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The Contraceptive Potential of Lactation for Bangladeshi Women

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Lactational amenorrhoea deserves careful consideration within the family planning programme.

The relationship between breastfeeding and the possibility of conception has been noted for over a century and has been a topic of investigation for at least the past 40 years (see for example Henripin, 1954; Jain, 1969). Data from numerous settings have demonstrated the correlation between breastfeeding duration and birth interval duration (Jain and Bongaarts, 1981), as well as the duration of postpartum amenorrhoea (Jain and Sun, 1972; Bongaarts and Potter, 1983). An impressive body of clinical evidence also suggests that breastfeeding has an important contraceptive effect (McNeilly, 1979 and 1987; Glasier, McNeilly and Howie, 1984; and Thapa and Williamson, 1990).

In Bangladesh, long durations of intensive breastfeeding have traditionally resulted in extended durations of postpartum amenorrhoea and long intervals between births even in the absence of contraception (Hobcraft and McDonald, 1984). The national Bangladesh Fertility Survey (BFS) of 1975 reported a median duration of postpartum amenorrhoea of 14.6 months (Singh and Ferry, 1984) and analyses of data from the 1989 BFS suggest that lactational amenorrhoea continues to have an important contraceptive effect, reducing fertility overall by 35 per cent (Cleland and others, 1994) (see also Islam, Mamun and Bairagi, 1998).

However, the contraceptive effect of breastfeeding is not absolute and, since ovulation may occur in the first menstrual cycle following the birth of a child, a woman may conceive even without any visible menses. Recent studies have attempted to evaluate the contraceptive potential of breastfeeding more precisely and to develop guidelines for use by individual women.

Drawing on results from eight countries, the Bellagio Consensus Statement concluded that, for women who breastfeed "fully or nearly fully"1 and remain amenorrhoeic, the cumulative risk of conception over the first six months postpartum is less than 2 per cent, that is, similar to or lower than the risks attached to the use of modern methods of contraception (Kennedy, Rivera and McNeilly, 1989). Subsequent studies have further investigated the relationship between breastfeeding patterns and conception, and have addressed two important questions: does breastfeeding have to be full or nearly full for a conceptive effect to exist and can contraceptive protection be achieved beyond six months postpartum?

Recent studies suggest that a high degree of contraceptive protection can be achieved even among women who are not breastfeeding fully (Kennedy, Labbok and VanLook, 1996). Gray and others (1990) concluded that a certain level of protection may be achieved by different patterns of breastfeeding, for example either long, infrequent feeds or shorter, frequent feeds, but that a certain degree of nipple stimulation must be maintained to suppress ovarian activity. Other researchers have concluded that amenorrhoea alone can be taken as the indicator of low pregnancy risk among breastfeeders, regardless of whether or not supplements have been introduced to the baby's diet (Short and others, 1991; Kennedy and Visness, 1992).

Most studies have confirmed the findings of the Bellagio Consensus Statement, namely that lactation can provide a high degree of protection up to six months postpartum. There is less agreement, however, as to whether this protection can be relied upon beyond six months. Some researchers have concluded that six months is the point at which the risk of pregnancy increases to an unacceptably high level (Gray and others, 1990), whereas others suggest that protection extends beyond this time, particularly in populations where there is intensive and prolonged breastfeeding. Recent findings suggest that lactational amenorrhoea may be relied upon for protection against pregnancy up to nine or even twelve months in certain situations (FHI, 1996). It has been suggested that protection may be relied upon up to the resumption of menses, regardless of the time since birth (Short and others, 1991).

Thus, despite the Bellagio "consensus", research in this area continues to produce varying results and recommendations. Partial explanation for divergent results lies in inconsistent study designs and analyses. Many studies have employed small samples, often consisting of individuals who are unrepresentative of the population at large, have failed to use life table methodology (or are not explicit about the way life tables were constructed), or have failed to control for potentially confounding factors. Different researchers have used different outcome measures, some looking at ovulation (using a range of biochemical assays), others considering hypothetical pregnancy rates, and still others considering observed pregnancies. Leaving methodological issues aside, however, there appears to be significant real variation in the natural protection against pregnancy afforded by lactation, both between and within populations. Though this variation is probably largely explained by differing breastfeeding patterns, recent research also suggests that the effect of lactation on ovarian activity may be mediated by other physiological factors such as maternal nutrition (Panter-Brick, 1991; Rosetta, 1992). This finding highlights the need for population-based analyses and suggests that generalizations across settings may be dangerous.

Bangladesh is a particularly appropriate setting for an investigation into postpartum infecundability since durations of breastfeeding and lactational amenorrhoea have traditionally been among the longest in the world. At the same time, recent years have seen a steady rise in use of modern contraception, largely as a result of a very active family planning programme (Cleland and others, 1994). To date, little research has addressed the issue of natural protection against pregnancy in Bangladesh. Weis (1993) analysed data from the 1989 BFS and concluded that breastfeeding affords good protection against pregnancy among amenorrhoeic Bangladeshi women for the first 12 months after birth. The present article uses longitudinal surveillance data in order to explore in more detail the issue of lactational protection against pregnancy among Bangladeshi women.

Study sites, data and methods

The data used in this article come from surveillance systems maintained in two research sites of the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B): the Record Keeping System of the Matlab MCH-FP project treatment area and the Urban Surveillance System of the Dhaka slum study area of the Urban Health Extension Project.

Record Keeping System

Matlab is a large rural thana (administrative area) situated about 55 km to the south-east of Dhaka. In 1977, the Matlab Family Planning and Health Services Project, now called the Maternal and Child Health/Family Planning Project (MCH-FP Project), was launched in order to test whether an intensive family planning programme could succeed in the absence of extensive socio-economic development. Half the villages in the study area, with a population of 89,000, were designated as the treatment area and received intensive services, while the rest comprised the comparison area, receiving only government services (Koenig and others, 1987).

Throughout the treatment area of the MCH-FP Project, the community health workers use field registers to record information regarding married women of reproductive age (15-44 years) and their children aged under five years, as they make their routine service visits. This information is kept in a computerized database known as the Record Keeping System (RKS). When a woman enters the treatment population for the first time, baseline information is recorded. Thereafter, a longitudinal record of each woman's monthly reproductive, contraceptive and lactational status is available, together with other health-related information and background data. A number of in-depth surveys and censuses have also been carried out there over the past 20 years.

Urban Surveillance System

The Urban Health Extension Project of ICDDR,B, a health and family planning research project, worked in the slum communities of five of the fourteen thana of the Dhaka metropolitan area. The Urban Surveillance System (USS) is a demographic, health and family planning surveillance of a probability sample of slum settlements in the five study thana. Following household registration and a baseline survey, demographic surveillance was maintained from January 1992 to June 1994 in approximately 8,000 households. Demographic, family planning and health-related information was collected routinely on a three-monthly cycle. In addition, special surveys, addressing particular issues of importance, were fielded from time to time. A more detailed description of the system can be found in Baqui and others (1994).

Data sets and data limitations

Despite some methodological complexities, the longitudinal data from the RKS and USS provided an excellent opportunity to explore the risks of pregnancy following birth in two relatively large samples drawn from natural populations of Bangladeshi women.

In order to explore the risks of pregnancy in the postpartum period, a population totally not practising contraception ideally should be taken, since the adoption of contraception obviously affects the risk of pregnancy, and is also likely to be positively associated with fecundity. Since contraceptive use in the postpartum period has risen sharply in Matlab in recent years (Salway and Nurani, 1998), an examination of pregnancy risks during postpartum amenorrhoea would be severely biased for recent cohorts of women. Therefore, data from the early years of the MCH-FP Project were chosen (1978/79) when the practice of contraception during amenorrhoea was relatively uncommon. The use of data from 1978/79 implies caution in extrapolating the results to the present time. However, as discussed further below, the prevailing patterns of breastfeeding and postpartum amenorrhoea do not appear to differ substantially between the rural Matlab population of 1978/79 and the national rural population of the 1990s. Furthermore, since information was available for a large cohort of women, differentials in pregnancy risk between sub-groups of women could be explored and the findings produced are of relevance to present-day policy decisions.

As well as the rural data set, more recent data on pregnancy risks during amenorrhoea could be analysed from the Dhaka slum population, from 1992/93. In both the study cohorts, contraceptive use in the early postpartum period was relatively low and unlikely to affect seriously the estimates produced.2

The RKS data analysed in the present study were gathered through the existing data collection system described above. The data consisted of the two-year cohort of women who had a live birth in the Matlab treatment area in the period 1978/79. For each live birth, the woman's monthly reproductive and contraceptive records for the 36 months following the birth were extracted from the RKS database, together with background variables describing the woman's education, religion and socio-economic status. In creating the data file for analysis, 229 cases had to be dropped owing to missing data or inconsistencies and the final sample size was 5,558.

The data analysed from the USS related to women who had a live birth between April 1992 and June 1993 in the sample clusters of the USS. A special add-on questionnaire was administered to each woman at each three-monthly visit following the birth, and careful probing was used to ascertain the timing of resumption of menses, uptake of contraception and any subsequent pregnancy. Each woman was followed up until any one of three possible end-points: resumption of menstruation and initiation of contraception, conception, or loss to follow-up (owing to out-migration from the cluster, or absence from the household for two consecutive visits). A total of 1,201 women were reported to have had a live birth in the period, of whom 1,151 were successfully followed up and received the special questionnaire at least once. The remaining 50 women were lost to follow-up before the questionnaire could be administered. In the absence of out-migration, the maximum period of follow-up was 27 months and the minimum was 12 months.

Women's reports of resumption of menses postpartum are obviously prone to a number of potential sources of error. The urban data, in particular, are less accurate, because they involved a greater period of recall (on average six weeks versus two weeks for Matlab). However, our own detailed qualitative fieldwork suggests that the resumption of menses postpartum is a key event for Bangladeshi women and an important trigger for the start of contraception. The duration of postpartum amenorrhoea and the return of menses was commonly discussed among women, and pregnancy during amenorrhoea was given a special term (mura). Earlier research also suggests that women can recall menstrual events quite accurately (WHO, 1981) and that women's descriptions of bleeding episodes correspond closely to hormonal profiles (Campbell and Gray, 1993) suggesting that women do take notice of their postpartum bleeding experiences. Furthermore, an examination of the distribution of the reported timing of resumption of menses postpartum for the urban sample did not show any serious irregularities when compared with that for Matlab. During data collection in both areas, special care was taken to avoid confusion between postpartum lochial bleeding and resumption of menses.

A limitation of the study was that breastfeeding information was not available for the urban cohort. This meant that analyses of pregnancy risk could not be explored for different breastfeeding patterns in the urban population. Nevertheless, pregnancy risks could be calculated for all amenorrhoeic women and are presented below.

In both the Matlab and the Dhaka slum cohorts, the majority of women were Muslim. The mean age of the Matlab women was 25.9 years and their mean number of living children was 3.1. For the Dhaka women, these figures were 25.1 years and 2.7 living children, respectively. Around 30 per cent of the Matlab women had received some schooling compared with 20 per cent of the urban women.

Pregnancy reporting and adjustments

In the absence of hormonal data indicating the resumption of ovarian activity, the pattern of reported conception by time postpartum was used to assess the risks of pregnancy following birth. Relying on women's self-reports of pregnancy necessarily means that rates of conception are somewhat underestimated. A certain number of pregnancies that result in early miscarriage will remain undetected. In addition, experience suggests that women do not always report pregnancy soon after it occurs, either because they do not realize they are pregnant or, more likely, choose not to divulge the information to others at an early stage of the pregnancy. This delay is particularly likely in cases where the woman chooses to terminate the pregnancy. Reports of pregnancies that occur during postpartum amenorrhoea are likely to be subject to particularly long delays even where a woman wants to be pregnant, since she may not suspect pregnancy until familiar symptoms arise.

Recognizing the potential for delayed reporting of pregnancy, the RKS and USS data were carefully examined before embarking on an analysis of pregnancy risks. The nature of the analysis called for caution - it would clearly be unwise to underestimate the risks of pregnancy in the postpartum period, and draw exaggerated conclusions about the contraceptive potential of lactation. Examination of reported gestational lengths suggested that the vast majority of women in both Matlab and the Dhaka slums reported their pregnancy within three months of conception and therefore the following adjustments were made to the pregnancy reporting in the data sets:

RKS: For all live birth outcomes, the timing of conception was adjusted to give a gestational period of nine months. For pregnancies where the outcome was not a live birth, the timing of conception was adjusted back in time by three months (or less if this resulted in a period of gestation of nine months).3

USS: For all live birth outcomes, the timing of conception was adjusted to give a gestational period of nine months. For pregnancies where the outcome was not a live birth, the timing of conception was adjusted back in time by four and a half months (or less if this resulted in a gestational period of nine months).4, 5

Findings

Durations of postpartum amenorrhoea and breastfeeding

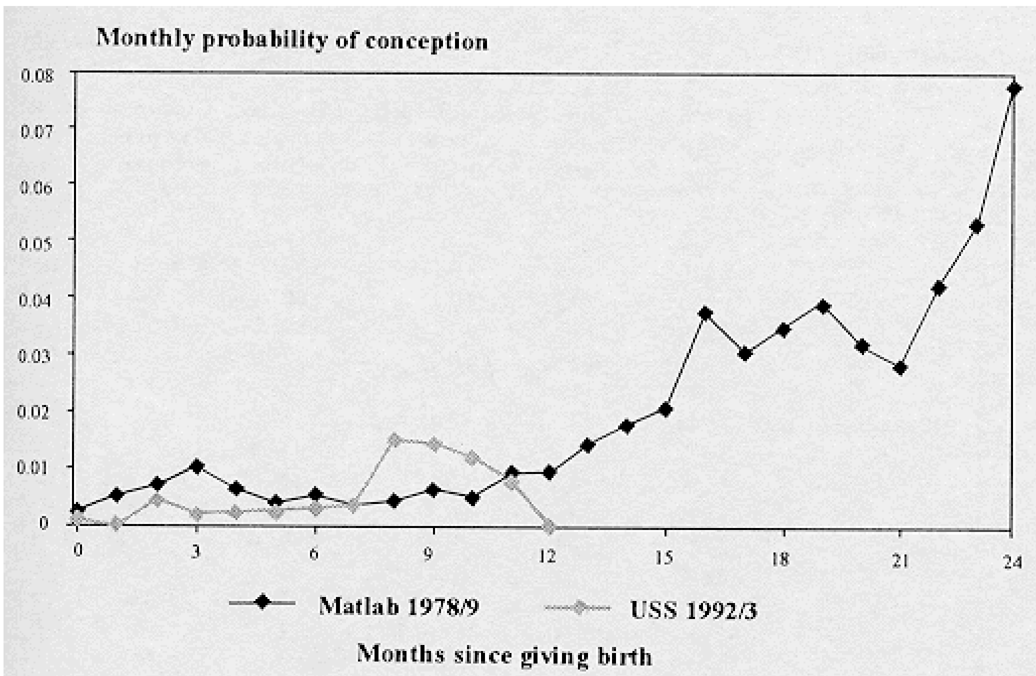
There was wide variation in the reported durations of postpartum amenorrhoea between and within the two cohorts of women. Among the urban women (1992/93), the median duration of postpartum amenorrhoea was 7.5 months (se=0.5), whereas among the Matlab women (1978/79), the median was 13.7 months (se=0.2). In both samples, some women reported resumption of menses very soon after birth. However, life table analysis showed that less than 1 per cent of the Matlab women reported resumption of menses within two months of giving birth compared with 13 per cent of the urban slum women.

As noted above, breastfeeding information was unfortunately not available for the cohort of urban women. However, information has been presented for the same surveillance area for a slightly earlier period (1990) by Baqui and others (1993).

Women in both populations appear to breastfeed for extended periods of time. The median duration of all breastfeeding (full plus partial) was 33.9 months (se=0.2) in the Matlab 1978/79 cohort. Similarly, the data reported by Baqui and others (1993) indicate a median duration of all breastfeeding of over 30 months. Turning to exclusive breastfeeding, larger differentials were evident between the rural Matlab and the urban slum populations. Baqui and others (1993) reported that, among children aged three to five months in the USS areas, only 10 per cent were exclusively breastfed. In the Matlab 1978/79 cohort, at three months old 82 per cent of children were still fully breastfed, and by five months of age, this figure was 60 per cent. Though the difference may in part be explained by the fact that the USS definition of "exclusive" breastfeeding was more strict than the Matlab definition of "full" breastfeeding, field-level observations support the suggestion that supplementation of the infant's diet occurs earlier in the slum setting, even though the overall duration of breastfeeding remains long.

Probabilities of conception during postpartum amenorrhoea

Figure 1. Monthly probability of contraception among



In the first stage of the analysis of pregnancy risk, the monthly probabilities of conception during amenorrhoea by time after birth for women not practising contraception were calculated using life table analysis (cases being censored at loss to follow-up, resumption of menses, or adoption of contraception). Figure 1 plots the risks for all such women, regardless of breastfeeding status, for the RKS and USS data. The figure shows that in both Matlab and the Dhaka slum populations, the monthly probability of conception among amenorrhoeic women fluctuated at around 0.006 over the first 12 months postpartum. The estimates for the USS are based on smaller numbers and are therefore less stable. When the analysis was repeated excluding women whose child died within the first two months of life (and thus ceased breastfeeding soon after birth or were not breastfed at all), the pregnancy risks were lower, as expected, fluctuating around 0.004 for the first 12 months. The small numbers and truncated follow-up in the USS sample make it difficult to draw any firm conclusions about changing risk of pregnancy over the first 12 months postpartum. However, the figures for Matlab suggest that the probability of conception begins to rise only beyond 10 months postpartum.

Table 1. Life table cumulative percentage of amenorrhoeic women not practising contraception, conceiving, by time since birth, in Matlab (1978/79) and Dhaka slums (1992/93) Months after giving birth All women Excluding women whose child died before two months of age

Months after giving birth	All women			Excluding women whose child died before two months of age		
	Effective sample size	Cumulative percentage	Standard error	Effective sample size	Cumulative percentage	Standard error

Matlab 1978/79						
0	5,532.5	0	(0)	5,123.0	0	(0)
1	5,459.5	0.2	(0.1)	5,072.0	0.1	(0.04)
2	5,264.0	0.7	(0.1)	4,950.5	0.2	(0.05)
3	4,889.0	1.4	(0.2)	4,685.0	0.3	(0.08)
4	4,431.5	2.4	(0.2)	4,323.0	0.7	(0.1)
5	4,044.0	3.0	(0.2)	3,983.0	1.0	(0.1)
6	3,744.5	3.3	(0.3)	3,704.5	1.2	(0.2)
7	3,477.5	3.8	(0.3)	3,448.5	1.6	(0.2)
8	3,236.5	4.1	(0.3)	3,211.5	1.9	(0.2)
9	3,020.5	4.5	(0.3)	2,999.0	2.3	(0.2)
10	2,822.5	5.0	(0.3)	2,803	2.8	(0.3)
11	2,643.5	5.4	(0.4)	2,626.0	3.2	(0.3)
12	2,453.5	6.2	(0.4)	2,438.5	3.9	(0.3)
13	2,257.0	7.0	(0.4)	2,245.0	4.6	(0.4)
14	2,050.5	8.2	(0.5)	2,041.0	5.9	(0.4)
15	1,848.5	9.8	(0.5)	1,839	7.4	(0.5)
Dhaka slums 1992/93						
0	1,051.0	0	(0)	975.0	0	(0)
1	854.0	0.1	(0.1)	805.0	0	(0)
2	688.0	0.1	(0.1)	667.0	0	(0)
3	580.0	0.5	(0.3)	571.5	0.3	(0.2)
4	500.5	0.7	(0.3)	496.5	0.5	(0.3)
5	432.5	0.9	(0.4)	429.5	0.7	(0.3)
6	378.5	1.1	(0.4)	376.0	0.9	(0.4)
7	330.5	1.4	(0.5)	328.5	1.2	(0.5)
8	277.5	1.7	(0.6)	276.5	1.5	(0.6)
9	221.0	3.1	(0.9)	221.0	2.9	(0.9)
10	178.5	4.4	(1.1)	178.5	4.2	(1.1)
11	141.5	5.5	(1.4)	141.5	5.3	(1.4)
12	108.0	6.2	(1.5)	108.0	6.0	(1.5)

Notes: Includes all amenorrhoeic women regardless of breastfeeding status.

In the first 12 months, out of all women in the Matlab cohort, 2,480 cases were censored. Of these, 63 per cent were due to the return of menses, 31 per cent due to the adoption of contraception and 6 per cent due to loss to follow-up.

In the first 12 months, out of all women in the Dhaka slum cohort, 1,005 cases were censored. Of these, 59 per cent were due to return of menses, 7 per cent due to start of contraception and 34 per cent due to loss to follow-up.

Standard errors are given in parentheses.

Table 1 shows the cumulative percentage of amenorrhoeic women not practising contraception who conceived by time since birth in the Matlab and USS cohorts. In Matlab, among all women who remained amenorrhoeic, 3.4 per cent (se=0.3) conceived within six months of their birth, and 6.2 per cent (se=0.4) by 12 months. In the USS population, these figures were 1.1 per cent (se=0.4) and 6.2 per cent (se=1.5). When the women whose child died within two months were excluded, less than 2 per cent of the remaining amenorrhoeic women not practising contraception conceived by six months postpartum in both Matlab and the Dhaka slums. That is, among women whose child survived to at least two months of age, the cumulative risk of conception among all those who remained amenorrhoeic regardless of their breastfeeding status was less than 2 per cent by six months and less than 3 per cent by nine months (table 1).

Differentials in pregnancy risk during postpartum amenorrhoea

The above analysis suggests that lactational amenorrhoea provides good protection against pregnancy in the first six to nine months following birth for Bangladeshi women. We turn now to examine differentials in pregnancy risk during postpartum amenorrhoea. It is of particular interest to explore whether breastfeeding status has an important influence on the risk of pregnancy during amenorrhoea for Bangladeshi women. Furthermore, to what extent postpartum amenorrhoea affords the same protection against pregnancy among different subgroups of women is an important issue and one that has not been addressed in most earlier studies. Data for the 1978/79 Matlab cohort provided an opportunity to explore in more detail the change in risk of pregnancy during lactational amenorrhoea by time postpartum, as well as the risks associated with different breastfeeding patterns and other maternal characteristics. Unfortunately, breastfeeding data were not available for the USS cohort and the sample size was too small to perform hazard model analyses using the USS data.

Methodological comments

In order to explore these relationships, the logistic formulation of the hazard model was used. Hazard models are now commonly employed in demographic analysis in order to allow the incorporation of time-varying covariates and censored observations (John, Menken and Chowdhury, 1987; Becker and Ahmed, 1994). In the logistic formulation of the hazard model, each individual's period of observation is represented in the model by several observations, one for each time unit of observation. In the present case, each individual woman contributes several months of observation to the analysis, one for each postpartum month during which she was followed up. A woman's period of follow-up continues from the month of her child's birth until she becomes pregnant again or is censored. In this case, censoring can occur for any of three reasons: loss to follow-up, adoption of contraception, or resumption of menses. In each observation, the dependent variable takes the value of "1" if pregnancy occurred, and "0" if pregnancy did not occur. Fixed covariates take the same value in every observation relating to a particular individual, for example age, education or number of living children. However, the value of time-varying covariates is allowed to change between monthly observations. In addition, the models can be used to test whether the effects of variables vary over time. The models estimated therefore test the general hypothesis that the probability of a woman conceiving during amenorrhoea depends on both the time since her last birth and a number of other factors.

The logistic model for the odds of conceiving in a given month after birth can be expressed as:

$$\log \frac{\pi}{1-\pi} = \beta_0+\beta_1 x_1+\beta_2 x_2+\beta_3 x_3+ \ldots \beta_n x_n+\varepsilon$$

where:

π	=	probability of conceiving during amenorrhoea in a given month.
β_0	=	constant term representing the value of $\log(\pi/(1-\pi))$ for months with the baseline value of all variables to x_1 to x_n in the model.
x_1 to x_n	=	independent variables associated with the month of observation (which may be fixed characteristics of the woman, or time-varying characteristics, including time postpartum).
β_1 to β_n	=	unknown regression coefficients associated with the independent variables x_1 to x_n. A unit change in the corresponding independent variable produces a change in $\log(\pi/(1-\pi))$ of this amount.
ε	=	error or disturbance term representing unobserved variables that influence the risk of conception.

In the present example, one time-varying covariate was of interest, namely breastfeeding status. The RKS data available included three categories of breastfeeding status: full, partial and none. Defining breastfeeding status and collecting information on breastfeeding patterns is complex, and comparisons between different populations are often difficult. Breastfeeding patterns are diverse and transitions between states gradual. In Matlab, "full" describes those women who give no regular supplementation to the baby's diet in addition to breastmilk, whereas the "partial" category includes women who give foods other than breastmilk (either liquid or solid) on a regular basis. "None" describes women who are not feeding their child at the breast at all. Because the "partial" category is clearly broad and includes a variety of breastfeeding patterns, the technique used by John, Menken and Chowdhury (1987) was followed in order to divide the partial category into two groups, depending on how many months earlier supplementation had been initiated. In this way, breastfeeding status for each woman was described by up to four categories over the period of follow-up: full; partial (supplementation occurred 0-6 months earlier); partial (supplementation occurred seven or more months earlier); and no breastfeeding. The rationale for this categorization is that the process of weaning is gradual, with supplements to breastmilk being introduced occasionally at first, and then more often later. Therefore, the frequency of supplementary feeds and the proportion of all feeds that are supplementary are likely to be greater among women who initiated supplementation of the child's diet longer ago, than among those who started supplementation only recently. In cases where the value of the breastfeeding variable changed in the same month as pregnancy status, it was assumed that the change in the independent variable occurred first. Though it is unreasonable to assume that this sequence is valid in all cases, findings from previous research suggest that this is the most appropriate assumption to make.

Time postpartum and breastfeeding status

Initial analysis explored the pattern of risk of pregnancy by time postpartum. Life table analysis presented above suggested that the risk of pregnancy does not increase significantly until around 10 months postpartum. In the present logistic regression analysis, having examined the monthly risks of pregnancy graphically, four categories of time postpartum were initially selected: 2-6 months, 7-10 months, 11-15 months and 16-24 months.6 Results of the basic model, which included only time postpartum, suggested that risk of pregnancy does not differ between the 2-6-month time period and 7-10-month period (odds ratio 1.37, p=0.097), but that the risk does increase significantly beyond 10 months.

Next, the relationship between breastfeeding status and risk of pregnancy was explored. Results of the model which included only breastfeeding status suggested that partial breastfeeding, even when it has been only recently introduced, does significantly increase the risk of pregnancy compared with full breastfeeding (odds ratio 1.85, p=0.003), and that the risk is increased further for partial breastfeeders who initiated supplementation longer ago, and further again for women who are not breastfeeding at all.

However, further analysis revealed that the relationships between time postpartum, breastfeeding status and risk of pregnancy, are not simple. Evidence of effect modification (or interaction) was found, so that the effect of a change in breastfeeding status was seen to differ at different times postpartum. Table 2 presents the results of four basic models including only the breastfeeding variable, one for each of the four time periods: 2-6 months, 7-10 months, 11-15 months and 16-24 months.

Table 2. Logistic regression odds ratios of conception during amenorrhoea associated with breastfeeding status, modelled for different time periods after childbirth, Matlab (1978/79)

Breastfeeding status	Time period after birth							
	Model 1 2-6 months		Model 2 7-10 months		Model 3 11-15 months		Model 4 16-24 months	
	Odds ratio	P	Odds ratio	P	Odds ratio	P	Odds ratio	P
Full breastfeeding	1	--	1	--	1	--	1	-
Partial, 0-6 months	1.83	0.05	1.23	0.60	1.10	0.27	1.56	0.54
Partial, 7+ months	--	--	2.85	0.03	1.22	0.59	1.71	0.24
No breastfeeding	66.10	<0.001	33.09	<0.001	8.99	<0.001	3.38	0.04
N[a]	20,938		12,055		10,767		8,211	

a N refers to the total number of months of observation contributed by all women in each group.

It should be noted that some categories contained smaller numbers of observations, such as "full, 16-24 months" and "no breastfeeding 2-6 months", so that the power to detect differences was lower for these subgroups. Nevertheless, the results suggest that the odds ratios for partial breastfeeding and no breastfeeding compared with full breastfeeding decline with increasing time since the birth. In the first six months postpartum, women who introduce supplements to their child's diet are at higher risk of pregnancy than those who breastfeed fully (though the odds ratio only just reaches significance at the 5 per cent level). However, beyond this time, there is no significant difference in the risks of pregnancy associated with full breastfeeding and partial breastfeeding where supplementation has been introduced within the past six months. In the time period 7-10 months, women who are breastfeeding partially and who introduced supplements seven or more months previously are at higher risk of pregnancy than full breastfeeders (and partial breastfeeders who introduced supplements within the previous six months). Beyond 10 months postpartum, there is no significant difference in the risks of pregnancy associated with partial breastfeeding compared with full breastfeeding, even if it has been initiated seven or more months previously. This suggests that women who introduce supplements to their child's diet within the first six months postpartum are at higher risk of pregnancy during the first six months, and remain at higher risk up to 10 months postpartum. Thereafter, as long as these women continue to breastfeed, it appears that their risk is not significantly higher than women who introduced supplements later in the child's life, or continue to breastfeed fully.

The risk of conception among non-breastfeeders remains significantly higher than among full breastfeeders at all times postpartum, though the odds ratio declines with increasing time since the last birth. Several factors may contribute to the declining odds ratios with time. First, the risk of pregnancy for full breastfeeders appears to increase sharply beyond 10 months postpartum. Second, a selection mechanism is in operation where the more fecund among the partial and non-breastfeeding women conceive rapidly, leaving a pool of less fecund women behind in these groups. Third, women who are not breastfeeding at all in the early months postpartum are a selected group, largely consisting of women whose child has died. These women may have particularly high risks of pregnancy owing to higher coital frequency.

As well as comparing the risks of pregnancy to a baseline of full breastfeeding, it is of interest to examine the differentials in risk between partial breastfeeding and no breastfeeding at all. The results suggest that up to 15 months postpartum, partial breastfeeding continues to provide some additional protection against pregnancy compared with no breastfeeding at all. In the period 11-15 months, the odds ratio of no breastfeeding compared with partial breastfeeding with supplementation seven or more months previously was 7.4 (p<0.001). Beyond 15 months, women who were still fully breastfeeding or had initiated supplementation within the previous six months had significantly lower risks of pregnancy than those who were not breastfeeding at all. However, for women who had started supplementation seven or more months earlier, the risk of pregnancy was not significantly lower than for those who were not breastfeeding. It can therefore be concluded that women who start to introduce supplements to their child's diet at around five or six months postpartum (as currently recommended) but continue to breastfeed partially, can enjoy a significantly higher degree of protection against pregnancy during amenorrhoea for well over a year following the birth, than women who wean their child completely.

Further exploration confirmed that risks of pregnancy do not increase with time postpartum per se until beyond 10 months postpartum. Two models were estimated where the pattern of risk with time postpartum was examined, first for full breastfeeders alone, and second for partial breastfeeders who had initiated supplementation within the previous six months. The results showed no significant difference in the risk of pregnancy among full breastfeeders in the period 7-10 months compared with the period 2-6 months. Beyond 10 months, however, the risk of pregnancy increased significantly. The same pattern was seen among partial breastfeeders who had introduced supplements within the previous six months (results not shown).

Other maternal characteristics

In addition to examining the pattern of pregnancy risks during amenorrhoea by time postpartum and breastfeeding status, it was of interest to explore whether other maternal characteristics are associated with risk of conception. In this stage of the analysis, age, number of living children, religion, education and household area (a measure of socio-economic status) were considered as independent variables. Bivariate analyses suggested that risk of pregnancy during amenorrhoea is negatively associated with age, and positively associated with education. No significant association was found with number of living children, religion or household area.

The associations observed could be explained by differing breastfeeding patterns, and/or differing levels of underlying fecundability (fecundity and/or coital frequency). When models were estimated that included breastfeeding status, the effect of education was found to lose significance, suggesting that the higher risks of pregnancy among more educated women are explained by their tendency to introduce supplements to their child's diet earlier.

Table 3. Logistic regression odds ratios of conception during amenorrhoea: final model, Matlab (1978/79)

	Odds ratio	P	95 per cent confidence interval
Women's age (years)			
30+	1	-	-
<30	1.89	<0.001	1.56-2.29
Time postpartum and breastfeeding status			
2-10 months, full	1	-	-
2-10 months, partial	1.87	0.005	1.21-2.87
2-10 months, none	54.62	<0.001	32.74-91.10
11-15 months, full	5.44	<0.001	2.69-10.97
11-15 months, partial	6.63	<0.001	4.57-9.60
11-15 months, none	54.65	<0.001	27.14-110.04
16-24 months, full	12.64	<0.001	4.92-32.51
16-24 months, partial	22.66	<0.001	16.08-31.92
16-24 months, none	52.62	<0.001	23.78-116.47

N = 51,970 months of observation contributed by all women.

In the case of age, however, even when breastfeeding status was controlled for, a significant negative association persisted, and in fact the size of the effect increased. Table 3 presents the results from the model where time postpartum and breastfeeding status were controlled for using an interaction term. In order to keep the number of cells manageable, three categories have been used for breastfeeding status: full, partial and none. A baseline of full breastfeeding during the 2-10-month period has been used. The odds ratio for risk of pregnancy for women aged less than 30 years compared with women 30 years or older was 1.89 (p<0.001). No significant difference was found between women aged less than 20 years and those aged 20-29 years.

Table 4. Percentage of amenorrhoeic women not practising contraception, conceiving, by time since birth, under different breastfeeding scenarios (based on predicted probabilities rom Matlab 1978/79 regression model)

Hypothetical scenario	Percentage of women who would conceive		
	By 6months postpartum	By 9 months postpartum	By 12 months postpartum
Breastfeed fully for 6 months			
Age <30	1.1	-	-
Age 30+	0.6	-	-
Breastfeed fully for 6 months and partially from 6 to 12 months			
Age <30	1.1	2.3	5.5
Age 30+	0.6	1.2	3.0
Breastfeed partially from birth to 12 months			
Age <30	2.1	3.3	6.4
Age 30+	1.1	1.7	3.5

Having fitted the final model, the predicted probabilities were used to calculate cumulative risks of pregnancy for hypothetical scenarios as shown in table 4. In this way, it was estimated that 0.6 per cent of women aged 30 or older who fully breastfeed for six months would conceive during amenorrhoea by six months postpartum, compared with 1.1 per cent of women aged less than 30. For women who fully breastfeed for six months and then go on to partially breastfeed up to one year, 1.2 per cent of women aged 30 or older would conceive by nine months postpartum and 3.0 per cent by 12 months, compared with 2.3 per cent and 5.5 per cent, respectively, of women aged less than 30. For women who partially breastfeed from birth onwards, the risks are somewhat higher, though still low. Among women aged 30 or older, 1.1 per cent would conceive by six months postpartum, 1.7 per cent by nine months and 3.5 per cent by 12 months, compared with 2.1 per cent, 3.3 per cent and 6.4 per cent, respectively, among women aged less than 30.

Comparisons with findings from other populations

The results suggest that postpartum amenorrhoea afforded significant protection against pregnancy in these two contrasting Bangladeshi sub-populations. Whereas the data from Matlab were from an older cohort, i.e. 1978/79, among whom breastfeeding was relatively intense and extended, the USS 1992/93 data came from a population among whom supplementation occurred soon after birth in many cases (Baqui and others, 1993). Despite these differences, risks of pregnancy during lactational amenorrhoea were found to be low among women in both the cohorts. Among women whose child survived to at least two months of age, the cumulative risk of conception among women who remained amenorrhoeic by six months was less than 2 per cent in both populations. In line with other studies, hazard model analysis of the Matlab 1978/79 data showed that full breastfeeding affords significantly greater contraceptive protection than partial breastfeeding. However, partial breastfeeders were also found to enjoy good protection against pregnancy during amenorrhoea in the months after birth.

Results also suggest that lactational amenorrhoea can afford good protection against pregnancy beyond six months postpartum. The Matlab analysis showed that the monthly probability of conception during amenorrhoea does not start to rise until around 10 months postpartum, and in both study populations, the cumulative percentage of amenorrhoeic women (whose child survived to at least two months) conceiving by nine months was less than 3 per cent.

Earlier estimates of monthly probabilities of conception during amenorrhoea have not been very consistent. The present results for women whose child survived beyond two months accord very well with the figure of 0.0032 for the monthly probability of conception during the first six months after birth, estimated by Campbell and Gray (1993) for a sample of American women. They are also in line with the estimates presented by Zablan (1985) for Filipino women. Moreover, the current findings, which suggest that lactational amenorrhoea provides good contraceptive protection even when supplementation is provided and that this protection may extend beyond six months, are consistent with findings from other recent studies. Table 5 shows that the current estimates are remarkably similar to those from a pooled data set including data from eight countries (Kennedy and Visness, 1992). Other recent studies in Pakistan (Kazi and others, 1995) and Rwanda (Cooney and others, 1996) have also reported low risks of pregnancy for amenorrhoeic women beyond six months postpartum.

Table 5. Life table cumulative percentage of amenorrhoeic women not practising contraception, conceiving, by time since birth: findings from different sources compared

Months after birth	Matlab 1978/79		Dhaka slums 1992/93		FHI pooled data	
3	0.3	(0.1)	0.3	(0.2)	0.4	-
6	1.2	(0.2)	0.9	(0.4)	2.9	(2.3)
9	2.3	(0.2)	2.9	(0.9)	2.9	-
12	3.9	(0.3)	0.6	(1.5)	5.9	(4.7)
N	5,144		1,063		346	

Notes: FHI pooled data come from eight different countries and were reported by K.I. Kennedy and C.M. Visness (1992). "Contraceptive efficacy of lactational amenorrhoea" Lancet 339(8787):227-230.

Matlab and Dhaka slum estimates are from the samples where woman whose child died before two months of age (and were therefore breastfed for only a very short time or not at all) were excluded.

Life table analyses. For the FHI pooled estimates, women were censored if menses resumed or they stopped breastfeeding altogether, or at loss to follow-up. In the Matlab and Dhaka slum analyses, women were censored if menses resumed or at loss to follow-up. No information was available for the USS cohort on breastfeeding. However, we know that breastfeeding was extended in both the study populations. Therefore, very few women would have been censored due to the complete termination of breastfeeding had the information been available.

However, other studies have reported higher risks. A study of Australian women produced an estimate of the monthly probability of conception of 0.01 for the first six months postpartum and 0.025 for the second six months (Short and others, 1991), figures which are significantly higher than for the current data. This suggests that there may be real variations between populations of breastfeeding women in the risk of pregnancy during amenorrhoea, particularly in the second six months postpartum.

Table 6. Percentages pregnant by time since last birth among breastfeeding and non-breastfeeding women not practising contraception: findings from various studies compared

Breastfeeders					
Months postpartum	**Punjab**	**Eskimo**	**FHI pooled data**	**Matlab 1978/79**	**Australia**
3	0.4	0	-	1	3
6	2	1	8	3	14
12	13	19	17	8	51
N	800	300	346	5,370	101
Non-breastfeeders					
Months postpartum	Punjab	Eskimo	Chile	Matlab 1978/79	United Kingdom (UK)
3	7	9	5	18	6
6	40	44	72	50	46
12	55	82	85	79	84
N	200	100	74	188	90

Notes: Australian data are from R.V. Short, P.R. Lewis, M.B. Renfree and G. Shaw (1991). "Contraceptive effects of extended lactational amenorrhoea: beyond the Bellagio Consensus" Lancet 337(8743):715-717; and UK data from T.J. Cronin (1968). "Influence of lactation upon ovulation" Lancet 24 August, 2:422-424.

Punjab and Eskimo data are cited in J.K. Van Ginneken (1974). "Prolonged breast feeding as a birth spacing method" Studies in Family Planning 5(6):201-205.

Chilean data are from S. Zacharias, E. Aguilera, J.R. Assenzo, J. Zanartu (1987). "Return of fertility in lactating and non-lactating women" Journal of Biosocial Science 19(2):163-169.

Breastfeeders were women who initiated breastfeeding, while non-breastfeeders were those who never breastfed. Some breastfeeders may have stopped breastfeeding prior to conception, but in all populations the great majority of women who initiated breastfeeding continued to do so for an extended period.

It is of interest to consider to what extent such differentials reflect differences in the breastfeeding patterns of the populations, and to what extent an alternative explanation is required, such as differing levels of underlying fecundability and maternal nutritional status. Table 6 presents results from the Matlab 1978/79 cohort and the Australian cohort (reported by Bracher, 1992), along with those from a number of other studies. Here, the percentage of women not practising contraception and conceiving (irrespective of menstrual status) by time since last birth is contrasted for women who breastfeed and those who do not. Among breastfeeders, the results reported for the Punjab and the Eskimo populations (cited in Van Ginneken, 1974), as well as those from the FHI study (Kennedy and Visness, 1992) and the results from the present analysis of the Matlab RKS data, show similar low percentages of women conceiving in the first year following the birth of a child. In contrast, the data from the Australian study show quite a different picture. Among the Australian breastfeeders, 3 per cent conceived within three months, 14 per cent by six months and 51 per cent by one year, compared with figures for the Matlab women of 1, 3 and 8 per cent, respectively.

Comparing results for non-breastfeeders should throw light on whether there are underlying differences in fecundability between the populations.7 Unfortunately, the data Bracher (1992) presents for non-breastfeeders come from an older study in the United Kingdom of Great Britain and Northern Ireland. Table 6 shows the results for this population, together with those for the Punjab and Eskimo populations, a study in Chile and for the present analysis of Matlab data. Though the estimate at three months for the Matlab cohort is higher than for the other data sets,8 at six months and one year, the estimates for the different populations are remarkably similar. At six months, the cumulative percentage of non-breastfeeding women who had conceived were 40, 44, 50 and 46 per cent for the Punjab, Eskimo, Matlab and British data, respectively. The estimate for the Chilean population is higher, at 72 per cent, although it is based on a rather small sample. Though comparisons between different populations are complicated by differing study designs and, in many cases, small sample sizes, the available data did not suggest important differences in underlying fecundability.

However, despite apparent similar levels of fecundability among non-breastfeeding women, it is possible that poor maternal nutritional status could interact with the demands of breastfeeding to lower the capacity to conceive among lactating women. Previous research in Bangladesh has shown a small but significant difference in the duration of postpartum amenorrhoea among women with differing body weights. Huffman and others (1987) reported an increase of 3 per cent in the risk of resuming menses for each kg in the mother's weight, having controlled for other factors in a hazard model analysis. They posited that the effect operates both directly via hormonal responses influencing resumption of menses and also indirectly via variations in infant suckling patterns as a response to differential milk output from mothers of differing nutritional status. However, no study that we are aware of has systematically investigated whether the risk of pregnancy while amenorrhoeic varies significantly with maternal nutritional status. Nevertheless, such a relationship is entirely plausible and may account in part for the differences found in the risk of pregnancy during amenorrhoea between the Bangladeshi (and other developing country settings) and the Australian samples.

Though maternal undernutrition may play a part, it seems likely that differences in patterns of breastfeeding are also an important explanation for the differing risks of pregnancy during lactational amenorrhoea observed between some populations. The data available in the present study were inadequate for elucidating important differences in frequency and intensity of breastfeeding between the study cohorts and other populations. Nevertheless, the available evidence suggests that breastfeeding in Bangladesh is relatively intense, with frequent suckling. For example, among urban slum mothers the mean number of breastfeeds per day (among exclusive and not exclusive breastfeeders) was around 13 for children aged up to 11 months of age, and around 20 per cent of children received 18 or more breastfeeds per day (Baqui and others, 1993). This frequency did not decrease greatly until beyond the second year of life. For the rural population, it seems likely that the frequency may be even higher. Gray and others (1990) reported significantly higher frequencies of breastfeeding throughout the first year of life among Filipino women than American women in their study of intensively breastfeeding women. The assertation of Bracher (1992:24) therefore seems questionable, i.e. that his data "present the best-case scenario in terms of durations of lactation and lactational amenorrhoea since few women in developing countries have the leisure to breastfeed with the dedication exhibited by the participants in the Australian study".

Discussion and implications

The results from both study populations indicate a high degree of protection against pregnancy for amenorrhoeic women. Whereas the data from Matlab were from an older cohort, 1978/79, when breastfeeding was relatively intense and extended, the USS 1992/93 data came from a population where supplementation occurred soon after birth in many cases. Despite these differences, risks of pregnancy during lactational amenorrhoea were found to be low among women in both cohorts. In Matlab, full breastfeeding was found to afford significantly greater contraceptive protection than partial breastfeeding, though partial breastfeeders were also found to enjoy good protection against pregnancy while amenorrhoeic in the months after birth. This effect is most likely the result of intensive breastfeeding despite supplementation. The results also suggest that lactational amenorrhoea can afford good protection against pregnancy beyond six months postpartum, particularly for women who fully breastfeed in the first six months. Findings from the multivariate analysis of the Matlab data also revealed an age differential that has so far been overlooked in most investigations of the risk of pregnancy during amenorrhoea. Older women were found to have significantly lower risks of conception during postpartum amenorrhoea than younger women.

Although the data allowed an examination of pregnancy risks among two large cohorts of Bangladeshi women, some potential limitations should be acknowledged. First, as noted above, women's reports of resumption of menses and timing of conception are necessarily subject to a certain degree of error. However, efforts were made during data collection to ensure good quality data and, at the time of analysis, conservative adjustments were made in order to avoid overestimating the contraceptive effect of lactational amenorrhoea.

Second, a number of unobserved factors could have resulted in the low risks of pregnancy recorded. No information was available on coital frequency. It might be suggested that low pregnancy rates compared with western populations are explained by postpartum abstinence and reduced coital frequency. Evidence from in-depth interviews with women presented elsewhere suggests that this is unlikely, and that Bangladeshi couples may often resume sexual relations even before the end of the traditional period of ritual impurity (Salway, 1996). Spousal separation could also contribute to low risks of pregnancy. However, data from the 1989 BFS suggest that in only very few cases do husbands spend longer than a month away from home (Islam and Islam, 1993). In addition, it is less likely that urban husbands would spend long periods away from home, especially following the birth of a child. Unreported menstrual regulation or abortion may also contribute to low pregnancy rates, though this is unlikely to be an important bias in the RKS where surveillance is extremely intense. Maternal undernutrition may also be an important factor in explaining the low pregnancy rates among our amenorrhoeic Bangladeshi women compared with those observed in some developed country settings. Although these factors may all contribute to the low risk of pregnancy observed in the study cohorts, it seems likely that intensive breastfeeding behaviour is an important determinant. It is also likely that changes in breastfeeding behaviour will be the most important factor in any decline in natural protection against pregnancy observed in coming years.

Despite an inevitable degree of uncertainty, we are confident that the risks of pregnancy during postpartum amenorrhoea in the two study populations were consistent with the Bellagio guidelines (Kennedy, Rivera and McNeilly, 1989). The next issue to be addressed is to what extent the findings from these two sub-populations can be extrapolated to the wider Bangladesh population today. The data for Matlab came from a relatively long time ago. However, the situation which prevailed in Matlab in 1978/79 does not appear to be hugely dissimilar to that of the national population in the 1990s in terms of breastfeeding and postpartum amenorrhoea. The 1991 contraceptive prevalence survey (CPS) estimated a median duration of postpartum amenorrhoea for the national rural population of 12.1 months (Mitra and others, 1993) and the 1993/94 Bangladesh Demographic and Health Survey (BDHS) estimated a median duration of 10.6 months (Mitra and others, 1994), compared with 13.7 months in the 1978/79 Matlab cohort. Also, it is apparent that any decline in the duration of postpartum amenorrhoea that has occurred in the national rural population over time has been to date quite small. Comparisons of breastfeeding patterns and trends in Matlab and the national rural population are fraught with difficulties. National surveys have shown little consistency in the selection of samples or the use of definitions or estimation techniques. Overall, the impression is that durations of all breastfeeding (full plus partial) have not changed greatly over the past 10 to 15 years. The 1991 CPS estimated the mean duration of all breastfeeding to be around 30 months (Mitra and others, 1993), almost as long as that reported for Matlab in the period 1978/79. There is evidence to suggest that patterns of supplementation may have changed somewhat over time in Bangladesh. An analysis of the trend in duration of "full" breastfeeding in the Matlab area revealed a decrease from a median of around six months in the period 1978/79 to around five months in the period 1986/87. Changes in breastfeeding patterns and declines in the duration of postpartum amenorrhoea appear to have been more marked among the urban population. The presentation of findings from the urban slum setting is therefore an important complement to the Matlab analysis.

The consistency in findings from both the study populations suggests that low risks of pregnancy during amenorrhoea may prevail for Bangladeshi women more generally. Taken together with evidence from other recent studies in Bangladesh (Weis, 1993) and other similar settings (Kazi and others, 1995), the present results suggest that lactational amenorrhoea deserves careful consideration within family planning programmes in this context.

At present, the family planning programme in Bangladesh does not promote breastfeeding for its contraceptive qualities, and in many cases actually undermines breastfeeding practices that are beneficial to birth spacing (as well as child health). Evidence suggests that contraceptive methods are promoted early in the postpartum period, commonly after 40-45 days, regardless of breastfeeding or amenorrhoeic status (Salway, 1996). Such an approach appears inappropriate because the majority of women in Bangladesh breastfeed and are naturally protected against pregnancy for an extended period of time. Moreover, it runs counter to strongly held beliefs. Most women are reluctant to initiate contraception soon after birth. Women are aware of the diminished risk of pregnancy during postpartum amenorrhoea, and are also unwilling to use "strong", modern methods of contraception at a time when they feel weak and vulnerable, and have concerns about their child's breastfeeding and health (Salway and Nurani, 1998).9 Also, since the majority of women deliver at home with the assistance of traditional birth attendants or relatives, contact between women and family planning services is no more likely at the time of delivery, or within the 40-45-day postpartum period, than at other times. Finally, contraceptive continuation rates remain low (Mitra and others, 1990; Salway and Nurani, 1998) so that early adoption will have a limited impact on birth intervals since use is unlikely to extend beyond the period of natural protection against pregnancy.

It is therefore clear that current policy regarding the timing of promotion of contraception among amenorrhoeic women in Bangladesh needs careful review. While a policy of withholding contraceptives in the early postpartum period from women who desire to initiate use cannot be justified, measures should be taken in order to provide greater support for breastfeeding and explicitly to incorporate lactational amenorrhoea into the range of methods promoted for women in the postpartum period. Findings from the present study and the increasing number of investigations in other parts of the world must be assessed, and a comprehensive and consistent policy developed for family planning programmes in Bangladesh.

Regardless of the exact policy guidelines that are developed, it is clear that in order to incorporate lactational amenorrhoea into family planning programmes, steps will be needed to increase both the knowledge of, and trust in, the contraceptive potential of breastfeeding among family planning providers (Salway, 1996). Efforts must also be directed at educating clients about the contraceptive potential of breastfeeding, including the importance of frequent and intensive suckling, the increasing risk of pregnancy beyond about nine months postpartum, and the need to initiate contraception promptly if menses resumes before this time. Despite findings which suggest that partial breastfeeding may confer good protection against pregnancy, it is nevertheless important that family planning and health workers still emphasize the importance of full breastfeeding for the first five to six months, since this will ensure lower risks of pregnancy as well as be beneficial for child health. Moreover, it should be stressed that, in cases where women do not breastfeed at all, or where menses resumes at 40-45 days, contraception is needed immediately if another pregnancy is to be avoided.

Though the wisdom of directing scarce resources to promoting breastfeeding as a contraceptive has been questioned (Bracher, 1993; Islam and others, 1998), such steps are likely to have positive effects on both child health and fertility. Findings from studies where women were actively using breastfeeding as a method of child spacing (rather than purely for child feeding) suggest that breastfeeding practices may be enhanced (Perez, Labbok and Queenan, 1992; Kocturk, 1988). In the context of Bangladesh, where many women currently prefer to delay the adoption of modern contraception until menses, such an approach would appear to be sensitive to the needs of those the family planning programme is seeking to serve.

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Endnotes

1 The Bellagio Consensus Statement recognized that "exclusive breastfeeding", wherein "the infant receives only breastmilk given directly from the mother's breast (with the possible exception of medicine or vitamin drops)" would maximize lactational protection against pregnancy. However, since such breastfeeding is rare in developing country settings (with the majority of infants being given, at the least, small amounts of traditional mixtures, water, teas or juices) the recommendations were based on "full or nearly full breastfeeding". No precise definition of "full or nearly full breastfeeding" was offered, and it was pointed out that local variations in breastfeeding habits make such a definition difficult. However, it was understood that "for breastfeeding to be sufficient to be used for family planning, the breastfeeding pattern must include at least these aspects: breastfeeding should constitute the overwhelming majority of the baby's diet; breastfeeding frequency and duration should be high, and not affected by additional feedings; and additional feedings should not act as replacements for breastfeeding" (Kennedy, Rivera and McNeilly, 1989:486-487).

2 In the Matlab 1978/79 cohort, 9 per cent of amenorrhoeic women had adopted contraception by six months postpartum, and 19 per cent by twelve months postpartum. In the USS 1992/93 cohort, these figures were 7 and 10 per cent, respectively.

3 In the RKS 1978/79 cohort, 90 per cent of pregnancies during postpartum amenorrhoea ended in a live birth, and 10 per cent ended in a non-live birth or were lost to follow-up before the pregnancy outcome.

4 In the USS 1992/93 cohort, 33 per cent of pregnancies during postpartum amenorrhoea ended in a live birth, and 67 per cent ended in a non-live birth or were lost to follow-up. The percentage that ended in a live birth is much lower than in the case of the RKS because the duration of follow-up was shorter and so many pregnancies were censored prior to the pregnancy outcome. In order to test the sensitivity of results to the type of adjustments made, analyses were also conducted using a more extreme adjustment. In this, the same adjustment was made for live birth outcomes, but in the case of non-live birth outcomes, the timing of conception was adjusted back in time by six months in the RKS file, and by seven and a half months in the USS file. The results were found to be very similar for both adjustments. Therefore, only the results arising from analysis of the data sets where the smaller adjustments were made are presented here (since these are felt to be the most reasonable considering the patterns of pregnancy-reporting in the two populations).

5 As well as the pregnancies that were reported and recorded, some women may have been pregnant at the time of loss to follow-up but not have reported this (Trussell, 1991). In order to overcome this potential bias, the period of follow-up was shortened for any woman whose observation was censored. In the same way as the reported pregnancies were backdated, the period of follow-up was shortened by three months and four and a half months.

6 Since the probability of pregnancy was very low in the first month postpartum and this could potentially affect the estimates for the whole of the first six-month period, the first month was omitted from this stage of the analysis.

7 It should be remembered that many of the non-breastfeeders are women whose child has died. Therefore, there may

be other factors, aside from lactational protection against pregnancy, such as coital frequency, which explain the difference between the two groups in terms of the time to conception. Nevertheless, breastfeeding is assumed to be the most important factor.

8 This large difference may in part be explained by the fact that the Matlab data set was adjusted for late reporting of pregnancy, which was probably not the case for the Punjab or Eskimo data sets.

9 Similar findings have been reported in Rwanda (Cooney and others, 1996).

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