Maternal Mortality in Rural Bangladesh: Lessons Learned from Gonoshasthaya Kendra Programme Villages

The finding that nearly one third of maternal deaths due to pregnancy and childbirth-related complications result from a delay in seeking care underscores the need to raise community awareness, including that of family decision makers on the likely adverse consequences of pregnancy and childbirth if timely care is not sought.

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Bangladesh has made significant strides towards achieving the Millennium Development Goals (MDGs); however, the scorecard on maternal health falls short of expectations. According to the MDG target, Bangladesh is expected to reduce the maternal mortality ratio (MMR) from around 574 maternal deaths due to

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pregnancy and childbirth-related complications per 100,000 live births in 1990 to 143 by 2015. Despite some progress, only 44 per cent of this target was achieved by 2000. An additional 56 per cent reduction has to be achieved to meet the MDG target in less than a decade. MMR was estimated to be around 320 per 100,000 live births during 1998-2000 (NIPORT and Johns Hopkins University, 2003). An estimated 14,000 Bangladeshi women die from pregnancy and childbirth-related complications per year (UNFPA, 2006).

The Government is aware of this unfinished task and fully committed to meet the challenge to achieve this goal by 2015. The most recent Government initiative in this respect is to increase the availability of skilled birth attendants (SBAs)[1] at the community level by arranging six-month theoretical and 12-month practical training (nine months supervised work experience, plus three months additional training) in midwifery skills, including selected basic emergency obstetric care (EOC) services. The Government also plans to increase antenatal care (at least three visits to new mothers) to 60 per cent from its present level of 20 per cent (Bangladesh, 1993).

Role of non-governmental organizations, particularly Gonoshasthaya Kendra, in the reduction of maternal mortality

Non-governmental organizations (NGOs) are collaborating with the Government of Bangladesh in reducing MMR. Of these organizations, particular mention must be made of Gonoshasthaya Kendra[2] (GK), the country's pioneer NGO in the health field. It made its debut in 1972, soon after the independence of Bangladesh, with a project in Savar Upazila in Dhaka District, with a view to improving the quality of life of the rural masses by ensuring affordable health services. GK has come a long way during the last three and a half decades, in terms of coverage and achievements. In 1972, its basic health-care coverage, including reproductive and child health-care, served approximately 50,000 people in 50 villages; now, coverage extends to more than one million people in 592 villages spread across the country in 31 unions of 16 upazilas (subdistricts) in 11 districts.[3] GK is now one of the largest service providers in the Bangladesh health sector, outside of the Ministry of Health and Family Welfare.

Gonoshasthaya Kendra's health-care services

GK provides a wide range of reproductive and child health (RCH) and family planning services in its programme aimed at villages. The services include: (a) registration and follow-up of pregnant women, and various ANC related services; (b) immunization of pregnant women against tetanus, and of children under age

one against six diseases (diphtheria, pertussis (whooping cough), Tetanus (DPT), polio, tuberculosis and measles; (c) identification and regular follow-up of high-risk mothers to ensure their timely treatment, including referral; (d) promotion of additional nutrients and emphasis on the importance of a balanced diet for pregnant and/or lactating women and newborns, among the new mothers and other family members; (e) organization of follow-up meetings with family members and villagers on the possible cause(s) of maternal and infant deaths and how those deaths could have been prevented; (f) promotion and delivery of family planning services; (g) pro-poor social health insurance scheme; and (h) organization of mobile camps to treat pregnant women. Given the plethora of health-related interventions delivered by GK, ranging from immunization to insurance, only those components directly related to maternal health are highlighted here.

Gonoshasthaya Kendra's health-care strategies

Village-based services: Anchoring of GK Programme
within the local community

GK provides health services, including reproductive health and family planning services at the village and community levels through a network of village-based trained health workers, who have completed the Secondary School Certificate examination in science; most are female. The participants are expected undergo a six-month foundation training in basic physiology, anatomy and other components of primary health-care. Upon successful completion of the above formal training, they are posted at GK union-level health sub-centres for a 12-month practical training, during which they work under the close supervision of their senior colleagues.

Involvement of traditional birth attendants in the delivery of health services

Doctors or nurses attend only 6 per cent of rural births taking place in Bangladesh (World Bank, 2006). In villages where GK implements projects, this figure is closer to 3 per cent. In recognition of this reality, and to meet the acute shortage of trained birth attendants in rural areas, GK decided to involve the existing traditional birth attendants (TBAs) by giving them training in the scientific basis of pregnancy and handling of normal delivery (the training is periodically repeated, reinforced and updated). TBAs are trained to deliver the baby at home without the supervision of GK health paramedics, except when complications arise. As a result, from 2002 to 2005, over 80 per cent of births in GK villages were delivered by trained traditional birth attendants, compared with only 12 per cent at the national level (NIPORT and Johns Hopkins University, 2003). This is a

testimony of how much can be achieved in the absence of skilled birth attendants or doctors in rural settings with the help of well-trained low-cost traditional birth attendants.

Integrated and cohesive responses

Gonoshasthaya Kendra offers an integrated package, in which it provides the target population with basic primary health services including reproductive health, child care, family planning and elderly service through its village- or community-based health workers. Secondary- and tertiary-level care uses well-established referral linkages to both GK and government hospitals. Patients requiring more advanced intervention are referred (often escorted) to a better-equipped health facility. GK also promotes nutrition education among family members, particularly on the need for additional nutrients and a balanced diet for newborns and pregnant and lactating mothers. In this effort to promote nutrition education, GK organizes *bou-shasuri* meetings (bringing together daughters-in-law and mothers-in-law) to discuss, among other things, workload and nutritional needs of pregnant women as well as the necessity for them to rest during the day. Mothers-in-law are urged to allow their daughters-in-law to eat first, along with the children. Traditionally, daughters-in-law in these patrilineal households are the last family members to eat and usually get what is leftover.

Transparency and accountability in service delivery

Gonoshasthaya Kendra actively cultivates village or community partici-pation in health delivery through the constitution of a village health committee, composed of members from various segments of society and usually headed by a female-elected member of the Union Parishad (the lowest tier of the local government). To ensure accountability, GK health workers are answerable for each maternal and child death in the village during a specially arranged "death meeting", where family members, teachers, priests and local elected representatives, including members of the village health committee, are present. The meeting is organized to discuss the possible causes of a maternal or neonatal death and explore whether or not this death could have been avoided. This has a huge social awakening impact. Beyond this village-level social auditing, all GK field-level health workers, ranging from paramedics to their immediate supervisors, must independently prepare a detailed case history and submit reports to their respective supervisors within 72 hours of the reported death, explaining why the maternal or neonatal death could not be prevented. The manager of the concerned GK health sub-centre will verify the reports with a field visit and share his or her observations with field workers, before submitting investigation reports

within the following seven days to a higher authority. The GK doctor attached to the corresponding union-level health sub-station also selectively investigates the death reports submitted by the various field staff.

Objectives of the study

Since 1972, GK has made significant progress towards achieving some of the Millennium Development Goals (MDGs), particularly those related to maternal and child health. The purpose of this monograph is to highlight those achievements and their underlying factors, particularly in reducing maternal mortality. In the absence of a proper baseline, variations in duration of programme exposure will be used to examine differences in levels and trends of maternal mortality. Programme areas which have been served by GK for a long period of time will be contrasted with areas where GK has started activities only recently, using appropriate econometric selection and controls. These events will also be evaluated against other comparable national and subnational level data sets to assess the effect of the Gonoshasthaya Kendra programme. The monograph will also examine the patterns, causes and determinants of maternal deaths based on a panel data set, in which several cohorts were followed from the time pregnancy is confirmed until the outcome (until 42 days after the delivery). It is extremely rare to have such a unique data set in a developing country setting. The panel data consist of those who had conceived and delivered between 15 April 2002 and 14 April 2005.[4] The data were collected by GK field-level health workers as part of routine monitoring.

Reliability of data

How reliable is the data on maternal mortality collected by GK? Data on maternal mortality is suspect even in developed countries such as Netherlands and the United States of America. In those countries, the level of underreporting of maternal deaths may be as high as 25 per cent (Smith and others, 1984; Schuitemaker and others, 1997). Maternal deaths are reported to constitute about 25 per cent of reproductive-age deaths in developing countries (Royston and Armstrong, 1989), compared with only 14 per cent in GK programme areas. The possibility of underreporting of maternal deaths cannot be completely ruled out in GK programme areas, particularly in the case of abortion-related deaths, which take place in the early stage of pregnancy, before any GK worker has identified a pregnancy. Every effort was made to minimize this omission. GK health workers meticulously record all vital events in programme areas, including maternal deaths, under close supervision of and monitoring by their supervisors and the village-level health committee. All pregnant women are registered and followed for antenatal and post-natal care services by health workers. Moreover, GK

local-level health workers organize a follow-up meeting at the house of the deceased pregnant woman, and discuss with the family members, including the funeral attendees, the possible reason(s) for the death and how this could have been prevented. GK supervisors regularly check with local priests about funeral ceremonies (and even keep a count of new graves). Under this watertight follow-up system, it is unlikely that any maternal death would go unreported, unless it is intentionally hidden. An independent evaluation of the quality of the population data (including maternal deaths) routinely collected by GK field-level health workers was conducted by a new team of interviewers and supervisors from the GK Research and Evaluation Division in May 2006 in10 per cent of GK programme villages. The data on maternal deaths collected by this team matched the corresponding data that had been reported by health workers from April 2005 to May 2006 in the same 60 villages (GK, 2007). This further confirms the reliability of the data on maternal deaths collected by GK.

Adult female mortality

Table 1 presents adult female and maternal deaths in the programme villages of Gonoshayastha Kendra from 15 April 2002 to 14 April 2005. There were 616 adult female deaths, yielding an adult female death rate of 0.90 per 1,000 women in the reproductive ages 15-49 years. Of the 616 adult female deaths, 86 (14 per cent) were identified as maternity related, that is, occurring during pregnancy or within 42 days of the end of the pregnancy. The comparable figure at the national level was around 35 per cent during the 1980s (Ginneken and others,1998). There were 48,362 pregnancy terminations and 46,320 live births, resulting in a maternal mortality ratio of 1.78 per 1,000 reported pregnancy terminations or 1.86 per 1,000 live births during the period 2002 to 2005.

Table 1. Distribution of birth, reproductive age and maternal deaths during the period 15 April 2002-4 April 2005

Group	Population	Deaths	Death rate (per 1,000)
Females aged 15-49	684,328*	616	0.90
Females with pregnancy termination	48,362	86	1.78
Live births	46,320	86	1.86

Note: * Refers to total number of women of reproductive age (15-49 years) during 2002-2005.

Maternal deaths

This section presents an analysis of 86 maternal deaths (i.e., pregnancy-, childbirth- and puerperium-related deaths) identified among the total 616 reproductive-age deaths occurring in 592 villages from 2002 to 2005.

Levels and trends in maternal mortality ratio

Figure 1 examines maternal mortality ratio levels and trends in GK programme areas over the range of periods 1993-1997 to 2001-2005. It shows a considerable decline (37 per cent) in MMR during the last decade down from about 300 per 100,000 live births during 1993-1997 to 190 per 100,000 live births during 2001-2005. However, the pace of decline in MMR has slowed during the last five years (1997-2001 to 2001-2005), compared with the preceding five years (1993-1997 to 1997-2001). MMR has declined by 31 per cent, or 6 per cent per annum, during 1993-1997 to 1997-2001, compared with 7 per cent, or just over 1 per cent per annum, during 1997-2001 to 2001-2005.

Figure 1. Maternal mortality ratios in GK programme areas for the periods 1993-1997, 1997-2001, 2001-2005 and 2002-2005
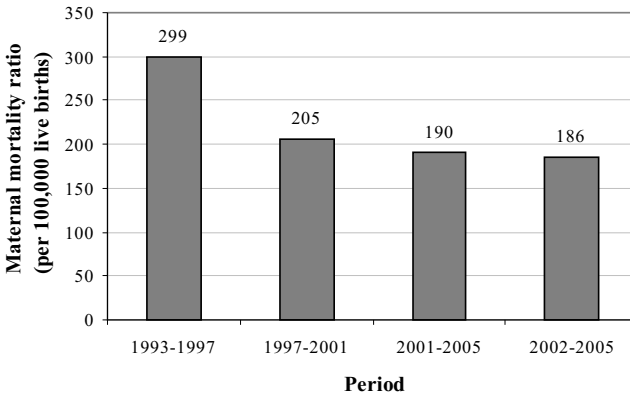
Furthermore, the data show an inverse relationship between MMR and the number of years villages have been under the GK programme. Villages which have been under the programme for a longer time have lower MMR compared with villages that have been under the programme for a shorter period. MMR was reduced to 177 per 100,000 live births in 63 per cent of programme villages that have been under the programme for 10 years or more, compared with an MMR of 211 per 100,000 live births in villages that were under the programme for less than

four years (see table 2). The pace of decline in MMR would increase by 100 per cent from 7 to 14 per cent if all the villages had been under the GK programme for 10 years or more between 1997-2001 and 2001-2005.

Table 2. Maternal mortality ratio by life span (duration) of GK programme area, 14 April 2002 to13 April 2005

Life span of GK programme areas	Number of villages	Number of live births	Number of maternal deaths	MMR (per 100,000 live births)
0 - 4 years	167	9,938	21	211.3
5 - 9 years	50	6,414	12	187.1
10 years or more	375	29,968	53	176.9
Total	**592**	**46,320**	**86**	**186.0**

Timing of maternal deaths

Table 3 summarizes the timing, in relation to the pregnancy, of the 86 maternal deaths. Over three out of five pregnant women (60.5 per cent) died during the post-partum period, nearly one in three (32.5 per cent) during pregnancy most (27.9 per cent) at 24 weeks or later and the remaining 7 per cent during labour. Of the 52 women who died after delivery, 37 (71.1 per cent) died within 0-12 hours, 13 (25 per cent) within 1-7 days and 2 (4 per cent) within 8-42 days. A similar delivery pattern of post-partum deaths was observed in 233 villages in Bangladesh in 1970 (Chen and others, 1974). The finding that the highest concentration of post-partum deaths occur within 0-12 hours of delivery highlights the urgency of ensuring that obstetric first aid is within easy reach of pregnant women (WHO, 1991).

Table 3. Numerical and percentage distribution of maternal deaths by time course of pregnancy, 2002-2005.

Period of pregnancy	Maternal deaths	
	Number	Percentage
Prior to delivery	34	39.5
Earlier than 24 weeks	4	4.6
24 weeks or later	24	27.9
During labour but undelivered	6	6.9
Post-partum (up to 42 days)	52	60.5
Total	**86**	**100.0**

Maternity services

Table 4 presents data on maternity services, particularly those related to place and attendant of antenatal and post-natal care. Data in table 4 show that all 86 women who died due to pregnancy, childbirth and puerperium-related causes received at least one antenatal care visit at their home. Of these, GK health workers visited eight women (9.3 per cent) one-two times, 58 women (67.4 per cent) three-six times, 13 women (15.1 per cent) seven-eight times, and seven women (8.1 per cent) nine times or more for ANC services. On average, such woman had received five ANC visits. About 97 per cent of pregnant women in GK areas received a tetanus vaccination for their last pregnancy. Moreover, GK health workers identify high-risk mothers and closely monitor their health status, providing necessary follow-up services, including treatment and timely referral of complicated cases to specialists or health facilities.

Table 4. Maternity care factors (N=86)

Variable		Number	Percentage
Number of antenatal care visits	At least 1	86	100.0
	1-2	8	9.3
	3-4	30	34.9
	5-6	28	32.6
	7-8	13	15.1
	9 and above	7	8.1
	Mean number of visits	5.04	
Place of antenatal care	Home	86	100.0
Attendant at labour/delivery (N=58)*	Trained traditional birth attendants	34	58.6
	GK paramedic and government health workers	4	6.9
	Doctors/nurses	13	22.4
	Relatives/friends	7	12.1
Place of death (N=86)	Hospitals	42	48.8
	On the way to hospital	12	14.0
	Home	32	37.2

* Excludes 28 cases, who died before delivery.

Compared with GK area, ANC-related services at national level are considerably lower. For example, all pregnant mothers (100 per cent) in GK area received ANC services during their last pregnancies, compared with only 47.6 per cent for the country as a whole. Only 21 per cent pregnant women in Bangladesh received three or more ANC visits, compared with 91 per cent women in GK area for the last pregnancy. About 97 per cent women in GK area, compared with 85 per cent across the country received TT vaccination during the last pregnancy (NIPORT and Johns Hopkins University, 2003). A close monitoring of high-risk pregnant women for necessary follow-up services as practiced in GK areas is not routinely available at the national level. The higher ANC related services in GK areas, compared with the national level, are among the contributing factors, explaining the finding of lower maternal mortality in the former as compared with the latter.

Attendants at delivery

Data in table 4 show that nearly one third (29.3 per cent) of the 58 women who were in labour among women who died due to pregnancy and childbirth-related complications were attended by doctors and nurses or trained GK and government health workers, while 34 women (58.6 per cent) were attended by trained traditional birth attendants. Only seven women (12 per cent) were attended only by relatives/friends. It is to be noted that the percentage of deliveries attended by medically trained personnel (i.e. doctors and nurses) was higher for women who died due to pregnancy and childbirth related complications than for those pregnant women who delivered safely (22 per cent vs. 2.6 per cent) (see table 5). This would also explain the finding that the proportion of maternal deaths (49 per cent) occurring in hospitals or clinics is relatively higher than that of maternal deaths at home (37 per cent). Only complicated cases require hospitalization and hospital-based care and treatment. Only 10-12 per cent of deliveries in GK areas were assisted by untrained birth attendants (relatives, untrained traditional birth attendants) as compared to 74.3 per cent for the country as a whole (NIPORT and Johns Hopkins University, 2003). Home thus continues to remain the primary location for delivery both at the country level and in GK areas. More than 70 per cent of deliveries in GK areas and over 90 per cent in the country as a whole take place in a home-base setting. However, a major difference between GK programme areas and the rest of the country is that trained birth attendants, including medically trained personnel, assisted nearly 90 per cent of births in the former, compared to 24 per cent in the latter. This explains the finding of a higher maternal death rate for the country as whole, as compared to the GK areas.

**Table 5. Percentage distribution of pregnancy outcome of GK women
who delivered safely or died owing to pregnancy- or
childbirth-related complications**

Attendants at labour	Women who delivered safely	Women who died owing to pregnancy- or childbirth-related complications
Trained health workers (GK and government health workers)	5.5	6.9
Trained traditional birth attendants	81.84	58.6
Untrained birth attendants	..	..
Doctors and nurses	2.6	22.4
Relatives	10.06	12.1
Others	..	..
No one/self	..	..
Total (percentage)	**100**	**100**

Causes of maternal deaths

Table 6 presents data on direct and indirect causes of maternal deaths. Causes of maternal deaths were determined by verbal autopsy. Direct obstetric cause of death refers to a death resulting from complications of the pregnancy itself, from interventions elected or required by the pregnancy or from a chain of events initiated by the complications or the intervention. Indirect obstetric causes of death refer to death resulting from disease contracted before or developed during pregnancy (not a direct effect of the pregnancy), often aggravated by the physiological effects of the pregnancy, thus leading to the death. In addition to direct and indirect causes of maternal deaths, causes of deaths, which occurred during pregnancy or within 42 days of its termination, yet not related to maternal deaths, were also identified and reported in table 6 as non-related causes of maternal deaths.

Seventy of the 86 maternal deaths (81.4 per cent) were attributed to direct obstetric causes, 6 (7.0 per cent) were classified as indirectly related to pregnancy and 10 (11.6 per cent) were considered not related to childbearing per se. The most common direct causes of maternal deaths occurred post-partum primarily due to retained placenta and eclampsia. Of direct causes of maternal deaths, direct complications related to labour and delivery accounted for 68.6 per cent (48 of 70 cases). This was followed by eclampsia and abortion, accounting for 27.1 per cent

and 4.3 per cent respectively. Of the deaths resulting from direct complications related to labour and delivery, post-partum haemorrhage (PPH) accounted for the highest proportion: 28 out of 48 cases (58.3 per cent).

Table 6. Numerical and percentage distribution of causes of maternal deaths (N=86)

	Causes of death	Number	Percentage of direct causes	Percentage of all causes
Direct causes	Direct complications of labour and delivery	48	68.6	55.8
	Post-partum haemorrhage with retained placenta	19	27.1	22.1
	Post-partum haemorrhage without retained placenta	9	12.9	10.5
	Obstructed labour	8	11.4	9.3
	Ruptured uterus	4	5.7	4.7
	Antepartum haemorrhage	8	11.4	9.3
	Pre-eclampsia or eclampsia	19	27.1	22.1
	Abortion	3	4.3	3.5
	Sub-total	70	100	81.4
Indirect causes	Aneamia	6	37.5	7.0
	Jaundice	4	25.0	4.7
	Cardiac failure	3	18.8	3.5
	Snake-bite	1	6.3	1.2
	Acute diarrhoea	1	6.3	1.2
	Respiratory failure	1	6.25	1.2
	Sub-total	16	100.0	18.6
Total		**86**	**100.0**	**100.0**

The predominance of PPH and eclampsia, among direct causes of maternal deaths, was also found in Matlab villages and the country as a whole in 2001 (Dieltiens and others, 2001; NIPORT and Johns Hopkins University, 2003). Some 28 deaths, or 40 per cent of all direct causes of maternal deaths, were due to post-partum haemorrhage, itself the outcome of a retained placenta, involved in

19 of the 28 cases (67.8 per cent); 9 were post-partum deaths. Of all 28 PPH cases, 11 died at home, 12 at hospital and the remaining 5 passed away on their way to hospital. The majority of PPH deaths occurred shortly after the delivery 15 (53.5 per cent) within 3-6 hours and 10 (35.7 per cent) within 7-12 hours; the remaining 3 died within one to seven days of the termination of pregnancy (see table 7). Those deaths were all due to emergency obstetric complications. Only four women received oxytocin injection from non-qualified practitioners.

A close examination of case histories of maternal deaths due to PPH reveals that 14 (50 per cent) of those deaths could have been prevented if appropriate treatment and care were available from the first-level health-care facilities. In most cases, they called on multiple providers and facilities to seek appropriate care and treatment. Usually, a pregnant woman first calls on a TBA. If TBA detects an abnormality, she refers the patient to a village practitioner not usually medically trained or to the first referral-level health centre, such as, the union health and family welfare centre, the upazila health complex, or a private or NGO clinic. If none of the first-referral-level centres is able to provide appropriate care or treatment, the patient is referred to a district hospital or a maternal and child welfare center. This search for appropriate care takes up valuable time needed to save a life. Though officially 8-12 doctors are posted in each upazila health complex, 70 per cent are absent during office hours and hardly any doctors are available in the afternoons or evenings (Chaudhury and Hammer, 2004). Private clinics at the upazila level do not have regular doctors. Such clinics bring in a gynaecologist and an anaesthetist after a patient is admitted.

Manual removal of placenta, timely use of misoprostol and oxytocin and timely referral could prevent most of the deaths caused by post-partum haemorrhage. Only rarely is major surgery required. The high number and percentage of maternal deaths owing to retained placenta, as well as the under-use of oxytocin injection, non-availability of required services at the first level health-care facility and rapidness of death have important implications for the delivery of services. This underscores the need for (a) availability of oxytocin injection and misoprostol at the first-level health facility (i.e. union health and family welfare centre; (b) training of community-based health workers (family welfare assistants, sub-assistant community medical officers and health assistants, including GK health workers, in the management of post-partum haemorrhage with intra-muscular oxytocin and immediate intravenous infusion; (c) knowledge of procedure for manual removal of the placenta; and (d) identification of emergency obstetric cases for timely referral. The findings of non-availability of required services at the first-level health-care facility which explains 50 per cent

of PPH-related deaths and most deaths taking place shortly after the termination of pregnancy underscore the need to strengthen the capacities of first-level health-care facilities in basic emergency obstetric care services, particularly blood transfusions.

Of the pregnancy, childbirth and puerperium-related causes, eclampsia (pregnancy-induced high blood pressure and convulsions that may develop during pregnancy or immediately after delivery) claims the second highest toll of lives, accounting for 27 per cent (19 of 70) of all direct causes of maternal deaths (see table 6). A majority (10 of 19) of victims are young and nulliparous women aged between 18 and 30. Of all 19 deaths due to eclampsia, 10 died during pregnancy; 4 died at home, 5 at hospital and 1 on her way to hospital. There were eight post-partum deaths: one occurring at home, six at hospital and one on the way to hospital. One woman died during delivery at hospital. Only one out of 19 women who died due to eclampsia-related causes had received oxytocin injection by medically non-qualified practitioners. Three out of eight (38 per cent) post-partum deaths owing to eclampsia took place within zero to two hours of delivery and the remaining within one to seven days. All eight eclampsia-related post-partum deaths took place within a span of one week, with the highest toll (88 per cent) occurring within the first three days (see table 7). A close look at the case histories of maternal death owing to eclampsia reveals that 10 out of 19 (52.6 per cent) such deaths could have been avoided if appropriate services had been available at the facility where they first called for care, i.e. the first-level health facility.

Most of these eclampsia-related maternal deaths could have been avoided if GK health workers had been more careful and vigilant in identifying and monitoring these cases during their ANC visit. A GK health worker is required to identify complicated cases, monitor such cases more frequently and provide necessary advice and services, including referral advice, if necessary, during their visit. Unfortunately, only one out of these 19 cases was diagnosed with pre-eclampsia during the ANC visit. This is sheer negligence on the part of GK health workers. GK field-level supervisors should be more vigilant in cross-checking the work of health workers through independent field visits, and help identify high-risk pregnant women including complicated eclampsia cases and oversee their proper management. The findings call for strengthening the skill of field-level government as well as GK health workers in the identification and management of high-risk pregnancies, including complicated eclampsia cases.

The third most important cause of maternal death is obstructed labour, with 12 cases altogether, including 4 ruptured uterus cases representing 17 per cent of

the maternal deaths investigated. A similar level of such deaths was also reported by the International Centre for Diarrhoeal Disease Research, Bangladesh in Matlab villages in 2001 (Dieltiens and others, 2004). The Bangladesh Maternal Health Services and Maternal Survey 2001 also found obstruction as the third leading cause of maternal death in Bangladesh (NIPORT and Johns Hopkins University 2003). Of all 12 maternal deaths caused by obstructed labour, seven occurred during labour without successful delivery of the baby (three at home, four at hospital); and five deaths occured after ultimately giving birth (one at home and four in hospital). These maternal deaths caused by obstructed labour could have been avoided with improved family education, skilled attendance at labour and referral for caesarean section. The finding calls for further improvement of the skills of community-level GK health workers, including government health workers.

The fourth most important cause of maternal death is abortion, accounting for 4.3 per cent (3 out of 70) of all maternal deaths due to direct causes. Abortion as a cause of maternal death is also reported to be the fourth largest at the national level in Bangladesh according to the 2001 Bangladesh Maternal Health Services and Maternal Survey 2001 (NIPORT and Johns Hopkins University, 2003). However, the International Centre for Diarrhoeal Disease Research, Bangladesh found a much higher proportion (15 per cent) of maternal deaths owing to induced abortion than that was reported in GK programme villages (Dieltiens and others, 2004).

Two of the three deaths reported (one at home, one at hospital) were due to septic abortions and one (at hospital) was due to unsafe induced abortion. All three pregnancies were accidental and unwanted. Two of the three women secretly sought the help of local charlatans to abort their pregnancies and had been prescribed an herbal abortifacient. Both experienced severe vaginal bleeding following the use of the herbal concoction. One died at home within two hours after the bleeding, having received no treatment. The other woman was taken to the local district hospital following the severe vaginal bleeding but died on the same day. The remaining one sought the help of a local government family planning worker (family welfare assistant) to abort the pregnancy through the menstrual regulation method. The assistant performed the menstrual regulation method and prescribed the patient some abortifacient drugs.

All these abortions-related deaths could have been prevented if abortion and treatment for post abortion complications had been made available at the primary health-care facility. Abortion is not legal but menstrual regulation, which is an abortion procedure for pregnancy up to 10 weeks, is available in most major hospitals, clinics and union health and family welfare centres.

Six (6.98 per cent) deaths were classified as indirectly related to pregnancy. These were due to complications associated with anaemia. These six plus other direct obstetric deaths associated with haemorrhage are not unexpected, given the finding that a large proportion of women in rural Bangladesh have abnormally low haemoglobin levels (Dhaka University, 1998). Of the remaining 10 deaths not directly related to maternal deaths, four were due to hepatitic failure, three to cardiac failure and one each to acute diarrhoea, respiratory failure and snake-bite. Those deaths may be considered unrelated to pregnancy and childbirth but may have been aggravated by the physiological effects of pregnancy.

Table 7. Time interval between birth and death

Causes	Time interval								Total
	Hours				Day				
	0-2	3-6	7-12	13-24	2-3	4-7	8-14	15-42	
Post-partum haemorrhage with retained placenta	1	10	7	1	0	0	0	0	19
Post-partum haemorrhage without retained placenta	0	5	3	0	0	1	0	0	9
Eclampsia	3	0	1	1	2	1	0	0	8
Antepartum haemorrhage	0	3	0	0	0	0	0	0	3
Obstructed labour	0	2	0	0	0	1	0	0	3
Ruptured uterus	1	0	0	1	0	0	0	0	2
Abortion	0	0	0	0	0	0	0	0	0
Anaemia	0	0	0	1	0	2	1	1	5
Jaundice	0	0	1	0	1	1	0	0	3
Cardiac failure	0	0	0	0	0	0	0	0	0
Respiratory failure	0	0	0	0	0	0	0	0	0
Acute diarrhoea	0	0	0	0	0	0	0	0	0
Snake-bite	0	0	0	0	0	0	0	0	0
Total percentage	9.6	38.5	23.1	7.7	5.7	11.5	1.9	1.9	100
Total numbers	5	20	12	4	3	6	1	1	52

An analysis of this data clearly confirms the predominance, as shown in studies worldwide of five direct causes of maternal deaths: haemorrhage, obstructed labour, ruptured uterus, eclampsia and complications due to unsafe abortion. Although all pregnancies must be considered at risk, professional health workers and skilled attendants should be able to manage all five of these life-threatening complications.

Table 7 examines the time interval between birth and death in the 52 cases of post-partum death. Data show a link between timing and cause of death. For example, 57 per cent (16 of 28) of deaths caused by PPH, with or without retained placenta, took place within zero to six hours of delivery. Another 36 per cent (10 of 28) died within 7 to12 hours. All three deaths due to antepartum haemorrhage took place within three to six hours of the delivery. Most of the women with anaemia died many hours or days after giving birth and could have been saved by improving their haemoglobin level with a higher nutrient intake.

Considering all cases, 25 out of 52 post-partum deaths (48 per cent) took place within six hours of the delivery and all were due to emergency obstetric conditions. These findings clearly underscore the need to make emergency obstetric case services available to pregnant women.

Timeliness in receiving maternal care

Maternal deaths can be attributed to both medical (biological) and non-medical factors. Among the non-medical factors, particular mention may be made of (a) delay in arranging transport to reach a health facility, (b) delay in seeking care and (c) delay in getting required care and treatment. An attempt is made to explore and analyse those delays by closely examining the case studies of each of the 86 maternal deaths reported in this study. This examination revealed that 63 out of 86 (73 per cent) of maternal deaths could possibly have been prevented had there been no delays in seeking and receiving appropriate treatment and arranging transportation (see table 8).

**Table 8. Percentage distribution of those who sought care,
by timeliness in receiving care**

Timeliness in receiving care	Number	Percentage
Delay in receiving required treatment	39	45.4
Delay in making decision	20	23.3
Delay in arranging transportation	4	4.7
No delay	23	26.7
Total	**86**	**100.0**

Delay in receiving required care and treatment

Thirty-nine of 63 (62 per cent) maternal deaths could have been prevented if the women had received appropriate care and treatment or, more precisely, had gone to an adequate health facility during their first emergency visit. In those cases, the pregnant women called on multiple providers or facilities to seek appropriate care and treatment, but were unsuccessful because of absent medical personnel and/or inadequate facilities at government and private clinics. During this search for appropriate care, precious time needed to save lives was lost. Eight of these 39 (20 per cent) maternal death cases received inappropriate and wrong treatment at health facilities. Twenty-two of 39 (56 per cent) of these deaths were associated with post-partum haemorrhage with or without retained placenta. This calls for providing first level health-care facilities with emergency obstetric care equipments, particularly for blood transfusions. The findings also call for further skill development of community-based health workers in proper risk identification and management, better communication with families and timely referral of emergency obstetric cases to appropriate facilities.

Delay in seeking care

Twenty out of 63 women (31.7 per cent) whose lives could have been saved died owing to delays in seeking care. Although the exact reasons for such delays could not be determined from the case studies, a variety of factors can be identified: (a) lack of understanding of the seriousness of the risks associated with pregnancy, (b) non-availability of doctors at government health facilities and concern of cost for maternity services, (c) traditional beliefs and practices, (d) apathy towards modern allopathic treatment and (e) lack of negotiating power of women to ask for care owing to their lower social position and dependency on men. This calls for raising awareness and community education on the life-threatening risks of pregnancies.

Delay in arranging transportation

In four cases only, delay in seeking care was caused by delay in arranging the transportation. This may have also resulted from a delayed decision to seek timely care i.e., when the decision is made, the condition is already too serious and leaves little time for arranging transport, particularly if it happens late at night and the village is far from a health centre.

Socio-economic and sociodemographic factors affecting maternal mortality

The effect of sociodemographic factors on MMR is examined at bivariate and multivariate levels. At the bivariate level, simple two-way relationships are

examined between MMR and sociodemographic variables. At the multivariate level, the net effect of a sociodemographic variable (independent variable) on MMR (dependent variable) is examined taking into account the effect of other sociodemographic variables, using a logistic regression specification:

(a)

$$\ln(\frac{p}{1 \quad p}) \quad \bar{X}^{-}$$

p is the relative frequency of MMR in the ith sample

X is a vector of independent variables (age, gravidity, socio-economic status, anaemia, tetanus and smoking status)

is the corresponding vector of coefficients

is the stochastic disturbance term.

Equation (a) is estimated using the generalized least square estimator. Some of the significant factors that emerging from the econometric analysis (see Appendix for results) are described below:

- Maternal mortality is higher among very young and much older childbearers (a U-shaped relationship between age and MMR);

- There is also a U-shaped relationship between gravidity (number of pregnancies experienced prior to the birth and death event) and MMR, which is relatively higher among women giving birth for the first time. The rate falls sharply for women with one or two previous pregnancies, and rises again among women with three or more prior pregnancies;

- Mothers who were vaccinated against tetanus are less likely to die compared to mothers who have not been vaccinated.

- Pregnant women with moderate to severe anaemia are 35.45 times more likely to die, compared with pregnant women with normal haemoglobin levels or mild anaemia.

- Pregnant women who smoke are 14.17 times more likely to die, compared to women who do not smoke.

Policy lessons

Professional health workers and trained birth attendants can manage most life-threatening complications faced by mothers, in particular the five most frequent

cases: haemorrhage, eclampsia, obstructed labour, ruptured uterus and complications from abortion. For example, the present findings suggest that most cases of post-partum haemorrhage fatalities caused by a retained placenta could have been prevented with intra-muscular oxytocin injections, manual removal of the placenta and timely referral. The finding that non-availability of required services at the first-level health-care facility explains more than 50 per cent of PPH- and eclampsia-related deaths underscores the need for stronger first-level health-care facilities (union health and family welfare centers) with appropriately trained staff[5] and basic emergency obstetric services (e.g., availability of misoprostol, oxytocin, safe blood transfusion, essential antibiotics and proper refrigeration). It also further confirms that MMR could be even lower in GK areas if complementary public services such as emergency obstetric were more efficient.

The finding that nearly one third of maternal deaths due to pregnancy and childbirth-related complications result from a delay in seeking care underscores the need to raise community awareness, including that of family decisionmakers on the likely adverse consequences of pregnancy and childbirth if timely care is not sought. Likewise, antenatal health services could prevent most cases of eclampsia. Further reductions in MMR are possible through vigorous anti-smoking campaigns, discouraging births to women with four or more children and delaying births to primigravidas, treatment of aneamia and promotion of full doses of tetanus vaccination among pregnant mothers.

There are two major distinctions between the GK and government strategies, which has direct implications for the lives of poor rural mothers. First, while it is understandable that a Government cannot adequately provide doctors, nurses and paramedics at the village level, the Government is not currently tapping into the potential capacity of utilizing traditional birth attendants. The GK experience of involving village-level trained paramedics and trained traditional birth attendants in rendering maternal and child care services under close supervision can be replicated by the Government. This would entail the training of grassroot-level health and family welfare workers (family welfare assistants, sub-assistant community medical officers and health assistants) in basic health for six months and improving the skills of traditional birth attendants in pregnancy management through continuing in-service training, linked with the existing reproductive-health-care systems. The finding that over 80 per cent of births are being delivered safely by trained birth attendants at home clearly indicates that much can be achieved in the absence of skilled birth attendants or doctors in rural settings if well-trained low-cost traditional birth attendants are available. This highlights the importance of trained traditional birth attendants in improving

maternal and child health in rural settings; every attempt should be made to integrate them into the formal rural-health-delivery system of the Government. The country would benefit from using traditional birth attendants and upgrading their skills rather than unjustifiably discarding them from the system.

The second major distinction is the paramount issue of accountability. Reduction in MMR is possible in rural areas, keeping the place of delivery at home and lowering cost,[6] if trained birth attendants are used. However, they must be closely monitored and supervised in discharging their duties and linked to a system of referrals to health services. Not only are GK paramedics held accountable to their supervisors (in turn accountable to their superiors), they are also held accountable by the community they serve through village-level health committees and local governments. Currently, government health workers are not accountable to local governments or the communities they are supposed to serve. Even for the most well-intentioned State, it is difficult to centrally monitor service providers at the micro-level. It will take a fundamental shift in the current nature of public service provision in Bangladesh to make public service providers directly accountable at the local level.

The grassroots-level government health officials should be engaged in rendering basic maternal and childcare services similar to those performed by GK paramedics under the close supervision of elected local government officials. In turn, these government paramedics (and their supervisors) must be held accountable to the communities they serve.

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Endnotes

1. A skilled attendant is a health professional with the competencies for care during normal birth and the capacity to recognize, manage and refer complications in the woman and newborn (WHO, 2004).

2. *Gonoshasthaya Kendra* is a Bangla name. *Gono* stands for people, S*hasthaya* means health and *Kendra* means centre; the name could be translated literally as "People's Health Centre".

3. For administrative purpose, Bangladesh is divided into 64 districts. Each district is divided into 508 subdistricts, which are called "upazilas". Each "upazila" consists of 9-15 unions, each 25,000-45,000 people.

4. All data are recorded in Bangla and the Bangla calendar was followed. *Baisha*k is the first month of the Bangla year, which begins on 14 or 15 April, while *Chaitra* is the last (12th). *Magh* is the ninth month of the Bangla year.

5. Not only should these government health-care workers be appropriately trained and posted in these facilities, but policymakers should ensure that these workers are present and perform their duties diligently.

6. The cost of providing health-care services in GK programme areas is estimated to be around Tk 0.30 (1US$=68.6 Bangladesh Taka) and Tk 130 per person and per client respectively. The cost of vaccines and family planning supplies were not included as they are supplied by Government free of charge.

Appendix. Logistic Binary Regression Model of Determinants of Maternal Mortality

(Chances of survival of pregnant women)

Independent variable	Regression coefficient	Level of significance
Age of mother		
20-29	-	-
15-19	1.11	0.80
30-39	1.10	0.52
40 and over	1.82	0.17
Gravidity (previous pregnancies)		
Zero	2.29	0.01
One to two	-	-
Three and over	2.25	0.01
Mother's education		
Some education	-	-
None	1.24	0.41
Smoking status		
Not smoking	-	-
Smoking	14.17	0.00
Immunization against tetanus toxoid		
Not immunized	-	-
Immunized	-0.18	0.00
Economic Status		
Very poor or poor	-	-
Well off	-0.82	0.58
Anaemia (haemoglobin) level		
Normal to very mild	-	-
Moderate to severe	35.45	0.00

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