The Lower Maternal Mortality in Matlab MCH-FP Area in Bangladesh: The Role of Non-Live-Birth Pregnancies

Mizanur Rahman
Pathfinder International

Julie DaVanzo
RAND

Abdur Razzaque
ICDDR,B: Centre for Health and Population Research

Abstract

We examine whether the Matlab MCH-FP project has had any impact on maternal mortality and, if so, the extent to which differences in pregnancy outcomes and their case-fatality rates between the areas explain the mortality difference. We analyze longitudinal data from the Matlab Demographic Surveillance System on 142,966 pregnancies during the 1982-2002. The MCH-FP Area experienced 19% lower mortality than the Comparison Area, most of the reduction was associated with lower mortality for women whose pregnancies resulted in non-live births. In both areas maternal mortality is considerably higher for pregnancies that resulted in non-live-births compared to those that resulted in live births, and this is especially the case in the Comparison Area. The incidence of non-live-birth pregnancy outcomes was 24% lower in the MCH-FP Area than in the Comparison Area, and the likelihood of maternal death following a non-live-birth pregnancy was 39% lower in the MCH-FP than Comparison Area.

Introduction

Over half a million women die from pregnancy- or delivery-related causes each year. The vast majority of these deaths occur in developing countries (WHO 2004). The reduction in maternal mortality is one of the Millennium Development Goals (MDGs) for developing countries.

In this paper, we analyze high-quality longitudinal data on 142,966 pregnancy outcomes obtained from the Matlab Demographic Surveillance System (DSS) during 1982-2002 to examine (i) whether maternal mortality was lower in the MCH-FP than Comparison Area and (ii), if so, to what extent the difference can be explained by differences in the distributions of pregnancy outcomes or in their case-fatality rates. The large-scale Matlab data on maternal mortality are unique in a developing country setting, and allow an analysis of the risk of mortality following each type of pregnancy outcome.

Non-live-birth pregnancy outcomes (induced or spontaneous abortions and stillbirths) are a risk factor for maternal mortality (Gissler et al. 2004; Reardon et al. 2002). Most induced abortions in developing countries are performed unsafely and carry a higher risk of maternal mortality.

Previous research has shown that the MCH-FP Area has lower incidences than the Comparison Area of all three types of non-live birth (ICDDR,B 2000) and that abortion-related maternal mortality was lower in the former (Fauveau and Blanchet 1989; Maine et al. 1996). We hypothesize that maternal mortality in the MCH-FP Area is lower than in the Comparison Area because of the former area's lower incidence of non-live births and because of better management of pregnancies and deliveries, especially of non-live birth pregnancies.

Background

Matlab is a typical rural riverain sub-district of Bangladesh, a South Asian poor country characterized by religious conservatism, low income, low literacy, low women's status, and high maternal mortality. (However, in recent years the country has achieved significant improvement in health and women's education.) Matlab is well known for its MCH-FP project and DSS (D'Souza 1981; Fauveau 1992; van Ginneken et al. 1998), which operates in half of the area covered by DSS to provide intensive and quality family planning, maternal and child health services. The other half, known as Comparison Area, is typical of much of Bangladesh in contraceptive use (ICDDR,B 2000), fertility and childhood mortality (NIPORT 2005) and maternal mortality (NIPORT 2003). Contraceptive prevalence has increased, and fertility and infant and child mortality have decreased in both areas of Matlab (ICDDR,B 2006). All of these trends are more pronounced in the MCH-FP Area.

Maternity Care Service in Matlab

Most deliveries in Matlab take place at home attended by traditional birth attendants, though, as we will see below, institutional deliveries have been increasing in the MCH-FP Area in recent years. Both the areas of Matlab have access to Chandpur government district hospital and some private clinics that provide emergency and intensive services including caesarian section and blood transfusion. However, residents of about half of the villages of both areas are relatively more remote and have less access to transportation to Chandpur. Residents of Matlab also seek higher-level health services from Narayangonj, a commercial town reachable in 4-5 hours by road or river transportation.

Since 1977, the Matlab MCH-FP Area has received a series of carefully designed reproductive health interventions that may directly and indirectly impact maternal health, especially maternal mortality. Until 2001, female community health workers (CHWs) provided family-planning counseling and supplies of injectable contraceptives, pills, and condoms at the doorstep during fortnightly or monthly visits. Four health centers were established in 1987 in the MCH-FP Area. Since 2001, health and family planning services have been provided from these health centers.[1] Tetanus immunization was introduced in 1979, and coverage has been universal since 1988.

Between 1987 and 2001 a number of safe motherhood interventions were introduced in the MCH-FP Area. In 1987, four trained midwives were posted in two of the four health centers; their tasks were to attend deliveries on call at home on a 24-hour basis and provide basic obstetric care. Midwives also encouraged family members of the pregnant women with complications to send them to Matlab Heath Center, where emergency care (but without caesarian section or blood transfusion) were available. Seriously complicated cases are transported to the district hospital in Chandpur. In 1990, additional midwives were posted in the other two health centers to provide above-mentioned services. Pregnant women in the MCH-FP Area receive antenatal information in a pictorial card about pregnancy care including danger signs of pregnancy; they are advised to contact the midwife for counseling, antenatal, and delivery services. CHWs refer women with danger signs or pregnancy complications to midwives or paramedics. Between 1996 and 2001, maternity care was gradually redesigned to be facility-based with basic obstetric care in the four health centers, and home-based delivery care by

[1] The MCH-FP Area has four health centers along with their accessibility to the ICDDR,B 24-hour maternity center in Matlab, while the Comparison Area has one government health and family welfare center and 24 monthly outreach satellite clinics. Residents of both areas have access to the government Thana Health Complex in Matlab.

midwives was withdrawn. The project made systematic efforts to increase institutional deliveries in the four health centers.[2]

During the 1996-2002 period, 58% women in the MCH-FP Area received at least one antenatal check-up at the MCH-FP health centers, and 52% received an antenatal check-up during the third trimester (Razzaque et al. 2005). Institutional deliveries have increased remarkably in the MCH-FP Area recently (Chowdhury et al. 2006). In the early 1990s only a few of births were delivered in the ICDDR,B health centers, but by 2005 it had increased to over 30%. (There are no comparable data for the Comparison Area, but it is expected that it was around 5-10% during this same period.)

Pregnancy Outcomes

While induced abortion is illegal in Bangladesh, early pregnancy terminations within eight weeks of gestation are permitted if referred to and performed as "manual vacuum aspiration" or "menstrual regulation (MR)." MR is available from trained female paramedics at the government and private health centers in both areas. MR abortions have a considerably lower risk of maternal mortality than abortions performed by traditional healers, which are common in both areas. The incidence of induced abortion was lower in the MCH-FP than Comparison Area (Rahman et al. 2001). The induced abortions that do occur in the MCH-FP Area tend to use the safer method of abortion; i.e., the proportion of abortions done by MR is higher in the MCH-FP Area than in the Comparison Area (DaVanzo et al., 2004). The incidence of other non-live births namely miscarriage and stillbirth is also lower in the MCH-FP than Comparison Area (ICDDR,B 2000).

Previous Studies of Maternal Mortality in Matlab

During the 1976-1985 period, maternal mortality ratios (maternal deaths/live births) were similar in the MCH-FP and Comparison Areas of Matlab (Koenig et al. 1988). Thereafter there was a substantial reduction of deaths from obstetric causes in the MCH-FP Area following a community-based maternity care intervention there initiated in 1987: trained midwives provided home-based delivery services, managed complications at home, and referred serious cases to higher-level maternity-care centers

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[2] For more information about maternity-care interventions in Matlab, see Fauveau et al. (1991), Fauveau et al. (1992), Maine et al. (1996), Ronsmans et al. (1997), and Chowdhury et al. (2006).

(Fauveau et al. 1991). Although such an intervention was important, mortality reduction depended mainly on the availability of emergency obstetric care including caesarian sections and blood transfusions at a nearby district government hospital (Maine et al. 1996). Investigators showed that there was a decline in maternal mortality in both the neighboring Comparison Area and the MCH-FP Area between 1976 and 1993, and the maternal mortality rate was similar in the two areas (Ronsmans et al. 1997). The decline over time was possibly associated with the increased use of services by pregnant women with complications and serious illness from the hospital equally distanced from the two areas. Following 1996, MCH-FP Area's maternity care was redesigned to be facility-based, and about 30% of deliveries during 2001 took place at the MCH-FP maternity-care centers (Chowdhury et al. 2006).

Data and Methods

Data

Matlab DSS contains longitudinal records of pregnancy outcomes (induced abortion; spontaneous abortion, or miscarriage; stillbirth; and live birth), deaths, marriages, and migrations in both areas. Information on these was collected by the CHWs during their fortnightly visits to each household between 1966 and 1996 and monthly visits since 1997. Pregnancy status during the visit and pregnancy outcome of each woman prior to the visit is recorded, and, therefore, the completion of demographic events is unusually high for a developing country setting (D'Souza 1981). In the DSS, a *live birth* is the delivery of a live baby at any gestational age; a *stillbirth* is a fetal loss at 28 weeks or more gestation; a *spontaneous abortion, or miscarriage*, is a spontaneous fetal loss prior to 28 weeks; and an *induced abortion* is coded in the data through self-report.[3] The data on induced and spontaneous abortion (miscarriage) are likely to be of high quality and not to suffer from underreporting by women declining to report abortion for personal, familial, social, or religious reasons. In their many years of work in the community the CHWs have established themselves as trustworthy and in a good position to collect reliable information on pregnancy outcomes and, because of their frequent household visits, they are likely to elicit accurate information. Even if some

[3]The 28-week distinction between spontaneous abortions and stillbirths is the one DSS has used in coding the data. We will refer to the former as "miscarriages" in this paper, even though shorter durations are typically used in other studies.

underreporting of spontaneous or induced abortion exists, it should not differ between the MCH-FP and Comparison Areas (Ahmed et al. 1996).

The DSS records causes of death. In general, the completion of death enumeration is very high, especially for adults, but maternal death may be underreported due to misclassification of cause of death. According to the Tenth Revision of the International Classification of Diseases (ICD-10), a maternal death is “the death of a woman during pregnancy or within 42 days of pregnancy outcome from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes” (WHO 1992).

Investigators in Matlab studying maternal mortality have devoted special efforts to collecting further information to improve the identification of maternal deaths between 1976 and 2001 (Fauveau et al. 1991; Koenig et al. 1988; Ronsmans et al. 1998; Ronsmans et al. 1997; Dieltiens 2005). These investigators followed the extended definition (AMA 1964), deaths within 90 days of a pregnancy outcome are considered maternal deaths. The DSS death files are accordingly updated with this information on maternal deaths. This is the definition we use here.

We analyze maternal mortality for a sample of 142,966 pregnancy outcomes that occurred in the two areas of Matlab during the period 1982-2002. We matched death records with the pregnancy outcomes through the unique identification numbers in the DSS. We exclude 3,041 pregnancies that resulted in live births with multiple outcomes (twins and triplets) because these outcomes carry a special risk of maternal deaths that should be separately studied.[4]

We consider a total of 503 maternal deaths during the period 1982 to 2002, of which 186 (37%) died during pregnancy, before having a pregnancy outcome (Table 1)[5] and 59 died between 43 and 90 days of pregnancy outcome. Though these 59 deaths would not be classified as maternal deaths according to ICD-10, we kept them in the analysis as they are recorded as maternal deaths in DSS. We repeated the analysis

[4] We consider 186 women who died during pregnancy. We don’t know whether any of them were carrying multiple fetuses.

[5] The 186 women who died during pregnancy but do not have a pregnancy outcomes recorded in the DSS for that pregnancy. These deaths were identified as maternal deaths by the investigators cited in Dieltiens (2005), Ronsmans et al. (1997), Ronsmans et al. 1998, Fauveau et al. (1991), and Koenig et al. (1988). We included them in our database and collected relevant information on them from various DSS data files.

without these 59 cases being considered maternal deaths and found that the main findings basically remain unaltered. There were 14 accidental deaths that occurred either during pregnancy or within 90 days of pregnancy outcome which are not considered as maternal deaths.

Methods of Analysis

We examine how the likelihood of maternal mortality, defined as maternal deaths per 1,000 pregnancies, varies by pregnancy outcome and area (MCH-FP or Comparison). The pregnancy outcomes considered are induced abortion, spontaneous abortion (miscarriage), stillbirth, live birth, and death while pregnant before having any outcome. When the mortality rate is calculated for a particular type of pregnancy outcome, it is equivalent to the case-fatality rate for women with that outcome. Odds ratios and their 95% confidence intervals are constructed. We refer to maternal deaths per 1,000 pregnancies as the "maternal mortality rate among at-risk women" (i.e., women at risk to maternal mortality because they are pregnant or recently given birth). We will often shorten this to "maternal mortality rate" for ease of exposition. It is important to keep in mind that this differs from the standard definition of the maternal mortality rate, which includes all women of childbearing age in the denominator, regardless of their pregnancy or delivery status.

Finally, we perform a simulation exercise to assess the extent to which the mortality difference between the areas are attributable to differences between them in the distribution of pregnancy outcomes or to differences between them in the case-fatality rates associated with various pregnancy outcome. The mortality (case-fatality) rates of each area are applied to the pregnancy-outcome distribution of the other area and these simulated rates are compared to the observed maternal mortality rates in each area.

Results

There were 503 maternal deaths between 1982 and 2002 among the 142,966 pregnancies in our sample, yielding an average maternal mortality rate among at-risk women of 3.52 per 1,000 pregnancies (Table 1), and a maternal mortality ratio of 4.00 per 1,000 live births. The maternal mortality rate among at-risk women was 3.13 per

1,000 pregnancies in the MCH-FP Area -- 19% (95% CI 3%-32%) lower than the 3.84 per 1,000 in the Comparison Area.

Table 2 shows the distributions of pregnancies in each area among non-live births (induced abortion, miscarriage, and stillbirth), live births, and those who died during pregnancy. The likelihood of dying during pregnancy was 20% (95% CI -2%-44%) lower in the MCH-FP Area than in the Comparison Area. In the MCH-FP Area 2.19% of pregnancies were terminated by induced abortion; this is 49% (95% CI 46%-52%) lower than the comparable figure in the Comparison Area (4.21%). The incidence of miscarriage was 10% (95% CI 6%-14%) lower in the MCH-FP Area (5.32%) than in the Comparison Area (5.89%), and the incidence of stillbirth was 6% (95% CI 1%-12%) lower (2.91% vs. 3.10%). Overall, pregnancies were 24% (95% CI 21%-26%) less likely to end in non-live births in the MCH-FP Area than in the Comparison Area.

Maternal mortality rates by pregnancy outcome, or case-fatality rates, by area are shown in Table 3. (The numbers of deaths and pregnancy outcomes underlying these rates are shown in Table 2.) The first two columns of Table 3 show the mortality risks associated with different types of outcomes for both areas together. The maternal mortality rate was 1.47 per 1,000 pregnancies for women who had live births. This is 58% lower than the overall maternal mortality rate among all at-risk women of 3.52 per 1,000 in both areas. At 7.74 per 1,000, the maternal mortality rate was 5.29 (95% CI 4.23-6.62) times higher among women whose pregnancies ended in a non-live birth (induced abortion, miscarriage, or stillbirth) than for women who had live birth. Maternal mortality was 5.54 per 1,000 among women with induced abortion, 3.23 per 1,000 among women with miscarriage, and 18.55 per 1,000 among women with stillbirth. The odds ratios in the second column show that the risks of dying following an induced abortion, miscarriage, and stillbirth were 3.77 (95% CI 2.50-5.70), 2.20 (95% CI 1.46-3.32), and12.83 (95% CI 9.85-16.71) times higher, respectively, than following a live birth.

The last three columns of Table 3 compare risks of mortality associated with different outcomes between areas. There is very little difference between the areas in the mortality of women who had live births -- 1.47 per 1,000 in the MCH-FP Area versus 1.38 per 1,000 in the Comparison Area, a difference that is not statistically significant. In contrast, mortality among women with non-live births was 40% (95% CI 12%-59%)

lower in the MCH-FP Area (5.57 per 1,000) than in the Comparison Area (9.19 per 1,000). Overall, maternal mortality was 19% (95% CI 3%-32%) in the MCH-FP than in the Comparison Area (3.13 versus 3.84 per 1,000). Thus the lower maternal mortality in the MCH-FP Area is largely due to the area's lower risk of dying from non-live-birth (induced abortion, miscarriage, and stillbirth) pregnancies. The maternal mortality rate is lower in the MCH-FP for every type of non-live-birth pregnancy outcome. The difference is largest for induced abortion (70% lower) followed by stillbirth (39% lower). The mortality difference for miscarriage is not statistically significant. The rate of maternal mortality associated with stillbirths in the Comparison Area is very high—22.45 maternal deaths/1,000 stillbirths.

Observed and simulated maternal mortality rates are shown in the four cells of Table 4. Rates in cells *a* and *d* are the observed rates in the MCH-FP and Comparison Areas, respectively. The rate in the cell *c* is calculated by applying the case-fatality rates of the MCH-FP Area to the pregnancy outcomes distribution of the Comparison Area. Similarly, that in cell *b* is calculated by applying the case-fatality rates of the Comparison Area to the pregnancy outcomes distribution of the MCH-FP Area. The third column (M - C) shows the extent to which the overall difference in maternal mortality between the two areas is due to differences in case-fatality rates, whereas the third row shows the extent to which the difference is due to differences in the distribution of pregnancy outcomes. Of the overall difference in maternal mortality rates between the two areas of 0.71 deaths per 1,000 pregnancies, 0.03-0.17 of this is due to differences in the distribution of pregnancy outcomes, and 0.54-0.68 is due to differences in case-fatality rates. If the case fatality rates of the Comparison Area remained the same but the pregnancy outcome distribution were changed to that of the MCH-FP Area, mortality would have reduced from 3.84 to 3.67, or by only 4%. In contrast, if the distribution of pregnancy outcomes in the Comparison Area remained the same but the case fatality rates were changed to those of the MCH-FP Area, maternal mortality would be reduced from 3.84 to 3.16, or by about 18%. Similarly, if MCH-FP Area had the pregnancy-outcome distribution of the Comparison Area, its maternal mortality rate would increase from 3.13 to 3.16, or by only 1%. If the case-fatality rate changed to that of the Comparison Area, mortality in the MCH-FP Area would increase from 3.13 to 3.67, or by

17%. Hence, despite the fact that pregnancies in the Comparison Area are more likely to result in non-live births and such pregnancies have higher risks of maternal mortality on average, the majority of the overall difference in maternal mortality rates between the areas is due to the higher case-fatality rates for each type of non-live-birth outcome in the Comparison Area.

Discussion

We have been able to analyze a large sample of pregnancy outcomes and maternal deaths over a period of two decades using data, from the Matlab DSS, that are unlikely to suffer from the underreporting usually encountered in data on maternal mortality and non-live births. To our knowledge, this is the first assessment for Matlab of the risks of maternal mortality associated with non-live-birth pregnancies.

We find that maternal mortality rates in Matlab as a whole were 5.29 times higher for non-live-birth outcomes than for pregnancies that resulted in a live birth. (The risks were 2.20 times higher (compared to live births) for miscarriages, 3.77 times higher for induced abortions, and 12.83 times higher for stillbirths.) If all pregnancy outcomes were live births in Matlab or women with non-live birth outcomes had similar mortality risk to those after live births, maternal mortality would have been 1.47 deaths per 1,000 pregnancies, a 58-percent reduction from the overall mortality rate of 3.52 in Matlab, achieving an MDG goal.

We find that between 1982 and 2002 women in the MCH-FP Area experienced 19% lower maternal mortality overall than those in the Comparison Area. Non-live-birth outcomes were less common in the MCH-FP Area, where they accounted for 10.4% of all pregnancy outcomes, than in the Comparison Area (13.2%). (Overall, the incidence of non-live births was 24% lower in the MCH-FP Area than in the Comparison Area; the incidence of induced abortion was 49% lower, of miscarriage was 10% lower; and of stillbirth was 6% lower). The risk of dying from non-live-birth pregnancies was 40% lower in the MCH-FP than Comparison Area (70% lower for induced abortions, 31% lower for miscarriages, and 39% lower for stillbirths). In contrast, risk of dying from live-birth pregnancies was 13% higher (non-significantly) in the MCH-FP Area than in the Comparison Area.

The two areas have virtually the same mortality from live-birth pregnancies (1.38 maternal deaths per 1,000 live births in the MCH-FP Area and 1.57/1,000 in the Comparison Area). The lower maternal mortality rate in the MCH-FP Area is partly attributable to its lower incidence of non-live births, but it is mainly due to the fact that mortality risks were lower for each type of non-live-birth pregnancy outcome. Only a small fraction of the lower mortality in the MCH-FP Area is due to the area's more favorable pregnancy outcome distribution, whereas most of the difference is due to the lower case-fatality rates for each type of pregnancy outcome. In a companion study, we showed a similar effect of the MCH-FP intervention, in that a small portion (up to 20%) of the differences in infant and child mortality between the areas could be attributed to differences between them in reproductive patterns (maternal age, parity, pregnancy spacing) while the remainder was due to unexplained differences between the areas, presumably mainly in medical care (Hale et al. 2006).

The very high risk of maternal mortality associated with stillbirth deserves public health attention. Stillbirths are defined in DSS as an outcome after pregnancy duration of 7 months or more, and some of these may occur at full term or near full term of pregnancies. Such cases are likely to be associated with delivery complications that do not receive appropriate and timely interventions. Most births in Bangladesh are delivered at home by untrained birth attendants, and when there are complications the relatives may adopt a wait-and-see approach or seek help from untrained or traditional health care providers and the mother's condition may worsen because of this. As in all societies, Bangladeshi families are happy after a successful childbirth, and the newborn and the mother are likely to receive attention and care. When the outcome is a non-live birth, the mother may not receive appropriate attention and care, when it is most needed, because family members may not feel the necessity. It is not known to what extent women receive post-natal care after non-live births. This is a topic that merits further study.

The lower incidence of non-live births in the MCH-FP Area and the reduced risk of dying from non-live-birth pregnancies can be explained by several factors. The incidence of unintended pregnancy was lower in the MCH-FP Area because of its better family planning services, and this led to a lower level of induced abortion (Rahman et al. 2001). In addition, women in the MCH-FP Area have greater access to reproductive health services and information, and pregnant women are more likely to get health care from the community- and facility-based providers, which presumably results in fewer miscarriages and stillbirths. Perinatal mortality (stillbirth and early neonatal mortality) declined during 1979-1986 period in the MCH-FP Area of Matlab, but not in the Comparison Area (Fauveau et al. 1990).

Lower mortality among women whose pregnancies ended in induced abortion, miscarriage, and stillbirth in the MCH-FP than Comparison Area suggests that the former area's maternity-care program has been able to more effectively manage non-live birth pregnancies, especially stillbirths. As mentioned above, women in the MCH-FP area are more likely to use antenatal care and maternity services, both at home and hospitals, especially in recent years, and a substantial proportion of deliveries took place in ICDDR,B hospitals, which can tackle complications including performing caesarian sections and have a strong referral system to higher-level facilities. Because of greater accessibility to antenatal and maternity services, women in the MCH-FP Area with miscarriages and stillbirths are likely to seek health care more often and more quickly; this is likely to reduce the risk of dying from such outcomes.

The maternity centers equipped with post-abortion care services in the MCH-FP Area are likely to reduce the risk of women dying from unsafe abortions, which are still quite common in Bangladesh. MCH-FP maternity center staff and community-based midwives play a life-saving role in channeling cases with induced abortion and serious cases for blood transfusion and D&C to nearby district hospital in Chandpur (Maine et al. 1996). These services are not available in the Comparison Area. This undoubtedly helps explain the lower maternal mortality rate associated with induced abortions in the MCH-FP Area, as does the fact that unsafe abortions are a smaller fraction of all abortions in the MCH-FP Area than in the Comparison Area. The abortions that do occur in the MCH-FP Area tend to use a safer method of menstrual regulation (DaVanzo et al. 2004).

Better family planning services, in terms of access and quality, can reduce the incidence of induced abortion by reducing unintended pregnancies. Greater accessibility to maternity-care services if linked with high-level obstetric care could reduce the incidence of non-live-birth pregnancies thus causing a decline in risks of dying from pregnancy complications. More effective policies and safer management of non-live-birth pregnancies would have the single most positive impact in substantially reducing maternity mortality in Bangladesh and similar countries.

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Table 1. Number of pregnancies and maternal deaths and probability of death by area, Matlab, 1982-2002

Area	Number		Deaths/1,000 pregnancies
	Pregnancies	Maternal deaths	
Comparison	77,507	298	3.84
MCH-FP	65,459	205	3.13
Both areas	142,966	503	3.52

Table 2. Distribution of pregnancy outcomes by area, Matlab, 1982-2002

Outcome	Percent of outcomes			Number of outcomes (Number of deaths)	
	Comparison	MCH-FP	Odds Ratio [MCH-FP/Comparison] (95% confidence interval)	Comparison	MCH-FP
Woman died during pregnancy§	0.14	0.11	0.80 (0.60-1.07)	(111)	(75)
Induced abortion	4.21	2.19	0.51 (0.48-0.54)	3,263 (23)	1,434 (3)
Miscarriage	5.89	5.32	0.90 (0.86-0.94)	4,563 (17)	3,484 (9)
Stillbirth	3.10	2.91	0.94 (0.88-0.99)	2,404 (54)	1,907 (26)
All non-live births	13.20	10.43	0.76 (0.74-0.79)	10,230 (94)	6,825 (38)
Live birth	86.66	89.46	1.31 (1.26-1.35)	67,165 (93)	58,555 (92)
All	100.0	100.0	--	77,507 (298)	65,459 (205)

§ These women died during pregnancy, before having a pregnancy outcome. In a sense, all pregnant women are at risk of this outcome.

¶ Pregnancy outcomes of one woman in the Comparison Area and four women in the MCH-FP Area and were not reported.

Table 3. **Maternal mortality rates among at-risk women, by pregnancy outcome and area, Matlab, 1982-2002**

Outcomes	Both areas		Deaths/1,000 pregnancies		Odds ratio [MCH-FP/ Comparison] (95% CI)
	Deaths/1,000 pregnancies	Odds ratio [compared to live births] (95% CI)	Comparison Area	MCH-FP Area	
Woman died during pregnancy, before an outcome§	1.30	0.88 (0.72-1.08)	1.43	1.14	0.80 (0.60-1.07)
Induced abortion	5.54	3.77 (2.50-5.70)	7.05	2.09	0.30 (0.09-0.99)
Miscarriage	3.31	2.20 (1.46-3.32)	3.73	2.58	0.69 (0.31-1.56)
Stillbirth	18.55	12.83 (9.85-16.71)	22.45	13.63	0.61 (0.37-0.96)
All non-live births	7.74	5.29 (4.23-6.62)	9.19	5.57	0.60 (0.41-0.88)
Live births	1.47	1.00	1.38	1.57	1.13 (0.85-1.51)
All pregnancies	3.52	--	3.84	3.13	0.81 (0.68-0.97)

§ We treat all pregnant women as being at risk of this outcome.

Table 4. Simulation of maternal mortality rates among at-risk women assuming distribution of pregnancy outcomes or case-fatality rates of the other area

Distribution of pregnancy outcomes of	Case-fatality rate of		M - C
	MCH-FP Area (M)	Comparison Area (C)	
MCH-FP Area (M)	3.13 (*a*)	3.67 (*b*)	-0.54
Comparison Area (C)	3.16…… (*c*)	3.84 (*d*)	-0.68
M - C	-0.03	-0.17	

The difference between the actual maternal mortality rates in the two areas = -0.71