

# Equity in use of home-based or facility-based skilled obstetric care in rural Bangladesh: an observational study



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**Background** Few studies have assessed whether the poorest people in developing countries benefit from giving birth at home rather than in a facility. We analysed whether socioeconomic status results in differences in the use of professional midwives at home and in a basic obstetric facility in a rural area of Bangladesh, where obstetric care was free of charge.

**Methods** We routinely obtained data from Matlab, Bangladesh between 1987 and 2001. We compared the benefits of home-based and facility-based obstetric care using a multinomial logistic and binomial log link regression, controlling for multiple confounders.

**Findings** Whether or not a midwife was used at home or in a facility differed significantly with wealth (adjusted odds ratio comparing the wealthiest and poorest quintiles 1.94 [95% CI 1.69–2.24] for home-based care, and 2.05 [1.72–2.43] for facility-based care). The gap between rich and poor widened after the introduction of facility-based care in 1996. The risk ratio (RR) between the wealthiest and poorest quintiles was 1.91 (adjusted RR 1.49 [95% CI 1.16–1.91] when most births with a midwife took place at home compared with 2.71 (1.66 [1.41–1.96]) at the peak of facility-based care.

**Interpretation** In this area of Bangladesh, a shift from home-based to facility-based basic obstetric care is feasible but might lead to increased inequities in access to health care. However, there is also evidence of substantial inequities in home births. Before developing countries reinforce home-based births with a skilled attendant, research is needed to compare the feasibility, cost, effectiveness, acceptability, and implications for health-care equity in both approaches.

## Introduction

Concerns about inequalities between rich and poor in maternal health and health service use have had renewed attention in the past few years.<sup>1,2</sup> In most countries, differences between the rich and poor are larger for high-level health care than for primary care.<sup>2</sup> Maternal mortality is clearly linked to poverty, both between<sup>3</sup> and within developing countries.<sup>4</sup>

The poor face barriers to health care that are both demand-side (ie, high cost of access, lack of education about services available, and cultural norms) and supply-side (ie, when adequate facilities are not accessible).<sup>5</sup> One issue that is particularly important for safe motherhood is the preference of women to give birth at home.<sup>6</sup> In countries where such preferences are deeply rooted, trained attendants have been posted close to the women's homes.<sup>7,8</sup> But whether a home-based birth is better than facility based birth at reaching the poor is unknown. Although international policy is unequivocal about the need for a skilled attendant at birth, it provides little guidance on where the birth should take place.<sup>9</sup>

With 91% of births taking place at home, and only 12% attended by a health-care professional,<sup>10</sup> maternal health policies in Bangladesh have focused on villages having enough trained attendants.<sup>7,11</sup> Socioeconomic differentials in the use of trained birth attendants persist however,<sup>10</sup> and some researchers recommend clinic-based care.<sup>12</sup> We aimed to assess whether a home-based

approach to professional birth attendance results in more equitable use than a facility-based approach. During the study, home-based professional birth attendance was gradually replaced by a facility-based approach. All services were provided free of charge. By removing financial barriers, we were able to assess whether addressing geographical and cultural barriers through a home-based strategy would be more effective in reducing inequalities in access to basic obstetric care than a facility-based approach.

## Methods

### Study population

This study was done in Matlab, Bangladesh, a poor rural area southeast of the capital Dhaka. Matlab is flooded for part of the year, and people rely mostly on boats or walking for transport. In this predominantly Muslim society, women are not allowed to travel far unaccompanied, which can deter them from seeking obstetric care outside their home.<sup>6,13</sup> Our study took place in the Maternal and Child Health and Family Planning (MCH-FP) area with a population of about 110 000.<sup>14</sup> 80 community health workers visit all women in their homes every month to distribute contraceptives, and provide vaccines and education on nutrition.

In 1987, a safe motherhood programme was introduced in half the MCH-FP area, aimed at increasing skilled attendance at delivery.<sup>15</sup> Two midwives were posted in each of two health centres to provide antenatal, delivery,

*Lancet* 2006; 367: 327–32

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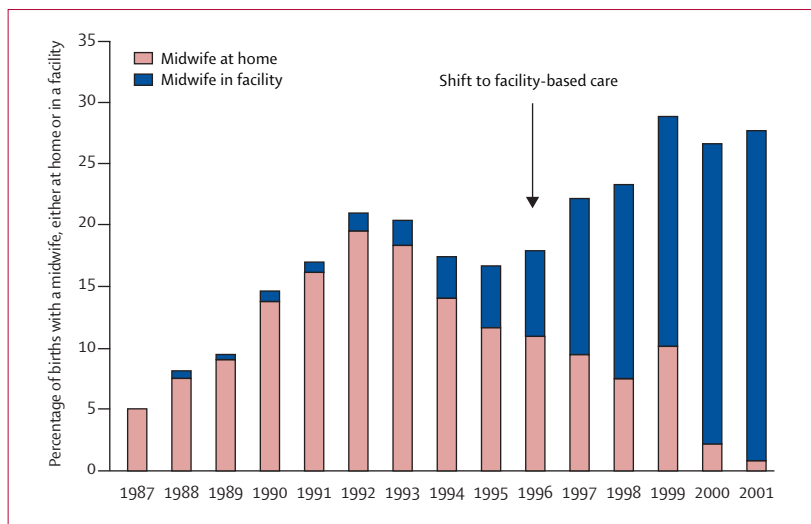


Figure: Percentages of births with a midwife, either at home or in a facility

and postnatal care at home. The midwives were trained and equipped to provide basic obstetric care, excluding assisted deliveries, and were on call 24 h a day. Each midwife covered a population of about 25 000 and 90% of the women lived within 3 kilometres of the health centre where the midwife was based. A basic obstetric clinic was established in Matlab town as a referral site when midwives felt that home birth was unsafe, but it could also be accessed directly by any woman seeking basic obstetric care. In 1990, the programme was expanded to cover the entire MCH-FP area: four more midwives were posted in the two remaining health centres, covering as many home births as possible.<sup>16</sup>

This strategy continued until 1996, after which it was redesigned to become facility-based. Between 1996 and 2001, all four health centres were gradually upgraded and equipped to provide basic obstetric care and the midwives were asked to stop attending home births. Both home-based and facility-based services were provided free of charge, but households were responsible for transport costs to the facility and food during their stay. Apart from midwives from the ICDDR,B: Centre for Health and Population Research (ICDDR,B), there were no other trained providers offering basic obstetric care in the area during the study period (1987–2001).

This study was approved by the Research Review Committee and the Ethical Review Committee of the ICDDR,B. All birth records obtained from the Health and Demographic Surveillance System (HDSS) between 1987 and 2001 were made anonymous. Women who gave birth during 1994–1996 were interviewed about the use of obstetric care only after they had provided informed consent.

### Procedures

We used multiple sets of data obtained by the ICDDR,B, including that from the routine HDSS, periodic

censuses, the geographic information system, and the safe motherhood programme.

The HDSS maintains data on all births, deaths, marriages, and migrations since 1966, and each individual has a unique identifier.<sup>17</sup> Data for all stillbirths and livebirths, maternal age, and gravidae were extracted from the HDSS. Data for asset ownership and religion were obtained from the 1996 census. All women were assigned their husbands' socioeconomic status at the time of the census. Educational status was obtained at the time of marriage. Linear distance from the health centre to the woman's home was obtained from the geographic information system.

Data for the place of birth and attendant for basic obstetric care were obtained from safe motherhood programme records. For each pregnancy, the midwives kept a record card with information on the place of birth, attendant at delivery, and referral, for all visits made to either the home or a facility. Between 1987 and 1993, this record card was given only to women who had seen a midwife at any time during or after pregnancy. From 1996 onwards, community workers completed a card for all pregnant women in their area, and if contacted, the midwife completed relevant sections.

Records were not available between the start of 1993 and the end of 1996 because the research component of the safe motherhood project was interrupted at the end of 1993, resuming activities at the end of 1996. Delivery of obstetric care continued, however, which means that our results should not be affected by this interruption in research activities. All women who gave birth during 1994–1996 were interviewed in 2002 about where and from whom basic obstetric care was received. Information on the use of obstetric services from the cards and interviews was supplemented by data from the Matlab clinic's registers (1987–2001) and from the midwives (1996–2001).

Women were classified as having received basic obstetric care from a trained provider if the ICDDR,B midwife was present at any time during labour, delivery, or immediately after delivery—irrespective of whether they actually delivered the baby. Births in high-level facilities outside Matlab were classified by whether or not—and where—basic obstetric care was obtained before referral. Trained attendance was classified as facility-based if the first point of contact was either the health centre or the Matlab clinic. Women first seen by a midwife at home and then referred to the Matlab clinic were classified as home-based.

Wealth was measured by an asset index.<sup>18</sup> Assets included durable goods (eg, table, chair, watch, television, or bicycle), housing facilities (eg, type of toilet, or source of drinking water), housing materials (eg, type of wall or roof), and land. Educational status of parents was not included in the index but was considered an independent variable. Five wealth quintiles were created. Equity was defined as equal use for equal need.<sup>19</sup> International policy

	Home-based care				Facility-based care		
	N	n (%)	Partly adjusted OR* (95% CI)	Fully adjusted OR† (95% CI)	n (%)	Partly adjusted OR (95% CI)	Fully adjusted OR (95% CI)
<b>Socioeconomic determinants</b>							
<b>Wealth quintile</b>							
Most poor	7059	499 (7.07)	1.00 ..	1.00 ..	4.43	1.00 ..	1.00 ..
Very poor	7635	709 (9.29)	1.37 (1.22–1.55)	1.33 (1.16–1.52)	5.13	1.22 (1.04–1.44)	1.19 (0.99–1.41)
Poor	8143	755 (9.27)	1.40 (1.24–1.58)	1.29 (1.13–1.48)	6.16	1.41 (1.21–1.65)	1.29 (1.09–1.53)
Less poor	8530	940 (11.02)	1.73 (1.54–1.94)	1.40 (1.23–1.61)	8.46	1.98 (1.71–2.29)	1.50 (1.27–1.78)
Least poor	7705	1168 (15.16)	2.91 (2.60–3.27)	1.94 (1.69–2.24)	13.37	3.54 (3.07–4.07)	2.05 (1.72–2.43)
Unknown	2347	218 (9.29)	1.58 (1.33–1.88)	1.27 (1.05–1.53)	6.69	2.11 (1.70–2.62)	1.41 (1.10–1.81)
<b>Mother's formal education (in years)</b>							
0	21 143	1176 (8.40)	1.00 ..	1.00 ..	4.20	1.00 ..	1.00 ..
1–4	4789	507 (10.60)	1.41 (1.27–1.57)	1.19 (1.05–1.35)	6.80	1.40 (1.21–1.61)	1.20 (1.03–1.39)
5–9	11 222	1426 (12.70)	1.87 (1.73–2.02)	1.32 (1.19–1.46)	11.00	2.06 (1.87–2.26)	1.44 (1.27–1.62)
10+	2099	368 (17.50)	4.29 (3.74–4.93)	2.02 (1.69–2.42)	27.80	5.83 (5.10–6.67)	2.69 (2.26–3.20)
Unknown	2166	206 (9.50)	1.16 (0.99–1.36)	1.16 (0.97–1.39)	3.70	1.24 (0.97–1.59)	1.17 (0.88–1.54)
<b>Father's formal education (in years)</b>							
0	23 245	2011 (8.65)	1.00 ..	1.00 ..	6.35	1.00 ..	1.00 ..
1–4	6381	673 (10.55)	1.26 (1.15–1.39)	1.16 (1.04–1.29)	6.90	1.17 (1.04–1.32)	1.06 (0.93–1.21)
5–9	7636	938 (12.28)	1.50 (1.38–1.64)	1.21 (1.09–1.34)	9.25	1.61 (1.46–1.79)	1.22 (1.08–1.37)
10+	3468	584 (16.84)	2.50 (2.24–2.78)	1.46 (1.27–1.67)	13.32	2.82 (2.48–3.21)	1.32 (1.13–1.55)
Unknown	689	83 (12.05)	1.39 (1.09–1.78)	1.35 (1.04–1.77)	4.50	1.31 (0.89–1.94)	1.31 (0.85–2.04)
<b>Religion</b>							
Muslims	34 158	3517 (10.30)	1.00 ..	1.00 ..	7.10	1.00 ..	1.00 ..
Others	6061	638 (10.50)	0.95 (0.87–1.05)	1.04 (0.93–1.16)	8.70	1.21 (1.09–1.35)	1.34 (1.18–1.53)
Unknown	1200	134 (11.20)	1.31 (1.08–1.59)	0.93 (0.74–1.17)	12.60	1.72 (1.41–2.09)	1.03 (0.82–1.31)
<b>Distance (km) from the basic health facility</b>							
≤1.0	8031	1308 (16.30)	1.00 ..	1.00 ..	14.40	1.00 ..	1.00 ..
1.1–2.0	15 015	1440 (9.60)	0.44 (0.41–0.48)	0.46 (0.42–0.51)	6.40	0.39 (0.35–0.43)	0.43 (0.39–0.49)
2.1–3.0	14 095	1227 (8.70)	0.39 (0.36–0.43)	0.41 (0.37–0.46)	5.50	0.31 (0.28–0.35)	0.34 (0.31–0.39)
≥3.1	4063	290 (7.10)	0.27 (0.24–0.31)	0.27 (0.23–0.32)	5.20	0.22 (0.18–0.26)	0.21 (0.17–0.26)
Unknown	215	24 (11.20)	0.65 (0.41–1.02)	0.77 (0.48–1.24)	7.00	0.63 (0.35–1.13)	0.71 (0.38–1.33)

\*Adjusted for time by geographical area, and for clustering of births to the same mother; †Adjusted for time by geographical area, age, gravidity, twins, all other factors shown in table, and for clustering of births to the same mother.

**Table 1: Socioeconomic determinants of use of basic professional obstetric care with a midwife at home or in a health facility (1987–2001)**

is unequivocal that all women need a skilled attendant at birth, regardless of health status.<sup>9</sup>

### Statistical analysis

Denominators for use of basic obstetric care were all stillbirths and livebirths recorded in the MCH-FP area between 1987 and 2001. All multiple births were treated as single births. We did two analyses. First, we used multinomial logistic regression to analyse basic obstetric care for a midwife present at home and in a facility. To adjust for different trends over time by geographical area, all logistic analyses included an interaction term for geographical area by year of birth. Second, we assessed the divergence over time in the percentage of births with a midwife according to wealth quintile, and used a binomial regression with the risk factors in a logarithmic (not logistic) link to present proportional change. All analyses were adjusted for clustering of births to the same mother. We report odds ratios (OR) for the logistic regression and risk ratios (RR) for the log link regression.

### Role of the funding source

The sponsors of the study had no role in study design, data collection, data analysis, data interpretation, or

writing of the report. The corresponding author had full access to all the data in the study and had final responsibility for the decision to submit for publication.

### Results

Data were available for 41 419 (96.9%) of the 42 766 births recorded between 1987 and 2001 in the MCH-FP area. Use of trained midwives around the time of birth was low in 1987, increasing steadily over time (figure). The numbers seeking basic obstetric care at home increased from 175 (5.0%) in 1987 to a peak of 531 (19.6%) in 1992, while the proportion with midwives in a facility increased from 0 in 1987 to 733 (26.8%) in 2001. At the peak of the home-based strategy in 1992, each pair of midwives attended on average 133 home births per year, compared with 183 births per year in each facility in 2001.

The differences in wealth between individuals in the study population are substantial (webtable). For example, fewer than 2% of the poorest quintile owned a chair or a table, compared with 100% of the richest quintile. But even the wealthiest group is still poor in absolute terms: most of their houses are made of

See Online for webtable

	Using a midwife at home or in facility				
	1987–1989 n (%) <sup>a</sup>	1990–1992 n (%)	1993–1995 n (%)	1996–1998 n (%)	1999–2001 n (%)
<b>Wealth quintile</b>					
Most poor	91 (5.4%)	195 (12.9%)	176 (12.0%)	164 (13.5%)	186 (15.8%)
Very poor	116 (6.2%)	276 (17.1%)	229 (15.3%)	218 (15.8%)	262 (20.5%)
Poor	131 (7.1%)	257 (15.5%)	260 (16.2%)	263 (17.1%)	346 (22.9%)
Less poor	161 (8.6%)	310 (18.6%)	309 (18.5%)	385 (23.0%)	497 (30.0%)
Least poor	157 (10.2%)	364 (25.5%)	426 (28.3%)	524 (33.9%)	727 (42.9%)
<b>Divergence between least and most poor</b>					
Absolute	4.8	12.6	16.3	20.4	27.1
Proportional					
Crude risk ratio (95% CI)	1.91 (1.49–2.44)	1.98 (1.69–2.32)	2.35 (2.00–2.76)	2.52 (2.15–2.95)	2.71 (2.35–3.13)
Adjusted risk ratio <sup>†</sup> (95% CI)	1.49 (1.16–1.91)	1.35 (1.12–1.62)	1.49 (1.24–1.78)	1.51 (1.26–1.81)	1.66 (1.41–1.96)

<sup>a</sup>Except for absolute and proportional divergence; <sup>†</sup>Adjusted for time by geographical area (in 3-year time bands), mother's and father's education, religion, mother's age, gravidity, and for clustering of births to the same mother. Models fitted for those in lowest and highest quintiles only.

**Table 2: Trends in use of basic obstetric care with a midwife by wealth quintile (1987–2001)**

bamboo or tin, and less than half have access to electricity.

There were substantial differences in the use of a midwife by wealth quintile, parents' education, and distance to the facility (table 1). After allowing for the changing overall patterns of use over time by geographical area, the wealthiest group was three times more likely than the poorest group to use a midwife whether for a home birth (OR 2.91 [95% CI 2.60–3.27]) or in a facility (3.54 [3.07–4.07]).

After adjusting for the other determinants, the poor-rich differences in the use of a midwife remained substantial (adjusted OR 1.94 [95% CI 1.69–2.24] for home-based care and 2.05 [1.72–2.43] for facility-based care). Both mothers' and fathers' education were strong independent predictors of midwife use, whether for home-based or facility-based births. Women with ten or more years of schooling were twice as likely to call a midwife at home (2.02 [1.69–2.42]) or to attend a health facility for birth (2.69 [2.26–3.20]) compared with those with no education, independently of their wealth status. The effect of the father's education was somewhat smaller, but still significant. Despite the proximity of the services, distance was a major barrier, both for facility-based and home-based care. Use of a midwife dropped by more than half for women living further than 1 kilometre from a health centre, whether or not they called a midwife at home or attended the health centre.

The change in trends over time for the use of a midwife by wealth quintile are shown in table 2. There was a substantial divergence in absolute percentages for use of a midwife either at home or in a facility. In 1987–1989 the gap between the wealthiest and the poorest was 4.8%, increasing to 27.1% when most births took place in facilities in 1999–2001. There was far less divergence proportionally, the risk ratio (RR) between the least and most poor being 1.91 in 1987–89 (adjusted risk ratio 1.49 [95% CI 1.16–1.91]) and 2.71 in 1999–2001 (RR 1.66 [95% CI 1.41–1.96]).

## Discussion

In this poor, rural area of Bangladesh, despite considerable community and cultural barriers inhibiting women from seeking care outside their home,<sup>6,13</sup> a shift from home-based to facility-based basic obstetric care is feasible but might be associated with increased inequalities in access to care. Even in the absence of major financial barriers, substantial poor-rich differences in the use of a trained birth attendant persist irrespective of where the delivery takes place. The level of education of the parents explains only part of these differences, suggesting that poor women face barriers other than financial or education-based when seeking maternal health services.

The increase over time in the proportion of births with a midwife was remarkable. In the late 1990s, only 8% of rural women in Bangladesh delivered their baby with a health professional in attendance. Just 5% of births took place in a health facility,<sup>10</sup> compared with 25% in our study in 2001. Since national figures include care in secondary or tertiary facilities (we restricted our analysis to primary care), the real difference is probably even greater. Part of the success of Matlab might lie in the provision of free care, availability of drugs and supplies at the point of care, community-outreach through community health workers, higher salaries and regular supervision of the midwives, and comparatively mother-friendly and accountable services. Although we acknowledge that the provision of services in Matlab might be unique, our findings do suggest that cultural and community barriers can be reduced if services are made geographically, financially, and culturally acceptable to women.

The increase in trained attendance at birth was not uniform across wealth groups, but our findings were mixed. There was an absolute increase in the poverty differential over time, suggesting a widening gap between rich and poor after the introduction of facility-based care. When measured in relative terms against the

unequal starting point in each wealth group, however, progress made by the wealthier groups was only marginally greater than that made by the poorest. New public-health interventions tend to initially reach the comparatively wealthiest, only later reaching out to the poorest.<sup>20</sup> Whether the widening gap seen here is due to the effect of facility-based care as such, or simply to the introduction of a new intervention is not known. More time might be needed to close the gap between the rich and the poor.

Our study has some limitations. First, the place of birth and birth attendant could have been misclassified for some women, particularly for cases when we relied on interviews for information. Potential misclassification could explain the slight drop in the proportion of births with a midwife between 1994 and 1996. Errors are likely to be small, however, since dates of birth and names of the children were available from surveillance data, and women were asked questions about one specific birth event.

Second, high-level public or private facilities were not considered in the classification of place of delivery and birth attendant because the high costs involved in such care<sup>21,23</sup> would have inflated the poor-rich differentials in access to facility-based basic obstetric care.<sup>2</sup> Our study compared having a midwife present in a home-based birth compared with a facility-based one at the primary-care level, and it was essential to consider the professional care received at the first point of contact before referral took place.

Finally, our method of calculating assets might be a poor proxy for socioeconomic status. We could not analyse changes in assets over time because the measurement was made only once, in 1996. Some researchers have suggested that the ranking of households is not sensitive to the asset items included,<sup>24</sup> whereas others suggest the opposite.<sup>25</sup> The asset score was surprisingly good at identifying inequalities in birth attendance in this rural area, however, and the items used to differentiate the wealth groups seemed to be conceptually valid.

The magnitude of the socioeconomic differentials in service use is remarkable. Many investigators have emphasised the direct consequences of financial constraints on service use by poorer groups.<sup>5,21,22</sup> This is notable when households must pay user charges, especially in the case of complications.<sup>21</sup> Services in Matlab are free of charge however, and the cost of transport was small (\$0.3) since most women walked to the health centre.<sup>26</sup> The average costs of food, gifts, and other supplies was \$5 at home and \$8 in a health centre,<sup>26</sup> and these costs might partly explain the differences in where women from different wealth quintiles chose to give birth. It is also possible that the time taken by households to call a midwife to the home, or to accompany a woman to the facility acts as a deterrent for the poorest, or that there is more fear and

uncertainty about exposure to an attendant from outside the immediate community in poorer groups. These questions remain unanswered but are key areas for further research.

The important role of women's education in the use of skilled care is well-known. Better education has been linked to increased autonomy and decision-making power, a better ability to acquire and process new knowledge, and different attitudes towards health problems and health services, than women with little education.<sup>1,5,27</sup> Few studies have explored the independent role of the father's education, however.<sup>27,28</sup> Although reproductive health issues are traditionally viewed as a women's issue, women in Bangladesh need permission from their husbands to travel outside their home. Men, as the primary income earners, often participate in decisions about what form of care women should seek. Data suggest that increasing father's education improves their understanding of the dangers of childbirth and need to access skilled attendance (Blum L, unpublished). Their education also improves communication regarding childbirth between husband and wife, ultimately enhancing the couple's autonomy in the decision-making process.

Distance can hinder the extent to which patients use a health-care service, and is also cited as a reason why women choose to deliver at home rather than at a health facility.<sup>5,27,29</sup> The detrimental effect of distance on facility-based care has been shown in other studies,<sup>27,29</sup> and is not surprising in view of the cultural context of Bangladesh. The equally large effect of distance on home-based professional care was unexpected, however, and is in sharp contrast with other findings from Bangladesh suggesting that the use of a trained traditional birth attendant at home is not affected by distance.<sup>28</sup> This finding highlights the fact that attending a home birth can be difficult for health professionals who do not live nearby: someone has to be sent to call the midwife (there are no telephones), the midwife has to arrange transport (by boat, rickshaw, or by walking), and she may have to travel at times when the same distance could take much longer to travel or at night when security is of concern. Cultural norms might also prevent midwives from moving far away from their home.

Many countries, particularly in South-East Asia, opt for home-based care.<sup>7,8</sup> Although designed to make midwife services more accessible, such policies have been formed with scant empirical evidence. In industrialised countries, there is no strong evidence to favour either home or hospital births for low-risk pregnant women if the service is backed up by a modern hospital system.<sup>30</sup> Whether these findings apply to resource-poor settings with limited access to higher level care is uncertain. Our evidence suggests that a facility-based strategy, if introduced after a transitional period of home-based care, is acceptable to women, although it might initially contribute to widening the gap between

the rich and the poor. Before further reinforcing home-based birthing strategies with a skilled attendant in developing countries, research comparing the feasibility, cost, effectiveness, acceptability, and equity implications of skilled home-based and facility-based obstetric care is needed.

#### Contributors

C Ronsmans conceived the study and wrote the first draft. All the authors contributed to the final draft. M E Chowdhury, T Marshall and C Ronsmans did the analysis and all authors contributed to data interpretation. M E Chowdhury, J Killewo, I Anwar, K Gausia, S Das-Gupta, L S Blum, G Dieltiens and S Saha supervised data collection and data management.

#### Conflict of interest statement

We declare that we have no conflict of interest.

#### Acknowledgments

We thank the midwives, community health workers, and women in Matlab for making this research possible; Jyotsnamoy Chakraborty for valuable comments; the Geographical Information Systems staff for providing relevant data; and Zubaida Nasreen for administrative support. This research was funded under the Cooperative Agreement #388-A-00-97-00032-00 with the United States Agency for International Development (USAID), ICDDR,B grant number GR-00089. ICDDR,B acknowledges the commitment of USAID to the Centre's research efforts. Carine Ronsmans and Jo Borghi are funded by the Department for International Development, UK.

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