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CONTRACEPTIVE FAILURE: LEVELS, TRENDS AND DETERMINANTS IN MATLAB, BANGLADESH

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Summary. This study investigated the levels, trends and determinants of contraceptive use-failure in Matlab, Bangladesh, using a set of prospective data on 25,960 women of reproductive age. The data were extracted from the Record Keeping System (RKS) of Matlab for the period 1978–94. If there was any live birth during the use or within 7 months after the discontinuation of use, it was considered as a failure. The life table technique and hazard model were used as analytical tools. The results suggest that use-failure for pills, IUDs (TCu 200) and injectables and other temporary methods increased from 1978 to 1988, but began to decline after 1988. The cumulative probability of first-method failure within 1 year of method acceptance of the cohort of 1990–94 acceptors was 12·9% for pills, 2·0% for IUDs, 0·5% for injectables, 22·0% for condoms and 13·4% for 'other' methods (sampoon, foam, jelly and traditional methods). For pills, condoms and 'other' methods, the likelihood of failure declined with the duration of use; by contrast, the probability of an IUD failure increased over time, peaking at 3 years of use. The injectables maintained a low likelihood of failure regardless of the duration of use. The quality of Community Health Workers' (CHWs) performance was associated with the risk of failure of all temporary methods except condoms; women's background characteristics associated with failure varied by method. The effect of the quality of the CHWs' performance and the background variables on failure did not change much over time. It is felt that contraceptive failure deserves the serious attention of programme managers and policy makers to make the Bangladesh national family planning programme more successful.

Introduction

Contraceptive failure, defined as unintended pregnancy occurring while contraception is practised, becomes a progressively more important determinant of fertility in the face of declining trends in the fertility target of couples and of increasing trends in the use of contraception. Family planning programmes can have only a limited impact on

fertility reduction if contraceptive failure rates are high, regardless of contraceptive prevalence rate (Laing, 1985). In developed societies where abortion is widely available, unwanted pregnancies resulting from contraceptive failure can be aborted, leaving fertility levels relatively unaffected by variations in contraceptive failure rates (Westoff, Hammerlough & Paul, 1987). However, in societies (such as in Bangladesh) where abortion is not freely available or is restricted, fertility rates are quite sensitive to the level of contraceptive failure. The proportion of unwanted births due to contraceptive failure is thus likely to rise as fertility targets decline, to a degree that depends upon the aggregate contraceptive efficacy of the mix of methods used in the population.

In the recent past, while evaluating the demographic impact of family planning programmes, the importance of contraceptive prevalence has typically been stressed. Level of prevalence, however, is not a sufficient measure of programme success. The impact of contraceptive use on fertility depends not only upon prevalence but also upon both use-effectiveness and continuity of use. Some cross-country evidence suggests that a consistent relationship between the level of contraceptive use and fertility does not always exist (Jejeebhoy, 1991). Part of the reason for this apparent discrepancy is that increases in contraceptive use in some countries may be merely compensating for other fertility enhancing trends, such as declining levels of lactation and post-partum abstinence (Bongaarts, 1987). A second, but little explored explanation is that in some countries high prevalence is offset by high rates of discontinuation and use-failure among acceptors.

Although family planning programme managers in developing countries are increasingly able to assess the number of contraceptive users, serious questions remain concerning the length of contraceptive protection, use-failure and the impact of contraceptive use on fertility. Therefore, planners and programme managers should be provided with improved, timely and comprehensive information on the quality and duration of contraceptive protection. Such information has a number of policy implications: better monitoring and evalaution of programme activities; improved effectiveness in meeting the needs of users; and more generally, improved ability of governments to achieve goals set for fertility and for maternal and child health. It should be mentioned that the risk of failure may be related to characteristics of the method itself, but is more likely to depend on the characteristics of users (Barnes, 1976).

Since the 1960s, data from hundreds of large-scale surveys have documented a substantial increase in contraceptive practice in developing countries. But, until recently, there was little information available on the effectiveness of contraceptive practice in these countries. Undoubtedly, the paucity of estimates of contraceptive failure results in large from the limitations of the available data. The national fertility and family planning surveys that are most frequently used to track contraceptive behaviour, particularly the Contraceptive Prevalence Survey (CPS) and the World Fertility Survey (WFS), have mainly sought information on knowledge, availability and accessibility of contraceptive methods and on current use and ever use of a method. As a result, most current estimates of failure for developing countries were obtained either from clinical trials or from specialized studies, such as those using a calendar to collect information on contraceptive use (Laing, 1974, 1985; Narkavonnakit, Bennett & Blakrishnan, 1982; Chowdhury *et al*., 1986; Goldman,

Morens & Westoff, 1989; Lassner *et al*., 1987). Recently conducted Demographic and Health Surveys (DHSs) in a large number of developing countries in Latin America, Asia and Africa have also collected limited information on contraceptive history which facilitates calculation of failure rate of these countries. However, clinical studies and DHS data present serious problems with regard to either drawing a representative and comprehensive picture of contraceptive failure and continuation among typical users, such as selection of non-representative samples of the population or inconsistencies and restrictions in the way 'failure' is defined, as well as methodological problems with many individual studies (Jejeebhoy, 1991; Moreno & Goldman, 1991; Trussell & Kost, 1987).

Studies on contraceptive failure in Bangladesh, both at the national and sub-national level, are limited in size, scope and coverage, and these findings are not consistent. Chowdhury *et al*. (1986) made a limited attempt, based on field survey data, to study the use-effectiveness of oral pills and condoms. Akbar, Philips & Koenig (1991) used the Matlab data for the period 1978–87 to estimate the first-method and all-method continuation and failure rates. Recently, Bairagi & Rahaman (1996) used the Matlab data to study the levels and differentials of failures of different methods from a small sample of 2865 women for the period 1984–89. This study, however, lacks estimates of trends, and the standard errors of estimates were expected to be large due to the small sample size (only about 1000 users were studied). Nevertheless, the results of all these studies differ very widely, which is most likely due to problems in data and variations in definition and perception of failure between the studies. In this regard, a unique dataset which is prospective in nature and is thought to be very high in quality and free from memory lapse or recollection of past contraceptive behaviour as is present in the retrospective datasets is being collected by the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B).

The objectives of this study are: to examine the levels and trends and differentials of failure of different contraceptive methods, and to investigate socioeconomic, demographic and programmatic determinants of failure of different contraceptive methods and any change in the effect of these determinants over time (interaction) using a set of prospective data from the Record Keeping System (RKS) of Matlab for the period 1978–94.

Methods

There are various conventional concepts of contraceptive failure and effectiveness used in the literature. Since unintended pregnancies may occur as a result of either method failure or failure to use the method consistently and correctly, three types of measures of contraceptive failure are in use in the literature, depending on the definition of 'unintended' pregnancy. The narrowest definition of contraceptive failure is the *method or theoretical* failure (Tietze, 1971), which attempts to measure failure under ideal conditions and perfect use. A second, more feasible and more appropriate measure from the point of view of programme evaluation is *use-failure*: unintentional pregnancies occurring under average use conditions of the method, i.e. the method is either used imperfectly or is not used during every act of intercourse or the method fails to prevent the conception. This definition includes both method failure and failures attributed to inconsistent or incorrect use of the method. The third and

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broadest definition of contraceptive failure is *extended use-failure*. Extended use-failure includes all accidental pregnancies following acceptance of a particular method, even if the method in use has been switched or its use is interrupted or discontinued at the time of conception (Ryder, 1973).

Life table methodology was used to estimate failure rates. This methodology provides a framework that facilitates the analysis of discontinuation for reasons other than failure, through the construction of both multiple and associated single-decrement life tables. Termination rates for multiple-decrement life tables are called net rates, which retain the confounding effects of termination for reasons other than pregnancy. Net termination rates for various causes add up to the total discontinuation rate. The net pregnancy rate, however, cannot be considered a pure measure of failure; its value tends to decline with increases in termination from other causes, because other causes eliminate the possibility of observing a subsequent accidental pregnancy (Trussell & Menken, 1982). For this reason, the gross failure rate may be a more useful measure: it assumes independence of competing risks by other causes of termination. Women who discontinue for any reason other than failure are treated as censored at the time of exit, and the gross rate is calculated from the associated single-decrement life table. Gross use-failure rate is used in this study.

Depending upon the nature of the continuation of contraceptive methods, failure rates may be divided into two categories: the first-method failure rate and the all-method failure rate. The first-method failure rate of a particular method refers to failure occurring while using that method continuously during the period from acceptance to the specified ordinal month. It ignores pregnancies that occur during the period following switching to another method. The all-method failure rate allows for switching to any other methods including sterilization and includes the period covered by the first method as well as subsequent methods used during the interval.

The study is based on the data from the intervention area of Matlab where the ICDDR,B has been operating a comprehensive Maternal and Child Health and Family Planning (MCH-FP) programme for a population of about 100,000 people in 70 villages since 1977 (Koenig *et al*., 1992). In 1977, ICDDR,B launched the Matlab MCH-FP programme in order to test whether an intensive family planning programme can bring a demographic change in the absence of socioeconomic development. Matlab is a totally rural, riverain area largely inaccessible by modern transportation and communication, except river transport. The social setting has also been relatively insulated from extensive change, with little economic, social or political improvements over the years that could influence demographic trends (Phillips *et al*., 1988). Half of the villages in the study area were designated as the treatment area (MCH-FP area) and received intensive services, while the rest comprised the comparison area, receiving only government services (Koenig *et al*., 1987). The MCH-FP project in Matlab is characterized by an intensive service outreach programme by female community health workers (CHWs), a system of extensive back-up by female paramedical and medical staff, a well-defined system of management and supervision, and an emphasis upon the provision of a wide range of contraceptive methods for individual women in the most accessible and convenient manner possible (Bhatia *et al*., 1980).

The information on contraceptive use dynamics in Matlab is recorded by the CHWs

in field registers, known as the Record Keeping System (RKS), which are routinely compiled in the course of fortnightly household visits. As part of regular service delivery activities, workers maintain information on past and current contraceptive use status, reproductive status and lactational status, together with some health-related information and background data on a monthly basis, i.e. a prospective data collection system exists. The work of a CHW is supervised by a Senior Health Assistant (SHA) and a Family Welfare Visitor (FWV) who come to visit and check the progress of husband and wife separately once a month. There are also separate teams consisting of a male and a female supervisor for independent spot checking on a sample basis. A separate team collects the data from the record-keeping books of all CHWs and transfers the data into PCs. The PCs have several checks for identifying inconsistencies. Due to so many checks at different levels, a false recording at the final stage of the data is unlikely. Since the data collections are prospective in nature, they are largely free from the recall errors and biases that characterize most retrospectively collected data. Data from Matlab thus provide a unique opportunity to examine trends in contraceptive failure over a period of time in a rural Bangladesh population.

The study considers respondents' educational level and dwelling space as their socioeconomic indicators. These data were obtained from the 'socioeconomic survey' (SES) of 1982 in Matlab and then matched with the respondent's identity. The dwelling space was found to be a good indicator of wealth and economic status in the area (Islam & Becker, 1979). As the dwelling space of a few families might have changed slightly over the period, it has been updated continuously since 1989.

One interesting aspect of the study is to examine the effect of the quality of the field workers, known as Community Health Workers (CHWs), on contraceptive failure. There are 56 such CHWs who provide family planning services through door-to-door visits once every 2 weeks. The performance of each of the CHWs, who had been with the Matlab MCH-FP project since August 1980, was evaluated in 1987 jointly by their immediate supervisors and the project manager. The workers were scored on a scale of 1–3 on each of the eight components: (i) regularity at work, (ii) attitude/behaviour with clients, (iii) innovative technique in communication, (iv) technical competence; (v) enthusiasm for work, (vi) accuracy for record keeping, (vii) polite and outspoken and (viii) conformity to social norm. These components were totalled to create an index with scores as low as 8 and as high as 24 points. Total scores were then categorized into three groups, viz. 8–15, 16–20 and 21–24 to signify poor, moderate and high levels of performance, respectively. During the period of the study, there was no transfer of any worker from one area to another in the project.

The main aim of this study was to investigate the use-failure rate of different contraceptive methods, which include both user's failure and method error. The use-failure of a method was calculated on the basis of total months of use of that method either continuously or with a small break or switching to another method, followed by conception during use of contraceptive methods that subsequently led to a live birth. This study considers two types of failure rates: first-method (first-segment) failure rate, and all-method failure rate. These methods have been defined earlier. However, the estimate of failure largely depends on perception and recall memory of the respondent, whether or not particular births are reported as having resulted from contraceptive failure. To make data free from individual perception, bias and response

error, a specially designed data analysis methodology has been followed. Bairagi & Rahman (1996) also followed a similar analysis design in studying failure rates in Matlab. In calculating the probability of failure, it was assumed that a live birth requires a gestation period of at least 7 months (average gestation period is considered to be 9 months). Thus, if a live birth occurred within 7 months after discontinuation of the method, the pregnancy was considered to be the result of contraceptive failure. The gestation period preceding abortion (induced and spontaneous) or still-birth varies widely; therefore it could not be determined whether pregnancies with those outcomes resulted from contraceptive failure. As a result, the estimate of use-failure rate may be downward biased.

Since the aim of this study was to assess the gross use-failure rate of a contraceptive method that resulted in accidental pregnancy, single-decrement life tables were employed to obtain the duration-specific cumulative probability of failure. Life table methodology was employed to allow for the inclusion of censored and non-censored cases. Discontinuation of method for any reason other than accidental pregnancy, out-migration, death, loss of eligibility (not currently married, not in reproductive age, etc.) and end of the study (March, 1994) were treated as censored cases. To control the left censoring, all the users before the follow-up began were excluded. After excluding all the current users (as their first-method adoption date was unknown) at the beginning of the MCH-FP project and also excluding the women who were using permanent methods, the study population consisted of 25,960 women of whom 18,440 were ever users of different temporary methods during the period 1978–94. Five methods were considered in the study: pills, condoms, IUDs (every IUD user used TCu 200), injectables and 'other' methods. The 'other' methods included sampoon, foam or jelly and traditional methods such as periodic abstinence and withdrawal. These were combined together as they were less prevalent methods in Matlab. The permanent methods were excluded from the study because their failure rates were negligible in Matlab.

Data were analysed for the contraceptive users following the date of acceptance of a method. To examine the change in method-specific failure rates, a cohort trend analysis was done for four-yearly cohorts from 1978–81 through 1990–94, with each cohort consisting of approximately 5000 users. For the 1990–94 cohort, information was available up to March 1994. The results of the last cohort (1990–94) may be taken as the current level of failure. To identify the factors affecting the failure of contraceptive methods a multivariate analysis using a hazards regression model was done.

Results

The life table cumulative failure rate refers to the probability that a woman will become pregnant while using a method within a given time from the beginning of use of that method. Table 1 presents the levels and trends of first-method (first-segment) failure rates of different contraceptive methods during the first year of use. As is evident from Table 1, the condom shows the highest failure rate, followed by 'other' methods (sampoon, foam, jelly and traditional methods) and then pills. Injectables show the lowest failure rate among the methods used in Matlab. Among the users of the most recent cohort (1990–94), the results of which may be considered as recent levels of

Table 1. First-method failure rate during the first year of use of different contraceptive methods by adoption cohort and first method adopted, Matlab, 1978–94

Adoption cohort	First method adopted					Number of users
	Pill	IUD	Injectable	Condom	Other*	
1978–81	16·3	2·8	1·7	17·3	18·2	5377
1982–85	20·0	3·2	2·0	19·0	29·5	3568
1986–89	17·7	2·1	1·4	32·6	23·1	4463
1990–94	12·9	2·0	0·5	22·0	13·4	5032
All	4591	2078	10,111	790	890	18,440

*The 'other' methods refer to sampoon, foam, jelly and traditional methods.

Table 2. All-method failure rate during the first year of use of different contraceptive methods by adoption cohort and first method adopted, Matlab, 1990–94

Adoption cohort	First method adopted					Number of users
	Pill	IUD	Injectable	Condom	Other	
1978–81	14·7	3·7	2·3	15·8	17·1	5377
1982–85	19·8	3·6	3·0	16·8	26·1	3568
1986–89	15·8	3·3	2·6	28·9	22·6	4463
1990–94	11·6	3·7	0·6	19·2	13·5	5032
All	4591	2078	10,111	790	890	18,440

failure, the annual cumulative failure rate is 12·9% for pills, 2·0% for IUDs, 0·5% for injectables, 22·0% for condoms and 13·4% for 'other' methods.

Table 2 presents all-method cumulative failure rates at 12 months after acceptance of a method. The all-method failure rates follow a pattern similar to that of first-method failure rates. For the 1990–94 cohort the all-method failure rates are 11·6% for pills, 3·7% for IUDs, 0·6% for injectables, 19·2% for condoms and 13·5% for 'other' methods. Comparison of all-method and first-method failure rates shows that for pills and condoms, the all-method failure rate is lower than the first-method failure rate, while for IUDs and injectables the all-method failure rate is higher than the first-method failure rate. This finding reflects the tendency of acceptors of pills and condoms to shift to relatively more effective methods, and IUD and injectable acceptors may shift to relatively less effective methods. But for 'other' methods, the first-method and all-method failure rates are almost identical (reflecting the tendency to continue using the same methods or to shift to another method with the same use-effectiveness).

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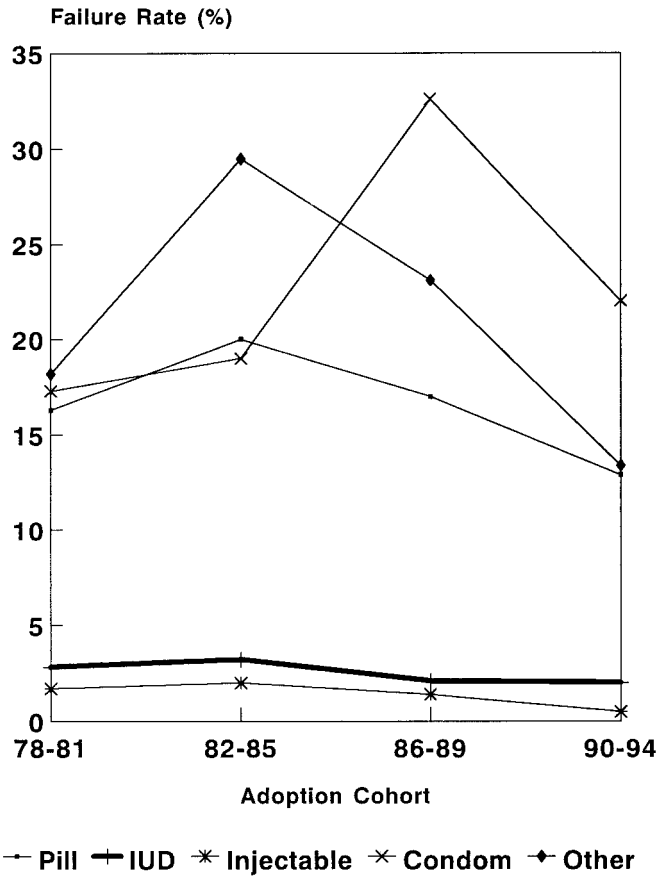

Fig. 1. Cohort trends in 12-month failure rate of different contraceptive methods, Matlab, 1978–94.

To examine the change in the failure rates of different contraceptive methods over the period 1978–94, a cohort trend analysis was done. Four cohorts of acceptors were considered, each of 4 years starting from 1978–81 through 1982–85, 1986–89 and 1990–94. Table 1 presents the 12-month failure rates of first-method acceptors for different cohorts. It can be seen that the failure rates of each method show a curvilinear relationship with successive cohorts of acceptors. The failure rates of pills, IUDs, injectables and 'other' methods initially started rising from the period 1978–81, reached a maximum during the period 1982–85 and then started declining. For condoms, the failure rates show an increasing trend up to the period 1986–89 and after that it decreased. Table 2 also shows similar patterns of the all-method failure rates for different contraceptive methods (except IUDs) that were first adopted. Figure 1 depicts more clearly the changing pattern of the first-method contraceptive failure rates for different methods. It is evident from Tables 1 and 2 and Fig. 1 that the failure rate for each of the methods has been declining in recent years.

The curvilinear relationship between cohort of acceptors and failure rates may be attributed to the characteristics of the users in Matlab. Studies of the characteristics of

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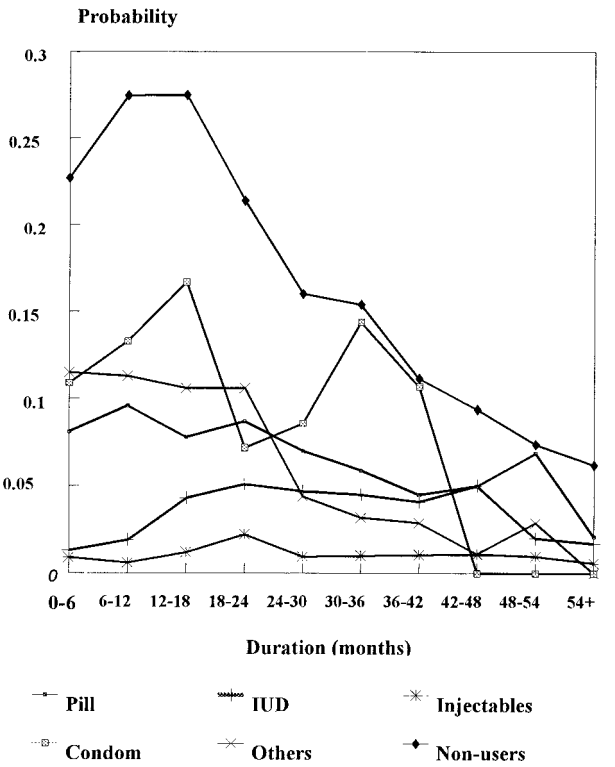

Fig. 2. Conditional probability of pregnancy in 6 months by contraceptive (first) method according to duration of use, 1978–94.

contraceptive adopters in Matlab have shown that women who adopted methods early in the project period were older and of higher parity (Bhatia, 1983; Koenig *et al.*, 1987; Akbar *et al.*, 1991). The early period of the project, by meeting the pre-existing demand for contraception, predominantly attracted women who sought to terminate childbearing but lacked the means to do so prior to the MCH-FP project. These women were highly motivated to practise contraception and thus more likely to experience a lower failure rate than subsequent adoption cohorts who were more typical of the married couples and thus more likely to be ambivalent about contraceptive practice, resulting in increased failure rates at that stage of the programme. But with the passage of time, as the programme attained maturity the users and workers gained experience in how to use the methods more effectively. As a result the risk of failure of contraceptive methods declined. That the risk of failure typically declined with the duration of use is also illustrated in Fig. 2, which shows the conditional probability of first-method contraceptive failure and of conception among the non-users at 6-month intervals. Except injectables and IUDs, the failure rates for all other methods declined with increase in duration of use. Failure rates for pills, condoms and 'other' methods (sampoon, foam, jelly and traditional) were very high at the beginning of use, but declined after 2 years of use. The more efficient use after 2 years of use of these methods may be responsible for this declining trend in failure with

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increased duration of use. Bairagi & Rahman (1996) obtained similar findings. The likelihood of failure of IUDs increased, even after 2 years of use. This suggests that IUDs may have lose their effectiveness substantially after 2 years of use. However, the failure rate for injectables did not change with duration of use, remaining low at all times.

As observed by Bairagi & Rahman (1996), the probability of conception among non-users has declined very rapidly with time. This suggests that fecundity among non-users may vary widely and high-fecund women conceive very quickly, leaving the less-fecund women in the cohort. Perhaps the fecundity of users also varies to some extent, and high-fecund women conceive earlier leaving the less-fecund women in the cohort.

Differentials of failure rate

To examine the effect of socioeconomic and demographic factors and workers' quality of services on contraceptive failure, a differential analysis has been done with some selected socioeconomic and demographic variables. To see whether the effect of any of these variables changes over time, the differential analysis has been accomplished for two distant cohorts of acceptors. Since the socioeconomic status information was available from 1982 onwards, the 1982–85 cohort was selected as the initial cohort and 1990–94 as the terminal cohort. The results for the two cohorts are presented in Table 3. It is seen that the effect of socioeconomic, demographic and workers' quality of services did not undergo much change over the period.

Among the demographic variables, age at the time of acceptance of the methods shows a negative effect on failure rates of pills, injectables and 'other' methods. However, for IUDs and condoms, no consistent relationship between age and failure rate was found. Muslim women show a higher risk of failure than their non-Muslim counterparts. This is true for almost all methods. Women's educational levels show an effect on failure rates of pills and condoms (educated women had a lower failure rate), but no consistent effect for injectables and 'other' methods. Number of living children shows an effect on failure rate of pills, injectables and 'other' methods with women of higher parity having a lower failure rate.

Household size does not show any consistent effect on failure rate. Fieldworkers' performance shows a substantial effect on the failure of different methods. Failure rate decreases with increase in quality of the fieldworkers for almost all methods.

Determinants of failure

To identify the factors affecting the failure rate, a proportional hazard model was fitted, considering failure as the dependent variable and some selected socioeconomic, demographic and workers' quality variables as the explanatory variables. The proportional hazard model was considered appropriate in this case because the dependent variable is time-dependent. A relative risk below 1·00 means that the independent variable has a negative effect while a value above 1·00 means that the independent variable has a positive effect. For continuous explanatory variables, relative risk measures the change in the risk of failure for a unit increase in the variable. To examine the linear and quadratic effect of a cohort on change in failure, cohort and cohort-square respectively were introduced in the model as explanatory variables. The results of this hazard analysis are presented in Table 4.

Table 3. First-method failure rate during the first year of use by socioeconomic and demographic characteristics of women and first method adopted, Matlab, 1982–85 and 1990–94

	Pill		IUD		Injectable		Condom		Other	
Characteristics	82–85	90–94	82–85	90–94	82–85	90–94	82–85	90–94	82–85	90–94
Age										
<20	28·0	15·9	5·3	—	4·4	0·6	14·5	17·5	52·3	—
20–29	19·7	12·1	3·0	3·3	1·7	0·4	18·4	33·8	35·4	23·4
30+	18·2	8·3	0·8	—	0·6	0·4	28·0	5·6	24·0	10·6
Religion										
Muslim	24·6	13·6	3·4	2·2	2·0	0·5	21·0	27·2	34·5	13·6
Hindu	10·6	8·8	2·7	—	2·1	0·2	—	—	10·6	13·0
Education (years)										
No schooling	24·8	13·6	3·3	1·6	2·2	0·3	26·3	27·6	27·4	9·2
Primary (1–5)	23·2	11·9	3·2	1·7	1·2	0·7	13·9	29·2	32·3	26·0
Higher (6+)	14·1	10·9	0·4	—	2·0	0·9	7·4	19·4	31·4	10·9
No. living children										
0	29·2	—	5·2	—	5·2	1·8	12·2	—	30·2	—
1–2	22·7	7·5	3·4	1·6	2·4	0·3	12·3	15·7	33·0	18·5
3+	14·8	6·5	2·8	—	1·1	0·5	35·8	16·2	28·9	14·1
Size of dwelling (sq. ft)										
0–199	25·7	12·9	2·7	0·9	2·5	0·5	28·9	30·4	25·5	8·0
200+	20·5	13·1	3·8	3·2	1·8	0·4	14·3	20·7	31·9	17·2
Worker's quality										
Poor	29·9	16·3	3·6	3·3	3·0	0·9	18·2	23·8	56·4	22·0
Moderate	20·1	12·4	3·1	2·3	1·8	0·4	21·3	37·1	21·8	10·4
High	20·8	11·9	3·4	1·1	1·9	0·4	16·5	18·2	34·2	14·0
Household type										
Modern	15·9	10·3	3·4	—	1·6	—	15·4	21·2	34·2	15·5
Rudimentary	27·9	14·4	3·4	3·0	2·4	0·6	23·9	27·7	36·3	12·4
All	22·3	12·9	3·3	1·9	2·0	0·5	19·0	25·0	29·5	13·4

Table 4. Proportional hazard model estimates of relative risk of first-method failure of different contraceptive methods by some selected socioeconomic and demographic characteristics and worker's quality, Matlab, 1978–94

Characteristics	Pill	IUD	Injectable	Condom	Other
Cohort	1·16***	1·43***	1·13*	1·22***	1·21**
Cohort square	0·99***	0·97***	0·98***	0·99*	0·98***
Age	0·96***	0·95**	0·94***	0·95***	0·91***
Religion					
Muslim	1·64***	1·33	1·38*	1·03	1·17
Hindu	1·00	1·00	1·00	1·00	1·00
Education (years)					
No schooling (0)	1·00	1·00	1·00	1·00	1·00
Primary (1–5)	0·78**	0·65**	0·87	0·72†	0·82
Higher (6+)	0·57***	0·60*	0·93	0·41***	0·87
No. living children					
0	1·00	1·00	1·00	1·00	1·00
1–2	0·57***	0·67†	0·65*	0·47***	0·90
3+	0·58***	0·54*	0·66*	0·72	1·74**
Size of dwelling (sq. ft)					
0–199	1·00	1·00	1·00	1·00	1·00
200+	0·80*	1·03	0·76†	0·78	1·03
Worker's quality					
Poor	1·00	1·00	1·00	1·00	1·00
Moderate	0·74***	0·65*	0·44***	1·17	0·93
High	0·71***	0·78	0·62***	0·87	0·92

Reference cohort: in years. Age: in years.
†$p<0·1$; *$p<0·05$; **$p<0·01$; ***$p<0·001$.

The results in Table 4 indicate that the cohort had a significant positive effect on contraceptive failure for all the methods considered in the study. As expected, cohort-square was significantly negatively related to the change in contraceptive failure of all the methods. This confirms a curvilinear relationship between contraceptive failure and time.

Among the selected socioeconomic and demographic variables a number of factors emerged as significant determinants of contraceptive failure, although the data reveal no clear pattern (Table 4). Age at the time of adoption appeared to be a significant determinant of failure, which affected failure rates of all the methods negatively. Muslim women had a higher risk of failure for all methods than their non-Muslim counterparts. However, the effect was significant only for pills and injectables. Women's educational levels were clearly associated with contraceptive failure. Those who had primary and higher levels of education were less likely to experience failure than the women with no formal education. Except for injectables and 'other' methods, education appeared to be a significant determinant of failure or success for pills, IUDs and condoms. Number of living children was another important determinant of failure, which affected the failure in pills, IUDs, injectables and condoms. The risk of failure

of these methods decreased with the increase of number of living children. The risk of failure was less among the women who had at least one living child than the women who had no living children. Size of the dwelling was a relatively less important determinant of contraceptive failure. Only for pills and injectables was it a significant factor for failure rate.

Workers' quality of services also appeared as one of the important determinants of contraceptive failure. The risk of failure was reduced when a fieldworker's performance was moderate or high. However, workers' quality appeared to be a significant factor only for pills, IUDs and injectables. It should be noted that these were the only three methods that the CHWs were directly involved with.

Interaction terms of each of the variables including worker's quality with the cohort were included in the model, but none was significant. This suggests that the relative change in the effect of any of the variables did not depend on time (cohort).

Discussion and conclusion

In estimating contraceptive failure rates, the quality of data is of utmost importance. Any estimate of failure depends critically on whether or not particular births are reported as having resulted from contraceptive failure, and respondents are likely to be sensitive about reporting such information. In addition, there are obvious ambiguities of classification for conceptions following imperfect or sporadic method use. Life table measures are also dependent on the correct reporting of duration for each segment of use and the acknowledgment of multiple segments of use within intervals. In this regard, this study is unique because it follows a specially designed data analysis plan, discussed earlier in the methodology section, to make the data free from response bias and recall error. The analysis did not take into account the respondents' perceptions of whether a conception was due to contraceptive failure. Such perceptions are likely to result in bias, and are thought to be responsible for the wide variation in failure rates reported in earlier studies in Bangladesh (Akbar *et al.*, 1991; Akhter & Ahmed, 1991). However, the study has some limitations. One limitation is that failures that end in either abortion, menstrual regulation (MR), still-birth or miscarriage were not considered. Abortion and MR rates in Bangladesh are quite high (Khan *et al.*, 1986; Dixon-Mueller, 1988), and Matlab is no exception. Indeed, studies in Matlab suggest a rising trend in MR and abortion (Ahmed, Rahman & van Ginneken, 1998). It is expected that a significant number of unintended pregnancies caused by contraceptive failure end in MR and abortion, but these were not considered in this study. As a result, the estimated contraceptive failure rate may be downward biased, and the size of the underestimate is not known. This issue deserves investigation. Besides, differences by method or characteristic in the degree of underestimation associated with abortions and MRs might have biased the comparisons slightly. On the other hand, the possibility that the intensive programmatic effort might increase contraceptive acceptance among less-motivated women, who may use a method inconsistently or incorrectly, cannot be ruled out, which might have increased contraceptive failure rates to some extent. However, it was found that the knowledge of proper use of any method, including pills and condoms, was better in the Matlab MCH-FP area than in the comparison area (Nasreen *et al.*, 1996). The comparison area is considered to be

representative of the national scenario. Nevertheless, the Matlab MCH-FP project is known to be biased towards injectables. Moreover, better knowledge of pill and condom use does not necessarily mean a better compliance of these methods in the MCH-FP area. Further study could be directed along this line to compare the compliance of pills and condoms in the two areas to be sure that failure rates of different methods obtained in this study can be applied to the Bangladesh national programme, and also to measure the extent of discrepancies between the estimates of failure rates from direct reporting and the methodology of the study, and also to test the robustness of the current methodology.

A review of international programmes by Ross & Frankenberg (1993) demonstrates that the failure rates range from 2·7 to 14% for pills, 0·3 to 0·4% for IUDs, 0 to 1% for injectables, 0 to 24% for condoms and 8·2 to 38·4% for traditional methods. For IUDs and injectables the current estimates are consistent with the international experience but for other methods the estimates are in the vicinity of the upper limit of the range of failure of the international experience. This indicates that the overall failure rate is quite high in Matlab, suggesting a low average use-effectiveness. The study, however, demonstrates that the failure rate of almost all methods is declining in Matlab. This decline cannot be attributable to an increase in abortions, because the abortion ratio per 1000 live births has been stable or declining in the Matlab MCH-FP area since 1991 (Bairagi, 1997).

The analysis reveals that among contraceptive acceptors in Matlab, the condom is the most inefficient method, while the injectable is the most effective method.

The IUD is another highly effective method in Matlab. However, pills and 'other' temporary methods have moderate effectiveness. Indeed, the 'other' methods, which are mostly traditional methods, were found to be used more effectively than condoms, an actively promoted programme method.

The failure rates observed by Bairagi & Rahman (1996) in Matlab during the period 1984–89 were 15% for pills and other temporary methods, 3·0% for IUDs and 1·0% for injectables. Bairagi and Rahman, however, considered the first-method, all-segment failure rate rather than the first-method, first-segment failure rate based on a sample of 1000 users only and the findings are not strictly comparable with the findings of the present study.

The high failure rates for condoms, pills and 'others' may be attributed to the unsystematic use of these methods in Matlab, despite rigorous field support and follow-up from community health workers. A study on pill compliance (Seaton, 1985), and the high failure rates of pills, condoms and 'other' methods found in the present study, bring into question the appropriateness of these methods for rural Bangladesh. However, it is encouraging to note that the method mix in Matlab is heavily dependent upon injectables (more than 50% of total use) and its effectiveness is also high in Matlab. What is needed, then, is to sustain the reliance on injectables and a greater programmatic effort should be made in this direction.

The programme performance and method mix in the study area are quite different from those in the rest of the country. So, an overall unweighted estimate of the probability of failure for the country cannot be obtained from this study. However, there is an indication from the results of this study that in Bangladesh contraceptive failure is a major problem for users of all temporary methods except injectables and

the IUD; these two methods have a relatively low probability of failure, but are little used at the national level (Mitra *et al*., 1994). The pill is the most popular method at the national level (39% of total use), as are other temporary methods (including traditional methods).

A policy implication that could be made from the present study is that policy planners and programme managers should give due attention to contraceptive failure in order to make family planning programmes more successful. Some change in the method mix may be suggested as part of the solution. There is unlikely to be Matlab-level quality of care in the near future in the national programme for different contraceptives, particularly injectables, which are administered in Matlab by the CHWs at the homes of acceptors on due dates recorded in biweekly visits. The compliance of injectables in Dhaka city, where an acceptor needs to come to a clinic for it, has been found to be quite poor (personal communication). Overall, the high failure rates of different temporary methods raise concern about the heavy dependence on these methods in the national programme. Perhaps efforts should be made to maximize reliance on the most effective methods, especially sterilization and IUDs, and minimize reliance on the least effective methods, especially pills, condoms and traditional methods. Clear priorities should be set centrally and followed by clinic staff and fieldworkers. However, while implementing the programme the policy planners and programme managers should remember that Bangladeshi women will not readily accept contraception if services are not made available in a culturally appropriate manner (Islam & Islam, 1993). No woman should be refused a less effective method if she will not or cannot use a more effective one, but efforts should be made to persuade her to try the more effective one. Furthermore, contraceptive users should be educated in their use so that they are more effective. This could be done through a special Information, Communication and Education (ICE) campaign. Finally, as found earlier (Baiargi & Rahman, 1996), the quality of workers, which may be improved by training, can play an important role in preventing unwanted pregnancy during contraceptive use.

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