection and analysis methodology are different from the studies shown in Table 2.1 but the results should be broadly comparable.[2] On the whole, the overall rates of discontinuation are lower than those found in the DHS studies, falling in a narrow range from 28 to 36 percent. This may be a reflection of the data collection technique, which probably resulted in underreporting of some episodes of use.[3] Health concerns and side effects combined account for the most discontinuations in three of the six countries shown while failure is the most important reason for discontinuation in Morocco and other reasons combined account for the largest proportion of discontinuations in the remaining countries. An interesting observation made by Ali and Cleland in their analysis of discontinuation rates by method is that overall discontinuation rates were similar for users of hormonal and traditional methods because the rate of discontinuation due to side effects and health concerns among users of hormonal methods tends to be balanced by the rate of contraceptive failure among users of traditional methods. In a later study using the same data, Ali and Cleland (1996) find that demographic factors—desire for another child, number of living children, and the woman's age—are the strongest predictors of discontinuation in these six countries. The effects of socioeconomic factors, such as urban-rural residence and education were more variable.

[2] In fact, for Indonesia, the only country that appears in both tables, the results are very similar.

[3] In DHS-I surveys contraceptive histories were collected in a tabular format that collected information on up to two episodes of use in each birth interval only.

Table 2.2 Twelve-month gross discontinuation rates by reason for discontinuation

Twelve-month discontinuation rates by reason for discontinuation, all methods except sterilization. Demographic and Health Surveys, 1978-1989

	Failure	To get pregnant	Health concerns/side effects	Other	Total
Ecuador 1987	11.6	5.9	9.8	12.8	34.6
Egypt 1988/89	7.1	5.3	12.4	6.7	28.0
Indonesia 1987	2.8	7.5	8.7	8.7	25.1
Morocco 1987	12.2	9.8	11.3	7.7	35.2
Thailand 1987	3.9	14.1	6.8	17.1	36.3
Tunisia 1988	8.4	5.8	11.5	7.5	29.5

Source: Ali and Cleland, 1995

Population-based studies that address the question of women's behavior following discontinuation of a method are scarce in spite of the fact that they can yield results that are important for family planning programs. For example, a study in Sri Lanka showed that almost half of the women in the sample had switched methods at least once (Kane et al., 1988). Switches to sterilization were the predominant type while few couples whose first method was a traditional one switched to a temporary modern method. It was much more common to switch from a modern to a traditional method but a substantial percentage of the switches from traditional to modern methods followed a contraceptive failure. Similarly, a recent study in Peru showed that women who switch methods do so frequently, although another study in Malaysia reports very little switching between pregnancies (DaVanzo et al., 1989). Further, the Peru study shows that women who abandon use of a method and who do not immediately adopt another one are more likely to get pregnant than they are to adopt another method or to return to the previous method (Kost, 1993). Almost half of those who experienced a failure returned to the same method within 12 months, which is interpreted as a sign that women are resigned to some contraceptive failure either because there are no acceptable alternative methods or because preferred methods may not be consistently available.

Results from eight of the DHS studies are shown in Table 2.3, which presents 12-month net discontinuation rates according to the status of the user in the month after discontinuation. The data allow few generalizations but overall, between 4 and 25 percent of users switch to another method within 12 months of beginning use; the majority of these switch to a modern method. In the countries outside of Latin America, except Bangladesh, the largest proportion of discontinuations is due to a reduced need for contraception with lower rates of switching and abandonment for other reasons. In Bangladesh, the rates of abandoning due to reduced need, abandoning for other reasons, and switching to a modern method are almost the same, with the rate of switching to traditional methods being much lower. Among the three Latin American countries, women who discontinue in Brazil and Dominican Republic are most likely to abandon use for a non-pregnancy related reason, while in Colombia, the largest proportion of discontinuations are due to contraceptive failure or a desire to get pregnant.

This review of the literature demonstrates the need for population-based studies of the various dimensions of contraceptive use. Even basic descriptive information on contraceptive failure, switching, and overall discontinuation is lacking for many developing country settings, although more recent data collection efforts have improved the availability of data. Further, there exists only a small number of multivariate analyses that help to identify the determinants of contraceptive behaviors other than current use of contraception.

Table 2.3 Twelve-month net discontinuation rates by status

Twelve-month net discontinuation rates by status after discontinuation, all methods except sterilization, selected Demographic and Health Surveys, 1990-1994

	No need for contraception[1]	Switch to: Modern method	Switch to: Traditional method	Abandon use	Total
Africa/Asia/Near East					
Bangladesh 1993/94	15.0	15.5	4.4	14.5	49.4
Indonesia 1994	10.6	—9.9—		6.1	26.5
Philippines 1993	21.9	3.0	3.9	8.4	37.2
Turkey 1993	17.8	10.7	5.3	3.9	37.7
Zimbabwe 1994	10.8	—3.7—		5.2	19.7
Latin America/Caribbean					
Brazil (NE) 1991	15.9	16.1	9.0	18.6	59.6
Colombia 1990	16.4	13.6	3.4	10.1	45.2
Dominican Rep. 1991	23.6	—13.2—		27.4	64.9

[1] Bangladesh, Indonesia, Philippines, Turkey, and Zimbabwe include failure, want to get pregnant, infrequent sex, separation/widowhood, infecund/menopause. Brazil (NE), Colombia, and Dominican Republic include failure and want to get pregnant.
Source: Adapted from Enülü and Doğan, 1996; Fathonah, 1996; Ferraz, 1994; Gómez, 1994; Mitra and Al-Sabir, 1996; Perez and Tabije, 1996; Polanco, 1994; Sambisa, 1996.

2.2 CONCEPTUAL MODEL

Figure 2.1 portrays a conceptual model of the dynamics of contraceptive use within a pregnancy interval. The model posits three primary changes in contraceptive use status among those who are using a given method of contraception: getting pregnant while using (contraceptive failure), switching to another method,[4] and abandoning use. Among those who experience a contraceptive failure, two outcomes are specified: an induced or spontaneous abortion, or an unwanted or mistimed birth.

Among those who abandon the use of a method, the model delineates two possible outcomes. The first is that a user abandons contraception because she no longer needs to use, either because she wants to get pregnant or her exposure to the risk of pregnancy is reduced. The second possible outcome is that a user abandons contraception for reasons that leave her 'in need' of resuming use to avoid an unwanted pregnancy.

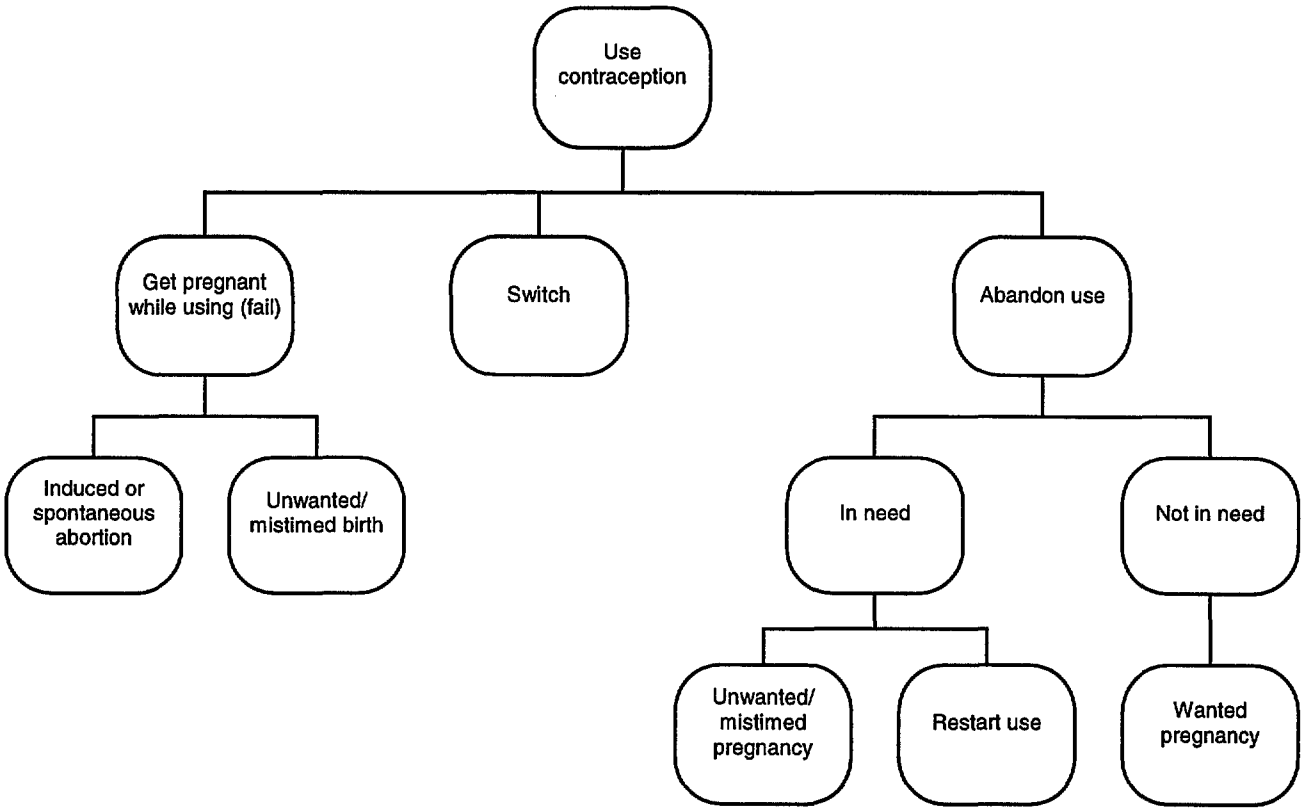
Following abandonment of contraception, those who abandoned use and remain in need may have an unwanted/mistimed pregnancy while those who abandoned due to reduced need may have a wanted pregnancy.[5] Alternatively, women who are in need of contraception may restart contraceptive use.[6] Those who are not in need of contraception may also subsequently restart use but presumably they would have to become in need of contraception again before they restart use so the transition from 'not in need' to 'restart use' operates through the 'in need' state. In this report, only the transitions from contraceptive use to failure, to another method, and to nonuse (subdivided into those who are in need of contraception and those who are not) are examined.

[4] It would also be of interest to differentiate between those who switch to a more effective method and those who switch to a less effective method.

[5] Women who abandon use and are not in need of contraception may also experience an unwanted/mistimed pregnancy if they subsequently become in need of contraception and fail to adopt a method at that time. In this case, the transition from 'not in need' to 'unwanted/mistimed pregnancy' operates through the 'in need' state.

[6] Again, it would be of interest to specify those who restart using the same method they had abandoned and those who restart use with a different method (see for example, Kost 1993).

Figure 2.1 Conceptual model of contraceptive use dynamics



3 Data and Methods

3.1 DATA

The analyses in this report are based on data collected in the calendar of recent events collected in six DHS surveys, combined with background data collected elsewhere in the questionnaire. The six surveys used are; Bangladesh 1993/94, Colombia 1995, Egypt 1992, Indonesia 1994, Peru 1991/92, and Zimbabwe 1994. These surveys were chosen to achieve wide geographic coverage and variation in the family planning environment across the six surveys. Figure 3.1 presents the contraceptive prevalence among currently married women in the six countries by method. Prevalence is highest in Colombia at 72 percent and lowest in Bangladesh at 45 percent. The method mix varies across the six populations. Pill dominates in Zimbabwe and, to a lesser extent, in Bangladesh. IUD use is most common in Egypt but is very low in Bangladesh and Zimbabwe while traditional methods (periodic abstinence and withdrawal) are popular in Peru but are not widely used in Egypt and Indonesia. The method mix is quite varied in Indonesia and Colombia but sterilization is more widely used in Colombia than in the other five populations while the prevalence of injectables is highest in Indonesia.

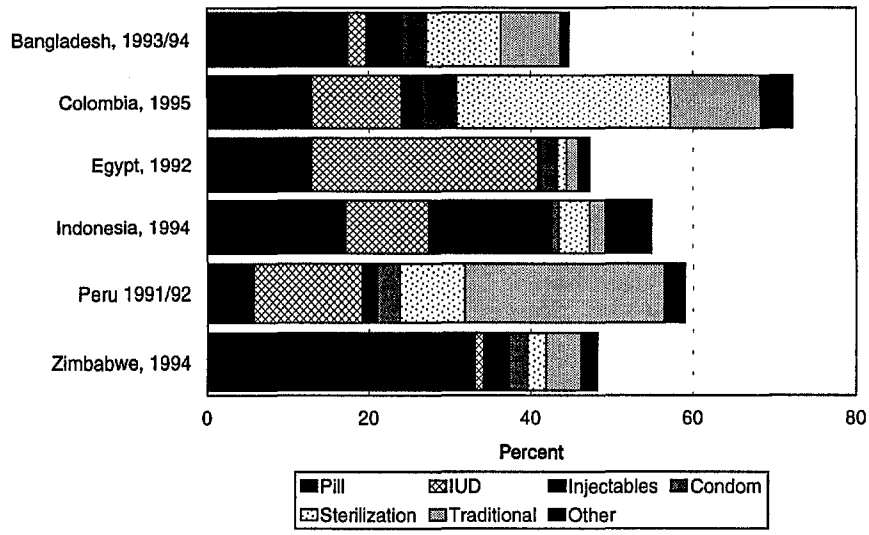
The DHS calendar is collected only in surveys that use the DHS model "A" questionnaire (i.e. those that have relatively high contraceptive prevalence). It consists of a matrix of rows and columns (Appendix A). Each row represents a particular month with the first row usually representing January of the fifth calendar year before the survey (e.g. January 1986 for surveys conducted in 1991, etc.) The columns are used to record different types of information for each month. In DHS-II surveys, there were typically eight columns included in the calendar but this was reduced to four in most DHS-III surveys to reduce the interview burden associated with the calendar. The first column is used to record information on periods of contraceptive use, nonuse, and pregnancies; the reason for discontinuation of each episode of contraceptive use is recorded in the second column in the row corresponding to the last month of continuous use of each method. Based on this information, episodes of contraceptive use can be identified and linked to the reason for discontinuation. The third column of the calendar records the months in which the respondent was married or cohabiting (column 6 in DHS-II surveys). The marriage history data can be linked with the contraceptive history data in the first two columns to permit analysis of the relationship between marital status and contraceptive discontinuation.

The unit of analysis is an episode of contraceptive use. In this analysis, an episode of use is defined as a period of continuous use of a specific contraceptive method: A switch to another method initiates a new episode of use. Episodes of use that begin in the period 3 to 62 months before the survey date are included in the analysis sample. The three months immediately before the survey are excluded to allow for underreporting of first trimester pregnancies at the time of the survey which can bias estimates of contraceptive failure rates. Episodes of use of sterilization are not included in the analysis sample because sterilization cannot be discontinued. Episodes of use of vaginal methods, implants, and traditional methods other than periodic abstinence and withdrawal are also excluded because there were few users of these methods in most of the countries examined.

Four reasons for discontinuation are examined corresponding to the four outcomes outlined in Figure 2.1: failure, switching, abandoning while in need of contraception, and abandoning due to reduced need for contraception. Failure is defined as episodes that were ended because the respondent said she got pregnant while using the method. Switching is defined as episodes that were followed in the next month by use of a different method (including folk methods) and abandoning use refers to episodes that were followed in the next month by nonuse (including pregnancy but excluding contraceptive failures). 'Abandon, in need' is defined as episodes that were discontinued because of side effects, husband's disapproval, health concerns, access/availability, desire for a more effective method, inconvenience of use, a fatalistic attitude, cost, other unspecified reasons, and 'don't know' responses.[1] If the reason for discontinuation is missing, women are considered to still need contraception. 'Abandon, not in need' is defined as episodes that were ended due to a desire to get pregnant, infrequent sex, menopause/infecundity, marital dissolution and, in Egypt, husband's death. While it is recognized that women may have multiple reasons for discontinuing the use of a contraceptive method, only the main reason is recorded in the questionnaire.

[1] In Egypt, reasons for discontinuation that are considered to leave the woman in need of contraception, also include IUD expelled, doctor's advice, to switch methods, IUD expired (Indonesia also includes this last reason).

Figure 3.1 Contraceptive prevalence among currently married women, by method, selected DHS surveys, 1991-1995



Source: DHS country reports

Table 3.1 Sample characteristics

Selected information on the analysis samples for each survey, Demographic and Health Surveys, 1991-1995

Country	Number of clusters	Number of women	Number of episodes of use	Mean no. Episodes per cluster	Mean no. women per cluster	Mean no. episodes per woman
Bangladesh	299	4,127	6,662	22.3	13.8	1.6
Colombia	955	4,146	7,319	7.7	4.3	1.8
Egypt	539	4,199	5,992	11.1	7.8	1.4
Indonesia	1,391	9,971	13,495	9.7	7.2	1.4
Peru	896	5,669	9,288	10.4	6.3	1.6
Zimbabwe	230	2,489	3,272	14.2	10.8	1.3

One important feature of the analysis sample is that individual women may contribute more than one episode of use to the sample. In addition, DHS surveys use a cluster sample design. These features of the analysis sample result in a hierarchical structure with episodes of use (level 1) nested within individual women (level 2) nested within clusters (level 3). Table 3.1 presents the structure of the analysis samples for the six countries. The number of episodes of use ranges from 3,272 in Zimbabwe to 13,495 in Indonesia. The mean number of episodes of use per woman is in the range of 1.3 to 1.8 in all six surveys. There is more variation in the cluster sizes: the mean number of women per cluster ranges from 4.3 in Colombia to 13.8 in Bangladesh while the mean number of episodes of use per cluster ranges from 7.7 in Colombia to 22.3 in Bangladesh.

Table 3.2 presents a more detailed breakdown of the samples showing the distribution of the number of episodes of use per woman in each country and the percentage of women who experienced multiple discontinuations of each type. In all six countries more than half of the women in the sample contributed only one episode of use, while one-fourth contributed two episodes. Less than 2 percent of the women contributed six or more episodes of contraceptive use. Relatively few women experienced more than one contraceptive failure in the analysis period, except in Peru, but multiple switches are more common, except in Zimbabwe. For example, in Colombia 9 percent of women switched methods at least twice in the analysis period. Multiple abandonments are also relatively common but when these are classified by abandonment while in need of contraception and abandonment due to reduced need for contraception, the percentage of women who experienced multiple events declines substantially and is less than 3 percent in all six countries for both types of event.

Table 3.2 Sample characteristics: episodes of use per woman

Distribution of the number of episodes of use per woman and the percentage of women who experienced more than one contraceptive failure, switched methods more than once, or abandoned use more than once within 36 months of initiating use, Demographic and Health Surveys, 1991-1995

Characteristic	Bangladesh	Colombia	Egypt	Indonesia	Peru	Zimbabwe
Number of episodes						
1	60.2	54.4	67.2	72.9	58.3	72.5
2	27.0	28.7	25.5	21.8	27.5	23.9
3	8.8	10.5	5.6	4.1	9.7	3.1
4	2.3	4.1	1.3	0.8	2.9	0.4
5	0.7	1.1	0.3	0.2	1.1	0.0
6 or more	0.9	1.2	0.1	0.3	0.5	0.0
Total	100.0	100.0	100.0	100.0	100.0	100.0
Number	4,127	4,146	4,199	9,971	5,669	2,489
Percentage of women with:						
>1 failure	0.3	1.9	1.2	0.4	4.5	0.7
>1 switch	7.2	9.4	2.2	2.7	6.8	0.6
>1 abandon	5.8	5.4	4.3	1.6	3.5	3.4
>1 abandon, no need	1.6	2.3	1.9	0.6	1.5	1.5
>1 abandon, in need	2.5	1.4	1.5	0.7	1.0	0.6

3.2 DATA QUALITY

Retrospective reporting of contraceptive use and discontinuation rely heavily on the ability of respondents to accurately recall events. Contraceptive use histories collected in a calendar format, such as those used in DHS surveys, have been shown to be more complete, internally consistent and accurate than data collected in a tabular format (Goldman et al., 1989; Westoff et al., 1990). Using overlapping data from the 1992 Morocco DHS and the 1995 Morocco Panel Survey, Strickler et al. (1997) found that reporting of contraceptive behavior at the aggregate level was fairly reliable in the calendar. However, there was considerable unreliability in individual level responses, particularly for complex histories. Indeed, inconsistency in the reporting of contraceptive events was more strongly related to the number of events to be reported than to individual characteristics. Aggregate estimates of contraceptive prevalence were fairly robust to the reporting errors but estimates of failure, switching, and discontinuation rates were more sensitive to the errors present in the data. Nevertheless, the errors in individual reports appear to be random rather than systematic.

The quality of the data can vary from survey to survey and depends on an array of factors, including the training of interviewers, recall ability of respondents, types of contraceptive methods that predominate in a country, and average durations of use. Clearly, since DHS respondents are asked to report all episodes of use during a relatively long period, there may be some tendency to forget or omit episodes, particularly short ones. If this occurs, discontinuation rates would be underestimated to some extent. In addition, the underreporting of unintended pregnancies, which seems more likely to occur if the pregnancy was aborted, would bias failure rates downward (Jejeebhoy, 1991). Attempts have been made to correct failure rates for underreporting of induced abortions in the U.S. (Grady, Hayward, and Yagi, 1986; Jones and Forrest, 1992). Such corrections rely heavily on the assumptions made, but the effect is substantial. However, reliable external estimates of induced abortion are rarely available to permit similar adjustments in DHS surveys.

Heaping of reported durations of use is also a potential source of bias in the data, since it indicates a tendency among respondents to estimate durations that

they may not recall very accurately. Figure 3.2 shows the percent distribution of reported durations of episodes of contraceptive use for the six countries. In the absence of heaping, these distributions would be expected to decline smoothly across duration. All of the countries show some evidence of heaping on durations of 6 and 12 months, although the heaping is trivial in Egypt at 6 months and in Zimbabwe at 12 months. Perhaps the most pronounced heaping occurs in Indonesia and Bangladesh at 3, 6, 9, and 12 months where, for example, the percentage of episodes reported at 12 months is about 1.7 times the percentage at either 11 or 13 months. Inexplicably, there is also a very high proportion of episodes of 1-month duration in Colombia. Overall, however, heaping in these countries is probably not severe enough to significantly affect estimates of discontinuation.

Another measure of data quality is shown in Table 3.3. In this table, estimates of contraceptive prevalence from the calendar data and from current status data taken from a previous survey are compared for the same point in time. If the calendar data are complete, the contraceptive prevalence estimate based on the calendar and the estimate based on the current status data should be the same, allowing for sampling error. Since the calendar estimates are based on retrospective reports of women age 15-49 at the time of the survey, the current status estimates are adjusted so that they correspond to the matching age group.[2]

Overall, the current status and calendar estimates are extremely close. In absolute terms, the largest difference occurs in Indonesia where the current status estimate is greater than the calendar estimate by 5 percentage points. In Colombia and Egypt, the difference is less than 1 percentage point. Somewhat surprisingly, traditional methods are not more likely to be underreported than modern methods. In general, there is no evidence of systematic underreporting of contraceptive use in the calendar in any survey.

3.3 STATISTICAL METHODS

The analysis of contraceptive discontinuation, failure, and switching raises a number of statistical issues. Right-censoring of episodes of use occurs if the episode is still in progress at the end of the observation period (i.e. the survey date minus three months). The full duration of the episode is, therefore, unknown; we simply know that it is as least the number of months observed at the end of the period. Dropping these incomplete episodes of use would bias our results so we use event history methods to handle the right-censoring. The discontinuation rates presented in Section 4.1 are based on life table methods which are the simplest form of event history analysis. For methodological discussions of life table discontinuation rates, see Curtis and Hammerslough, 1995; Kost, 1993; and Steiner et al., 1996.

The multivariate analyses of the determinants of contraceptive discontinuation, switching, and failure are based on hazards models. In the analysis, each episode of use is divided into three-month intervals and piecewise-constant hazards models are fitted. These models assume that the hazard of discontinuation is constant within each three-month interval so that it takes the form of a step function. In the analyses presented, the step function for the hazard is modeled as a quadratic function of the time intervals to smooth out the effects of heaping and other data irregularities. Covariates are assumed to act multiplicatively on the baseline hazard function (i.e. the hazard when all the covariates are set to zero). Therefore, the exponentiated parameter estimates can be interpreted as relative risks where the risk is relative to the risk in the baseline category of the explanatory variable.

Many hazards models assume that the hazards for different subgroups are proportional, i.e. that the effects of the covariates are constant over time. We tested this assumption explicitly and found that some of the effects were nonproportional. When appropriate, nonproportional effects are included in the models and are displayed graphically. For a full discussion of the statistical model and the model selection process see Appendix B.

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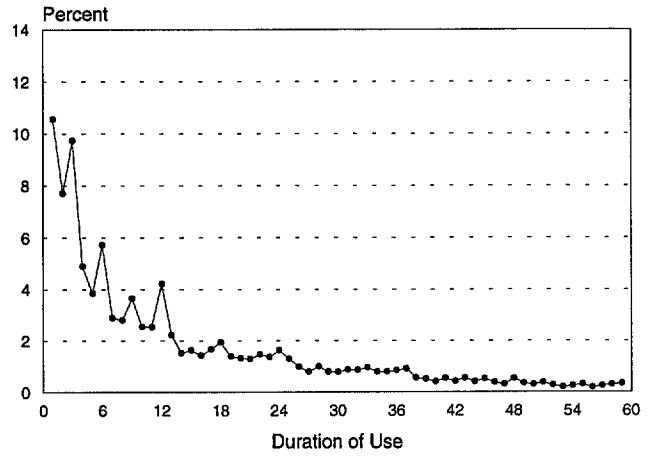
[2] For example, the Colombia survey used in this analysis was conducted in 1995; the previous survey for Colombia was conducted in 1990. To estimate contraceptive prevalence for 1990 from the 1995 data, the percentage of respondents who reported in the calendar that they were using contraception in July 1990 (the mid-point of the earlier survey) is calculated. However, the women who were age 15-49 at the time of the 1995 survey were age 10-44 in 1990, so a contraceptive prevalence rate is calculated for women 15-44. A comparable current status estimate is calculated for women 15-44 from the 1990 data.

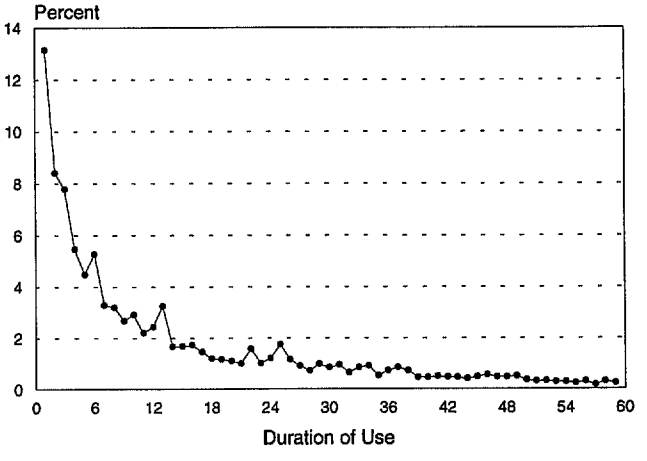
For Bangladesh, a published current status estimate is used because the authors did not have access to the data file. For Zimbabwe, the calendar data from the 1994 survey begins in January 1989. The previous survey was conducted in October 1988 - January 1989, so the two estimates do not refer to exactly the same month but are very close.

Figure 3.2 Distribution of reported durations of episodes of contraceptive use, Demographic and Health Surveys, 1991-1995

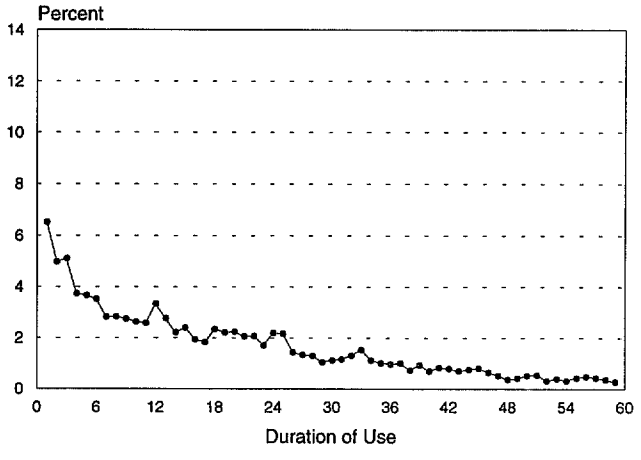
Bangladesh, 1993/94



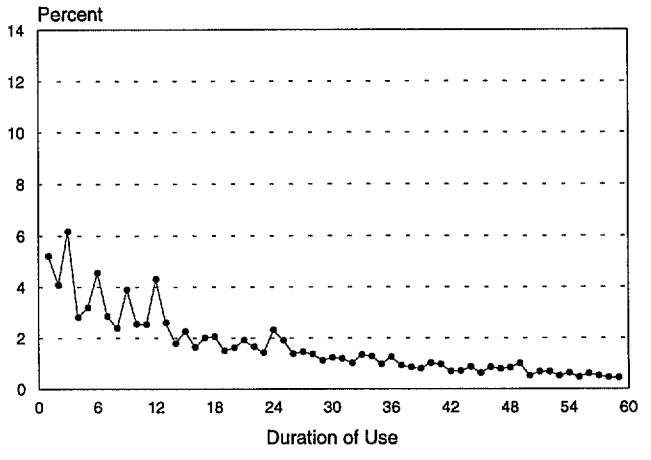
Colombia, 1995



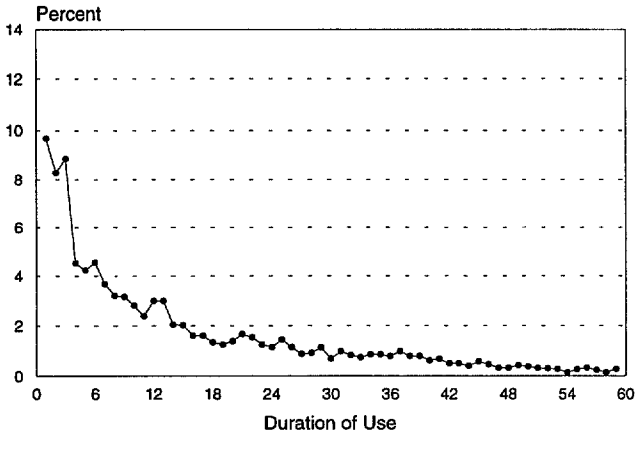
Egypt, 1992



Indonesia, 1994



Peru, 1991/92



Zimbabwe, 1994

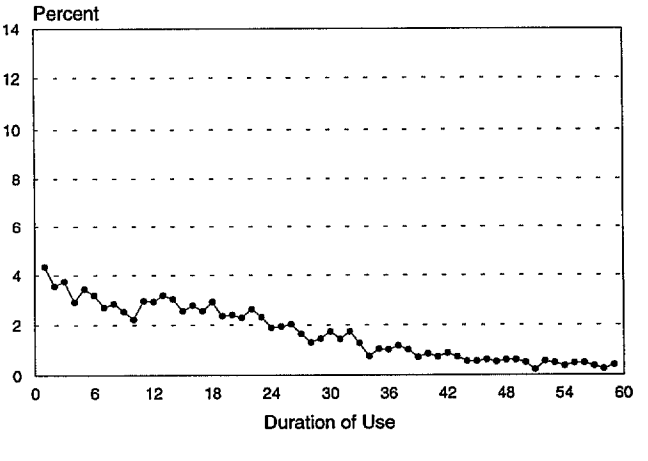


Table 3.3 Consistency between calendar and current status data on contraceptive prevalence

Percentage of currently married women using contraception at the time of an earlier survey from current status data and from calendar data for the corresponding point in time, Demographic and Health Surveys, 1986-1994

	Bangladesh, 1991 [1]		Colombia, 1990		Egypt, 1988-89		Indonesia, 1991		Peru, 1986		Zimbabwe 1988-89	
Method	1993-94 calendar (age 10-47)	1991 CPS (age 10-49)	1995 calendar (age 15-44)	1990 DHS (age 15-44)	1992 calendar (age 15-45)	1988-89 DHS (age 15-45)	1994 calendar (age 15-46)	1991 DHS (age 15-46)	1991-92 calendar (age 15-44)	1986 DHS (age 15-44)	1994 calendar (age 15-43)	1988-89 DHS (age 15-43)
Pill	15.0	13.9	16.6	15.4	14.7	15.8	14.7	15.4	6.9	7.1	31.8	33.5
IUD	2.0	1.8	11.1	13.4	17.8	16.5	11.2	13.6	9.0	8.0	0.8	1.1
Injectables	2.2	2.6	1.4	2.4	0.3	0.1	10.9	12.3	1.7	1.5	0.6	0.3
Vaginal methods	0.0	0.0	1.4	1.8	0.3	0.4	0.0	0.0	1.3	1.0	0.0	0.0
Condom	2.1	2.1	2.2	2.8	1.9	2.5	0.7	0.8	1.9	0.7	1.0	1.2
Female sterilization	8.2	9.1	20.5	19.9	0.9	1.3	2.6	2.6	5.9	5.8	1.0	1.8
Male sterilization	1.2	1.2	0.3	0.5	0.0	0.0	0.5	0.6	0.1	0.0	0.2	0.3
Periodic abstinence	4.2	4.7	6.3	5.8	0.7	0.6	1.1	1.1	20.4	19.0	0.3	0.3
Withdrawal	1.5	2.0	4.7	4.8	0.5	0.5	0.7	0.7	3.1	3.9	4.5	5.2
Other	0.8	2.0	2.0	0.6	1.3	1.3	3.9	4.1	1.7	1.5	1.4	1.5
Total	37.2	39.9	66.6	67.5	38.4	39.0	46.3	51.3	52.0	48.4	41.5	45.2

[1] Source: Mitra and Al-Sabir, 1996

There are two additional complications created by the structure of the data. First, the data have a hierarchical structure, as described in Section 3.1. Individual characteristics and preferences of women are likely to affect their contraceptive behavior so the outcomes of episodes of use contributed by the same women are likely to be correlated. In addition, women who live in the same cluster are likely to be more alike than women who live in different clusters. Standard hazards models assume that observations are independent, an assumption which does not hold in clustered hierarchical data such as these. The failure of the independence assumption means that estimates of standard errors obtained from standard hazards models are likely to be biased downwards, which in turn may result in effects appearing to be statistically significant when, in fact, they are not. To allow for this problem, we use a multilevel form of the piecewise-constant hazards model that allows for variation at different levels. An advantage of these models is that they also provide an estimate of the amount of variation at each level of the model.

In this analysis, theoretically there are three levels in the model; episode of use (level 1), woman (level 2), and cluster (level 3). However, due to estimation problems, we restricted the model to two levels; episode of use (level 1) and cluster (level 2).[3] The general principle of the multilevel model is that the intercept of the model is allowed to vary across the clusters reflecting unobserved factors that result in some clusters experiencing an above-average hazard of discontinuation while other clusters experience a below-average hazard of discontinuation. The intercept is assumed to follow a normal distribution across the clusters and the random parameter estimated in the model represents the variance of this normal distribution. The larger the variance, the more variation there is across clusters and hence the stronger is the cluster effect. Appendix B includes a fuller discussion of the multilevel model.

The second complication in the data is that we are interested in four different types of discontinuation. At any point in time a woman is simultaneously at risk of any one of these different types of discontinuation so this type of data is often described as *competing risks* data. There are two ways to model competing risks in life tables. The first approach (the multiple decrement approach) models the observed dependent rates, while the second approach (the associated single-decrement approach) models the underlying independent rates. The life table rates calculated using the second approach are known as *gross rates.* These are generally thought to be the appropriate measures for comparing across groups (or countries) because they represent the underlying risk of discontinuation in a particular population and are unaffected by the rates of other types of discontinuation. In Section 4.1 the second approach is used because we are interested in comparing the life table rates across the six countries. Gross rates can be interpreted as the probabilities of discontinuing for a particular reason in the absence of other reasons but this interpretation requires an assumption of independence among the various causes of discontinuation (Kost, 1993).

In continuous-time multivariate hazards models, such as the piecewise-constant hazards model used here, the likelihood function for the competing risks model is the product of the independent likelihood functions for each type of discontinuation. Therefore, separate models can be fitted for each type of discontinuation treating discontinuations for all other reasons as censored (Kalbfleisch and Prentice, 1980). No distinction needs to be made between the dependent (net) and independent (gross) models because the continuous-time dependent and independent hazards functions are the same.

3.4 INDEPENDENT VARIABLES

The multivariate models contain both episode and cluster-level variables. Definitions of the independent variables are summarized in Table 3.4. Two episode level variables related to contraceptive use status were constructed. First, each episode of contraceptive use was coded according to the *method* used during that episode. The methods are coded as follows: pill, IUD, injectables, condom, traditional methods (periodic abstinence and withdrawal). Each episode was also assigned a code that corresponds to the *woman's contraceptive status in the month prior to the start of the episode.* This variable is intended to measure the effect of previous experience with contraception on the rate of discontinuation.

[3] Because the majority of women contribute only one episode of use to the sample (Table 3.2), this restriction should not compromise our general findings. However, it is possible that the model may overestimate the amount of cluster-level variation because the estimate of the cluster variation may pick up some unobserved woman-level variation. The estimation problems encountered are discussed in Appendix B.

Table 3.4 Summary of independent variables

Summary of independent variables used in the multivariate models of contraceptive discontinuation

Variable	Definition
Interval, Interval^2	Each episode of use for an individual woman is divided into 3-month intervals from 0-36 months. The effect is modeled using a quadratic term.
Individual-level variables	
Method	Pill, IUD, injectables, condom, traditional. All other methods are excluded. Reference category: Traditional
Previous status	Status in month immediately prior to start of episode. Coded in three categories: using a method, not using a method, birth or termination. Reference category: not using
Education	Highest level of education attended: none, primary, secondary or higher Reference category: none
Socioeconomic status	Takes values from 0-5 based on sum of: 1 if the HH drinking water is piped into residence or is bottled; 1 if the HH has a flush toilet; 1 if the HH has a bicycle, motorcycle, or car; 1 if the HH has a radio; 1 if the floor of dwelling is not dirt. Coded in three categories: low (0-1), medium (2-3), high (4-5). Reference category: low
Area of residence	Current type of place of residence: urban or rural Reference category: urban
Age	Woman's age at the start of the episode of use: Under 25, 25-34, 35-49 Reference category: under 25
Number of living children	Number of living children at the start of the episode of use: 0, 1-2,3-4, 5 or more Reference category: 3-4
Contraceptive intention	Whether the episode of use was for spacing or limiting purposes. Based on wantedness status of the next birth or current fertility preferences or (if not available) on ideal vs. actual family size. Reference category: using for spacing
Marital status	Time dependent variable indicating marital status at the start of the 3-month interval within the episode of use: married, not married Reference category: not married
Change in marital status	Time dependent variable indicating whether a change in marital status occurred during the 3-month interval within the episode Reference category: no change
Recent change in marital status	Time dependent variable indicating whether a change in marital status occurred during the previous 3-month interval within the episode Reference category: no change
Cluster-level variables	
Community contraceptive experience	Percentage of ever-married women in the cluster who have ever used a modern or traditional method of contraception.
Percent discussed family planning	Percentage of all interviewed women in the cluster who had discussed family planning with any person other than their partner in the last few months (before the survey).

Socioeconomic background variables included in the models are: *level of education*, *socioeconomic status*, and *area of residence*. The index of *socioeconomic status* takes values from 0-5 and is based on the sum of the scores indicated in Table 3.4. Cases with missing values on any of the household items score zero on that item (i.e. they are assumed not to have that item).[4]

Area of residence represents the place in which the respondent lived at the time of the survey. Ideally, this should be a time-dependent variable but the necessary information to calculate it as a time-dependent variable was not collected in Bangladesh, so in the interest of maintaining comparability, area of residence at the time of the survey was used.

A number of demographic variables are also incorporated in the multivariate models. *Age* refers to the woman's age at the start of the episode and the *number of living children* refers to the number the woman had at the start of the episode of use.

Contraceptive intention is included in the models to estimate the effect of use for different purposes and is, to some extent, expected to be a proxy for the strength of women's motivation to avoid pregnancy. The variable is based on the woman's report of the wantedness of the next birth after the episode of use. Those who said the birth was 'wanted then' or 'wanted later' are coded as using for spacing while those who said the birth was 'not wanted' are coded as using for limiting. If there is no birth following the episode, the variable is based on the woman's current fertility preferences. In this case, sterilized women are coded as limiters and women who are unsure about their current fertility preferences are coded as spacers. The data on wantedness status for the next birth are obtained from the health section of the DHS questionnaire but not all births following episodes of use are included in the health section, particularly in recent surveys. If the data are not available for a particular episode or if the episode is not followed by a birth and the respondent does not give a fertility preference (e.g. declared infecund, says she never had sex, missing), then the contraceptive intention is based on the difference between the ideal family size given by the respondent at the time of the survey and the number of living children the woman had at the start of the episode of use. If the woman had fewer living children than her ideal family size, the episode is coded as use for spacing, and if she had the same number or more living children than her ideal family size the episode is coded as use for limiting. If the respondent gave a nonnumeric ideal family size or if the ideal family size was missing, the contraceptive intention variable is missing.

Three time-dependent variables related to marital status were constructed. The first refers to *marital status* at the start of each three-month interval within the episode. The second indicates whether a *change in marital status* occurred during the interval within the episode (i.e., the woman either got married/started living with a man or got divorced, widowed, or separated). If the episode of use ended before the end of the three-month interval and a change of marital status occurred after the episode ended but within the three-month interval (e.g., in the month after discontinuation) it is coded as a change in marital status unless the episode is censored. The third variable represents the effect of a *lagged change in marital status* and indicates whether a change occurred in the 3-month interval prior to the current interval. This variable is included in order to account for the possibility that the effect of a change in marital status on contraceptive use is not immediate. This may be the case particularly for methods that cannot be terminated by the woman at will, such as injectables, Norplant, and IUD. The marital status variables were not included in the models of failure and switching in Bangladesh, Egypt, and Indonesia because these were samples of ever-married women and virtually all of those who had a contraceptive failure or switched methods were married.

Two cluster-level variables were included in the models. These variables are intended to measure the

[4] The categories for these household characteristics are not standard across the six countries so exceptions to this coding are: in Zimbabwe, no distinction is made between water piped into the residence and water piped to outside (e.g. yard), and bottled water is not listed as a separate category. Therefore, any type of piped water scores one point for source of drinking water. This does not include public tap, which is listed as a separate category. In Indonesia, bottled drinking water is not listed as a category. The categories for toilet facility are nonstandard and do not distinguish flush toilets. Therefore, cases score one point for toilet facility if they have a private toilet with a septic tank. In Colombia, no distinction is made between water piped into the residence and water piped to outside and source of piped water is given (public aqueduct, rural/private aqueduct, other). Cases score a point if they have any of the three sources of piped water (excluding public taps). Similarly, no distinction is made between own or shared flush toilet so all types of flush toilets score a point. In Egypt, no distinction is made between own and shared flush toilet and type of flush toilet is given (modern, traditional tank, bucket). Only modern flush toilets score a point.

effect of the 'contraceptive environment' on discontinuation. The first variable represents *community contraceptive experience* and is the percentage of ever-married women in the cluster who have ever used a modern or traditional method of contraception. The second variable, *community discussion of family planning*, is calculated as the percentage of all interviewed women in the cluster who had discussed family planning with any person other than their partner in the last few months (before the survey). Both variables refer to the time of the survey not necessarily to the time the episode of contraceptive use occurred. The second community variable is not available in Bangladesh, Egypt, or Peru.

4 Determinants of Contraceptive Discontinuation

4.1 LIFE TABLE ESTIMATES

Table 4.1 presents life table discontinuation rates according to the four reasons for discontinuation outlined in Figure 2.1.

The 12-month failure rates vary greatly across the six countries. Bangladesh, Indonesia, and Zimbabwe have overall failure rates around 4 percent in the first 12 months of use. In contrast, failure rates in Colombia and Peru are three and five times greater, respectively, while the failure rate in Egypt is moderate at 6 percent. To some degree, these differentials are due to the efficacy of the mix of methods that predominates in each country. During the period covered by the DHS calendar in Zimbabwe, the pill is by far the most common method, accounting for about 70 percent of episodes of use, while in Egypt, the pill and IUD together account for 84 percent of contraceptive use (El-Tawila, 1995; Sambisa, 1996). In Indonesia, the pill and injectables each account for about 30 percent of method use (Fathonah, 1996). Pill use comprises almost half of all contraceptive use in Bangladesh with traditional methods contributing about 20 percent (Mitra and Al-Sabir, 1996). In contrast, in Peru, almost half of the episodes are contributed by periodic abstinence and withdrawal (Padilla, 1994). Finally, in Colombia, about 30 percent of the episodes are accounted for by periodic abstinence and withdrawal while and an additional 30 percent are pill-use episodes.

The differentials in failure rates across countries largely persist at 24 months and 36 months duration. The rates in Zimbabwe, however, increase more rapidly than in other countries so that by 36 months, the failure rate in Zimbabwe is almost identical to that in Egypt at about 16 percent. This pattern is most likely a result of the pronounced overlap between contraceptive use and postpartum amenorrhea in Zimbabwe which can bias failure rates downward in the period following a birth (Sambisa and Curtis, 1997; Curtis, 1996). It is also worth noting that by 36 months from the start of use, in the absence of other reasons for discontinuation, more than one in three users in Peru and about one in four users in Colombia will experience a contraceptive failure.

Fewer than 10 percent of users in Zimbabwe and Egypt switch from one method immediately to another within one year of use. Switching rates are significantly higher in Bangladesh, Colombia, and Peru at 20 to 28 percent while in Indonesia about 14 percent switch within one year of starting use of a method. Rates of abandonment tend to be lower in general than switching rates, except in Zimbabwe and Egypt. The percentage of users who abandon use of a method within a year of starting use for reasons that leave them in need of another method ranges from 6 percent in Zimbabwe to 19 percent in Bangladesh.

Zimbabwe is notable for its low overall rates of discontinuation for any reason within a year of the initiation of use. By two years duration, however, close to half of users have discontinued in Zimbabwe, as well as in Egypt and Indonesia. In Bangladesh, Colombia, and Peru, overall discontinuation rates are higher with approximately two-thirds of the users discontinuing within two years.

4.2 CONTRACEPTIVE FAILURE

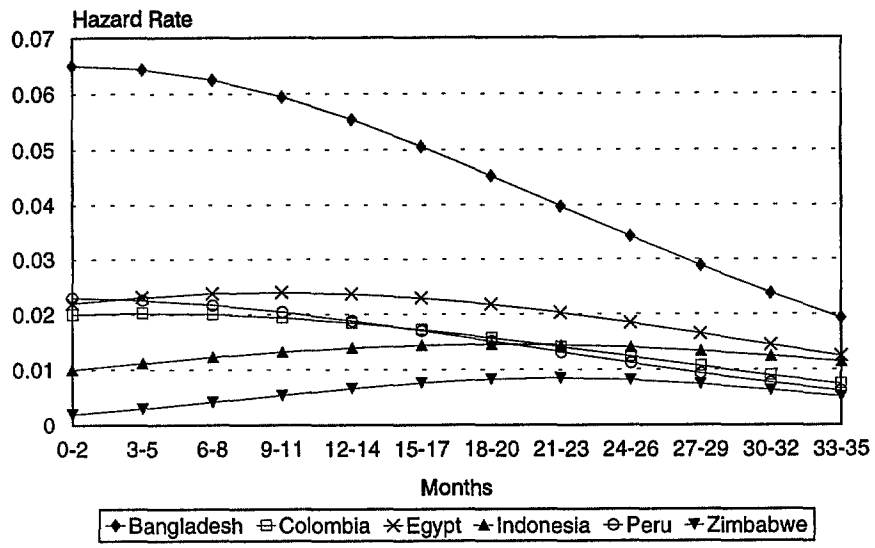
The baseline hazard rate for contraceptive failure derived from the multilevel model is illustrated in Figure 4.1. The risk of failure is expected to decline over time for two reasons. First, women who are poor users of a method or who are highly fecund are expected to fail early on, selectively leaving behind women who have a low risk of contraceptive failure. Second, couples' use of methods may improve over time so their risk of failure may decline as the duration of use increases. Our results are broadly consistent with this expectation but the decline is not always pronounced or consistent. The baseline hazard rate is much higher in Bangladesh than in the other five countries, particularly at shorter durations of use, but declines steeply over time. The baseline hazard also declines consistently, but much less steeply, in Peru and Colombia. In the other three populations, the hazard first increases slightly and then decreases. This pattern is particularly pronounced in Indonesia and Zimbabwe. Both of these countries experience a relatively high level of overlap between contraceptive use and postpartum amenorrhea (Curtis, 1996; Sambisa and Curtis, 1997) so it is possible that this pattern reflects a reduced risk of failure at early durations associated with this redundant use.

Table 4.1 Cumulative rates of contraceptive failure, switching, abandonment of use, and overall discontinuation

12, 24, and 36-month gross cumulative life table rates for failure, switching, abandonment and overall discontinuation of pill, IUD, injectables, condom, and traditional methods, by country, Demographic and Health Surveys, 1991-1995

Country	Failure	Switching	Abandon, not in need	Abandon, in need	Total	No. of episodes (weighted)
Bangladesh						
12 months	4.6	24.3	14.3	19.2	50.1	6,433
24 months	8.0	33.4	23.5	26.8	65.7	
36 months	9.4	40.9	32.3	33.9	76.1	
Colombia						
12 months	12.8	28.7	16.3	10.3	53.3	7,352
24 months	21.0	37.7	27.0	15.9	69.8	
36 months	26.3	45.8	36.1	21.4	79.9	
Egypt						
12 months	6.2	8.9	7.9	9.4	28.7	6,037
24 months	11.8	14.7	17.8	16.1	48.2	
36 months	16.3	19.4	25.6	23.8	61.7	
Indonesia						
12 months	3.7	13.3	8.9	7.9	30.0	14,022
24 months	7.6	20.5	16.1	11.5	45.5	
36 months	10.4	27.0	23.9	14.8	57.6	
Peru						
12 months	19.3	20.7	11.4	8.2	47.9	9,233
24 months	29.4	28.5	19.3	13.0	64.6	
36 months	34.9	34.5	26.2	17.0	73.9	
Zimbabwe						
12 months	3.7	4.6	7.2	6.2	20.1	3,321
24 months	10.5	7.3	24.5	16.5	47.8	
36 months	16.4	10.9	39.9	26.1	66.9	

Figure 4.1 Baseline hazard rate for contraceptive failure by country, DHS surveys 1991-1995



The covariates act multiplicatively on the baseline hazard and all effects are proportional. Table 4.2 presents the relative risks of experiencing a contraceptive failure estimated from the hazards models. As found in previous studies, the method used is consistently related to the risk of contraceptive failure. Relative to users of traditional methods, users of the four modern methods experience significantly lower failure rates. The risk of failure is lowest for the IUD, except in Indonesia where the injectables have a slightly lower risk of failure. In contrast, the condom tends to have the highest risk of failure among the modern methods, except in Zimbabwe where the risk of failure for the condom is similar to that of pills and injectables.

The previous status of the user also affects the risk of contraceptive failure in most of the six populations. Users who adopted the method immediately after a birth or pregnancy termination and users who switched from another method are generally more likely to experience a contraceptive failure than other users who were not previously using a method. One possible explanation for this result may be that women who were not previously using may be selectively less fecund than other women because they were previously not using and did not become pregnant.

The demographic characteristics of women (age, number of living children, contraceptive intention, and the marital status variables) are generally associated with the risk of contraceptive failure while socioeconomic status, education, and area of residence are not. The risk of contraceptive failure consistently declines with age in all six countries. Women with no living children and those with five or more living children are more likely to experience contraceptive failure than other women. Women with no living children may not be very motivated to avoid pregnancy while women with five or more living children may include poor contraceptive users. Women who are using contraception to prevent future births are less likely to experience contraceptive failure than women who are using to space births. This again probably reflects the role of motivation to avoid pregnancy on the quality of contraceptive use.

Married women are more likely to experience a contraceptive failure than unmarried women. A change in marital status also increases the risk of failure around the time of the change. Married women are likely to be sexually active more regularly than unmarried women. A change in marital status from unmarried to married is likely to increase exposure to sexual activity and reduce

Table 4.2 Regression results for contraceptive failure

Baseline hazard and relative risks estimated from hazards models of contraceptive failure, Demographic and Health Surveys, 1991-1995

Characteristic	Bangladesh	Colombia	Egypt	Indonesia	Peru	Zimbabwe
Baseline	0.142	0.016	0.018	0.006	0.029	0.003
Interval	1.00	1.02	1.06	1.13	0.99	1.52
Interval^2	0.99	0.99	0.99	0.99	0.99	0.97
Method						
Pill	0.19	0.32	0.49	0.30	0.17	0.19
IUD	0.04	0.12	0.08	0.17	0.03	0.06
Injectables	0.11	0.32	0.18	0.15	0.21	0.20
Condom	0.81	0.38	0.55	0.96	0.55	0.20
Traditional	1.00	1.00	1.00	1.00	1.00	1.00
Previous status						
Using	1.30	1.40	1.03	1.51	1.15	0.82
Not using	1.00	1.00	1.00	1.00	1.00	1.00
Pregnant	1.15	1.65	1.31	1.52	1.33	1.17
Education						
No education	1.00	1.00	1.00	1.00	1.00	1.00
Primary	0.76	0.82	1.10	1.20	1.03	1.31
Secondary +	0.83	0.75	1.26	1.43	0.85	1.35
Socioeconomic status						
Low (0-1)	1.00	1.00	1.00	1.00	1.00	1.00
Medium (2-3)	1.03	1.32	0.83	0.75	0.92	0.96
High (4-5)	0.99	0.94	0.86	0.73	0.70	1.28
Area of residence						
Urban	1.00	1.00	1.00	1.00	1.00	1.00
Rural	0.68	1.04	1.27	0.90	1.05	1.54
Age						
Under 25	1.00	1.00	1.00	1.00	1.00	1.00
25-34	0.72	0.63	0.68	0.85	0.75	0.74
35-49	0.31	0.28	0.30	0.50	0.35	0.49
Number of living children						
0	0.66	1.09	3.19	1.99	1.61	3.61
1-2	0.68	0.78	0.87	0.97	1.01	1.35
3-4	1.00	1.00	1.00	1.00	1.00	1.00
5 or more	1.47	1.28	1.34	1.49	1.41	1.44
Contraceptive intention						
Spacing	1.00	1.00	1.00	1.00	1.00	1.00
Limiting	0.59	0.98	0.94	0.63	0.80	0.61
Marital status						
Not married	a	1.00	a	a	1.00	1.00
Married	a	1.86	a	a	2.03	1.48
Change in marital status						
No	a	1.00	a	a	1.00	1.00
Yes	a	2.44	a	a	3.04	1.45
Recent change in marital status						
No	a	1.00	a	a	1.00	1.00
Yes	a	1.27	a	a	0.68	1.71
Cluster variables						
Contraceptive exp.	0.99	1.00	1.00	1.01	1.00	0.99
% Discussed FP	a	1.00	a	1.00	a	1.02

Note: Shading indicates that the relative risk is significant at the 5 percent level.
[a] Not included in the model

motivation to avoid pregnancy. However, it is also possible that the causal order is reversed; a contraceptive failure may result in a marriage. A change of marital status in the opposite direction would be expected to reduce the risk of contraceptive failure but this effect is probably picked up by the lower risk associated with being unmarried. A change in marital status in the preceding three months does not affect the risk of contraceptive failure (except in Peru). Although significant in some individual cases, the two community level variables included in the model do not have a consistent effect on the risk of contraceptive failure in these six populations.

The cluster-level variation in the risk of contraceptive failure is significant in Bangladesh, Indonesia, and Peru but not in the other three countries (Table 4.3). The cluster-level variation means that, for a given combination of characteristics, the hazard of contraceptive failure is not fixed but varies across the sampling clusters according to a normal distribution (on the log scale) indicating geographic variation in the risk of failure. To illustrate the implications of cluster-level variation, the estimated hazards are presented for pill users at 12 to 14 months duration of use at different points in the distribution in Table 4.3. All other background characteristics are set at their baseline value. The hazard is presented at the mean and at plus and minus one standard deviation of the distribution of the hazard across the clusters. The hazard at one standard deviation above the mean can be thought of as the hazard in a cluster with moderately high risk of failure and the hazard at one standard deviation below the mean can be thought of as the hazard in a cluster with a moderately low risk of failure. The risk of failure will lie between the values at one standard deviation above the mean and one standard deviation below the mean for about 68 percent of the clusters in the country. The relative risk presented in Table 4.3 gives the risk of failure for a woman living in a cluster with a moderately high risk of failure (one standard deviation above the mean) compared to a woman living in a cluster with a moderately low risk of failure (one standard deviation below the mean).

The relative risk of failure in a moderately high-risk cluster compared to a moderately low-risk cluster varies from 1.1 in Colombia to 3.4 in Indonesia. This relative risk is frequently larger than that associated with the covariates in the model with the exception of the method used. The cluster-level variation may reflect variation in many factors including the service environment or may reflect strong regional effects that are not accounted for in the model.

4.3 CONTRACEPTIVE SWITCHING

Table 4.4 presents the relative risks obtained from the hazards models of contraceptive switching. The effect of the method used on the risk of switching method varies over the duration of use. Figure 4.2 illustrates the hazard by method in the six populations (all other characteristics are set at their baseline value). Although the effects are complex, some general patterns do emerge. The risk of switching methods is typically very high initially for the condom but drops rapidly so that at later durations of use, the risk of switching from the condom to another method is comparable or only slightly higher than the risk for other methods. In Colombia, Zimbabwe, and to a lesser extent Egypt, the risk of switching from the condom increases again toward the end of the three years for which the hazard is estimated. The risk of switching from injectables to another method also tends to be relatively high compared to other methods, but the pattern over time varies across the six populations. In Bangladesh and Colombia the risk of switching from injectables starts off relatively high but declines rapidly so that by the end of three years it is comparable to that of other methods. In Egypt and Peru the risk of switching from injectables also starts off relatively high but declines less steeply so that the risk of switching remains high relative to most other methods for the full three years. In contrast, in Indonesia and Zimbabwe the risk of switching from injectables starts off relatively low but increases so that the risk rapidly becomes higher than that for other methods. The differences in the risks of switching between the other three methods (pill, IUD, and traditional methods) are not consistent across the six populations and tend to be smaller in general.

The effect of previous status on the risk of switching also varies over time. Users who were using another method immediately prior to the index episode of use are more likely to switch methods again initially but the hazard declines rapidly so that at later durations of use their risk of switching is typically comparable to that of other users (Figure 4.3). There is little difference in the risk of switching methods between those users who had a birth or pregnancy termination immediately prior to the episode of use and those who were not using any method. The differences between these two groups do not vary over time. Bangladesh and Zimbabwe deviate slightly from this pattern but not enough to affect the general conclusions.

Table 4.3 Cluster effects on the risk of contraceptive failure

Cluster level variances, estimated hazards, and relative risks of contraceptive failure for a moderately high-risk cluster relative to a moderately low-risk cluster, Demographic and Health Surveys, 1991-1995

	Bangladesh	Colombia	Egypt	Indonesia	Peru	Zimbabwe
Variance	0.22	0.00	0.08	0.37	0.05	0.06
Hazard at +1 SD	0.037	0.005	0.013	0.005	0.005	0.002
Mean hazard	0.023	0.005	0.009	0.003	0.004	0.002
Hazard at -1 SD	0.014	0.005	0.007	0.001	0.003	0.001
Relative risk	2.56	1.09	1.76	3.38	1.56	1.63

Note: Shading indicates that the variance is significant at the 5 percent level. The hazard is estimated for the pill at 12-14 months duration of use with all other variables set at their baseline values. It is presented at the mean and at one standard deviation (SD) above and one standard deviation below the mean of the cluster-level distribution. The hazard at one standard deviation above the mean represents the hazard in a moderately high-risk cluster while the hazard at one standard deviation below the mean represents the hazard in a moderately low-risk cluster.

In contrast to the pattern observed for contraceptive failure in the preceding section, education does appears to affect the risk of contraceptive switching. The risk of switching increases consistently as education increases. This pattern is observed in all six populations and is statistically significant in four. In four of the six populations, there is also evidence that the risk of switching increases as socioeconomic status increases but this effect is only statistically significant in Bangladesh and Indonesia. In contrast, the only demographic variable that consistently affects the risk of switching is the age of the user. The risk of switching methods declines consistently with age and this effect is statistically significant in four of the countries. Neither of the community variables included in the model appears to affect the risk of switching methods. Area of residence also does not affect the risk of switching except in Egypt.

The cluster variation is statistically significant in Bangladesh, Colombia, Indonesia, and Peru suggesting that there is geographic variation in the risks of switching that is not captured by the covariates in the model (Table 4.5). The relative risk associated with living in a moderately high-risk cluster compared to a moderately low-risk cluster ranges from 1.0 in Zimbabwe where there does not appear to be any variation across clusters to 2.7 in Indonesia.[1]

4.4 CONTRACEPTIVE ABANDONMENT DUE TO REDUCED NEED

Table 4.6 presents relative risks of contraceptive abandonment due to reduced need derived from the models. Relatively few of the individual-level and cluster-level variables are statistically significant. The variables with the largest and most consistent effects are method, number of living children, contraceptive intention, and change in marital status.

The relationship between the method used and the risk of abandoning use due to reduced need varies over time and it is difficult to draw general conclusions across the six countries (Figure 4.4). However, during the first year of use the risk of abandoning condom use tends to be higher than that for other methods. The risk of abandoning IUD use due to reduced need for contraception tends to be low. After about the first year of use, the effects of the different methods become less consistent. These results suggest that women select a method that is consistent with their circumstances, i.e., women who expect to want to get pregnant soon or who have sex infrequently are more likely to adopt the condom, a method which can be discontinued at any time. Removal of an IUD, on the other hand, requires a visit to a health facility so women may be less likely to abandon the method immediately when their circumstances change and may be less likely to choose the IUD if they anticipate that they may wish to discontinue use in a few months. Under this hypothesis, the effect of method would be expected to decline and become less consistent as the duration of use increases because women may not be able to anticipate the need to stop using contraception more than a few months in advance, and because the choice of method is likely to be influenced less by anticipated events that are a long way in the future.

[1] See Section 4.1 for the definition of a moderately high-risk and a moderately low-risk cluster.

Table 4.4 Regression results for contraceptive switching

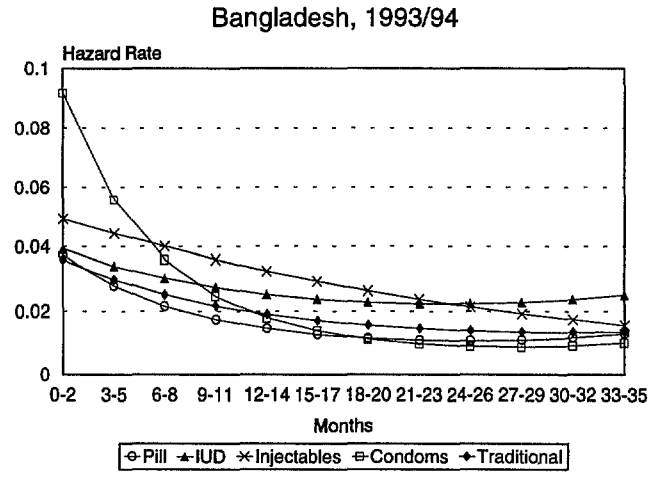
Baseline hazard and relative risks estimated from hazards models of contraceptive switching, Demographic and Health Surveys, 1991-1995

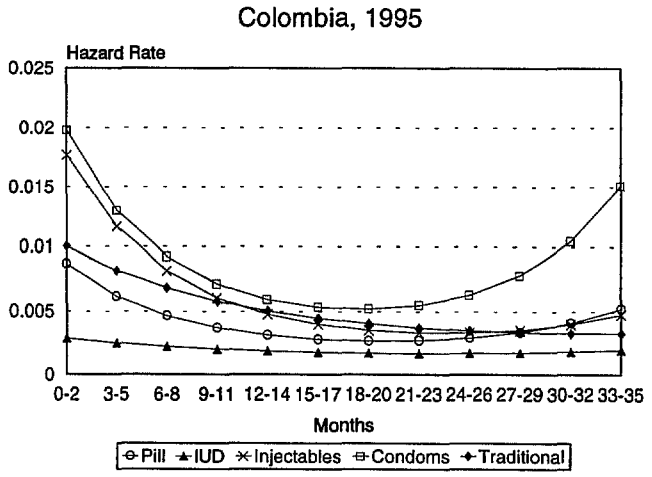
Characteristic	Bangladesh	Colombia	Egypt	Indonesia	Peru	Zimbabwe
Baseline	0.036	0.010	0.013	0.002	0.006	0.004
Interval	0.82	0.81	0.45	0.68	0.79	0.77
Interval^2	1.01	1.01	1.06	1.03	1.01	1.03
Method						
Pill	1.04	0.87	0.51	1.44	2.15	0.20
IUD	1.09	0.29	0.14	0.77	0.53	0.23
Injectables	1.37	1.77	1.25	1.00	3.21	0.55
Condom	2.55	1.98	1.97	3.12	3.97	1.49
Traditional	1.00	1.00	1.00	1.00	1.00	1.00
Previous status						
Using	1.94	1.79	1.92	1.84	2.15	1.96
Not using	1.00	1.00	1.00	1.00	1.00	1.00
Pregnant	1.08	0.98	1.05	1.07	1.14	1.23
Education						
No education	1.00	1.00	1.00	1.00	1.00	1.00
Primary	1.17	1.16	1.05	1.46	1.25	1.50
Secondary +	1.35	1.33	1.15	1.87	1.85	2.66
Socioeconomic status						
Low (0-1)	1.00	1.00	1.00	1.00	1.00	1.00
Medium (2-3)	1.15	1.06	1.18	1.15	0.87	1.23
High (4-5)	1.39	1.32	1.24	1.26	1.07	1.18
Area of residence						
Urban	1.00	1.00	1.00	1.00	1.00	1.00
Rural	1.11	1.07	1.24	1.03	1.08	1.20
Age						
Under 25	1.00	1.00	1.00	1.00	1.00	1.00
25-34	0.83	0.94	0.92	0.83	0.81	0.92
35-49	0.70	0.63	0.79	0.81	0.73	0.51
Number of living children						
0	0.91	0.94	2.09	0.60	1.22	1.11
1-2	0.93	0.92	1.18	1.13	0.98	1.08
3-4	1.00	1.00	1.00	1.00	1.00	1.00
5 or more	0.87	0.52	0.98	0.89	0.85	1.01
Contraceptive intention						
Spacing	1.00	1.00	1.00	1.00	1.00	1.00
Limiting	1.11	1.04	1.07	1.03	1.10	1.42
Marital status						
Not married	a	1.00	a	a	1.00	1.00
Married	a	1.13	a	a	1.22	1.45
Change in marital status						
No	a	1.00	a	a	1.00	1.00
Yes	a	1.40	a	a	1.23	0.98
Recent change in marital status						
No	a	1.00	a	a	1.00	1.00
Yes	a	1.18	a	a	1.17	0.43
Interaction						
Pill*interval	0.89	0.85	1.65	0.81	0.92	1.14
Pill*interval^2	1.01	1.02	0.96	1.02	0.98	0.99
IUD*interval	1.05	1.07	2.10	1.05	0.91	1.25
IUD*interval^2	1.00	1.00	0.95	1.00	1.02	0.98
	1.10	0.79	1.74	1.56	0.97	1.59
	0.99	1.02	0.96	0.97	1.01	0.96
	0.72	0.78	1.02	1.01	0.84	0.81
	1.02	1.03	1.00	0.99	1.01	1.01
Use*interval	0.92	0.91	0.99	0.83	0.83	0.65
Use*interval^2	1.01	1.00	0.99	1.01	1.01	1.03
Cluster variables						
Contraceptive exp.	1.00	1.00	1.00	1.01	1.00	1.01
% discussed FP	a	1.00	a	1.01	a	0.99

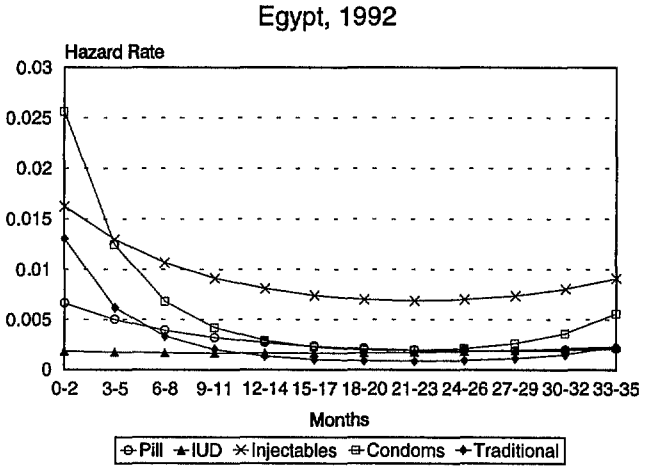
Note: Shading indicates that the relative risk is significant at the 5 percent level.

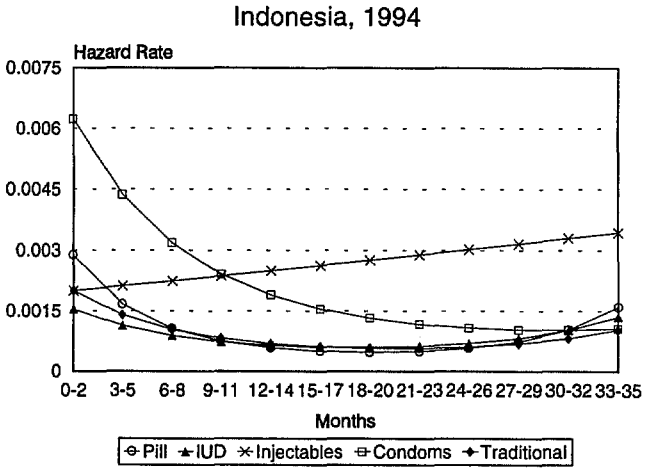
[a] Not included in the model

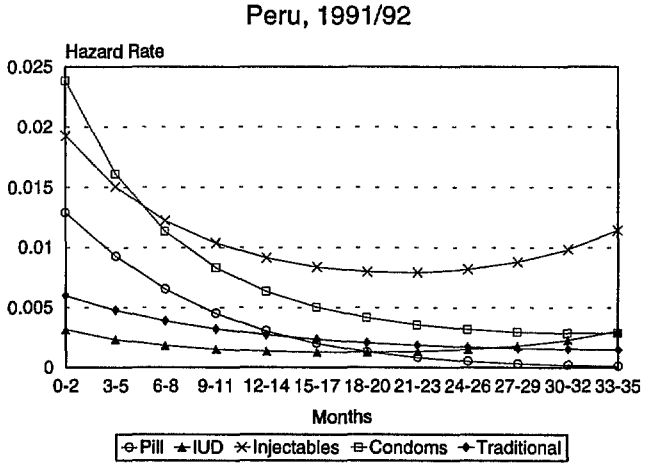
Figure 4.2 Baseline hazard rates for contraceptive switching by method, Demographic and Health Surveys, 1991-1995











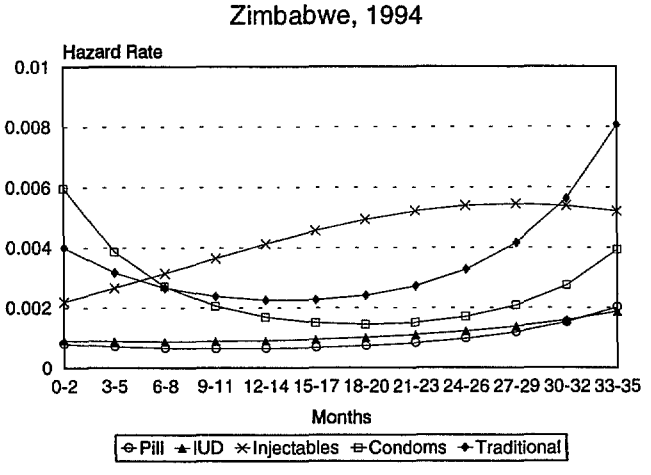
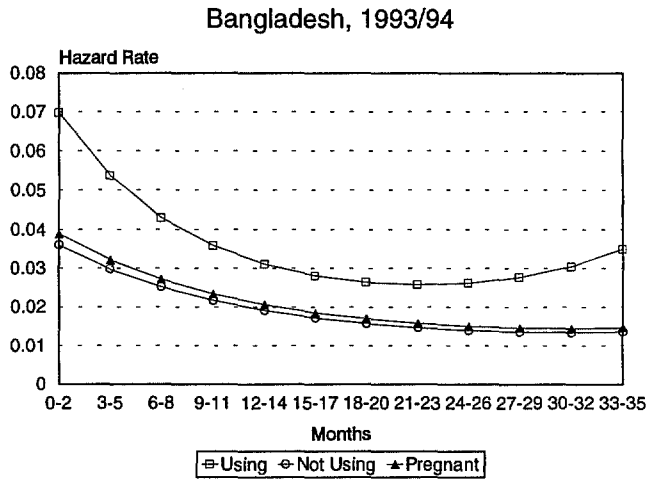
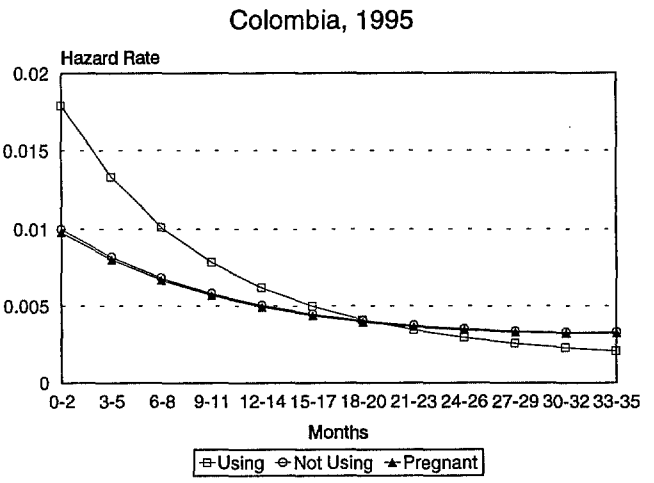
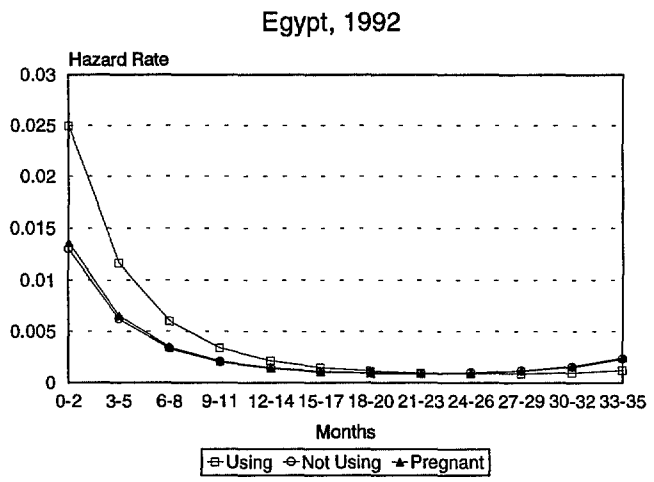
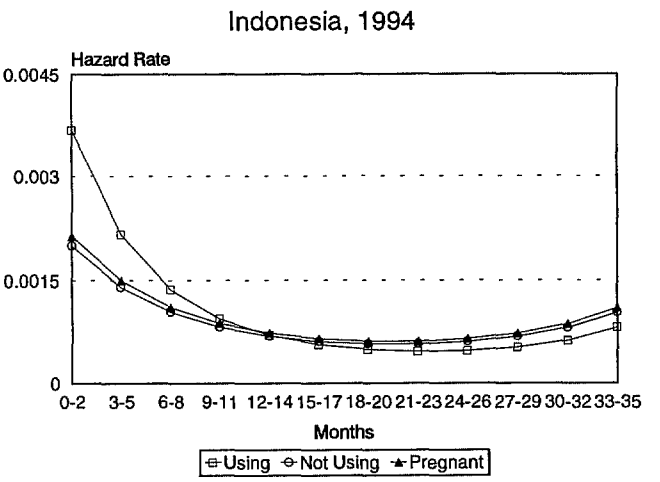


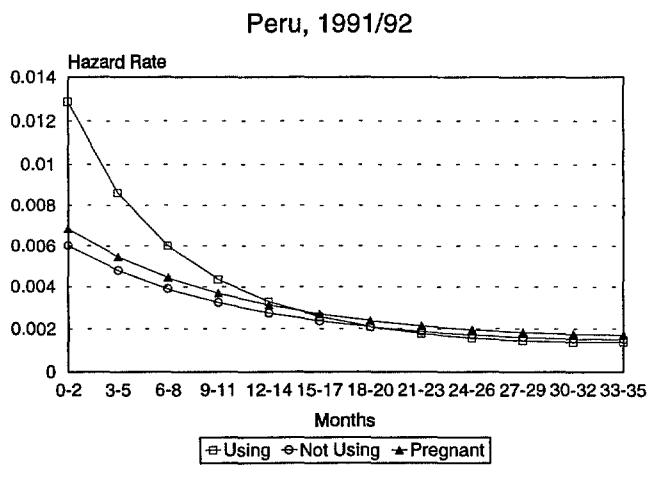
Figure 4.3 Baseline hazard rates for contraceptive switching by previous contraceptive status, Demographic and Health Surveys, 1991-1995











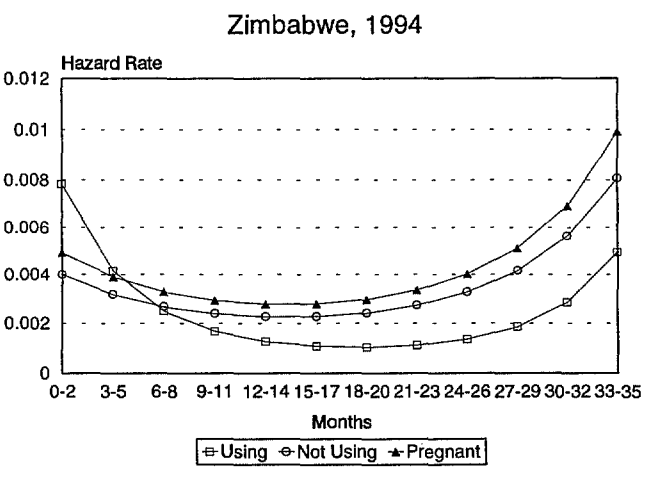


Table 4.5 Cluster effects on the risk of switching contraceptive methods

Cluster level variance, estimated hazards, and relative risks of switching for a moderately high-risk cluster relative to a moderately low-risk cluster, Demographic and Health Surveys 1991-1995

	Bangladesh	Colombia	Egypt	Indonesia	Peru	Zimbabwe
Variance	0.05	0.24	0.07	0.25	0.11	0.00
Hazard at +1 SD	0.018	0.005	0.003	0.001	0.004	0.001
Mean hazard	0.015	0.003	0.003	0.001	0.003	0.001
Hazard at -1 SD	0.012	0.002	0.002	0.000	0.002	0.001
Relative risk	1.56	2.66	1.70	2.72	1.94	1.00

Note: Shading indicates that the variance is significant at the 5 percent level. The hazard is estimated for the pill at 12-14 months duration of use with all other variables set at their baseline values. It is presented at the mean and at one standard deviation (SD) above and one standard deviation below the mean of the cluster-level distribution. The hazard at one standard deviation above the mean represents the hazard in a moderately high-risk cluster while the hazard at one standard deviation below the mean represents the hazard in a moderately low-risk cluster.

The likelihood of abandoning use due to reduced need declines as the number of living children increases in all countries except Colombia. This pattern is expected since women with many children would be less likely to stop using in order to get pregnant than would women with few living children, either because they are less likely to want additional children, or because they may want to wait longer until their next child than those with few children.[2] This pattern is also consistent with the result that users who want to limit their births are less likely to discontinue because they no longer need to use than women who are using contraception to space births (Figure 4.5). The baseline hazard of abandoning use tends to increase as the duration of use increases among spacers, while it tends to be much flatter among limiters. Consequently, the relative risk associated with using contraception for limiting tends to get smaller (i.e., the effect gets stronger) over time. Among spacers, most abandonments due to reduced need for contraception reflect discontinuations to get pregnant. Therefore, the risk of such discontinuations would be expected to increase as the duration of use increases. In contrast, among limiters most abandonments due to reduced need reflect discontinuations due to marital dissolution, reduced fecundity, and reduced coital frequency. These events are more random in nature so the hazard would not be expected to vary systematically according to the duration of use. Colombia presents an exception to this pattern. The reasons for this are unclear.

A change in marital status is significantly positively related to contraceptive abandonment due to reduced need in every country except Bangladesh (where the coefficient is also positive but not significant). The relative risks are particularly large in Egypt and Indonesia where a change in marital status is associated with a 17 and 12 times greater risk of abandonment, respectively, compared to users who did not change their status. These results are not surprising since marital dissolution is likely to be associated with reduced frequency of sex while the initiation of marriage is associated with a desire to get pregnant. The lagged marital status change variable is also positive and significant in Peru and Zimbabwe. However, the lack of a strong, consistent effect of the lagged marital status variable suggests that abandonment associated with a change in marital status tends to be fairly immediate.

The random effects are significant in every country except Zimbabwe; the effect is particularly large in Egypt where the relative risk associated with being in a moderately high-risk cluster relative to a moderately low-risk cluster exceeds 10 (Table 4.7).[3] This suggests that unobserved cluster-level effects have an important influence on the risk of abandoning contraceptive use due to reduced need. It is possible that the cluster variance is picking up unmeasured regional effects, particularly in Egypt where there are large differences in fertility behavior between Upper and Lower Egypt.

[2] A desire to get pregnant accounts for between 55 and 84 percent of discontinuations due to reduced need in the six countries.

[3] The estimate of the random effect for Egypt should be viewed with some caution because problems were encountered in the estimation of this model. Details of the estimation problems are given in Appendix B.

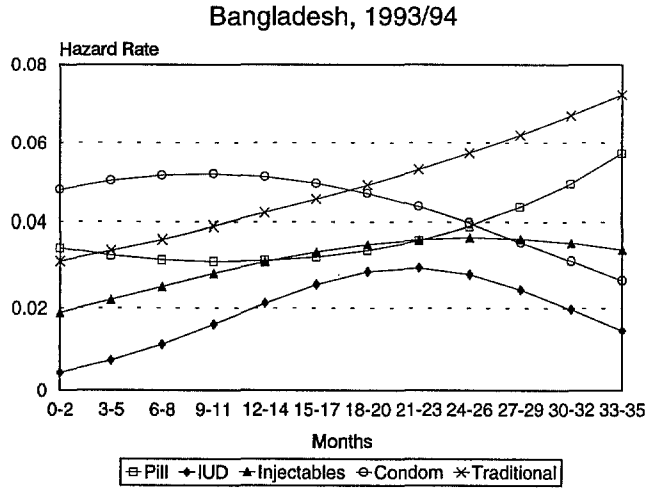
Table 4.6 Regression results for abandoning contraceptive use due to reduced need for contraceptives

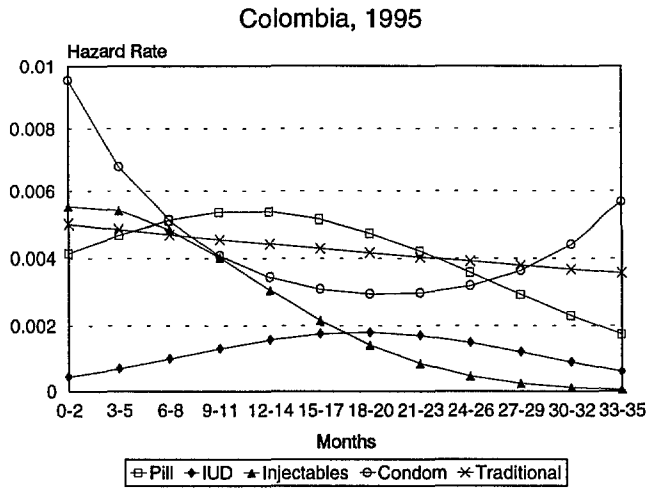
Baseline hazard and relative risks estimated from hazards models of abandoning contraceptive use due to reduced need for contraception, Demographic and Health Surveys, 1991-1995

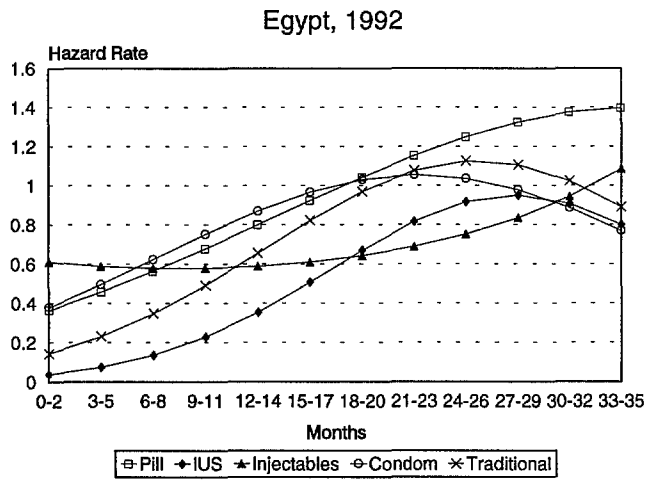
Characteristic	Bangladesh	Colombia	Egypt	Indonesia	Peru	Zimbabwe
Baseline	0.031	0.005	0.144	0.010	0.013	0.004
Interval	1.08	0.97	1.65	1.42	1.03	1.67
Interval^2	1.00	1.00	0.97	0.98	1.00	0.97
Method						
Pill	1.10	0.83	2.53	2.08	1.31	0.52
IUD	0.14	0.09	0.26	0.38	0.07	0.85
Injectables	0.61	1.10	4.24	1.23	1.06	0.57
Condom	1.55	1.91	2.63	3.21	1.87	5.53
Traditional	1.00	1.00	1.00	1.00	1.00	1.00
Previous status						
Using	0.80	0.87	0.93	1.48	0.97	1.15
Not using	1.00	1.00	1.00	1.00	1.00	1.00
Pregnant	0.87	0.77	0.89	1.02	0.94	0.76
Education						
No education	1.00	1.00	1.00	1.00	1.00	1.00
Primary	1.10	2.38	1.11	0.83	0.68	1.02
Secondary +	0.98	1.89	1.12	1.04	0.64	0.90
Socioeconomic status						
Low (0-1)	1.00	1.00	1.00	1.00	1.00	1.00
Medium (2-3)	1.01	1.13	0.88	0.78	0.92	0.80
High (4-5)	0.95	0.95	0.83	0.84	0.92	0.66
Area of residence						
Urban	1.00	1.00	1.00	1.00	1.00	1.00
Rural	0.97	1.00	1.24	1.06	0.98	1.00
Age						
Under 25	1.00	1.00	1.00	1.00	1.00	1.00
25-34	1.11	1.01	1.06	1.05	1.02	1.10
35-49	0.79	1.26	1.16	0.88	1.53	1.03
Number of living children						
0	4.85	6.18	9.25	12.32	2.63	3.81
1-2	1.63	2.26	1.68	1.40	1.31	1.45
3-4	1.00	1.00	1.00	1.00	1.00	1.00
5 or more	0.69	1.38	0.54	0.87	0.67	0.92
Contraceptive intention						
Spacing	1.00	1.00	1.00	1.00	1.00	1.00
Limiting	0.63	0.86	0.92	0.42	0.28	0.70
Marital status						
Not married	1.00	1.00	1.00	1.00	1.00	1.00
Married	1.19	1.02	0.05	0.35	1.06	1.77
Change in marital status						
No	1.00	1.00	1.00	1.00	1.00	1.00
Yes	3.33	5.70	16.88	11.63	5.25	4.64
Recent change in marital status						
No	1.00	1.00	1.00	1.00	1.00	1.00
Yes	0.82	1.33	0.92	1.09	1.54	3.58
Interaction						
Pill*interval	0.87	1.19	0.77	0.81	0.95	1.05
Pill*interval^2	1.01	0.98	1.02	1.01	1.00	1.00
IUD*interval	1.62	1.66	1.25	0.92	1.28	0.48
IUD*interval^2	0.96	0.96	0.99	1.02	0.99	1.05
	1.09	1.05	0.58	0.87	0.97	0.46
	0.99	0.96	1.04	1.01	1.00	1.05
	0.98	0.71	0.81	0.75	0.77	0.46
	0.99	1.03	1.01	1.01	1.02	1.05
Intent*interval	0.67	0.72	0.53	0.80	0.96	0.69
Intent*interval^2	1.03	1.03	1.05	1.01	1.00	1.03
Cluster variables						
Contraceptive exp.	1.00	0.99	1.00	0.995	1.00	0.99
% discussed FP	a	1.00	a	1.00	a	1.00

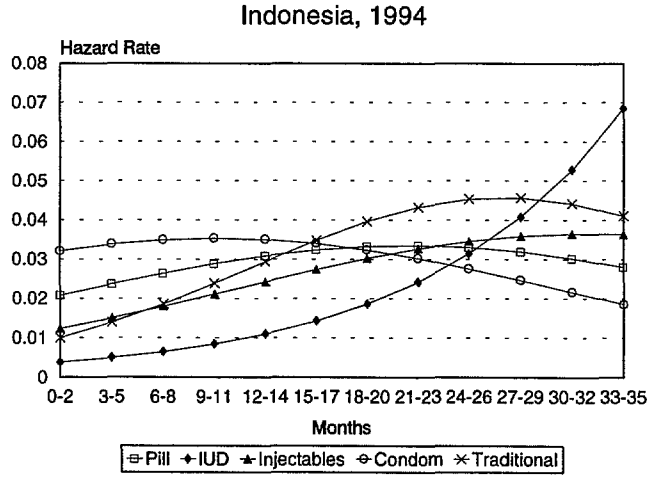
Note: Shading indicates that the relative risk is significant at the 5 percent level.
[a] Not included in the model

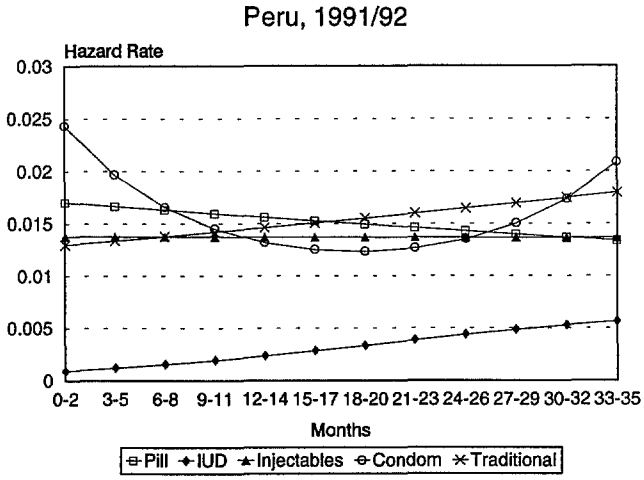
Figure 4.4 Baseline hazard rates for abandoning contraceptive use due to reduced need for contraception by method, Demographic and Health Survey, 1991-1995











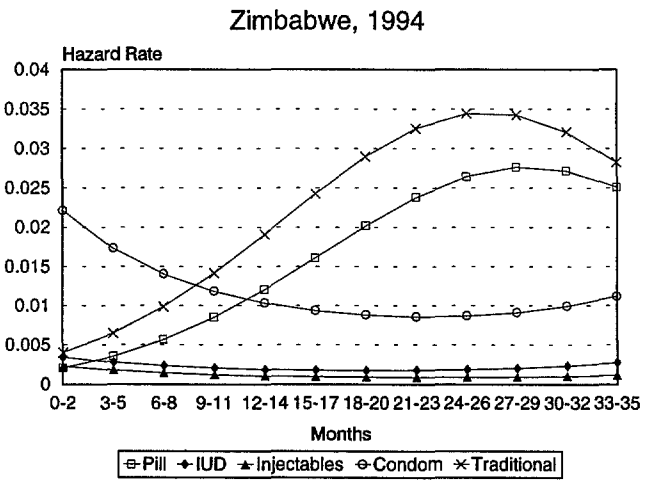
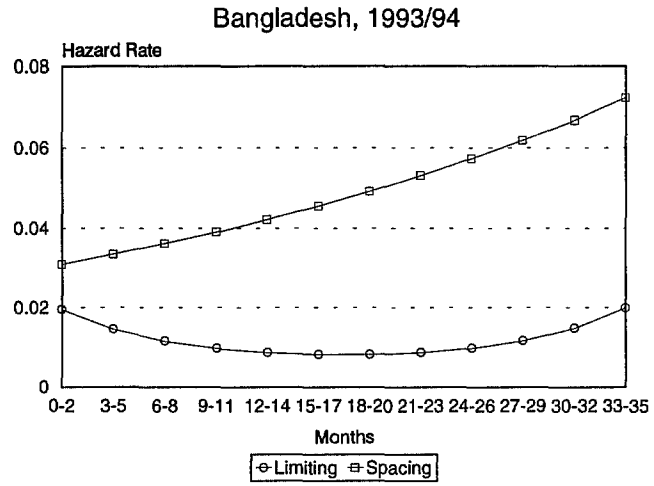
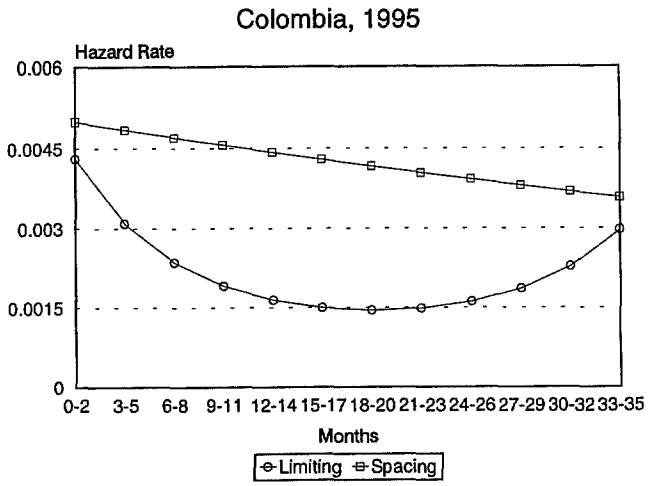
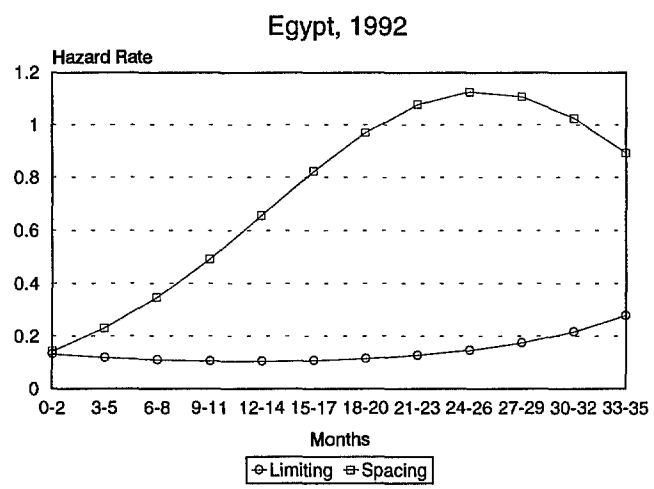
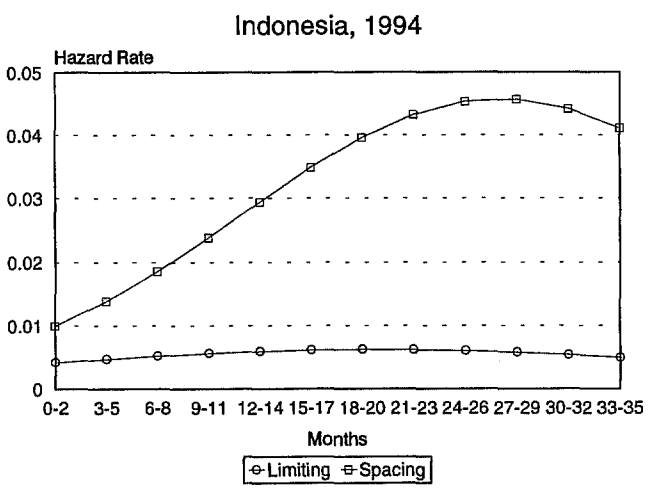


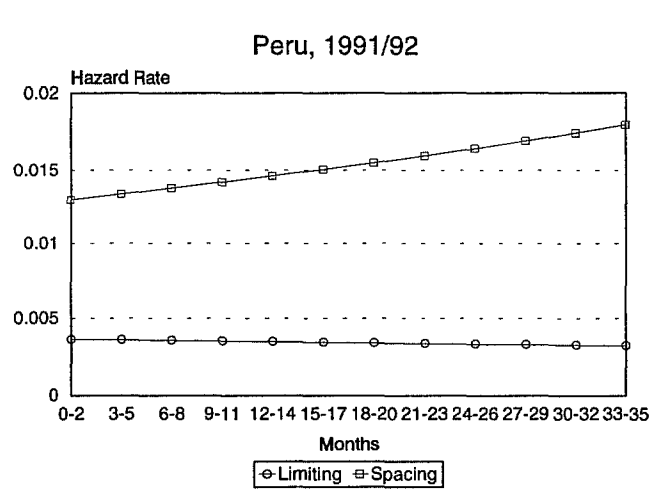
Figure 4.5 Baseline hazard rates for abandoning contraceptive use due to reduced need for contraception by contraceptive intention, Demographic and Health surveys, 1991-1995











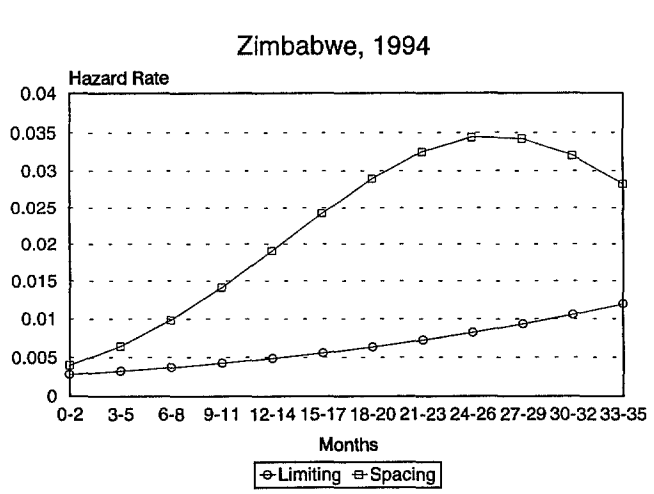


Table 4.7 Cluster effects on the risk of abandoning contraceptive use due to reduced need for contraception

Cluster-level variances, estimated hazards, and relative risks of abandoning contraceptive use due to reduced need for contraception for a moderately high-risk cluster relative to a moderately low-risk cluster, Demographic and Health Surveys, 1991-1995

	Bangladesh	Colombia	Egypt	Indonesia	Peru	Zimbabwe
Variance	0.12	0.07	1.40	0.25	0.18	0.03
Hazard at +1 SD	0.044	0.007	2.613	0.051	0.024	0.014
Mean hazard	0.031	0.005	0.800	0.031	0.016	0.012
Hazard at -1 SD	0.022	0.004	0.245	0.019	0.010	0.010
Relative risk	2.00	1.70	10.66	2.72	2.34	1.41

Note: Shading indicates that the variance is significant at the 5 percent level. The hazard is estimated for the pill at 12-14 months duration of use with all other variables set at their baseline values. It is presented at the mean and at one standard deviation (SD) above and one standard deviation below the mean of the cluster-level distribution. The hazard at one standard deviation above the mean represents the hazard in a moderately high-risk cluster while the hazard at one standard deviation below the mean represents the hazard in a moderately low-risk cluster.

4.5 CONTRACEPTIVE ABANDONMENT WHILE IN NEED

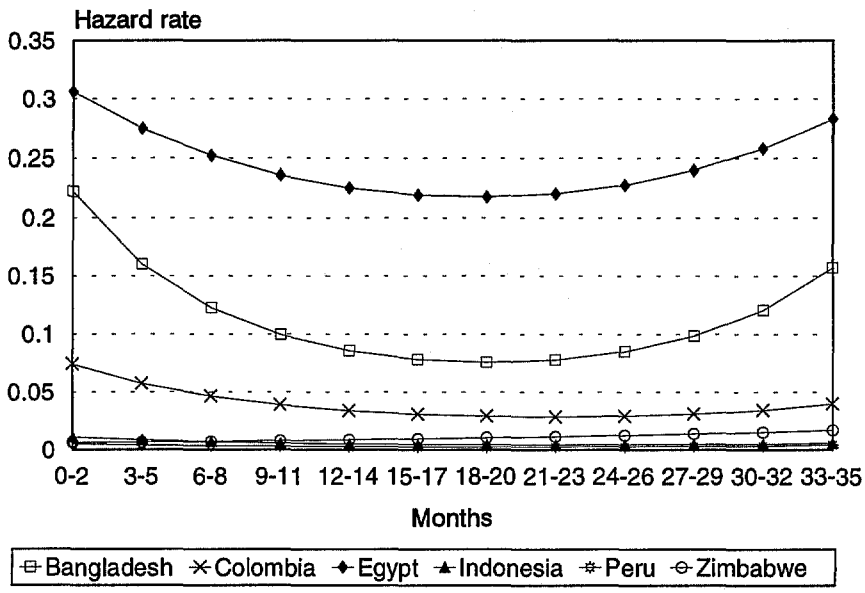
Figure 4.6 shows the baseline hazard of abandoning use while in need of contraception in the six countries. The hazard of abandoning use while in need is much higher in Egypt and Bangladesh than elsewhere. The shape of the hazard function is generally similar across the six populations; the hazard first decreases and then starts to increase again after about 18 months of use. However, in Zimbabwe the hazard increases over time.

As shown in Table 4.8, the method used strongly influences the risk of discontinuation while in need in all countries. Compared to users of traditional methods, users of modern methods are more likely to discontinue use even though they are still at risk of becoming pregnant and wish to avoid a pregnancy. In Bangladesh, Colombia, Egypt, and Peru, injectables are most likely to be discontinued; in Indonesia, pills, injectables, and condoms are about equally likely to be abandoned, and in Zimbabwe, the relative risk of discontinuation is about the same for pills and condoms. The relative risks associated with abandonment of modern methods relative to traditional methods are particularly high in Peru, which may reflect the influence of the Catholic Church on attitudes toward modern contraception.

Women who were using another method just prior to the episode of use are less likely to abandon use while in need than those who were not using any method in Bangladesh, Colombia, and Peru. Women who were previously using a method may represent women who switch methods in response to problems with methods rather than abandon use altogether. This group may be highly motivated to avoid pregnancy or may be more willing than other women to experiment with methods until they find one that suits them. This should presumably lead to greater satisfaction with the new method and they should subsequently be less likely to abandon the method to which they switched than other women. However, in the other three countries the effect of previous status is insignificant and is in the opposite direction so this effect is not strong or consistent across the six populations.

In contrast to the models of contraceptive failure and contraceptive abandonment due to reduced need, this model shows some influence of socioeconomic factors on the rate of discontinuation while still in need. The index of socioeconomic status is significantly negatively related to discontinuation in every country except Bangladesh and Egypt. Women of high socioeconomic status are 70 to 80 percent as likely to abandon a method as those in the lowest socioeconomic status group in Egypt and Indonesia, about half as likely in Peru and Zimbabwe, and about 40 percent as likely in Colombia. This suggests that cost factors may play an auxiliary role in contraceptive abandonment while in need even though cost is rarely reported as the main reason for discontinuation. This is supported by the evidence reported in Section 4.3 that women of high socioeconomic status are more likely to switch methods in some countries than women of low socioeconomic status. Another possible explanation for both these findings is that women of high socioeconomic status live in more developed areas and have access to better health and family planning facilities.

Figure 4.6 Baseline hazard rates for abandoning contraceptive use while in need of contraception by country, Demographic and Health Surveys, 1991-1995



A woman's level of education is not significantly related to abandonment while in need in any of the six countries. Urban-rural differentials are significant only in Indonesia where rural women are less likely to abandon use of a method than urban women.

As in the case of contraceptive abandonment due to reduced need, a contraceptive user's fertility intentions strongly influence the likelihood of abandoning while still in need. In Bangladesh, Egypt, Indonesia, and Zimbabwe, women who do not want another child are 60 to 75 percent as likely as those who want to delay their next birth to discontinue use.

Married women are generally less likely to abandon use than unmarried women, a relationship that is significant in Bangladesh and Egypt. Moreover, a *change* in marital status strongly increases the likelihood of discontinuing while in need in every country except Peru, where the effect is also positive but not significant. The largest proportion of discontinuations while in need is due to side effects and health concerns (data not shown). It may be the case that women who tolerate side effects to avoid a premarital pregnancy abandon the method following marriage because their desire to avoid pregnancy diminishes (or perhaps because their husband disapproves). At the same time, women who have side effects or health concerns about their method may abandon the method if they are divorced or widowed.

The contraceptive experience of the community in which the woman lives significantly affects the risk of abandoning contraceptive use while in need of contraception; women in communities in which a high percentage of ever-married women have ever used a contraceptive method are less likely than other women to abandon use while in need. Women living in communities with greater experience with contraception may receive more peer support to continue contraceptive use if they have problems, and may receive more peer pressure not to have unwanted pregnancies. In addition, these communities may include those in which services are better organized to support continued use among contraceptive users.

The random effects are statistically significant in all countries except Zimbabwe suggesting, as in the case of the previous model, that unobserved effects across clusters contribute in important ways to the risk of abandonment (Table 4.9). Except in Egypt, the random effects for this model are larger than for the previous model. This might be expected if unobserved effects of

Table 4.8 Regression results for abandoning contraceptive use while in need of contraception

Baseline hazard and relative risks estimated from hazards models of abandoning contraceptive use while in need of contraception, Demographic and Health Surveys, 1991-1995

Characteristic	Bangladesh	Colombia	Egypt	Indonesia	Peru	Zimbabwe
Baseline	0.222	0.074	0.306	0.011	0.005	0.006
Interval	0.70	0.76	0.89	0.76	0.79	1.10
Interval^2	1.03	1.02	1.01	1.02	1.02	1.00
Method						
Pill	3.72	4.63	5.74	4.12	16.31	3.08
IUD	3.12	2.00	2.42	2.38	3.81	1.03
Injectables	5.16	5.86	7.92	4.12	22.22	1.62
Condom	3.36	2.56	3.61	4.50	13.59	3.02
Traditional	1.00	1.00	1.00	1.00	1.00	1.00
Previous status						
Using	0.70	0.81	1.16	1.06	0.73	1.12
Not using	1.00	1.00	1.00	1.00	1.00	1.00
Pregnant	0.65	0.67	0.80	0.75	1.20	0.78
Education						
No education	1.00	1.00	1.00	1.00	1.00	1.00
Primary	1.00	0.84	0.90	0.88	0.98	0.97
Secondary +	0.82	0.70	0.80	0.87	0.88	0.88
Socioeconomic status						
Low (0-1)	1.00	1.00	1.00	1.00	1.00	1.00
Medium (2-3)	0.85	0.55	0.88	0.80	0.83	0.64
High (4-5)	0.88	0.40	0.77	0.79	0.57	0.52
Area of residence						
Urban	1.00	1.00	1.00	1.00	1.00	1.00
Rural	1.01	0.86	1.03	0.80	1.12	0.99
Age						
Under 25	1.00	1.00	1.00	1.00	1.00	1.00
25-34	1.02	0.84	0.87	0.96	0.67	0.83
35-49	0.94	0.79	0.92	1.15	0.83	0.66
Number of living children						
0	1.46	1.39	0.73	1.67	1.63	0.96
1-2	1.13	0.96	1.43	0.88	1.02	1.05
3-4	1.00	1.00	1.00	1.00	1.00	1.00
5 or more	1.16	0.79	1.05	1.41	0.97	1.55
Contraceptive intention						
Spacing	1.00	1.00	1.00	1.00	1.00	1.00
Limiting	0.75	0.84	0.60	0.59	0.89	0.61
Marital status						
Not married	1.00	1.00	1.00	1.00	1.00	1.00
Married	0.22	0.96	0.02	0.73	0.86	0.85
Change in marital status						
No	1.00	1.00	1.00	1.00	1.00	1.00
Yes	6.12	2.30	8.96	2.83	1.78	2.33
Recent change in marital status						
No	1.00	1.00	1.00	1.00	1.00	1.00
Yes	1.09	1.51	0.12	1.36	0.99	1.41
Cluster variables						
Contraceptive exp.	0.99	0.98	0.99	0.99	0.99	0.99
					9 99	
% discussed FP	a	1.00	a	1.00	a	1.00

Note: Shading indicates that the relative risk is significant at the 5 percent level.
[a] Not included in the model

the service environment are captured in the cluster variance; one would expect the service environment to have more influence on the rate of abandonment for side effects, health concerns, etc. than for reasons that are related to reduced need for contraception.

Table 4.9 Cluster effects on the risk of abandoning contraceptive use while in need of contraception

Cluster-level variances, estimated hazards, and relative risks of abandoning contraceptive use while in need of contraception for a moderately high-risk cluster relative to a moderately low-risk cluster, Demographic and Health Surveys, 1991-1995

	Bangladesh	Colombia	Egypt	Indonesia	Peru	Zimbabwe
Variance	0.15	0.47	0.16	0.37	0.26	0.06
Hazard at +1 SD	0.469	0.311	1.928	0.038	0.073	0.035
Mean hazard	0.318	0.157	1.292	0.021	0.044	0.027
Hazard at -1 SD	0.216	0.079	0.866	0.011	0.026	0.021
Relative risk	2.17	3.94	2.23	3.38	2.77	1.63

Note: Shading indicates that the variance is significant at the 5 percent level. The hazard is estimated for the pill at 12-14 months duration of use with all other variables set at their baseline values. It is presented at the mean and at one standard deviation (SD) above and one standard deviation below the mean of the cluster-level distribution. The hazard at one standard deviation above the mean represents the hazard in a moderately high-risk cluster while the hazard at one standard deviation below the mean represents the hazard in a moderately low-risk cluster.

5 Discussion and Conclusions

The contraceptive histories collected in the DHS surveys provide a unique opportunity to examine an array of issues related to the dynamics of contraceptive use. In this report, four types of discontinuation have been examined: failure, switching, and two types of abandonment. Several general conclusions emerge from life table and multivariate analyses of the six surveys. First, discontinuing use of a contraceptive method is a common event. Within two years of starting an episode of use, almost half of the users have discontinued in Egypt, Indonesia, and Zimbabwe. In Bangladesh, Colombia, and Peru, approximately two-thirds discontinue within two years. While much of this discontinuation reflects method switching and abandonment due to reduced need for contraception, contraceptive failure and abandonment while still in need of contraception are also relatively common. Contraceptive failure rates are particularly high in Peru and Colombia, whereas rates of abandonment while still in need of contraception are highest in Bangladesh.

The method chosen by women is strongly associated with the likelihood of each of the four types of discontinuation examined in all six populations. Users of modern methods have consistently lower rates of failure than users of traditional methods but are more likely to discontinue the method while still in need. The relationship between the type of method used and switching tends to be both duration and method specific in these six countries. In general, condoms are associated with high rates of switching at early durations. Switching rates for injectables are also high compared to other methods. Further, the abandonment of condoms due to reduced need tends to be relatively high compared to other methods, especially during the first year of use. In contrast, the risk of contraceptive failure, switching, and abandoning use due to reduced need tend to be lower for the IUD than for other methods. The risk of abandoning use while still in need is also generally lower for the IUD than for other modern methods, although it tends to be higher than for traditional methods.

These results suggest that method choice and method characteristics play an important role in contraceptive discontinuation behavior. The precise nature of the relationship between the method used and the risk of contraceptive discontinuation is complicated by the fact that method choice itself is influenced by women's balancing of a number of factors. The characteristics of methods, including ease of continuation or discontinuation and the risk of contraceptive failure are likely to be among the factors that women take into account in choosing a method, as is the intended length of use. In addition, other characteristics of women are likely to influence both their method choice and their risk of discontinuing use. Therefore, method characteristics influence discontinuation rates both directly through influencing the risk of discontinuation among those who choose a particular method, and indirectly through influencing women's choice of methods. For example, unlike discontinuation of the other methods in this study, discontinuation of the IUD requires a proactive decision on the part of the user to get the IUD removed. This characteristic of the method is likely to reduce discontinuation rates among women who choose the method. At the same time, women who have a high risk of discontinuation are probably less likely than women with a low risk of discontinuation to choose the IUD for this same reason. Disentangling the extent to which low discontinuation of the IUD is due to the characteristics of the method as opposed to the characteristics of the women who choose it is, therefore, very complex.

In contrast to studies of the determinants of current contraceptive use, socioeconomic variables are not consistently related to the outcomes examined here. In particular, women's level of education and socioeconomic status are not significant determinants of the likelihood of contraceptive failure or abandoning due to reduced need. The variables that influence these two outcomes tend to be more proximate, such as fertility intention and marital status. These findings are broadly consistent with those of the few other multivariate analyses of contraceptive discontinuation against which it is possible to compare these results. For example, Moreno (1993) found little evidence that either area of residence or education significantly affected the risk of contraceptive failure in the 15 countries studied, and Ali and Cleland (1996) concluded that "The demographic and motivational predictors emerge as the most consistent set of predictors of continuation of contraceptive methods in the six countries examined."

The effects of socioeconomic variables are important, however, in the case of switching and abandoning while in need. The risk of switching increases consistently with increasing education and, in some countries, with increasing socioeconomic status. In addition, women's socioeconomic status is negatively related to abandonment while still in need in every country except Bangladesh. These findings indicate that cost and access factors probably contribute to contraceptive outcomes even though they are seldom mentioned as the main reason for discontinuation.

The role of a change in marital status is substantial for both types of abandonment. To some degree in all six countries, but perhaps more so in Bangladesh, Egypt, and Indonesia, marital status is a proxy for exposure to sexual intercourse. It would therefore be expected that changes in marital status would lead to changes in contraceptive use. A shift in marital status is also undoubtedly related to altered fertility preferences. For example, getting married is associated with a desire to get pregnant for many women. Even if women who get married do not actively wish to get pregnant, they may be more likely to abandon a method due to side effects or health concerns if their motivation to avoid a pregnancy has decreased. A change in marital status is also positively associated with the likelihood of contraceptive failure in the three countries in which it was possible to measure this effect. This relationship may be due to increased exposure to sexual intercourse after marriage or to the possibility that a premarital contraceptive failure leads to marriage.

The fact that the more proximate characteristics (e.g. fertility intentions, marital status, etc.) tend to have the strongest and most consistent relationships with each of the outcomes (except switching) suggests that, in general, the majority of women behave consistently with their fertility objectives and their circumstances. Even when the outcome is apparently negative (i.e., contraceptive failure or abandonment while in need of contraception) the strong effects of fertility intentions and a change in marital status suggest that in many cases the outcome may not be inconsistent with the woman's circumstances. For example, if a woman discontinues a method due to health concerns, the timing of that discontinuation may coincide with marital dissolution. These results also demonstrate that asking women to provide only the main reason for discontinuing use, as is done in DHS surveys, gives an oversimplified picture of the decision to stop using a method. It would be more realistic to allow women to report all reasons for discontinuation. However, such an approach would be difficult to implement in the DHS calendar. An alternative approach might be to begin with smaller-scale in-depth and qualitative studies to examine specifically the issue of multiple motivations for discontinuation.

The community level variables included here—contraceptive experience and discussion of family planning—did not have consistently significant effects in any of the models. The one exception is that cluster-level contraceptive experience is significantly negatively related to the risk of abandonment while in need which is con-sistent with a positive role of peer support in communities where contraceptive use is common. The lack of statistical power of the community variables may be due to their inability to capture true community effects because, for example, the sampling cluster is not a relevant social unit or women's discussion of family planning is poorly reported. More refined measures of community variables, such as a time-dependent measure of community contraceptive prevalence constructed from the calendar, may also increase the discriminating power of these indicators. The size and significance of the random effects suggest that there are considerable cluster-level influences on contraceptive outcomes, which are unmeasured in this analysis and confirm the utility of including these effects through a multilevel model both from a substantive perspective and because omitting them would potentially bias the estimated effects of the other variables in the model.

The findings of this analysis suggest several areas for future research. First, the strong but complex relationship between method choice and contraceptive discontinuation merits further investigation. As discussed above, the nature of this relationship is complicated by the many interrelationships between these two behaviors. Therefore, analysis of this issue will require careful conceptualization of the problem and the use of innovative statistical methods that allow one to model factors associated with both method choice and discontinuation within the same analytical framework.

The strong effects of marital status, particularly a change in marital status, suggest an area to pursue further is the relationship between contraceptive discontinuation and other changes in women's live. This analysis of the relationship between a change in marital

status and contraceptive discontinuation was deliberately kept fairly simple in this study to fit in with the more general comparative framework of the analysis. However, a more detailed specification of the type of change involved (i.e., unmarried to married versus married to unmarried) is an obvious extension to this analysis, as is a more precise coding of the relative timing of events. For example, such an approach might allow one to disentangle the extent to which the increased risk of contraceptive failure associated with a change in marital status is due to increased risk after marriage or contraceptive failure precipitating marriage. However, on a cautionary note, the reporting of events may not be precise enough to make such distinctions, particularly if the respondent is trying to conceal a premarital conception.

In addition to the relationship between a change in marital status and contraceptive discontinuation, the DHS calendar also allows analysis of the relationship between a change of community and contraceptive discontinuation. This has not been pursued in this analysis, in part because the data required for such an analysis were not collected in Bangladesh. Moreno (1994) examined the relationship between a change in community and contraceptive use in Northeast Brazil, but did not examine its effect on contraceptive discontinuation explicitly. Further, DHS-II surveys include an additional column in the calendar on employment, which can be combined with the information on contraceptive use to study the relationship between changes in employment status and contraceptive discontinuation.

This analysis indicates that there are strong community-level effects on contraceptive discontinuation which were not accounted for by the community-level variables included in the model.[4] Further investigation of these community-level effects is an important area of research. Some of these community effects may represent regional differences that were not included in the models presented here because regional effects are country-specific. However, other community characteristics may play an important role and should be investigated. In particular, quality and availability of services are often thought to be important elements in encouraging contraceptive continuation but the relationship between service factors and contraceptive discontinuation has rarely been studied (Steele and Choe, 1997 present an illustrative analysis of the relationship between service factors and contraceptive discontinuation in Morocco).

Analyses of the role of service factors on contraceptive use dynamics are needed but present several challenges. First, data on services that can be combined with individual data on contraceptive use tend to be collected through facility surveys implemented at the same time as the household survey, whereas the individual data collected in the calendar refer to the five-year period before the survey. If the service environment has changed in the preceding five years, the situation at the time of the survey may not be relevant for episodes of use that began up to five years earlier. This problem is particularly acute for aspects of the service environment that are very variable over time such as the occurrence of stock-outs. This problem may be overcome to some extent if an individual survey is conducted in sampling clusters which had a facilities survey at an earlier point in time. Second, many measures of service environment are fairly simple and may not measure the aspects of service environment that are most relevant to contraceptive discontinuation. For example, the presence of a hospital may not have a strong effect on contraceptive continuation but the quality of counseling on side effects received at the respondent's initial visit may be important. However, information on counseling may not be available.

Finally, the conceptual framework presented outlines several aspects of the dynamics of contraceptive use which are not examined here and which have been virtually neglected in published research. For example, an analysis of the extent to which women who experience a contraceptive failure go on to have an unwanted or mistimed birth would allow an assessment of the demographic impact of contraceptive failure. Research is also needed on the subsequent contraceptive behavior of women who experience a failure. In addition, it would be useful to look at the consequences of abandoning a method while still in need. Some women will subsequently have an unwanted pregnancy while others will adopt another method or return to their original method. Switching behavior is also incompletely understood; the extent to which women switch between modern and

[4] It is possible that the estimates of community-level variation obtained from our models are overestimates of the true community-level variation due to the exclusion of the woman level from the multilevel model (see Section 3.3 and Appendix B). This is a methodological problem and more statistical research on the estimation of nonlinear multilevel models is urgently needed to address this issue.

traditional methods and the extent to which they return to a previously used method is of interest. All of these analyses can be carried out with the data collected in the DHS contraceptive histories.

One of the main motivations for this comparative study was to increase our understanding of the determinants of different types of contraceptive discontinuation so as to move toward a situation in which the determinants of these contraceptive behaviors are as well understood as the determinants of current use. Comparative studies such as this one, with their focus on general rather than country-specific patterns, are an important part of this process, as are numerous individual studies that contribute to building the body of evidence necessary to achieve a complete understanding of these processes. Given the general lack of other multivariate studies of contraceptive discontinuation in developing countries, both comparative and country-specific, there is still a need for additional studies of the determinants of contraceptive discontinuation to confirm our general findings. At the same time, a second objective of this study was to identify new areas of research so as to start to move beyond studying determinants. This analysis has highlighted several areas for future research. Contraceptive use dynamics is a relatively new area of study and presents many interesting and challenging problems.

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APPENDIX A

The DHS-III Monthly Calendar of Events

INSTRUCTIONS:
ONLY ONE CODE SHOULD APPEAR IN ANY BOX.
FOR COLUMNS 1, 3, AND 4, 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 INJECTABLES
- 4 IMPLANTS
- 5 DIAPHRAGM/FOAM/JELLY
- 6 CONDOM
- 7 FEMALE STERILIZATION
- 8 MALE STERILIZATION
- 9 PERIODIC ABSTINENCE
- A WITHDRAWAL
- X OTHER_____ (SPECIFY)

COL.2: Discontinuation of Contraceptive Use

- 0 INFREQUENT SEX/HUSBAND AWAY
- 1 BECAME PREGNANT WHILE USING
- 2 WANTED TO BECOME PREGNANT
- 3 HUSBAND DISAPPROVED
- 4 WANTED MORE EFFECTIVE METHOD
- 5 HEALTH CONCERNS
- 6 SIDE EFFECTS
- 7 LACK OF ACCESS/TOO FAR
- 8 COST TOO MUCH
- 9 INCONVENIENT TO USE
- F FATALISTIC
- A DIFFICULT TO GET PREGNANT/MENOPAUSE
- D MARITAL DISSOLUTION/SEPARATION
- X OTHER_____ (SPECIFY)
- Z DON'T KNOW

COL.3: Marriage/Union

- X IN UNION (MARRIED OR LIVING TOGETHER)
- 0 NOT IN UNION

COL.4: Moves and Types of Communities

- X CHANGE OF COMMUNITY
- 1 CITY
- 2 TOWN
- 3 COUNTRYSIDE

				1	2	3	4			
	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
4	05	MAY	08					08	MAY	4
*	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
9	06	JUN	19					19	JUN	9
3	05	MAY	20					20	MAY	3
	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
9	06	JUN	31					31	JUN	9
2	05	MAY	32					32	MAY	2
	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
9	06	JUN	43					43	JUN	9
1	05	MAY	44					44	MAY	1
	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
9	06	JUN	55					55	JUN	9
0	05	MAY	56					56	MAY	0
	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
9	05	MAY	68					68	MAY	9
	04	APR	69					69	APR	
	03	MAR	70					70	MAR	
	02	FEB	71					71	FEB	
	01	JAN	72					72	JAN	

* For fieldwork beginning in 1995, 1996, or 1997, the years should be adjusted.

APPENDIX B

Statistical Methods

This appendix describes in detail the procedures used in fitting the models presented in Chapter 4. It also outlines some of the problems encountered during the estimation of the models.

B.1 Piecewise-constant hazards model

The analyses presented in this report are based on event history models or hazards models. The continuous time hazard function is defined as:

$$h(t) = \lim_{\delta t \to 0^+} \frac{P(t \le T < t+\delta t)}{\delta t} = \frac{f(t)}{F(t)}$$

where T is a nonnegative random variable representing the time at which the event of interest (e.g. contraceptive discontinuation) occurs, f(t) is the probability density function of T, and F(t) is the cumulative density function of T. The hazard function represents the instantaneous rate of experiencing the event of interest (e.g. contraceptive discontinuation) at time t.

The single-level proportional hazards model is defined as:

$$\log(h(t;\mathbf{X})) = \log(h_0(t)) + \mathbf{X}'\beta$$

where:
$h(t;\mathbf{X})$ = the hazard rate at time t since the start of an episode of use with characteristics given by the vector of covariates **X**;
$h_0(t)$ = the hazard rate at time t in an episode of use with some baseline set of characteristics given by **X** = zero (the baseline hazard rate);
β = a vector of estimated regression parameters associated with the covariates **X**.

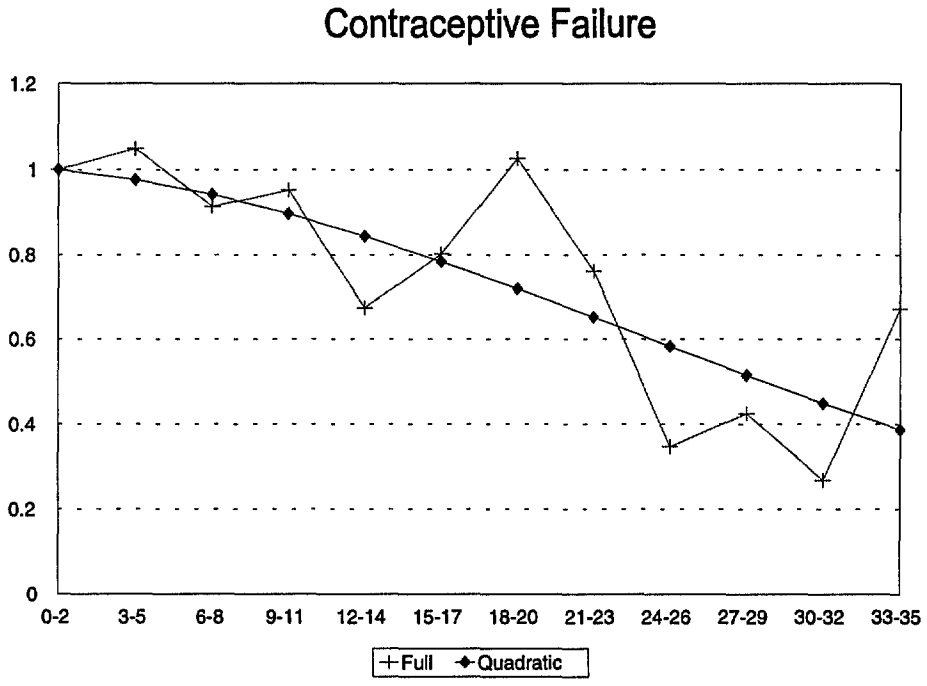
In the single-level piecewise-constant proportional hazards model the baseline hazard is assumed to take the form of a step function with a constant hazard within each specified time interval. In the analyses in this report, the time axis is divided into three-month intervals and a constant hazard is assumed within each three-month interval. In its most general form, a separate parameter can be estimated for each three-month interval which allows the "steps" in the baseline hazard function to vary freely. In this analysis, this would involve fitting 11 separate parameters (i.e., dummy variables corresponding to monthly intervals 3-5 through 34-36) to model the shape of the baseline hazard function. An alternative approach is to constrain the baseline hazard step function so that the steps vary according to a functional form. The hazard function is still a step function with a constant hazard within each three-month interval but the steps are constrained to vary according to, for instance, a log-linear or log-quadratic relationship with time. This approach reduces the number of parameters to be estimated (e.g. to two for the log-quadratic formulation, for time and time squared) and smooths the baseline hazard step function.

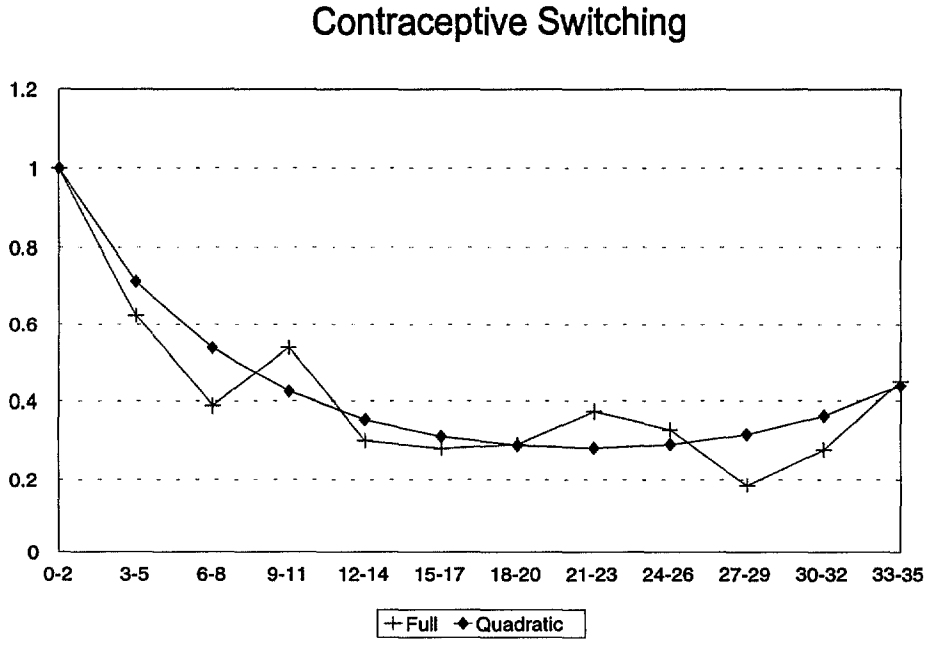
In the exploratory stage of this analysis, we began by fitting a single-level proportional hazards model containing all of the initial covariates using STATA. We first modeled the baseline hazard step function for each country and for each of the four types of events in its most general form by fitting 11 separate time parameters. Next, we repeated the fitting procedure modeling the log of the baseline hazard step function as a quadratic function of time. The two models were then compared graphically and using the Akaike Information Criterion (AIC).[1]

Although the AIC often tended to be slightly lower for the general specification of the baseline hazard function than for the quadratic specification, the graphical comparisons suggested that in most cases, the quadratic specification gave a reasonably good approximation of the general specification. The difference in the AIC for the two models was typically small and the loss of fit in the quadratic specification tended to reflect irregularities and heaping in the data. For example, Figure B.1 illustrates the graphical comparison for the models of contraceptive failure and switching for Bangladesh. The quadratic and general specifications of the baseline hazard are very similar for the model of switching but

[1] The AIC is appropriate for comparing nonnested models such as these. It looks for the model which best balances a low log-likelihood with parsimony. The AIC is calculated as -2(log-likelihood of fitted model) +2p, where p = number of parameters in the model. The AIC values for each model are compared and the model with the lowest value is considered the better one (Maddala, 1988).

Figure B.1 Full and quadratic specifications of the baseline hazard function for contraceptive failure and switching, Bangladesh





there are larger differences between the two specifications for the model of failure. In particular, the general specification produces a much higher hazard rate for the 18 to 20-month interval than the quadratic specification. However, the high hazard rate for the 18 to 20-month interval probably reflects heaping on 18 months and other irregularities in the data rather than a sudden, temporary increase in the risk of failure at that duration of use. Therefore, we decided to use the quadratic specification of the baseline hazard function. The model then becomes:

$$\log(h(t;\mathbf{X})) = \alpha_0 + \alpha_1 t + \alpha_2 t^2 + \mathbf{X}'\beta$$

where t = three-month time interval, t = 0, 1,..., 11,

α_i = estimated parameters associated with the time intervals t, I = 1, 2,

α_0 = intercept (i.e. baseline hazard rate at 0-2 months duration (t = 0)).

When all the covariates are categorical, the data can be arranged in the form of a contingency table and the piecewise constant model can be fitted as a log-linear model via Poisson regression (Holford, 1980; Trussell and Hammerslough, 1983). The outcome is the number of events in the cell of the contingency table defined by the covariates while the log of the exposure in each cell is fitted as an offset term. For example:

$$\log(\text{events}) = \log(\text{exposure}) + \alpha_0 + \alpha_1 t + \alpha_2 t^2 + \mathbf{X}'\beta$$

where: events = number events (e.g., discontinuations) in the cell of the contingency defined by the covariates, **X**, and time interval t.

Exposure = exposure in the corresponding cell of the contingency table.

The essence of this approach is that the likelihood function for the piecewise-constant hazards model happens to be the same as the likelihood function for the Poisson model.

For this analysis we adopted the same approach but expanded the data so that each record of the data file represents a three-month interval rather than an episode of use. The outcome for each three-month interval is either 0 (no discontinuation) or 1 (discontinuation) and the amount of exposure in each three-month interval may vary from one to three months. For example, if an episode of use lasts for seven months and ends in a contraceptive failure, the episode is expanded into 3 records in the data files. Record 1 represents the interval 0 to 2 months and has outcome=0 and exposure=3 months. Record 2 represents the interval 3 to 5 months and also has outcome=0 and exposure=3 months. Record 3 represents the interval 6 to 8 months and has outcome=1 (for the model of failure) and exposure=1 month. For the models for events other than contraceptive failure, the episode is treated as censored so the outcome for the final record is zero. Once the data were set up in this format, the piecewise-constant hazards model was fitted using log-linear (or Poisson) regression with the log of the exposure in each three-month interval included as an offset term.

The model as described above assumes that the effects of the covariates on the baseline hazard are proportional, i.e. they are constant over time. This assumption may or may not be true and should be tested. However, given the comparative nature of this study, a balance had to be sought between fully specifying each individual model for each country and maintaining comparability and interpretability across the six countries. We tested the proportionality assumption for each model by adding the interactions between each explanatory variable and time and time squared to the single-level model and testing their statistical significance. Each interaction was added individually to the model (i.e., the previous interaction was removed before the next one was added and tested etc.). This approach will miss any interactions that become significant only when another interaction is included in the model but is the most feasible to implement across six countries and four models. Likelihood ratio tests[2] were used to test the significance of each interaction and a 1 percent level of significance was used in all the tests to reduce the chance of obtaining a lot of spuriously significant interactions due to the large number of tests to be performed. Non-proportional effects were included in the final models only if they were significant in at least four of the six countries.

The models for switching and abandoning use due to reduced need for contraception each include two nonproportional effects. The switching model includes interactions between method and time and previous use and time. The model of abandoning due to reduced need

[2] The likelihood ratio test statistic is defined as -2(LL full model) - LL(reduced model) where LL = log-likelihood. The full model here is the model with the interaction added and the reduced model is the model without any interactions. The likelihood ratio test statistic is compared against a chi-squared distribution with degrees of freedom equal to the difference in the degrees of freedom between the two models (in this case the number of parameters required for the interaction).

includes interactions between method and time and contraceptive intentions and time. In this model, the interaction between the number of living children and time was also significant in four of the six countries even after including the other two interactions. However, the effects were not consistent across the six countries and the interaction did not add anything to the substantive conclusions. Therefore, in the interests of interpretability, it was not included in the final model.

B.2 Multilevel piecewise-constant hazards model

The multilevel form of the piecewise-constant hazards model is a generalization of the single-level form described above. The two-level model used in this report can be written as:

$$\log(h_{ij}(t;\mathbf{X}_{ij})) = \alpha_0 + \alpha_1 t + \alpha_2 t^2 + \mathbf{X}_{ij}'\beta + u_i$$

where

$h_{ij}(t;\mathbf{X}_{ij})$ = the hazard rate at time t for episode j in cluster I with characteristics given by the vector of covariates $\mathbf{X}_{ij}$, where $\mathbf{X}_{ij}$ includes both episode-level and cluster-level characteristics,

u_i = random effect associated with the i^{th} cluster where u_i is distributed normally with mean 0 and variance σ^2.

Standardizing u_i produces the following form of the model:

$$\log(h_{ij}(t;\mathbf{X}_{ij})) = \alpha_0 + \alpha_1 t + \alpha_2 t^2 + \mathbf{X}_{ij}'\beta + \sigma v_i$$

where v_i is distributed normally with mean 0 and variance 1.

Essentially, this model allows the intercept of the model to vary across clusters according to a normal distribution and is sometimes know as a random-intercepts or a variance-components model. In this form of the multilevel model, the effects of the covariates are constant across the clusters. The parameter σ is often called the level two variance component and the α and β parameters are known as the fixed effects. More general forms of the multilevel model are available in which the effects of covariates are also allowed to vary across clusters. These are sometimes known as random-slopes models. To maintain comparability and interpretability across the six countries in each of the four models, we did not attempt to fit any random-slopes models in this analysis.

The multilevel piecewise-constant hazards model was fitted via multilevel log-linear (Poisson) regression, as described above, using the MLn software (Rasbash and Woodhouse, 1995).[3] In MLn, the estimation of nonlinear multilevel models is done using approximate estimation techniques because the likelihood function for nonlinear multilevel models quickly becomes intractable for all but the most simple models. Two different estimation procedures are available in MLn; the Marginal Quasi-Likelihood (MQL) procedure and the Penalized Quasi-Likelihood (PQL) procedure. Both methods use a linear approximation of the inverse of the nonlinear link function based on a Taylor Series expansion (for details see Rodríguez and Goldman, 1995 and Goldstein and Rasbash, 1996). Either a first-order or a second-order approximation may be used in MLn producing four possible estimation procedures: first order MQL, second order MQL, first order PQL, and second order PQL.

Rodríguez and Goldman (1995) demonstrate that first order MQL estimates of both fixed and random parameters in non-linear models (specifically logistic models in their study) can be seriously biased downwards when the random effects are large, particularly if the number of lower level units per higher level unit is small (e.g. the number of episodes of use per woman). In response to this study, Goldstein and Rasbash (1996) developed the second order PQL procedure and demonstrated that the estimates produced are a considerable improvement over the first order MQL estimates: use of the second-order PQL procedure virtually eliminated the biases in the data sets used by Rodríguez and Goldman (1995). Rodríguez and Goldman (1997) confirm that second order PQL estimates are a considerable improvement over first order MQL estimates but show that they can still result in considerable under-estimation of both fixed and random effects when the random effects are large.

The second order PQL estimation procedure is more prone to convergence problems than the first order MQL procedure. In this analysis, we began by fitting first order MQL estimates and then used these as starting values to obtain second order PQL estimates. In four models the second order PQL procedure failed to

[3] Conceptually, episodes of use form level one of the model and clusters form level two. However, because of the way the data are expanded to fit the model, in MLn level one units are the three-month intervals and level two units are the clusters.

converge so we present first order MQL estimates.[4] These models are: abandoning while in need of contraception in Colombia, abandoning due to reduced need in Egypt, abandoning while in need of contraception in Indonesia, and contraceptive failure in Indonesia. For the remaining 20 models second order PQL estimates are presented. In general, when both first order MQL and second order PQL estimates are available for the same model the estimates are similar, particularly for the fixed effects. Therefore, we are confident that the estimates presented are valid and that our substantive conclusions are robust to the estimation problems that exist for nonlinear multilevel models.[5] However, given the findings of Rodríguez and Goldman (1997), some caution should be exercised in interpreting the random parameter, particularly in the four models in which only first order MQL estimates are presented.

B.3 Estimation problems in the three-level models

Our original intention was to fit a three-level model with episodes of use (level one) nested within women (level 2) nested within clusters (level 3). However, in the initial models of contraceptive failure and switching that we fitted for three of the countries the second order PQL estimates frequently failed to converge, and the first order MQL estimate of either the woman-level or the cluster-level variance, or both was often exactly zero. Rodríguez and Goldman (1995) also encountered the same problem of zero estimates of the variance components in their data sets which alerted them to the estimation problems with the first order MQL procedure.

It is possible that the zero estimates obtained in our analysis genuinely reflect low woman-level and/or cluster-level variation in the outcome of interest. However, it is impossible to know whether this is the case or whether we actually have large random effects and the first order MQL estimates are incorrect. In most cases we were unable to compare the first order MQL estimates against the second order PQL estimates because the second order PQL estimates failed to converge. In the absence of an external check of the validity of the first order MQL estimates, we did not feel confident presenting them and decided to drop the woman-level from the analysis. If the woman-level random effects are large, this omission from the model will result in some underestimation of the standard errors of the parameters in the models and possibly some underestimation of the fixed effects. In addition, it is possible that the cluster-level variation will be overestimated because the estimates of the cluster-level variance from the two-level models may pick up some unobserved woman-level variation. It would be useful to investigate the estimation problems in the three-level model further but such an investigation is beyond the scope of this report.

[4]We could have tried to obtain second-order MQL or first-order PQL estimates instead of second order PQL estimates for these four models. Rodríguez and Goldman (1997) demonstrate that these two estimation procedures tend to produce similar results and represent a modest improvement over first-order MQL estimates. However, the substantial improvement is obtained when using the second-order PQL estimation procedure. Given that the second-order MQL and first-order PQL estimates are subject to many of the same problems as first-order MQL estimates we decided to present the first-order MQL estimates.

[5]If substantial biases are a problem in these models we would expect the second order PQL estimates to differ from the first order MQL estimates. Even if biases remain, the estimates are no worse than those obtained using a single-level model (Rodríguez and Goldman, 1995).

Appendix C

Summary of DHS-I, DHS-II, and DHS-III Surveys, 1985-1996

Region and Country	Date of Fieldwork	Implementing Organization	Respondents	Sample Size	Male/Husband Survey	Supplemental Studies, Modules, and Additional Questions
SUB-SAHARAN AFRICA						
DHS-I						
Botswana	Aug-Dec 1988	Central Statistics Office	AW 15-49	4,368		AIDS, PC, adolescent fertility
Burundi	Apr-Jul 1987	Département de la Population, Ministère de l'Intérieur	AW 15-49	3,970	542 Husbands	CA, SAI, adult mortality
Ghana	Feb-May 1988	Ghana Statistical Service	AW 15-49	4,488	943 Husbands	CA, SM, WE
Kenya	Dec-May 1988/89	National Council for Population and Development	AW 15-49	7,150	1,133 Husbands	
Liberia	Feb-Jul 1986	Bureau of Statistics, Ministry of Planning and Economic Affairs	AW 15-49	5,239		TBH, employment status
Mali	Mar-Aug 1987	Institut du Sahel, USED/CERPOD	AW 15-49	3,200	970 Men 20-55	CA, VC, childhood physical handicaps
Ondo State, Nigeria	Sep-Jan 1986/87	Ministry of Health, Ondo State	AW 15-49	4,213		CA, TBH
Senegal	Apr-Jul 1986	Direction de la Statistique, Ministère de l'Economie et des Finances	AW 15-49	4,415		CA, CD
Sudan	Nov-May 1989/90	Department of Statistics, Ministry of Economic and National Planning	EMW 15-49	5,860		FC, M, MM
Togo	Jun-Nov 1988	Unité de Recherche Démographique, Université du Benin	AW 15-49	3,360		CA, SAI, marriage history
Uganda	Sep-Feb 1988/89	Ministry of Health	AW 15-49	4,730		CA, SAI
Zimbabwe	Sep-Jan 1988/89	Central Statistical Office	AW 15-49	4,201		AIDS, CA, PC, SAI, WE
DHS-II						
Burkina Faso	Dec-Mar 1992/93	Institut National de la Statistique et de la Démographie	AW 15-49	6,354	1,845 Men 18+	AIDS, CA, MA, SAI
Cameroon	Apr-Sep 1991	Direction Nationale du Deuxième Recensement Général de la Population et de l'Habitat	AW 15-49	3,871	814 Husbands	CA, CD, SAI
Madagascar	May-Nov 1992	Centre National de Recherches sur l'Environement	AW 15-49	6,260		CA, MM, SAI
Malawi	Sep-Nov 1992	National Statistical Office	AW 15-49	4,850	1,151 Men 20-54	AIDS, CA, MA, MM, SAI
Namibia	Jul-Nov 1992	Ministry of Health and Social Services, Central Statistical Office	AW 15-49	5,421		CA, CD, MA, MM
Niger	Mar-Jun 1992	Direction de la Statistique et des Comtes Nationaux	AW 15-49	6,503	1,570 Husbands	CA, MA, MM, SAI
Nigeria	Apr-Oct 1990	Federal Office of Statistics	AW 15-49	8,781		CA, SAI
Rwanda	Jun-Oct 1992	Office National de la Population	AW 15-49	6,551	598 Husbands	CA
Senegal	Nov-Aug 1992/93	Direction de la Prévision et de la Statistique	AW 15-49	6,310	1,436 Men 20+	AIDS, CA, MA, MM, SAI
Tanzania	Oct-Mar 1991/92	Bureau of Statistics, Planning Commission	AW 15-49	9,238	2,114 Men 15-60	AIDS, CA, MA, SAI
Zambia	Jan-May 1992	University of Zambia	AW 15-49	7,060		AIDS, CA, MA

DHS-III						
Benin	Jun-Aug 1996	Institut National de la Statistique	AW 15-49	5,491	1,535 Men 20-64	AIDS, CA, MA, MM, SAI
Central African Republic	Sep-Mar 1994/95	Direction des Statistiques Démographiques et Sociales	AW 15-49	5,884	1,729 Men 15-59	AIDS, CA, CD, MA, MM, SAI
Comoros	Mar-May 1996	Centre National de Documentation et de la Recherche Scientifique	AW 15-49	3,050	795 Men 15-64	CA, MA
Côte d'Ivoire	Jun-Nov 1994	Institut National de la Statistique	AW 15-49	8,099	2,552 Men 12-49	CA, MA, SAI
Eritrea	Sep-Jan 1995/96	National Statistics Office	AW 15-49	5,054	1,114 Men 15-59	AIDS, CA, MA, MM, SAI
Ghana	Sep-Dec 1993	Ghana Statistical Service	AW 15-49	4,562	1,302 Men 15-59	CA, MA
Kenya	Feb-Aug 1993	National Council for Population and Development	AW 15-49	7,540	2,336 Men 15-54	AIDS, CA, MA, SAI
Malawi (KAP)[a]	Jun-Oct 1996	National Statistical Office	AW 15-49	2,683	2,658 Men 15-54	AIDS
Mali	Nov-Apr 1995/96	CPS/MSSPA et DNSI	AW 15-49	9,704	2,474 Men 15-59	AIDS, CA, MA, MM, SAI
Tanzania (KAP)[a]	Jul-Sep 1994	Bureau of Statistics, Planning Commission	AW 15-49	4,225	2,097 Men 15-59	AIDS, PC
Tanzania (In-depth)	Jun-Oct 1995	Bureau of Statistics, Planning Commission	AW 15-49	2,130		Adult and childhood mortality estimation
Tanzania	Jul-Nov 1996	Bureau of Statistics, Planning Commission	AW 15-49	8,120	2,256 Men 15-59	AIDS, CA, MA, MM
Uganda	Mar-Aug 1995	Statistics Department, Ministry of Finance and Economic Planning	AW 15-49	7,070	1,996 Men 15-59	AIDS, CA, MA, MM, SAI
Uganda (In-depth)	Oct-Jan 1995/96	Institute of Statistics and Applied Economics, Makerere University	AW 20-44	1,750	1,356 Partners	Negotiating reproductive outcomes
Zambia	Jul-Jan 1996/97	Central Statistics Office	AW 15-49	8,021	1,849 Men 15-59	AIDS, CA, MA, MM
Zimbabwe	Jul-Nov 1994	Central Statistical Office	AW 15-49	6,128	2,141 Men 15-54	AIDS, CA, MA, MM, PC, SAI
NEAR EAST/NORTH AFRICA						
DHS-I						
Egypt	Oct-Jan 1988/89	National Population Council	EMW 15-49	8,911		CA, CD, MM, PC, SAI, WE, WS
Morocco	May-Jul 1987	Ministère de la Santé Publique	EMW 15-49	5,982		CA, CD, S
Tunisia	Jun-Oct 1988	Office National de la Famille et de la Population	EMW 15-49	4,184		CA, S, SAI
DHS-II						
Egypt	Nov-Dec 1992	National Population Council	EMW 15-49	9,864	2,466 Husbands	CA, MA, PC, SM
Jordan	Oct-Dec 1990	Department of Statistics, Ministry of Health	EMW 15-49	6,461		CA, SAI
Morocco	Jan-Apr 1992	Ministère de la Santé Publique	AW 15-49	9,256	1,336 Men 20-70	CA, MA, MM, SAI
Yemen	Nov-Jan 1991/92	Central Statistical Organization	EMW 15-49	5,687		CA, CD, SAI
DHS-III						
Egypt	Nov-Jan 1995/96	National Population Council	EMW 15-49	14,779		CA, FC, MA, WS
Morocco (Panel)	Apr-May 1995	Ministère de la Santé Publique	AW 15-49	4,753		

ASIA						
DHS-I						
Indonesia	Sep-Dec 1987	Central Bureau of Statistics, National Family Planning Coordinating Board	EMW 15-49	11,884		PC, SM
Nepal (In-depth)	Feb-Apr 1987	New Era	CMW 15-49	1,623		KAP-gap survey
Sri Lanka	Jan-Mar 1987	Department of Census and Statistics, Ministry of Plan Implementation	EMW 15-49	5,865		CA, NFP
Thailand	Mar-Jun 1987	Institute of Population Studies Chulalongkorn University	EMW 15-49	6,775		CA, S, SAI
DHS-II						
Indonesia	May-Jul 1991	Central Bureau of Statistics, NFPCB/MOH	EMW 15-49	22,909		PC, SM
Pakistan	Dec-May 1990/91	National Institute of Population Studies	EMW 15-49	6,611	1,354 Husbands	CA
DHS-III						
Bangladesh	Nov-Mar 1993/94	Mitra & Associates/NIPORT	EMW 10-49	9,640	3,284 Husbands	PC, SAI, SM
Bangladesh	Nov-Mar 1996/97	Mitra & Associates/NIPORT	EMW 10-49	9,127	3,346 EMM	CA, MA, SM
Indonesia	Jul-Nov 1994	Central Bureau of Statistics/ NFPCB/MOH	EMW 15-49	28,168		MM, PC, SAI, SM
Kazakstan	May-Aug 1995	Institute of Nutrition, National Academy of Sciences	AW 15-49	3,771		CA, MA
Nepal	Jan-Jun 1996	Ministry of Health/New ERA	EMW 15-49	8,429		CA, MA, MM
Philippines	Apr-Jun 1993	National Statistics Office	AW 15-49	15,029		MM, SAI
Turkey	Aug-Oct 1993	General Directorate of MCH/FP Ministry of Health	EMW <50	6,519		CA, MA
Uzbekistan	Jun-Oct 1996	Research Institute of Obstetrics and Gynecology	AW 15-49	4,415		CA, MA
LATIN AMERICA/CARIBBEAN						
DHS-I						
Bolivia	Feb-Jul 1989	Instituto Nacional de Estadística	AW 15-49	7,923		CA, CD, MM, PC, S, WE
Bolivia (In-depth)	Feb-Jul 1989	Instituto Nacional de Estadística	AW 15-49	7,923		Health
Brazil	May-Aug 1986	Sociedade Civil Bem-Estar Familiar no Brasil	AW 15-44	5,892		CA, S, SM, abortion, young adult use of contraception
Colombia	Oct-Dec 1986	Corporación Centro Regional de Población, Ministerio de Salud	AW 15-49	5,329		CA, PC, S, SAI, SM
Dominican Republic	Sep-Dec 1986	Consejo Nacional de Población y Familia	AW 15-49	7,649		CA, NFP, S, SAI, family planning communication
Dominican Republic (Experimental)	Sep-Dec 1986	Consejo Nacional de Población y Familia	AW 15-49	3,885		S, SAI
Ecuador	Jan-Mar 1987	Centro de Estudios de Población y Paternidad Responsable	AW 15-49	4,713		CD, SAI, employment
El Salvador	May-Jun 1985	Asociación Demográfica Salvadoreña	AW 15-49	5,207		CA, S, TBH
Guatemala	Oct-Dec 1987	Instituto de Nutrición de Centro América y Panamá	AW 15-44	5,160		CA, S, SAI

Mexico	Feb-May 1987	Dirección General de Planificación Familiar, Secretaría de Salud	AW 15-49	9,310		NFP, S, employment
Peru	Sep-Dec 1986	Instituto Nacional de Estadística	AW 15-49	4,999		NFP, employment,
Peru (Experimental)	Sep-Dec 1986	Instituto Nacional de Estadística	AW 15-49	2,534		
Trinidad and Tobago	May-Aug 1987	Family Planning Association of Trinidad and Tobago	AW 15-49	3,806		CA, NFP, breastfeeding
DHS-II						
Brazil (NE)	Sep-Dec 1991	Sociedade Civil Bem-Estar Familiar no Brasil	AW 15-49	6,222	1,266 Husbands	AIDS, PC
Colombia	May-Aug 1990	PROFAMILIA	AW 15-49	8,644		AIDS
Dominican Republic	Jul-Nov 1991	Instituto de Estudios de Población y Desarrollo (PROFAMILIA), Oficina Nacional de Planificación	AW 15-49	7,320		CA, MA, S, SAI
Paraguay	May-Aug 1990	Centro Paraguayo de Estudios de Población	AW 15-49	5,827		CA, SAI
Peru	Oct-Mar 1991/92	Instituto Nacional de Estadística e Informática	AW 15-49	15,882		CA, MA, MM, SAI
DHS-III						
Bolivia	Nov-May 1993/94	Instituto Nacional de Estadística	AW 15-49	8,603[b]		AIDS, CA, CD, MA, MM, S, SAI
Brazil	Mar-Jun 1996	Sociedade Civil Bem-Estar Familiar no Brasil	AW 15-49	12,612	2,949 Men 15-59	AIDS, CA, MA, MM, PC, S
Colombia	Mar-Jun 1995	PROFAMILIA	AW 15-49	11,140		AIDS, CA, MA, PC
Dominican Republic	Aug-Dec 1996	CESDEM/PROFAMILIA	AW 15-49	8,422	2,279 Men 15-64	CA, MA
Guatemala	Jun-Dec 1995	Instituto Nacional de Estadística	AW 15-49	12,403		AIDS, CA, MA, MM, S
Haiti	Jul-Jan 1994/95	Institut Haitien de l'Enfance	AW 15-49	5,356	1,610 Men 15-59	AIDS, CA, CD, MA, SAI
Peru	Aug-Nov 1996	Instituto Nacional de Estadística e Informática	AW 15-49	28,951	2,487 Men 15-59	CA, MA, MM

[a] No health or birth history section in questionnaire.
[b] Household questionnaire was administered in 26,144 households.

AIDS acquired immune deficiency syndrome
AW all women
CA child anthropometry
CD causes of death (verbal reports of symptoms)
CMW currently married women
EMW ever-married women
FC female circumcision
M migration
MA maternal anthropometry
MM maternal mortality
NFP natural family planning
PC pill compliance
S sterilization
SAI service availability information
SM social marketing
TBH truncated birth history
VC value of children
WE women's employment
WS women's status

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