# Contraceptive Failure in Matlab, Bangladesh

By Radheshyam Bairagi and Mizanur Rahman

*Contraceptive failure rates and the determinants of failure can be most accurately estimated using prospective data from an area served by a well-established maternal and child health and family planning program. In Matlab, Bangladesh, the cumulative probability of contraceptive failure within one year of method acceptance was 1% for the injectable, 3% for the IUD and 15% for the pill and other temporary methods among 2,856 married women aged 15–49 during the period 1984–1989. Among women using no method, the 12-month cumulative probability of conception was 38%. For the pill, the likelihood of failure was consistently high during the first 12–18 months of use, after which it declined substantially; by contrast, the probability of an IUD failure increased, peaking at 24 months of use. The injectable maintained a low likelihood of failure regardless of duration of use, and no pattern was evident for other temporary methods. The quality of community health workers' performance was associated with the risk of failure of all temporary methods except the injectable; women's background characteristics associated with failure varied by method. Calculations from failure rates suggest that 25% of births in Bangladesh may reflect contraceptive failure.* (International Family Planning Perspectives, **22:**21–25, 1996)

Contraceptive failure leads to about 20 million unintended pregnancies in developing countries each year.[1] It has serious consequences for the women involved, the children they bear and family planning programs. Pregnancies resulting from contraceptive failure often end in induced abortion,[2] a procedure that can be provided only clandestinely in many settings and that increases maternal morbidity and mortality in developing countries.[3] Furthermore, children whose mother did not intend to become pregnant have well-documented developmental deficits.[4] And family planning programs can have only limited effectiveness if contraceptive failure rates are high, regardless of contraceptive prevalence and continuation rates among the populations they serve.[5]

The risk of contraceptive failure may be related to characteristics of the method itself, but is also associated with characteristics of users.[6] Failure rates among highly motivated users are likely to be relatively low;[7] on the other hand, motivation depends largely on women's socioeconomic and other characteristics. Family planning managers need to know not only the failure rates of different methods, but also the determinants of failure, so they can give proper advice to prospective users, who will then be able to make informed choices.

Few studies have examined contraceptive failure in Bangladesh, and some of their findings diverge widely. Estimates of the 12-month failure rate for the pill have ranged from 1% to 26%; for injectables, from 2% to 3%; for the IUD, from 2% to 6%; and for the condom, from 1% to 12%.[8] In all of these studies, researchers assessed failure on the basis of users' responses to a question about their reasons for discontinuing a method; all but one of the studies[9] relied on retrospective data.

Since high-quality data on contraceptive failure are not available even for developed countries,[10] and methodological pitfalls may bias studies of contraceptive failure,[11] the reliability of retrospective data on failure in developing countries presumably is limited. Furthermore, researchers examining Demographic and Health Survey data on contraceptive failure in 15 developing countries have concluded that variations between and within countries may be attributable to errors in data;[12] variations in the definition and perception of failure, as well as response error, also can widen the disparity between findings within a country, such as in the studies of Bangladesh. Therefore, understanding contraceptive failure requires analysis based on reliable data and a strong methodology.

In the study on which we report in this article, we used a set of prospective, high-quality data to obtain better estimates than have thus far been available of contraceptive failure among rural Bangladeshi women. We also explore socioeconomic, demographic and programmatic factors that may influence the likelihood of failure.

## Data and Methods

### *Data Sources*

Our analysis is based on data from the area of Matlab where the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B) has operated a comprehensive maternal and child health and family planning program since 1977.[13] The area's population is about 100,000.

In 1984, a knowledge, attitude and practice survey was conducted in the intervention area. Since every individual in Matlab has been assigned an identification number, information about each woman who participated in the 1984 survey can be linked to other data for the area: the 1982 Socioeconomic Survey; 1977–1989 data from the ICDDR,B record-keeping system, a prospective data collection system; and the 1987 ICDDR,B Evaluation of Worker Performance. We selected approximately 3,000 currently married women aged 15–49 for interview on the basis of multistage random sampling; after cleaning and linking different files, we had a sample of 2,856 women.

The 1982 survey results on women's education and the size of respondents' dwelling space were used as socioeconomic indicators. Size of dwelling space, a good measure of wealth and economic status in the area, was the best indicator among the socioeconomic variables in the survey[14] and was unlikely to have changed appreciably by the time of data collection for this study (1984–1989). Women's age and number of living children were measured at the baseline.

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**Table 1. Percentage distribution of currently married women aged 15–49, by selected background characteristics, ICDDR, B project area, Matlab, 1982**

| Characteristic | N | % |
|---|---|---|
| **Size of dwelling (sq. ft.)** | | |
| 0–199 | 929 | 32.5 |
| 200–374 | 985 | 34.5 |
| ≥375 | 441 | 15.4 |
| Unknown | 501 | 17.5 |
| **Education (yrs.)** | | |
| 0 | 1,517 | 53.1 |
| 1–5 | 842 | 29.5 |
| ≥6 | 217 | 7.6 |
| Maktab/Madrasa† | 280 | 9.8 |
| **Age** | | |
| <25 | 824 | 28.9 |
| 25–34 | 1,106 | 38.7 |
| ≥35 | 926 | 32.4 |
| **No. of living children‡** | | |
| 0 | 131 | 4.6 |
| 1–2 | 907 | 31.8 |
| 3–4 | 974 | 34.1 |
| ≥5 | 844 | 29.5 |
| **Religion‡** | | |
| Muslim | 2,409 | 84.3 |
| Hindu | 447 | 15.7 |
| Total | 2,856 | 100.0 |

†A combined religious and secular education. ‡1984 data from the knowledge, attitudes and practices survey.

Information about contraceptive use, contraceptive continuation and pregnancies came from the record-keeping system. As part of their regular service delivery activities, workers maintain a field register in which they record monthly information about contraceptive use, reproductive status and breastfeeding for all married women of reproductive age (who currently number approximately 16,000[15]). The data are later computerized for the record-keeping system.

Of central interest in this study is the effect on contraceptive behavior of the 56 community health workers who provided family planning services in the program area through door-to-door visits once every two weeks throughout the study period. The quality of their performance was determined on the basis of a 1987 evaluation, conducted jointly by workers' immediate supervisors and the project manager, of all workers who had been with the program since 1980. The workers were scored on a scale of 1–3 on each of six components: regularity at work, innovative techniques in communication, behavior with clients, technical competence, enthusiasm for work and conformity to social norms while working. These scores were summed to create an index of the overall quality of performance. Total scores of 6–12, 13–15 and 16–18 signified poor, moderate and high levels of performance, respectively.

*"Other" methods are the condom, foam, withdrawal, rhythm and kabiraji (a traditional method made of indigenous and herbal ingredients).

### *Calculations*

Three measures of contraceptive failure are employed in the literature: method, or theoretical, failure; use failure; and extended-use failure. Method failure is reflected by pregnancies that are directly attributable to the limitations of the method; use failure includes all pregnancies that occur while a woman and her partner consider themselves users of the method; and extended-use failure includes pregnancies that occur both during use and during any period subsequent to discontinuation before another method is adopted.[16] Use failure and extended-use failure reflect method failure, as well as incorrect or inconsistent use of a method. In this analysis, we estimate contraceptive failure including both method failure and user error.

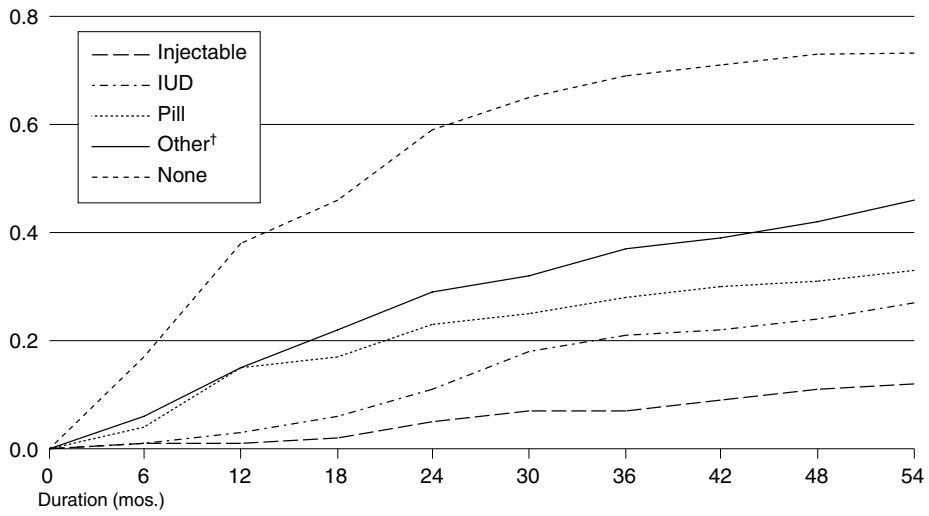
In calculating the probability of failure, we assumed that a live birth requires a gestational period of at least seven months. Therefore, for the pill, IUD (TCu 200) and other temporary methods* except the injectable, if a live birth occurred during use or within seven months after discontinuation, we considered the pregnancy the result of a contraceptive failure. For the injectable, which is expected to provide contraceptive protection for three months, live births occurring within nine months after method acceptance were counted as reflecting contraceptive failure. (The gestational period preceding spontaneous abortion or stillbirth varies widely; therefore, we could not determine whether pregnancies with these outcomes resulted from contraceptive failure.) We restricted our analysis to single-decrement measures of failure—the probability of becoming pregnant while using a method, in the absence of any other reason for contraceptive discontinuation.

Duration of use was based on the number of months of method use during a calendar year, continuously or with a break. For example, if a woman used the pill from January to June, rhythm from July to October, and the pill again in November and December, her duration of pill use for that year was eight months.

We used life-table techniques to estimate the cumulative probability of conception leading to a live birth among all nonusers at different intervals. Each nonuser's pregnancy status beginning at the survey date was checked from the record-keeping system. If a woman had a live birth within seven months after the survey, she was excluded. No allowance was made for the fact that many women were exposed to the risk of pregnancy for an unknown length of time before data collection began (known as left-censoring), and this might have biased the duration-specific probability of conception to some degree.

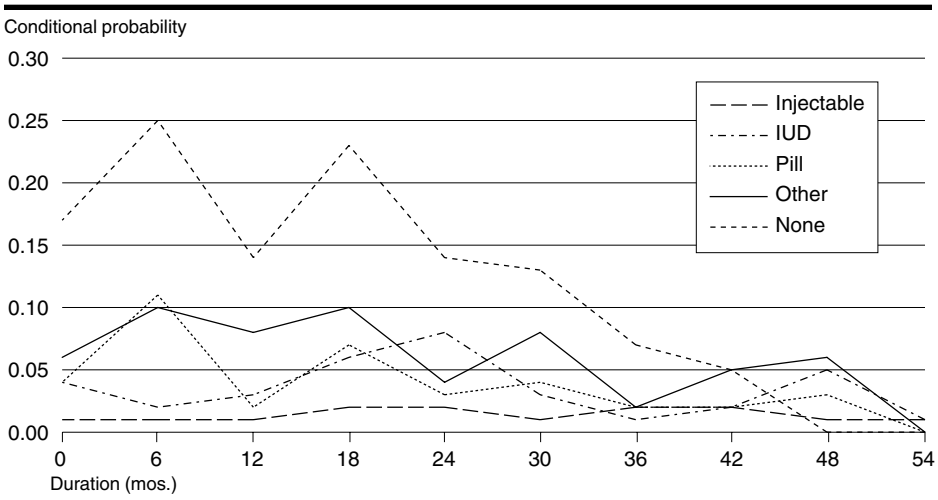
For contraceptive users, we examined pregnancy status from the date of method acceptance, which was usually a few months before the survey. We calculated the cohort failure rate rather than the pe-

**Figure 1. Cumulative probability of pregnancy, by contraceptive method used, according to duration of use, 1984–1989**




†In all figures and tables, "other" methods are the condom, foam, withdrawal, rhythm and traditional methods.

**Figure 2. Conditional probability of pregnancy, by contraceptive method used, according to duration of use, 1984–1989**




riod failure rate. Data on discontinuation of a method for any reason other than accidental pregnancy, such as outmigration, death, loss of eligibility for the study (because of marital dissolution or aging out of the reproductive years) and the ending of study, were censored. Attrition bias was not an issue in this study. About 2% of women migrated out of the project area (temporarily or permanently) or died during the study period, and another 10% lost their eligibility; these proportions did not vary significantly by socioeconomic characteristics. A multivariate analysis of risk factors for contraceptive failure or for conception among nonusers was conducted using hazards regression models.[17]

## Results

### *Background Characteristics*

Table 1 presents a socioeconomic and demographic profile of the study participants. Some 33% lived in a dwelling of less than 200 square feet. (A family in Matlab may be considered very poor if the size of its dwelling space is below this level.[18]) Educational attainment also was very low. More than half (53%) of the women did not have any education, and only 8% had six or more years of schooling. Another 10% had received Maktab/Madrasa instruction, which is a combination of religious and secular education. The women's husbands were better educated, on average, than the women themselves; fewer than 30% had no education (not shown).

The largest proportion of the women (39%) were aged 25–34, and the remainder were roughly evenly divided among younger and older women; most (95%) had children. Muslims far outnumbered Hindus (84% vs. 16%).

### *Probability of Conception*

The cumulative probability of failure among users of different contraceptives, and the probability of conception leading to live birth among nonusers, is shown in Figure 1. At 12 months, the cumulative probability of failure was 1% for injectables, 3% for the IUD, and 15% for the pill and other methods. Among women not using a contraceptive method, the cumulative probability of conception within 12 months after the survey was 38%.

Figure 2 shows the conditional probability of contraceptive failure and of conception among nonusers at six-month intervals. For the pill, the probability of failure was very high (11%) at the beginning of use, but it declined (to 2–4%) at durations of 24 months and longer. For the other methods, the likelihood of failure did not show a decrease with duration of use. Thus, the pill's declining probability of failure was probably not due to early pregnancy among the most fecund. Rather, it suggests that pill use became more effective after one or two years of use.

On the other hand, the IUD was most likely to fail at 24 months of use (8%). This may be an indication that the TCu 200 IUDs used in the Bangladesh program at that time lost effectiveness (and may have needed replacement) after two years. The probability that the injectable would fail did not change with duration of use, remaining low (1–2%) at all times.

Among nonusers, the probability of conception declined very rapidly with time (from 25% at six months to less than 10% at the longest durations). This finding suggests that fecundability differed among nonusers and that the women of higher fecundability conceived very quickly, leaving the less-fecund women in the cohort.

The effects of health workers' performance and women's background characteristics on the failure of different methods are shown in Table 2. For the pill and "other" methods, the quality of the workers' performance has a clear effect on failure: The probability of failure was 24–25% when workers' performance was poor and 9–18% when it was of moderate or high quality. No substantial effect of worker quality on the failure rate of the IUD and injectable is discernible.

**Table 2. Cumulative percentage of women who experience a contraceptive failure within 12 months of use, by method, according to the quality of workers and selected background characteristics of the women, 1984–1989**

| Characteristic | Pill | | IUD | | Injectable | | Other | |
|---|---|---|---|---|---|---|---|---|
| | N | % | N | % | N | % | N | % |
| **Total** | **130** | **15** | **284** | **3** | **500** | **1** | **105** | **15** |
| **Worker quality†** | | | | | | | | |
| Poor | 34 | 24 | 86 | 1 | 148 | 1 | 22 | 25 |
| Moderate | 49 | 10 | 99 | 2 | 169 | 2 | 48 | 9 |
| High | 47 | 14 | 99 | 4 | 183 | 1 | 35 | 18 |
| **Size of dwelling (sq. ft.)** | | | | | | | | |
| 0–199 | 46 | 17 | 89 | 2 | 161 | 3 | 36 | 20 |
| 200–374 | 45 | 16 | 113 | 3 | 173 | 1 | 31 | 21 |
| ≥375 | 17 | 13 | 39 | 6 | 74 | 1 | 22 | 0 |
| Unknown | 22 | 11 | 43 | 0 | 92 | 1 | 16 | 13 |
| **Education (yrs.)** | | | | | | | | |
| 0 | 46 | 16 | 119 | 2 | 280 | 2 | 40 | 17 |
| 1–5 | 42 | 13 | 114 | 2 | 134 | 1 | 36 | 20 |
| ≥6 | 24 | 10 | 29 | 4 | 28 | 0 | 22 | 9 |
| Maktab/Madrasa | 18 | 26 | 22 | 10 | 58 | 2 | 7 | ‡ |
| **Age** | | | | | | | | |
| <25 | 39 | 23 | 104 | 7 | 112 | 0 | 27 | 33 |
| 25–34 | 53 | 18 | 117 | 0 | 204 | 2 | 30 | 14 |
| ≥35 | 38 | 6 | 63 | 0 | 184 | 2 | 48 | 7 |
| **Number of living children** | | | | | | | | |
| 0 | 2 | ‡ | 1 | ‡ | 5 | ‡ | 0 | 0 |
| 1–2 | 42 | 20 | 119 | 6 | 124 | 1 | 29 | 22 |
| 3–4 | 51 | 14 | 102 | 0 | 185 | 2 | 36 | 17 |
| ≥5 | 35 | 12 | 62 | 0 | 186 | 1 | 40 | 8 |
| **Religion** | | | | | | | | |
| Muslim | 109 | 18 | 259 | 3 | 433 | 1 | 88 | 16 |
| Hindu | 21 | 0 | 25 | 0 | 67 | 1 | 17 | 13 |

†In a 1987 performance evaluation, workers were given a score of 1–3 on each of six components. Total scores of 6–12, 13–15 and 16–18 signified poor, moderate and high quality of performance, respectively. ‡Numbers are too small to permit calculations of percentages.

**Table 3. Proportional hazard model estimates of relative risk of pregnancy, by contraceptive method used, according to quality of workers and selected background characteristics of the women, 1984–1989**

| Characteristic | Pill (N=130) | IUD (N=284) | Injectable (N=500) | Other (N=105) | None (N=1,146) |
|---|---|---|---|---|---|
| **Worker quality** | | | | | |
| Poor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Moderate | 0.27* | 0.56 | 0.84 | 0.26** | 1.09 |
| High | 0.60 | 0.47* | 1.04 | 0.55 | 1.03 |
| **Size of dwelling (sq. ft.)** | | | | | |
| 0–199 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| 200–374 | 1.45 | 0.81 | 0.52* | 0.70 | 0.96 |
| ≥375 | 0.65 | 0.83 | 0.59 | 0.48 | 1.05 |
| Unknown | 0.76 | 0.65 | 0.64 | 1.73 | 0.93 |
| **Education (yrs.)** | | | | | |
| 0 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| 1–5 | 0.79 | 0.66 | 0.51 | 0.34* | 1.08 |
| ≥6 | 0.30 | 0.15 | 1.56 | 0.18** | 0.91 |
| Maktab/Madrasa | 0.89 | 1.17 | 1.01 | 0.76 | 1.24 |
| **Age** | 0.87 | 0.96 | 1.00 | 0.81** | 0.94** |
| **Number of living children** | 0.80 | 2.23 | 2.89* | 1.96 | 1.50** |
| **Religion** | | | | | |
| Muslim | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Hindu | 0.10* | 0.18 | 0.30* | 0.64 | 0.94 |

*p<0.05. **p<0.01. *Note:* Model excludes women who were protected by sterilization and users of no method who were pregnant at the time of the 1984 survey.

In a multivariate analysis, a number of factors emerged as significant determinants of contraceptive failure, although the data reveal no clear pattern (see Table 3). The quality of community health workers is associated with the risk of pregnancy among users of several methods. The likelihood of pregnancy is reduced by about one-half among IUD users when health workers' performance is high-quality, rather than poor; it is reduced by about three-quarters among users of the pill and "other" methods when workers perform moderately well.

Size of dwelling space was significantly associated with a change in the risk of conception only among users of the injectable. The risk of pregnancy generally declines as the level of education rises, but the effect is significant only for women using "other" methods. Increasing maternal age is associated with a modest decline in the failure rate of "other" methods, and an increasing number of children nearly triples the injectable failure rate. Hindus who use the pill or injectable are significantly less likely to conceive than are Muslims who use these methods.

## Discussion

Several limitations of this study should be underscored. First, family planning behavior and fertility have been very different in the well-known Matlab project area than in other parts of the country; therefore, the results of this study might not be representative of the entire country. In fact, our estimates might represent lower-bound estimates for Bangladesh, because the high-quality family planning services available in the area likely reduced use failure. Of course, the possibility that the intensive program increased contraceptive acceptance among less-motivated women, who may use a method inconsistently or incorrectly, cannot be ruled out, and the inclusion of these women might have increased contraceptive failure rates to some extent.

Second, the contraceptive method mix in the study area is different from that in the rest of the country.[19] Consequently, an overall unweighted estimate of the probability of failure for the country cannot be obtained from this study.

Third, although each of the "other" methods makes an important contribution to the national family planning program of Bangladesh,[20] the number of women in our sample using these methods was not adequate for calculation of method-specific probabilities of failure. Nor was it large enough to permit examination of socioeconomic and demographic differentials and their interactions with the quality of workers.

Fourth, only pregnancies that led to live births were considered to have resulted from contraceptive failure; those ending in stillbirths, abortions and miscarriages were excluded. Our results thus underestimate failure. Moreover, differences by method or characteristic in the degree of underestimation associated with these outcomes, particularly abortions, might have biased the comparisons slightly.

Fifth, the workers' performance scores might have been an effect rather than a cause of both contraceptive use and contraceptive failure. We checked this point and were convinced that the bias, if any, was small.

Finally, because appropriate data were lacking, we could not examine whether a failure was due to incorrect or irregular use, or to method failure.

In spite of these limitations, this study is unique because of its design and the quality of the data. These data were relatively free of response bias and recall error. The analysis did not take into account either the women's or the workers' perceptions of whether a conception was due to contraceptive failure. Such perceptions are likely to result in misestimation, and are thought to be responsible for the wide variation in failure rates reported in earlier studies in this country.[21]

Our analysis reveals that in Bangladesh, contraceptive failure is a major problem for users of all temporary methods except the injectable and the IUD; these two methods have relatively low probabilities of failure, but are used little at the national level.[22] The pill and other temporary methods are quite popular, used by 33% of women of reproductive age (18% and 15%, respectively), but have 12-month failure rates of 15%; thus, 5% of Bangladeshi women (0.33 x 0.15) will become pregnant annually because of the failure of one of these methods. Given the country's general fertility rate of 20 births per 100 married women of reproductive age, these figures suggest that 25% of births (0.05/20 x 100) reflect contraceptive failure.

A review of contraceptive prevalence and total fertility in 50 countries between 1984 and 1992 showed that in Bangladesh, fertility is higher than expected, given levels of contraceptive use.[23] (Furthermore, Bangladesh has one of the world's highest levels of postpartum amenorrhea, which is an additional source of protection from conception.[24]) This finding could be the result of high levels of failure for the pill and other temporary methods.

Policymakers and program planners must give contraceptive failure serious attention to make the family planning program in Bangladesh more successful. Some change in the method mix may be part of the solution. Furthermore, interventions are needed to reduce failure among young users of any method and pill users in their first year or two of use. Finally, the quality of workers, which may be improved by training, can play an im-

portant role in preventing unwanted pregnancy during contraceptive use.

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## Resumen


*Las tasas de falla de anticonceptivos y los determinantes de falla pueden ser estimados con mayor exactitud mediante el uso de datos prospectivos recogidos de un área atendida por un programa bien establecido de planificación familiar y de atención materno-infantil. En Matlab, Bangladesh, la probabilidad cumulativa de falla de anticonceptivos durante un año de aceptación de un método correspondió a los inyectables en un 1%, al DIU en un 3% y a la píldora y otros métodos temporales en un 15%, entre una población de 2.856 mujeres casadas, de entre 15 y 49 años, durante el período 1984–1989. Entre las mujeres que no utilizaban ningún método, la probabilidad cumulativa de concepción fue del 38% en un período de 12 meses. Con respecto a la píldora, las posibilidades de falla fueron regularmente elevadas durante el primer período de 12–18 meses de uso, luego del cual disminuyó sustancialmente, a diferencia de una probabilidad de falla del DIU que aumentó y logró su más alto nivel a los 24 meses de uso. Los inyectables mantuvieron una baja tasa de probabilidad de falla, fuere cual fuere el período de uso, y no se revelaron tendencias con respecto a otros métodos temporales. La calidad del rendimiento de los trabajadores de salud comunitarios estuvo relacionada con el riesgo de falla de todos los métodos temporales, excepto los inyectables; las características de antecedentes de las mujeres relacionadas con los niveles de falla variaron de acuerdo al método utilizado. Los cálculos de las tasas de falla sugieren que el 25% de los nacimientos en Bangladesh puede resultar de la falla de anticonceptivos.*


## Résumé


*On peut estimer les taux d'échec contraceptif et les déterminants de l'échec avec la plus grande exactitude en utilisant les données prospectives provenant d'une zone desservie par un programme bien établi de santé maternelle et infantile ainsi que de planning familial. A Matlab, au Bangladesh, la probabilité cumulative de l'échec contraceptif en moins d'un an de l'acceptation de la méthode s'élevait à 1% pour l'injectable, 3% pour le stérilet et 15% pour la pilule et autres méthodes temporaires parmi 2,856 femmes mariées âgées de 15 à 49 ans durant la période allant de 1984 à 1989. Parmi les femmes n'utilisant aucune méthode, la probabilité cumulative de conception était de 38% pour 12 mois. La probabilité d'échec de la pilule était uniformément élevée au cours des 12 à 18 premiers mois d'utilisation, puis baissait considérablement après cette période; par opposition, la probabilité d'un échec du stérilet atteignait un sommet à 24 mois d'utilisation. L'injectable présentait une faible probabilité d'échec, quelle que soit la durée d'utilisation, et aucun scénario ne se dessinait clairement pour les autres méthodes temporaires. La qualité des prestations des travailleurs communautaires de la santé était liée au risque d'échec de toutes les méthodes temporaires, à l'exception de l'injectable; les traits des femmes liés à l'échec variaient suivant la méthode. Les calculs effectués à partir des taux d'échec suggèrent que 25% des naissances au Bangladesh peuvent témoigner de l'échec contraceptif.*