Pregnancy-related mortality and access to obstetric services in Matlab, Bangladesh

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Introduction
Monitoring progress towards improved maternal health has proved to be a challenge, in particular because the preferred health outcomes are difficult to estimate reliably. The measurement of maternal mortality is thought to be too costly and insufficiently precise to be of use in assessing the effectiveness of safe motherhood interventions (Graham et al 1996). Maternal morbidity has been proposed as an alternative measure of health outcome, but research has shown that the reliability of estimates of obstetric morbidity may be poor, certainly when based on women's recall of their birth experience (Filippi et al 2000). Process evaluation has thus become the mainstay of safe motherhood evaluation in developing countries (UNICEF et al 1997, Maine et al 1997, Ronsmans et al 2002).

Process evaluation will adequately inform the design or management of maternal health care strategies if the processes of care that are being measured are those that are critical for improving maternal health so that levels and trends in maternal mortality can be inferred from their measurement. Strategies ensuring that all pregnant women have access to a health professional for delivery, for example, are thought to be critical for maternal mortality reduction, and the proportion of births with a skilled attendant has now become a widely promoted indicator for monitoring progress towards maternal mortality reductions (WHO 1997, Abouzahr and Wardlaw 2001). Similarly, ensuring access to specialised obstetric care is deemed essential for the reduction of maternal mortality, and many developing countries are now adopting the target of a minimum of 15% of births to take place in an essential obstetric care (EOC) facility or 5% of births with a caesarean section (UNICEF et al 1997, Maine et al 1997).

Rigorous evidence linking levels of maternal mortality with specific programme inputs is scant however, and the extent to which indicators of access to obstetric services reflect levels of maternal mortality is uncertain (Abouzahr and Wardlaw 2001, Graham et al 2001, Graham 2002, Ronsmans et al 2003). Renewed calls have been made to measure maternal mortality and process indicators concurrently so that the link between process and outcomes can be firmly established (Graham 2002, Ronsmans et al 2003). Research in this area is hampered by the lack of good maternal mortality data. In this study we examine the association between indicators of access to obstetric care and levels of pregnancy-related mortality using data from a surveillance site in rural Bangladesh. The study site is unique in that special efforts were made to assess the levels and causes of pregnancy-related mortality, while data on place of birth, delivery attendant and mode of delivery (by indication) are available for the same population.

Methods
Study population
This study was conducted in Matlab, Bangladesh, a poor rural area southeast of the capital Dhaka. In this predominantly Muslim society, female mobility is limited, restricting women from seeking care outside their home (Blanchet 1984).

The study took place in the Maternal and Child Health and Family Planning (MCH-FP) and Comparison areas. The MCH-FP area has received extensive health and family planning services since 1977, covering a population of about 110,000 (ICDDR,B 2002). Eighty community health workers visit the women in their homes

every month to distribute contraceptives and provide vaccines and nutrition education. The total fertility rate has declined from 6.2 live births per woman in 1976 to 2.9 in 2000 (ICDDR,B 2002). In 1987, a safe motherhood programme was introduced in the MCH-FP area (Fauveau et al 1991). The programme aimed at increasing the coverage of home births with a health professional by posting two trained midwives in each of two health centres, establishing a basic obstetric clinic in Matlab town, and providing a speedboat to the clinic for emergency cases. In 1996, the programme was redesigned to become facility-based. Between 1996 and 2001, all four health centres were gradually upgraded and equipped to perform basic obstetric care and the same midwives were asked to stop attending home births.

Women in the Comparison area do not have extensive access to trained birth attendants at home or in basic obstetric care facilities, but distance to referral care is virtually the same as in the MCH-FP area. Differences in the availability of contraceptive services between the intervention and comparison area have resulted in consistently and significantly lower fertility rates in the MCH-FP area since the 1970s (Rahman et al 2001).

Pregnancy-related mortality
The study area has been under demographic surveillance since 1966. The demographic surveillance system records all births, deaths, migrations, and marriages in a population of 220,000 (ICDDR,B 2002). Special efforts have been made to arrive at the levels and causes of pregnancy-related mortality in the MCH-FP and comparison areas between 1976 and 2001. In these studies, a specially trained female interviewer administered a semi-structured questionnaire to relatives of all women who died when aged 15-44 years. The questionnaires were reviewed by one (Koenig et al 1988) or two (Ronsmans et al 1998) physicians who assigned a single cause of death. Between 1990 and 2001, a similar study was conducted with semi-structured verbal autopsy questionnaires. They were reviewed by 3 physicians, in case of disagreement a fourth physician and by an experienced obstetrician in case of doubt, in order to assign the main cause of death. A pregnancy-related death was defined as the death of a woman while pregnant or within 90 days of pregnancy termination, irrespective of the duration of pregnancy or the method of termination. Deaths were further classified into deaths from direct obstetric causes (including antepartum, intrapartum and postpartum haemorrhage, induced abortion, hypertensive diseases of pregnancy, dystocia and sepsis), injuries and other causes.

Indicators of access to obstetric care
We used four indicators of access to obstetric services, consisting of the percent of births in the population with a trained attendant, in a comprehensive Essential Obstetric Care (cEOC) facility, with a caesarean section and with life-saving obstetric surgery (UNICEF et al 1997, Maine et al 1997, WHO 1997, Ronsmans et al 2004). Trained attendants refer to doctors, midwives and nurses, excluding trained and untrained TBA (WHO 1997). cEOC facilities are those that can perform surgery. Life-saving obstetric surgery refers to interventions with life-saving potential (including caesarean sections, laparotomy, hysterectomy, craniotomy and internal version) performed for conditions that are thought to have a high probability of dying if the woman fails to obtain a major surgical intervention (severe antepartum haemorrhage due to placenta praevia or abruptio placentae, unremitting postpartum

haemorrhage, major cephalo-pelvic disproportion, transverse lie and brow presentation, ruptured uterus) (Dubourg et al 2005).

We used different sources of data to capture the various indicators, including the health and demographic surveillance system (HDSS), the Matlab Health and Socioeconomic Survey (MHSS), service records from the safe motherhood programme in the MCH-FP area and a special study to assess met need for obstetric care. The HDSS collected prospective information on the place of and attendant at birth between 1989 and 1998. The MHSS was a population-based survey conducted in 1996, covering a random sample of 4,539 households in about one third of the entire surveillance area. The survey targeted the adult and elderly population, and all women were asked a full pregnancy history with place of and attendant at birth. From 1987 onwards, midwives kept records for all women receiving obstetric care in the MCH-FP area. The special study to assess met need for obstetric care collected information on maternal deaths and deliveries that took place in cEOC-facilities between 1990 and 2001, through patient interviews and record review in hospitals.

Data on the type of attendant at birth were obtained from the HDSS between 1989 and 1998, the MHSS between 1976 and 1996 and midwife records from 1987 onwards. Data on births in cEOC facilities were obtained from the MHSS between 1976 and 1996, and from the met need study after 1990. Data on caesarean sections and life saving surgery were obtained from the met need study.

Statistical methods
Pregnancy-related mortality ratios were expressed as the number of pregnancy-related deaths per 100,000 live births and were compared assuming Poisson rates. Trends in various process indicators were presented in graphical format.

Results
Trends in pregnancy-related mortality by cause and area are shown in figure 1. In the MCH-FP area, pregnancy-related mortality from all causes declined by 3 percent per year (rate ratio (RR) 0.97 (0.97-0.97)), from 600 to less than 200 per 100,000 live births. In the Comparison area, the decline was less pronounced, although statistically significant at 2 percent per year (RR 0.98 (0.98-0.99). Direct obstetric mortality declined in the MCH-FP area, both for abortion (RR=0.94 (0.91-0.98)) and non-abortion related causes (RR=0.95 (0.93-0.97)). In the Comparison area, only the decline in non-abortion-related direct obstetric mortality was significant (RR=0.98 (0.97-1.00)).

Direct obstetric mortality declined steadily over time in the MCH-FP area, with an overall reduction of two-thirds over 26 years. Patterns in the Comparison area were less clear, although mortality was lower in the nineties than in the early eighties.

Trends in process indicators are shown against a background of direct obstetric mortality (including abortions) in figures 2-5. The percent of births with a trained provider was extremely low in the late seventies and early eighties. By 1985, a mere 6% of births in the MCH-FP area were attended by a health professional. This proportion grew dramatically after the introduction of the safe motherhood programme in 1987, though only reaching a quarter of all births (27%) in 2001 at a time when direct obstetric mortality was as low as 110 per 100,000 live births. The

proportion of births with a health professional was extremely low in the Comparison area, remaining below 4% when the last data were available in 1998.

The percent of births in hospital, with a caesarean section and with life-saving obstetric surgery were remarkably low, though picking up gradually throughout the nineties. Births in hospital were extremely rare in the seventies and early eighties (about 3 per 1000 in the MCH-FP area and 1 per 1000 in the Comparison area), increasing to 44 and 28 per 1000 in the MCH-FP and Comparison area respectively by 2001. Similarly, caesarean sections rose from 2 to 27 per 1000 live births in the MCH-FP area between 1990 and 2001, compared to a rise from 1 to 16 per 1000 in the Comparison area. In the same period, the percent of births with life-saving obstetric surgery rose from 3 to 9 per 1000 in the MCH-FP and from 1 to 3 per 1000 in the Comparison area.

Discussion

Preliminary conclusions of the study include:

1. This study shows a dramatic decline in pregnancy-related mortality over 26 years in Matlab. Direct obstetric mortality declined by two thirds in the area receiving extensive maternal and child health interventions, whilst mortality decline was much less pronounced and less consistent in the area with a less elaborate health care infrastructure. Quite remarkably, this decline occurred in the context of overall poor access to obstetric care, although access to emergency obstetric care increased substantially over the last decade.

2. No single process indicator fully mirrors the declining trends in maternal mortality. Between 1976 and 1986, the decline occurred with almost no access to obstetric care. Between 1987 and 2001, access to emergency obstetric care may explain the recent accelerated decline in maternal mortality

3. The "natural" levels of pregnancy-related mortality are surprisingly low (600 per 100,000 live births at time when almost no births were with trained provider)

4. Alternative explanations for the decline include:
   – bias
   – family planning
   – access to safe abortion
   – nutrition
   – social change (women's empowerment, education, change in family structure)

Figure 1: Trends in pregnancy-related mortality by cause in the MCH-FP and Comparison areas

MCH-FP area (3-year moving averages)

Legend: Direct no abortion, Abortion, Indirect, Injuries

Comparison area (3-year moving averages)

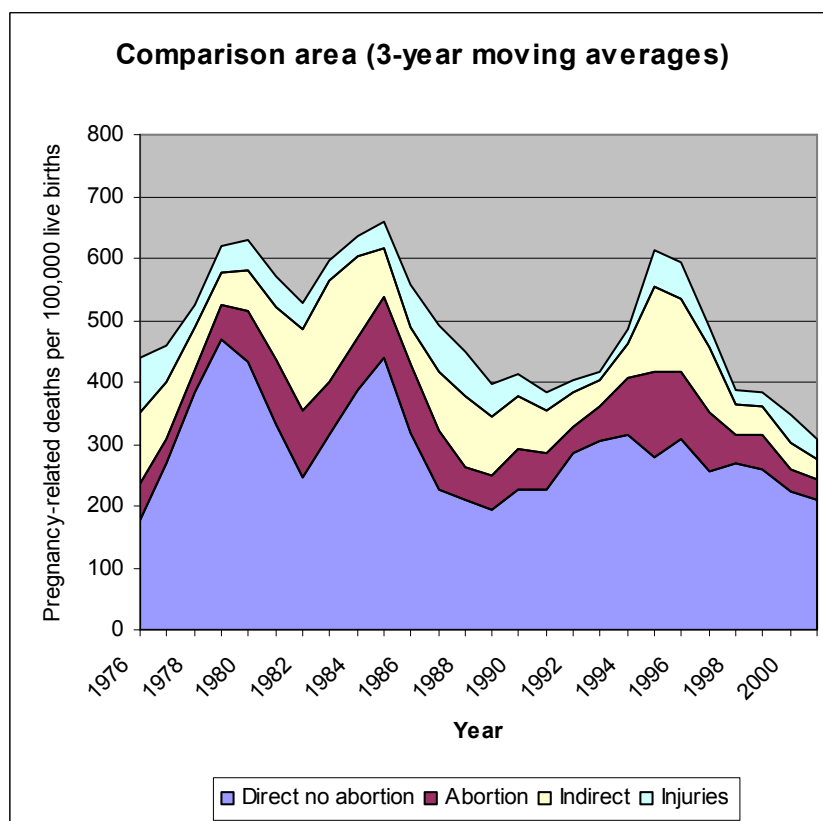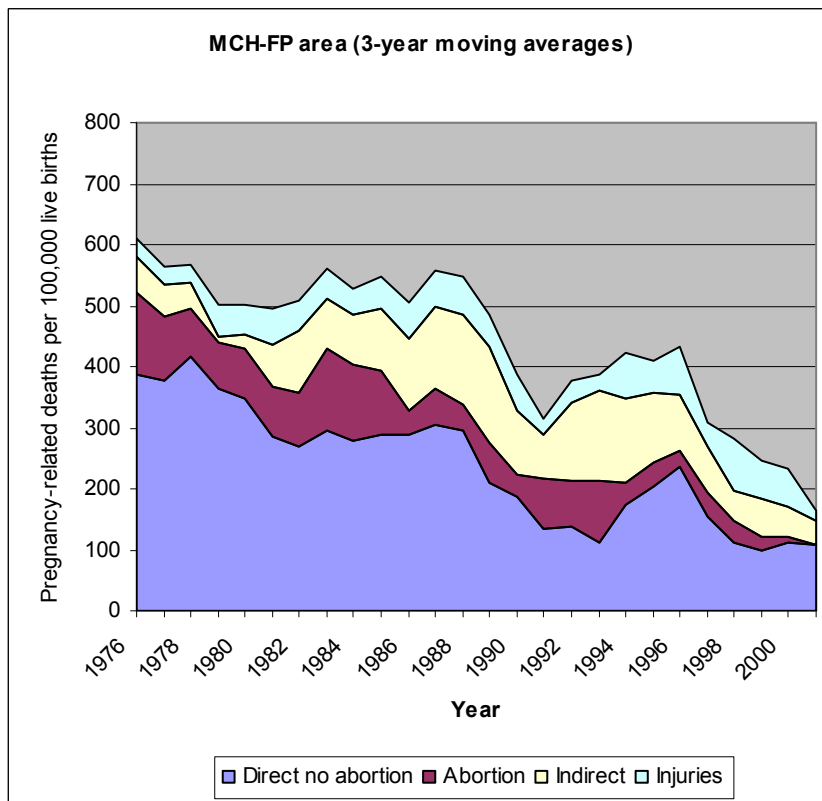Legend: Direct no abortion, Abortion, Indirect, Injuries

Figure 2: Trends in the percent of births with a trained provider in the MCH-FP and Comparison areas

MCH-FP area

Legend:
- Direct obstetric mortality ratio (3-year moving average)
- % of births with trained provider (hdss)
- % of births with trained provider (mhss)
- % of births with trained provider (midwife records)

Comparison area

Legend:
- Direct obstetric mortality ratio (3-year moving average)
- % of births with trained provider (hdss)
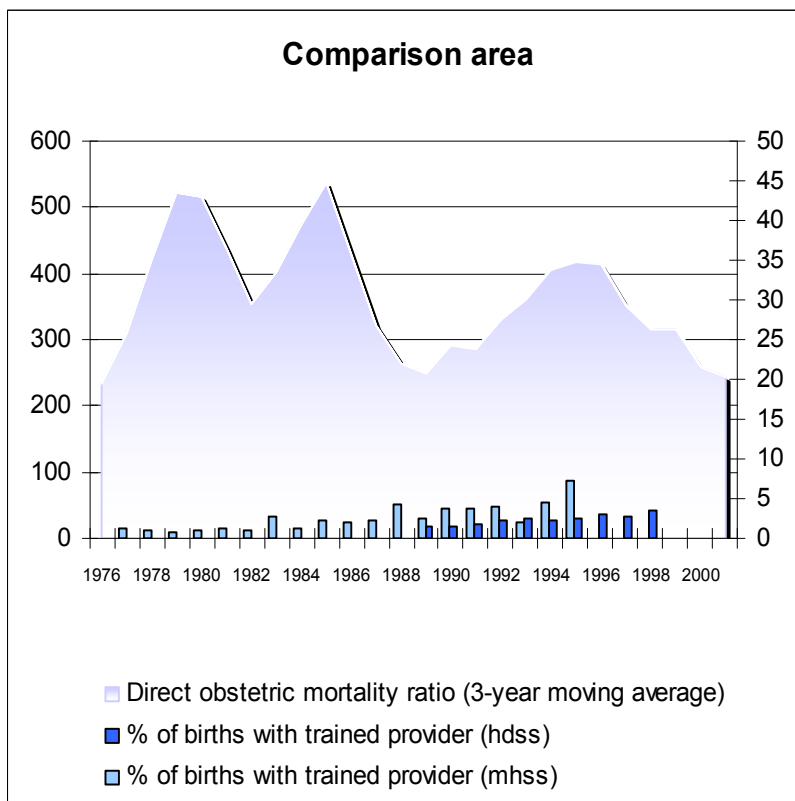- % of births with trained provider (mhss)
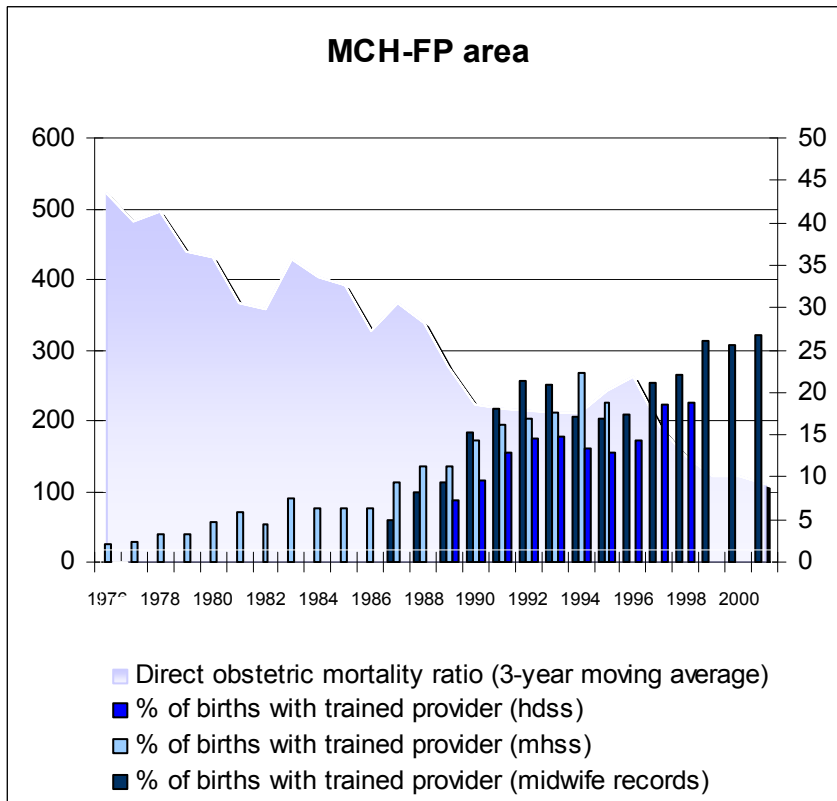
Figure 3: Trends in the percent of births in a Comprehensive EOC facility in the MCH-FP and Comparison areas

MCH-FP area

Legend:
- Direct obstetric mortality ratio (3-year moving average)
- % of births in cEOC (met need)
- % of births in cEOC (mhss)

Comparison area

Legend:
- Direct obstetric mortality ratio (3-year moving average)
- % of births in cEOC (met need)
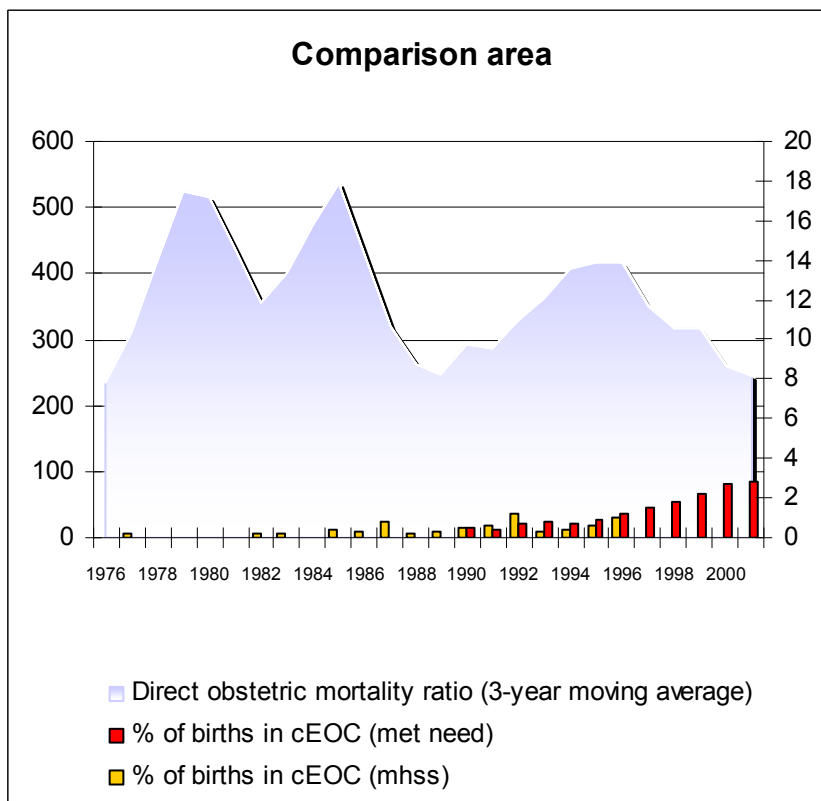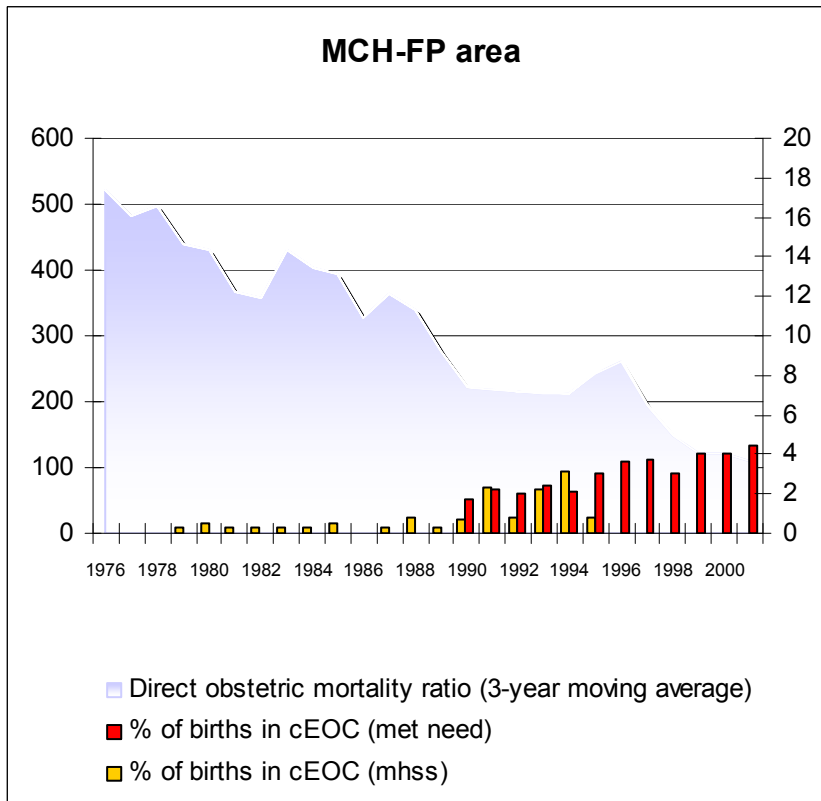- % of births in cEOC (mhss)

Figure 4: Trends in the percent of births with a caesarean section in the MCH-FP and Comparison areas

MCH-FP area

Direct obstetric mortality ratio (3-year moving average)

Percent of births with caesarean section

Comparison area

Direct obstetric mortality ratio (3-year moving average)
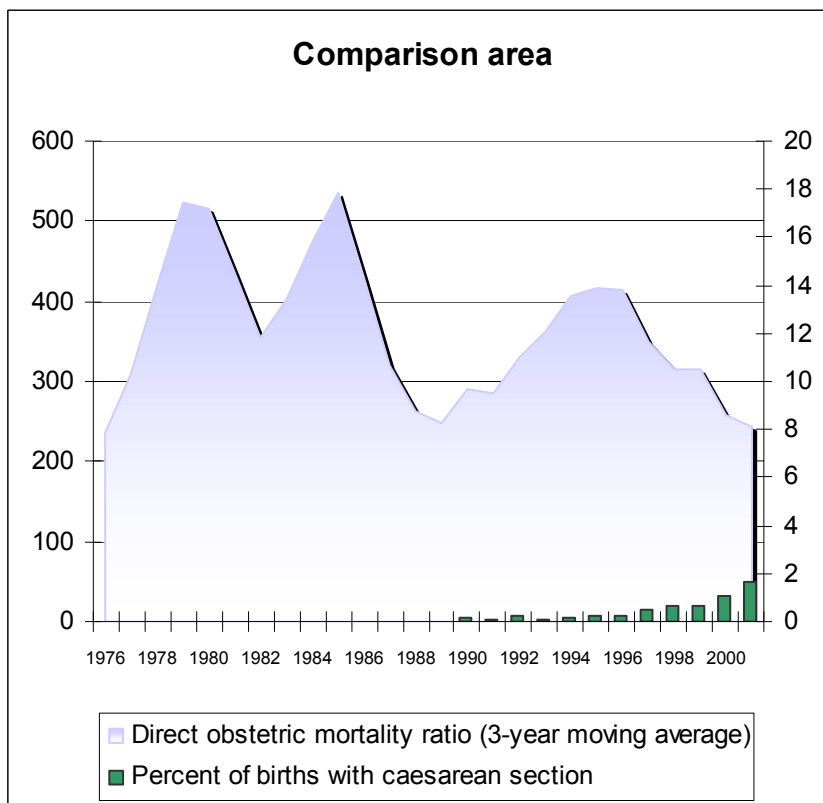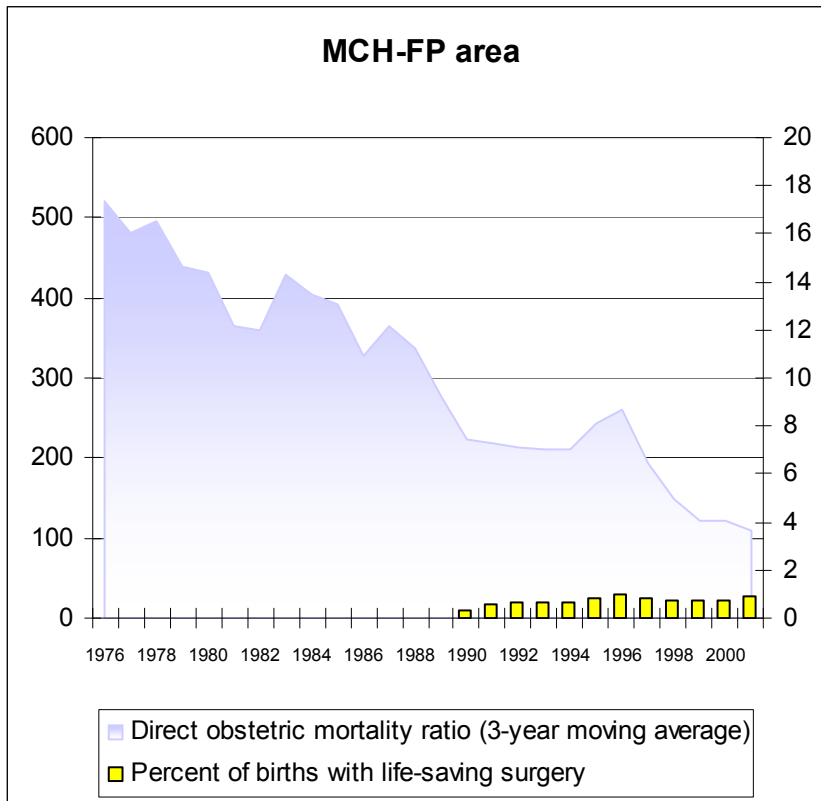
Percent of births with caesarean section
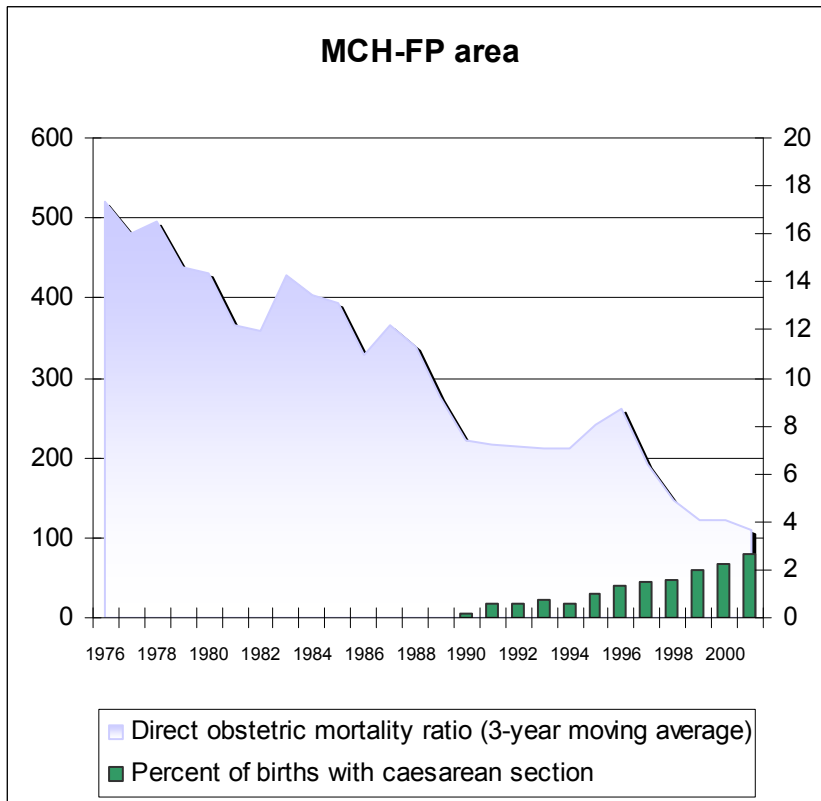
Figure 5: Trends in the percent of births with life-saving surgery in the MCH-FP and Comparison areas

MCH-FP area

Legend:
- Direct obstetric mortality ratio (3-year moving average)
- Percent of births with life-saving surgery

Comparison area

Legend:
- Direct obstetric mortality ratio (3-year moving average)
- Percent of births with life-saving surgery per 100,000 births
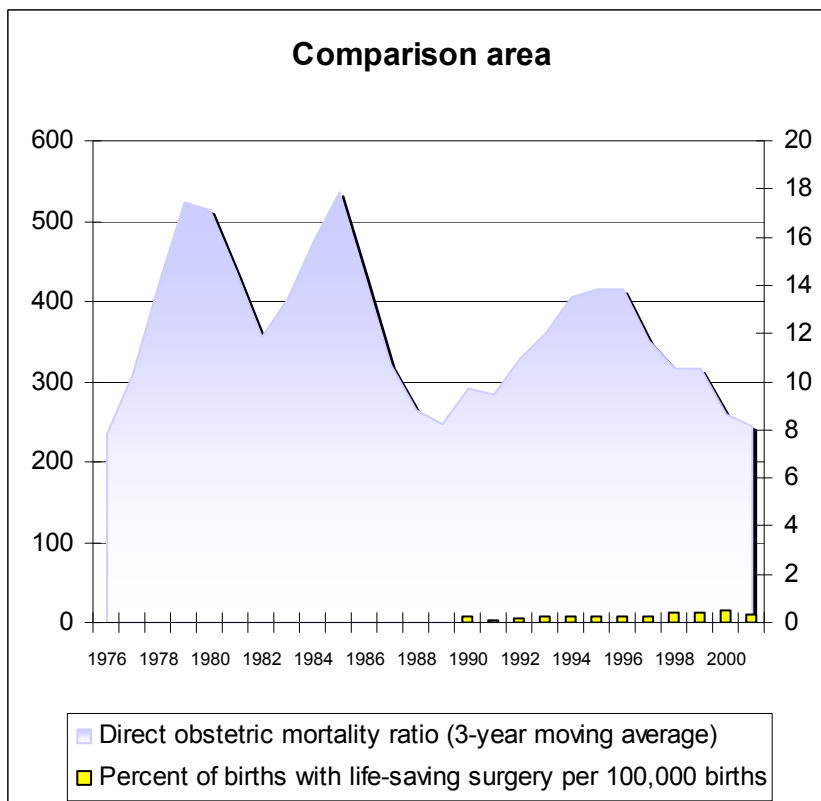
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