Maternal Mortality
Findings from EDHS 2005

Ethiopian Society of Population Studies

In-depth Analysis of the Ethiopian Demographic and Health Survey 2005

Addis Ababa, October 2008

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Abstract

Maternal health is a useful indicator to assess not only women's health status but also the accessibility, sufficiency, and effectiveness of a country's health service system. Thus, improving maternal health and reducing the 1990 level of maternal mortality rates by 75% by 2015 is set as a key objective in the Millennium Development Goals (MDGs). Measuring maternal mortality, however, is problematic because the data used to estimate it are likely to be affected by various types of reporting errors. Consequently, the results are often misleading. The objectives of this study are to: (a) examine the quality of the two rounds of the Ethiopian Demographic and Health Survey data; (b) re-estimate maternal mortality using various indicators; and (c) describe the demographic and health related factors that are likely to affect maternal health in the country.

The EDHS 2000 and 2005 collected information using the maternal mortality module questionnaire from respondents (female and male) about the maternal status at the time of death of their sisters born to the same mother by asking if the sister died while pregnant, during delivery or within two months after the end of a pregnancy or childbirth. The indirect sisterhood method of estimating maternal mortality is used in the analysis.

Assessment of the quality of data showed that the data are of reasonably good quality. There is no apparent difference in reporting of age, age of sibling at death or year since death of sibling. There is also no evidence of omission to bias the estimates considerably. One variable, time of death relative to pregnancy, childbirth, and the postpartum period, however, was incomplete. However, this is unlikely to have a significant bias on the estimates of maternal mortality as few cases were missed (6.7%).

The maternal mortality indicators show that there were 871 and 673 maternal deaths per 100,000 live births in 2000 and 2005, respectively, which are consistent with the estimates made by CSA and ORC Macro. Maternal deaths constituted about a quarter in 2000 and a fifth in 2005 of all adult female deaths aged 15-49, respectively. These estimates are consistent with the estimates reported in the DHS reports. This level of maternal mortality is the highest by any developing country standard. Lack of access to health services, low utilization of health services, high fertility, harmful traditional practices such as early marriage and female genital mutilation are among the likely factors for the high maternal mortality in the country.

Although the 2005 estimate is about three quarter of that of the 2000, there is a large degree of overlap between the two sets of estimates. There is no strong evidence to attribute the change observed in the two data sets to a reduction in maternal death. It may rather be due to the inherent problem in the method of estimation. The estimates indicate that maternal mortality is still the highest by any standard.

As the greatest risk of death is experienced during the peri-partum period, maternal deaths can be prevented or considerably reduced if the three delays are eliminated. Improving access to quality reproductive health services, changing peoples attitudes and habits through awareness creation and improving their health seeking behaviour, empowering women and eliminating harmful practices such as FGM and early marriage can also bring considerable reduction in maternal mortality.

Introduction

Maternal mortality is a fundamental though complex measure of a country's overall health and development status. It is defined as the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes (WHO, 1993).

United Nations agencies estimated that in 1990 alone, 585,000 women died as a result of complications directly attributable to childbirth (WHO and UNICEF, 1996), while another 15 million developed long-term disabilities (WHO, 1993). The global maternal mortality ratio stood at 430, that is, one in 200 live births worldwide resulted in the death of the mother (WHO and UNICEF, 1996). Ninety-nine percent of these deaths (out of the 585,000) occurred in developing countries. The discrepancy between the developing and developed world for this measure is higher than for any other major public health indicator monitored by the World Health Organization (WHO, 1998).

There are also variations in the level of maternal mortality among countries and within countries in the developing world. Available estimates show that maternal mortality ratio is the highest in Africa with 640 maternal deaths per 100,000 live births; within Africa, it is the highest in Western Africa (760/100,000) followed by Central (710/100,000) and Eastern Africa (680/100,000). Maternal mortality is lowest in Southern Africa (270/100,000) and moderate in Northern Africa (360/100,000) (WHO, 1991).

Maternal mortality in developing countries and economically restrained settings remains a daunting and largely unmet public health challenge. Thus, improving maternal health and reducing the 1990 level of maternal mortality rates by 75% by 2015 is set as a key goal in the UN Millennium Development Goals (MDGs). Economic development has its own contribution in improving maternal health in developing countries. There are examples that confirm that combining a strategy of professionalization of delivery care with a strong public commitment works. In Sri Lanka, for example, maternal mortality levels, compounded by malaria epidemics, had remained well above 1,500 during the first half of the twentieth century. From around 1947 they started to drop, "closely following the development of facilities for health care in the country" (Seneviratne and Rajapaksa, 2000). The network of facilities was backed up, in 1960, by a special committee appointed to investigate maternal deaths, whilst professional organisations were involved in establishing training and service links. This brought maternal mortality down to between 80 and 100 as of 1975 (Vincent De Brouwere and Wim Van Lerberghe, 2001).

Malaysia and Thailand are examples of how a country can reduce maternal mortality further down. In Malaysia maternal mortality was in the 120-200 bracket in the 1970s – the equivalent of the US or the UK in the post

World-War II years (Leng, 1990). In the 1980s, 'low risk delivery centres' were created, backed up by good quality referral care, all with close and intensive quality assurance and on the initiative of the public sector authorities (Koblinsky et al., 1999). In 1991, Malaysia introduced confidential enquiries (Suleiman et al. 1999). All this brought maternal mortality down to 60-80 in 1990 and further to 20 around 1995 (Vincent De Brouwere and Wim Van Lerberghe, 2001).

Up to the 1960s Thailand had maternal mortality levels above 400, the equivalent of the UK around 1900 or the USA in 1939. During the next fifteen years, the first three health plans (1961-1976) gave priority to the training of paramedical personnel. During the 1960s 7,191 midwives were newly registered, double the number of the previous decade. Gradually traditional birth attendants (TBAs) were substituted by certified village midwives. Mortality halved, down to between 200 and 250 in 1970. During the 1970s the registration of midwives was stepped up with 18,314 new registrations. Midwives became a key figure in many villages; it was the heyday of Thai midwives, as respected figures in the villages and with a high level of professional and social self-esteem. It was also effective: mortality dropped steadily and caught up with Sri Lanka by 1980, at 98 (Wibulpolprasert, 2000).

The fourth and fifth health plans then put the main thrust on strengthening and equipping district hospitals. In ten years time, from 1977 to 1987, the number of beds in small community hospitals quadrupled, from 2,540 to 10,800. The number of doctors in these districts rose from a few hundred to 1,339. By 1985 mortality had halved again, down to 42. By 1990 it was down to 25 and in 1995 to 11 per 100,000 – the downside being an impressive medicalisation with 28% of deliveries through caesarean section. A major commitment of the ministries of public health to organise professional assistance to deliveries clearly works. This, however, is not what happens in many poor countries. Apparently the obstacles they face are not unlike those that delayed reduction of maternal mortality in many Western countries in the first half of the twentieth century, including the sometimes appallingly bad quality care in hospitals (Prual et al., 2000).

Since the International Conference on Population and Development (ICPD) in 1994, there has been a growing concern about information on levels, trends and differentials in maternal mortality. However, in most developing countries, such information remains fragmentary. It is difficult to monitor maternal mortality in populations where it is highest and where vital registration is non-existent or incomplete. To measure maternal mortality accurately, information is required about deaths among women of reproductive age, their pregnancy status at or near the time of death and the medical cause of the death - all of which can be difficult to measure accurately. The rarity of the event itself even in high mortality populations further complicates the situation. Maternal mortality estimates can be obtained from vital registration, longitudinal studies of pregnant women or repeated household surveys.

Ethiopia has no vital registration system nor has there been a national household survey carried out that estimates maternal mortality. The huge sample size required to calculate the point estimates with a reasonable degree of confidence, which is very expensive to conduct, has further contributed to the dearth of information on maternal mortality at national level. The Demographic and Health Survey of 2000 conducted by the Central Statistical Agency and ORC Macro is the first population based national survey in Ethiopia to incorporate questions on maternal mortality. Consequently, until 2000, there had not been any national estimate of maternal mortality. Prior to 2000, policy initiatives were often based on judgments made on the basis of a small, selective cross-section of the population.

The 2000 EDHS obtained a maternal mortality ratio of 871 per 100,000 live births and the second round conducted in 2005 yielded an estimate of 673 per 100,000 live births (CSA and ORC Macro, 2000; 2005). Comparing the two results suggests that maternal mortality has declined by about 23 percent. However, it is not clear whether the decline is real or due to data quality or the inherent problem in the method of estimation. The main focus of this study is, therefore, to assess the quality of data used in the estimation of maternal mortality and thereby show whether or not the estimates are acceptable.

Objective

The paper has three main objectives:

(a) To examine the quality of the two rounds of the Ethiopian Demographic and Health Survey data;
(b) To re-estimate maternal mortality using various indicators;
(c) To show the trend in maternal mortality; and
(d) To describe the demographic and health related factors that are likely to affect maternal health.

Methodology

As pointed out earlier, very few developing countries have comprehensive vital registration system that captures a reasonable proportion of maternal deaths. In settings where complete vital registration system is lacking, population-based surveys are used to estimate maternal mortality. However, there are major caveats to using such approaches. Even in populations where levels of maternal mortality are high, the actual number of maternal deaths is likely to be relatively small because despite their major societal impacts, maternal deaths are relatively infrequent events compared to other deaths for a fixed reference period. Thus, large sample sizes are needed for reliable results. Depending on average household size, this may involve visiting up to 200,000 households, an impossibly large number in any setting and totally unrealistic (WHO,

1997). These problems led researchers to look for alternative and more efficient techniques for measuring maternal mortality.

The Sisterhood Method

The sisterhood method was developed in the late 1980s as an efficient means of measuring maternal mortality through population-based surveys. The method generates a variety of indicators- the proportion of maternal deaths among female deaths (PMDF), the maternal mortality ratio (MMR), the maternal mortality rate (MMRate), the lifetime risk of maternal death (LTR), and the adult female death rate (Graham, et al., 1989).

The method is based on information collected using four questions presented to adult respondents about the survival of all their adult sisters born to the same mother. These are (i) How many sisters have you ever had, born to the same mother, who ever reached age 15 (or who were ever married) including those who are now dead? (ii) How many of these sisters reaching age 15 are alive now? (iii) How many of these sisters are dead? (iv) How many of these dead sisters died during pregnancy, childbirth, or the six weeks after the end of the pregnancy?

The sisterhood method was designed to overcome the problem of large sample sizes and thus to reduce cost. The method reduces the need for large sample sizes because there may be more than one respondent per household, more than one sister per respondent, and because the time period of death is not restricted. Moreover, it obtains information by interviewing respondents about the survival of all their adult sisters (Graham et al., 1989).

There are two approaches of estimating maternal mortality using the sisterhood technique: the indirect technique and the direct technique. As stated above, the method involves asking a representative sample of adults about the survival of their sisters (born to the respondent's own mother) who reached adulthood and, for sisters who died, about the time of death relative to pregnancy and childbirth. By inquiring about female siblings in a high-fertility setting, sample size is expanded with little additional cost. By focusing only on adults, reporting problems such as ignorance of siblings' deaths prior to the respondent's birth are avoided or minimized.

The Indirect Method

Two indicators of maternal mortality are generated by the indirect method: the lifetime risk of maternal death and the proportion of adult female deaths due to maternal causes. An approximation of the maternal mortality ratio (MMR) is easily calculated by using the lifetime risk and the total fertility rate. The estimate centres on 12 years before the survey. The result is robust under conditions of little change in fertility and fairly steady change over time in maternal mortality risk (Stanton et al., 2000).

Direct Method (Sibling-history Approach)

The data requirements for the direct method are considerably more demanding than for the indirect approach. In the direct approach, a respondent is asked to provide the birth history of her mother, including the current age of all living siblings and the age at death and years since death for all deceased siblings. These data allow live births, exposure time, and deaths to be placed in calendar time and, therefore, permit the calculation of age-specific death rates for reference periods defined by the analyst. The three timing-of-death questions as to whether the woman died while she was pregnant, giving birth, or within 42 days of the end of the pregnancy are used to distinguish maternal from non-maternal deaths (Stanton et al., 2000).

While the sisterhood methods have many advantages including relatively modest sample size requirements, they also have some weaknesses, which are rarely clearly understood by those using the results.

The direct approach relies on fewer assumptions than the indirect method but requires larger sample sizes than the original method and the information is considerably more complex to gather and analyze. Moreover, it does not provide a current estimate of maternal mortality but the larger sample sizes permit the calculation of a ratio for a more recent period of time. For example, the reference point for estimates based on data from 0-6 years before the survey would be 3-4 years before the survey (WHO, 1997).

Both methods assume that no relationship exists between the number of siblings and their survival probabilities and that no correlation of mortality risks exists between siblings. The only other assumption required for the direct method concerns data quality: that respondents are able to report accurately the current age of their living siblings; the age at death and years since death for all dead siblings; and for dead sisters, the timing of death relative to pregnancy (Stanton et al., 2000). This assumption is clearly far-reaching, given the context in which these surveys are conducted. Nevertheless, reliance on the data provided by respondents avoids having to turn to the modelled distributions used in the indirect technique and provides estimates with a defined time reference.

After the experiences of using the indirect estimation technique, the decision was made at DHS Headquarters to proceed with the direct approach for future surveys. This decision was based on the advantages found to be associated with the direct approach: it allows (i) the calculation of rates and ratios for the reference period of interest; (ii) the monitoring of trends; (iii) analysis of maternal mortality by parity (or other characteristics added to the questionnaire); and (iv) a substantial number of data-quality checks for completeness and plausibility that are not possible with the indirect approach. The disadvantages of the direct approach include (i) more interview time (an additional eight to ten minutes, on average, per interview); (ii) additional training and supervision in the field; and (iii) it adds considerable complexity to data processing (Stanton et al., 1997).

Neither method provides a current estimate for the year of the survey. Moreover, estimates obtained using either method can have wide confidence intervals. For these reasons, estimates obtained using the sisterhood method can neither be used to monitor changes in maternal mortality nor to assess the impact of safe motherhood programmes in the short term (WHO, 1997). Nevertheless, they provide estimates of maternal mortality that are indicative of orders of magnitude rather than precise ratios.

Indicators of Maternal Mortality (Direct Method)

Maternal mortality can be measured using a number of different indicators. Based on data collected using the four basic questions, four different indicators of maternal mortality have been developed for the measurement of maternal mortality. The four most commonly used indicators are summarized in this report.

Maternal Mortality Rate (MMRate)

The MMRate is an indicator of the risk of maternal death among women of reproductive age. It is the equivalent of a cause-specific death rate. Since it is a woman-based statistics, it does provide an indication of the burden of maternal death in the adult female population. The MMRate is defined as:

$$MMRate = \frac{\text{No.}ofMaternalDeaths}{WomenExposureyears} \times 1000 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

Person-years of exposure are calculated as the sum of the number of months exposed in the five-year age group during the time period divided by 12. Exposure for living siblings is the sum of all the months contributed to the specific age groups through which each individual passed during the time interval. Exposure for dead siblings is the sum of all months contributed to the specific age groups through which each individual passed during the time interval up to the assigned month of death (Rutstein and Rogas, 2006).

(ii) Maternal Mortality Ratio (MMR)

Maternal mortality ratio (MMR) is the most commonly used indicator of maternal deaths. It is calculated as the ratio of maternal deaths in a period to the number of live births during the period, expressed per 100,000 live births. MMR relates maternal deaths to a measure of risky events, namely live births; ideally, the indicator should relate maternal deaths to the number of pregnancies, since pregnancies are the risky events, but good counts of pregnancies are rarely available (Hill et al., 1999). MMR is obtained by dividing the MMRate by the general fertility rate (GFR). MMR from the DHS, therefore, relies on data from two sections of the questionnaire. The MMRate is calculated from the sibling history and the GFR is calculated using data

from respondents' birth histories. The GFR is likely to be more accurate than the MMRate, because the GFR is based on women's reports concerning their own children, as opposed to women's reports of events concerning their sisters.

$$MMR = \frac{MMRate}{GFR}$$, Where GFR = General fertility rate ……..... (2)

Proportion of Maternal Deaths

The third indicator is the proportion of adult female deaths due to maternal causes. It expresses the risk of a maternal death relative to the risk of death from all causes during age 15-49.

The proportion of maternal death is expressed as:

$$\text{Pr}\ \text{oportion maternal of deaths} = \frac{\text{No}\ \ \text{of maternal deaths}}{\text{Female}(15\text{-}49\ \text{`daeths}} \qquad \text{…….. (3)}$$

Lifetime Risk of Maternal Death

A fourth indicator of maternal mortality is the lifetime risk (LTR) of dying of maternal cause. LTR takes into account not only the risk per event but also the number of risky events a woman may expect during her reproductive life. In other words, it reflects the chances of a woman dying from maternal causes over her 35 years of reproductive life span. It accounts for the probability of death due to maternal causes each time a woman experiences a pregnancy. The commonly used equation for approximating LTR is:

$$LTR = 1 - (1 - MMR)^{TFR}$$ ……...……...….(4)

Younger (and male) respondents may not know that their older sister was even pregnant if the sister was several years older or died during pregnancy or from an induced abortion, thus biasing maternal mortality rates downward. Women who intend to have an induced abortion may also not disclose their pregnancy status to family members. On the other hand, deaths due to non-maternal causes, such as accidents and illnesses, will be included as maternal deaths if they occurred during pregnancy or within two months after the end of the pregnancy or childbirth. Simulation models show that up to one-third of deaths classified as maternal may not be due to maternal causes, resulting in an upward bias. The final result of both these biases, which operate simultaneously, is unknown (Rutstein and Rogas, 2006).

Among the possible indicators of maternal mortality, the MMR has received the attention of policymakers, program managers, and the donor community nearly to the exclusion of other indicators.

This is unfortunate since the MMR has a number of limitations, some of which may be circumvented by using the other indicators or by presenting a combination of indicators. For example, because the MMR is not age-standardized measure, MMRs are not directly comparable across (within) countries as are other major demographic indicators such as probabilities of infant and child death. Focusing attention on the risk of maternal death per birth also ignores the fact that women face this same risk numerous times over their reproductive lifespan. Lastly, appreciating a risk per 100, 000 events is not immediately intuitive (Stanton et al., 1997).

As the main purpose of this analysis is to validate the estimates of maternal mortality obtained using EDHS 2000 and EDHS 2005 by examining the quality of the data, first the two data sets are examined for various types of errors and then indicators of maternal mortality are estimated.

Data Quality

Analysis of some of the direct sisterhood studies by DHS has found that there may be heaping in the reported year of death of the sisters, usually around the end of the decade or at five-year intervals. Alternatively, there may be a loss of reported data on the time elapsed since death. Both these factors could distort the results. When using the indirect method, investigators should check to ensure that the mean number of adult sisters reported is consistent with the known fertility level in the country. For example, if known levels of fertility in the country indicate that, on average, every respondent is likely to have two adult sisters, and the results of the sisterhood survey show that respondents are reporting an average of three sisters each, it is likely that respondents have included themselves among the sisters reported. These and other reporting errors as well as errors of sampling are likely to bias the estimates of maternal mortality upward or downward. Hence it is worth assessing the quality of the data before making any estimate of maternal mortality.

Sex and Age of Sibling

In general, the sibling-history data pertaining to basic demographic indicators such as reported vital status: sex, age for living siblings, and age at death for dead siblings are complete in the survey. For example, vital status was recorded for at least 99 percent of siblings. In the survey, a small number of siblings were reported with unknown sex (see table 1).

Table 1. Percentage of siblings with unknown vital status, by sex

	Brothers		Sisters		Total	
	N	%	N	%	N	%
All siblings	42 137	100.0	38 392	100.0	80 530	100.0
Alive	32 385	76.9	30 367	79.1	62 752	77.9
Dead	9 659	22.9	7 989	20.8	17 648	21.9
Unknown status	93	0.2	35	0.1	129	0.2

Overall, as shown in table 2, age was recorded for more than 99 percent of living siblings. Current age was missing only for less than half a percent of all living siblings. Moreover, there is no apparent difference by sex of the siblings.

Table 2. Percentage of living siblings with missing current age, by sex

	Brothers		Sisters		Total	
	N	%	N	%	N	%
Living siblings	32 385	100.0	30 367	100.0	62 752	100.0
Age reported	32 242	99.6	30 235	99.6	62 475	99.6
Age missing	143	0.4	132	0.4	277	0.4

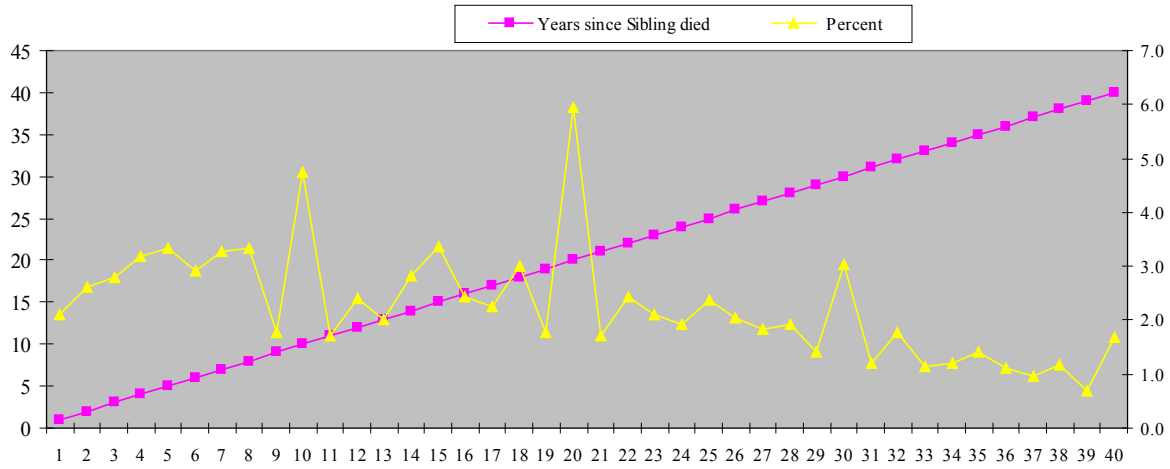
More data are missing for dead siblings than for living ones. Placement of a death in time appears to be more difficult for the respondent than declaring the sibling's age at death. In the survey, reports for 0.8 percent of dead siblings had age at death not reported and for 0.1 percent, years since death was missing (table 3).

Table 3. Percent of dead siblings with missing age at death/years since death, by sex

	Sisters	Brothers	Both
Years since sibling's death	0.1	0.1	0.1
Age of sibling at death	0.7	0.8	0.8
Number of dead Siblings	7 989	9 659	17 648

Further analysis of data for years since sibling died shows heaping in the reported duration of death of sisters, usually around the end of the decade or at five-year intervals (see figure 1). As can be observed in the figure, heaping at 10, 15, 20 and 30 are observed for a large majority of cases. The period 7 years before the survey is chosen in order to reduce the effect of recall errors of deaths that occurred in the distant past as well as to minimize the effect of heaping at 5 or 10. Hence, the maternal mortality estimates are less likely to be affected by age heaping on years since sibling died.

Figure 1. Percent and years since death of sibling



Time of Death Relative to Pregnancy

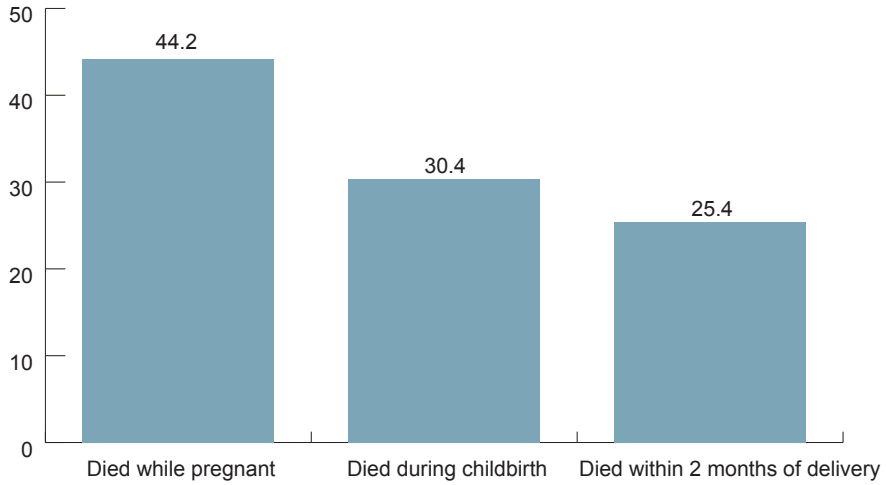
Table 4 below presents the proportion of adult female deaths recorded with missing data on time of death relative to pregnancy.The data show that close to seven percent of reports of adult female deaths were missing from the three time-of-death questions preventing the death from being identified as maternal or non-maternal.

Table 4. Percent of adult female deaths with missing data at the time of death, relative pregnancy, childbirth and the postpartum period

	0-6 period before the survey		Total period	
Death and pregnancy related	N	%	N	%
Death not related	739	72.6	1 939	72.8
Died while pregnant	78	7.7	241	9
Died during delivery	66	6.5	166	6.2
Two months after delivery	56	5.5	139	5.2
Missing	78	7.7	180	6.8
Total	1 018	100.0	2 664	100.0

Thus, the three variables determining time of death relative to pregnancy, childbirth, and the postpartum period show higher percentages of missing data than other variables in the sibling history.

Figure 2. Percent distribution of maternal deaths, by time of death



As table 4 shows, more than half of maternal deaths were reported during childbirth and peripartum periods. Deviations from the expected in these distributions do not necessarily imply faulty data in sibling history. The categories of pregnancy, childbirth and the two months following the termination of pregnancy may well be interpreted ambiguously among respondents (Stanton et al., 2000).

Evidence of Omission

A concern about the use of sibling data for estimating maternal mortality is that reporting on events in the distant past may be faulty as a result of inaccurate recall, especially among older respondents. The same problem could also be seen when younger respondents fail to report events in their siblings' lives that occurred when the respondents were young children or before they were born (Stanton, 1997).

Examining the parity of mothers of older respondents is one means of examining the completeness of reporting on the fertility component of the sibling history, since the average number of siblings reflects the respondents' mothers' lifetime fertility. Table 5 presents the average parity of respondents' mothers by respondents' age. The absence of a monotonic decline in the number of siblings is an indication that there may be some omission in the reporting of older siblings. However, this could also be due to the slight decline in fertility over the past fifteen years and may not necessarily imply omission. According to the data in the sibling history, fertility apparently increased over time by more than 7 percent when reports of respondents aged 45 to 49 is compared with that of respondents aged 15 to 19. Moreover, some of the mothers of the younger respondents could continue to have children.

The more likely explanation for the increasing pattern of fertility is that older respondents have omitted reporting all of their mothers' live births. The live births of siblings, particularly those siblings who died many years before the survey, may well have been forgotten and these live births may represent a substantial proportion of the omitted events. If the omitted live births resulted in childhood deaths, the omissions would not affect the estimation of adult or maternal mortality. Likewise, if the omissions represent adult deaths that occurred more than 7 years before the survey, neither the direct estimates of adult mortality nor those of maternal mortality would be affected, because the DHS used sibling-history data only for the 6 years before the survey.

Yet another crude measure of data quality is the sex ratio of siblings (see table 5). Sex ratios that are larger than the internationally accepted sex ratio of 103-105, especially further back in time, indicate that either sisters are underreported or brothers are over reported. However, since adult mortality rates are reported here for the seven years preceding the survey, this omission is unlikely to affect the calculation of mortality rates. Moreover, if the omission occurred mostly among sisters who did not survive to adulthood (which is most likely the case), it may not even bias the estimation of maternal mortality. Nevertheless, it should be borne in mind that any information that relies on recall of events will suffer from some degree of misreporting, especially if it pertains to deceased persons and occurred a long time before the survey.

Table 5. Average parity and sex ratio of siblings, by respondents' age

Age 5-year groups	Mean sibling	Sex ratio at birth
15-19	6.9	111.3
20-24	6.9	114.7
25-29	6.9	108.5
30-34	6.8	111.4
35-39	6.8	105.2
40-44	6.6	110.7
45-49	6.4	109.3

DHS respondents constitute a representative sample of living women of reproductive age in a country. An assumption underlying both the direct and indirect sisterhood approach is that their siblings constitute a representative sample of living and dead men and women. Table 6 provides the age distributions of respondents (15-49) and the percent distribution of all siblings aged 15-49 by five year age groups, as well as their respective median year of birth. As the median year of birth of siblings aged 15 to 49 showed not to be younger than the respondents, it would not indicate serious underreporting of older siblings by the respondents in the survey.

Table 6. Percent distribution of respondents' age 15-49 and percent distribution of all siblings age 15-49, by five-year age group

Age	Respondents	Siblings
15-19	23.2	16.3
20-24	18.1	18.3
25-29	17.9	19.8
30-34	12.8	16.1
35-39	11.4	13.9
40-44	8.4	9.4
45-49	8.1	6.2
Median year of birth	1971	1971

The data-quality assessment suggests that among reported events, the data are virtually complete for all but one variable: time of death relative to pregnancy, childbirth, and the postpartum period. However, even for this variable, it was not reported by only 6.7% of the siblings and it is unlikely to have a significant bias on the estimates of maternal mortality. None of the data-quality indicators of completeness suggests differential quality by sex of sibling.

Sampling and Non-sampling Errors

In evaluating the maternal mortality indicators produced from sibling data (by the direct or indirect method), it is important to recognize the non-sampling and sampling errors, which affect these estimates.

Non-sampling Errors:

- Recall errors that most likely lead to underreporting of distant events or shifting in the time of occurrence reported for adult and maternal deaths;
- Respondent's report of a sister's death when respondent is unaware that the sister was pregnant at the time of her death, which leads to a misclassification of the death as non-maternal (such reports may be especially likely to affect the number of deaths related to induced abortion);
- Incorrect placement of adult deaths in time;
- Use of a time-of-death definition of maternal death, whereby non maternal deaths occurring during the 11-month period of pregnancy, childbirth, and the postpartum period are counted as maternal deaths; and
- The likelihood, according to this evaluation, that male and female adult mortality are underestimated, even for the recent period. Regarding sampling errors, the standard errors for these estimates are large as a result of the rarity of maternal deaths and the sample size of the DHS surveys. The result is maternal mortality errors that are imprecise.

The majority of the non sampling errors are clearly associated with under- rather than over-estimation, however. These types of problems are not unique to the measurement of maternal mortality. Problems such as

inaccurate dating of events and omission in the reporting of deaths are common to mortality estimation for all ages when retrospective reports from a survey are used (Stanton et al., 1997).

Sampling Errors:

The standard errors for estimates of maternal mortality indicators are large due to the rarity of maternal deaths and the sample size for DHS surveys. The combination of other types of problems with the large sampling errors associated with maternal mortality indicators leads to estimates of maternal mortality that are not of comparable precision to DHS infant and under-five mortality estimates, and should be interpreted with caution. For example, the imprecision of the maternal mortality estimates will, in most cases, prevent the documenting of change in mortality over short periods of time. This restriction occurs when estimates are based on two sequential DHS surveys that are conducted close to each other (Stanton et al., 1997).

The issue of the existence of large sampling errors could be addressed by increasing DHS sample sizes. Table 7 shows the minimum required sample sizes to achieve a relative error comparable with those of DHS child mortality estimates. The simulation exercise to calculate the required sample size was based on a 5 percent relative error and 1.7 sisters living to adulthood per DHS respondent, on average. These sample sizes are based on the minimum design effect (deft = 1.2) associated with other DHS mortality estimates. Clearly, the enormous increases in sample size required to generate maternal mortality indicators of a similar level of precision as the child mortality estimates would not be justified (Stanton et al., 2000).

Table 7. Minimum sample-size estimates for DHS

MMRate per 100,000	No of DHS respondents
20	242 000
60	80 600
100	48 400
140	34 500
180	26 800
220	22 000
260	18 600

Source: Stanton et al., 2000.

To sum up, the quality of data collected in the Ethiopian DHS showed that the data are of reasonably good quality. No obvious difference in reporting of age, age of sibling at death or year since death of sibling was observed. There is also no evidence of omission to bias the estimates considerably. One variable, time of

death relative to pregnancy, childbirth, and the postpartum period, however was incomplete. Nevertheless, this is unlikely to have a significant bias on the estimates of maternal mortality as the few cases were missed (6.7%).

Estimates of Maternal Mortality

Table 8 presents estimates of maternal mortality calculated using the indirect sisterhood method. The lifetime risk of death due to maternal factors was 414 per 100,000 live births. The corresponding maternal mortality ratio was 780/100,000. The indirect estimate of maternal mortality ratio is higher than the direct DHS estimate (780 maternal deaths/100,000 live births as compared to 673/100,000). This is because unlike the direct method, the indirect method encompasses deaths from the recent past.

Table 8.Estimates of maternal mortality: the indirect method

Age 5-year groups	Number of respondents (b)	Adult siblings (c)	Maternal deaths (d)	Adjustment factor (e)	Sister unit of risk of exposure (f=e*c)	Lifetime risk of maternal death (g=d/f)
15-19	4 928	4 944	74	0.107	529	0.1399
20-24	3 868	5 536	134	0.206	1 140.4	0.1175
25-29	2 464	5 830	121	0.343	2 000	0.0605
30-34	1 753	4 733	99	0.503	23 80.7	0.0416
35-39	1 557	4 172	68	0.664	27 70.2	0.0245
40-44	1 160	2 769	24	0.802	22 20.7	0.0108
45-49	1 099	1 820	5	0.9	1 638	0.0031
Total	13 745	29 804	525		12 679	0.0414**

Life time risk of maternal death = 0.0414, Probability of survival = 0.9586,
MMR = 1-[(Probability of survival) $^{1/TFR}$*)]*, MMR = 780 per 100, 000 live births

It is worth noting that age specific lifetime risk of maternal mortality declines with increasing age. It is the highest for women in their teens (14%) and then it steadily drops with advancing age. The high value for teens may be due to the high risk associated with teenage pregnancy and childbirth.

Table 9 shows that the annual number of maternal deaths per 1,000 women aged 15-49, for the past seven years is 1.34. It provides an indicator that is more closely comparable to other mortality indicators such as adult, infant, or under-five mortality rates. The comparison effectively conveys the frequency of maternal death in the population relative to these more commonly measured deaths.

Table 9. Estimates of maternal mortality: the direct method

Age	Maternal deaths in the past seven years	Exposure years	Maternal mortality rate	Total female adult deaths	Proportion of maternal deaths to female death
15-19	15	32,168	0.466	122	12.3
20-24	44	32,171	1.368	171	25.7
25-29	53	28,305	1.872	181	29.3
30-34	45	22,881	1.967	179	25.1
35-39	35	16,170	2.165	131	26.7
40-44	4	9,742	0.411	73	5.5
45-49	1	5,997	0.167	57	1.8
Total	197	147,433	1.336	914	21.6

GFR = 193 per 1 000 woman, MMR = 673 per 100,000 live births, 95% CI = (548, 799), Relative Errors = 0.095

As shown in table 9, the relative error (the standard error as a percentage of the estimate) for the past seven years is 9.5 percent. By contrast, the relative errors for most DHS infant and child mortality estimates fall between 4 and 8 percent; relative errors for DHS fertility rates fall between 2 and 3 percent (Stanton et al., 1997). The large standard errors lead to very wide confidence intervals. The 95 % CI for the maternal mortality ratio in 2005 EDHS is between 548 and 799 per 100, 000 live births. The 95 percent CI represents 19 % of the MMR. For comparison purposes, the 95 percent confidence intervals surrounding DHS infant mortality estimates are, on average, plus or minus 15 percent. Maternal mortality rates and ratios are subject to high levels of relative sampling error due to their relatively rare occurrence. For example, a maternal mortality ratio of 500 maternal deaths per 100,000 live births has the same sampling error as an infant mortality rate of 5 infant deaths per 1,000 live births (Rutstein and Rogas, 2006).

Maternal deaths account for 21.6 percent of all deaths among women aged 15-49. In other words, one in five Ethiopian women who died in the seven years preceding the survey died from pregnancy or pregnancy related complications. This shows that women of reproductive age face a very high risk of maternal death in the population, regardless of the level.

Comparison of Maternal Mortality Indicators in EDHS 2000 and 2005

Table 10 presents various estimates of maternal mortality indicators from the two consecutive rounds of DHS undertaken in the country. Maternal mortality ratio estimated using the 2005 DHS was 673 maternal deaths per 100,000 live births for the period 1998 - 2004, while the corresponding figure based on the 2000 data was 871 for the period 1994 – 2000. Lifetime risk (LTR) of maternal mortality from the DHS 2000 data was 0.05 while it was 0.036 from DHS 2005 data. For ease of interpretation, the reciprocal of the LTR is more frequently used than the LTR itself, i.e., one in 20 Ethiopian women in 2000 and one in 28 in 2005 experienced death from maternal causes throughout their reproductive lives.

Table 10. Maternal mortality indicators: EDHS 2000 and 2005

Indicators	2000	2005	% Change
Proportion of maternal deaths	25.6	21.6	18.5
Maternal Mortality Rate	1.8	1.34	34.3
LTRMM	0.050	0.036	38.9
MM ratio	871	673	29.4

All these indicators suggest that maternal mortality has declined in Ethiopia. The proportion of maternal deaths suggests that maternal related deaths have declined by 18.5%. Other indicators suggest a much higher decline. Maternal mortality ratio declined by 29 percent, maternal mortality rate by 34 percent and the lifetime risk of maternal mortality by 39 percent.

Although these estimates of maternal mortality suggest a considerable decline over time, as the estimates are point estimates, it is difficult to accept them at face value. Point estimates are often misleading and would indicate a degree of precision in the estimates that is unwarranted. Interval estimates on the other hand are measures that indicate how precise an estimate is. It shows the likely range of the estimate. In EDHS 2000, the interval estimate of maternal mortality ratio was between 703 and 1,039 per 100,000 live births; in EDHS 2005 it was between 548 and 799.

Factors Affecting Maternal Mortality

In accordance with international policy, Ethiopia's National Reproductive Health Strategy, 2006-2015 (states that a "key factor contributing to both high maternal and newborn mortality is the low rate of skilled care during pregnancy and delivery" (MOH, 2006:16). The percentage of births attended by skilled professionals is estimated at 9.7 percent, with nearly 85 percent attended by untrained traditional birth attendants or relatives. In Kafa Zone in south-west Ethiopia the results of a community-based baseline study showed that only 3.5 percent of women gave birth in a health institution or with the assistance of a trained health worker or trained traditional birth attendant (Habtamu, 2002).

Health Status

A woman's personal health status prior to and during pregnancy can have an important influence on her chances of developing and surviving a complication. The leading preexisting health conditions that are exacerbated by pregnancy and delivery and account for approximately one-quarter of maternal deaths in developing countries are malaria, hepatitis, anaemia, and malnutrition (Maine et al., 1987; Royston and Armstrong, 1987). The presence of some of these conditions may put women at higher risk of dying from one of the direct complications of pregnancy. An increase in maternal mortality risk during peak malaria season in

endemic countries is thought to implicate malaria in maternal deaths. Malaria, far example, is more severe in pregnant women, and anaemia also contributes a lot for the increase of the risk of haemorrhage (Carthy and Maine, 1987). A study in the Gambia found out that there was 168% increase in MMR, a three-fold increase in the proportion of deaths due to anaemia, and an eight-fold increase in the anaemia MMR.

In Ethiopia, malaria is a leading public health problem. In 2004-05, the disease was reported as the primary cause of health problems, accounting for 17 percent of outpatient visits, 15 percent of hospital admissions, and 29 percent of in-patient deaths. Almost 75 percent of the land is infested and an estimated 50 million people (68 percent) live in areas at risk of malaria (MOH, 2005).

Concerted effort is being made in recent years to control the malaria vector. Indoor residential spraying with DDT or malathion as per WHO recommendation and increasing access to mosquito nets are widely used approaches. In 2005, for example 10.5 percent of houses were sprayed in the preceding six months and 6.5 percent had at least one mosquito net (CSA and ORC Macro, 2006). In addition to these efforts, as of July 2004, chemoprophylaxis is recommended to pregnant women living in malaria endemic areas.

Malnutrition

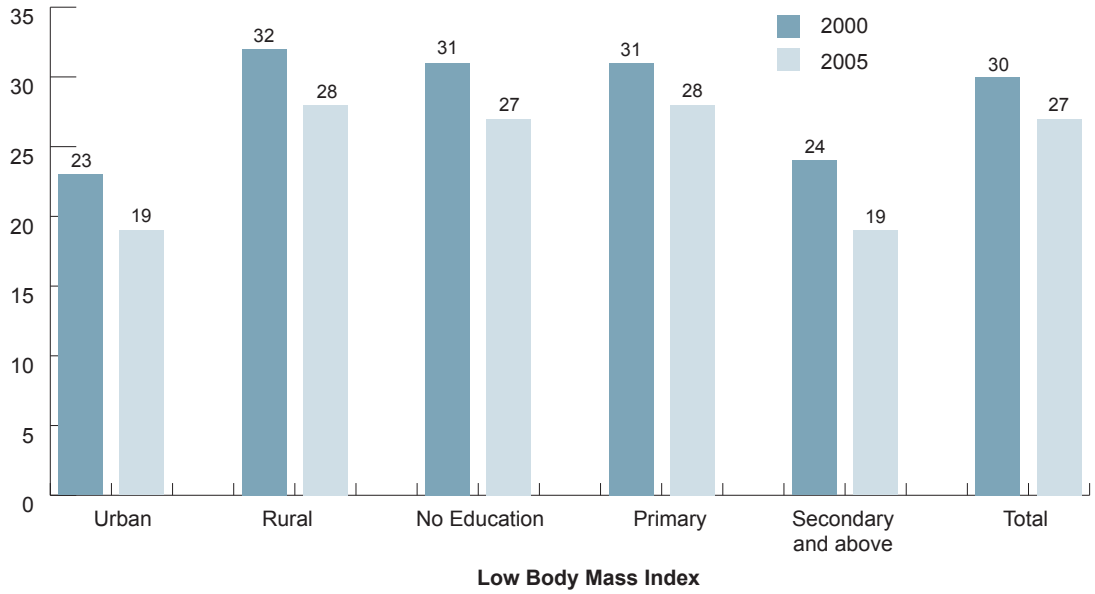
Women's nutritional status is an important indicator of their overall health and as a predictor of pregnancy outcome. Calorie, vitamin, mineral, and protein requirements increase markedly during pregnancy. Iron deficiency is the most common form of maternal malnutrition and the most common cause of anaemia. Iron deficiency anaemia can be the result of lack of iron in the diet, poor absorption of dietary iron, malaria, or other parasitic infections. Mothers with severe anaemia are at increased risk of complications during pregnancy and of maternal death. The United Nations Children's Fund (UNICEF) estimates that anaemia alone may contribute to as much as 20 percent of maternal mortality worldwide (UNICEF, 2002).

The body mass index (BMI) is an important indicator of adult nutritional status, and is defined as the weight in kilograms divided by the height squared in meters (kg/m2). A cut-off point of 18.5 is used to define thinness or acute under nutrition and a BMI of 25 or above usually indicates overweight or obesity. About 27 percent of women in Ethiopia have a body mass index (BMI) of less than 18.5 and more than a quarter (27%) were anaemic in 2005 indicating a high level of chronic energy deficiency. Women aged 15-19 years and those aged 45-49 years have a much higher level of chronic energy deficiency (32.5% and 30.9%, respectively).

Stunted growth due to childhood malnutrition could lead to the occurrence of small pelvis. This is a major cause of cephalo-pelvic disproportion (Yemane et al., 1999). Hence, women's height is used to predict the risk of difficulty in delivery because small stature is often associated with small pelvis size and the potential for obstructed labour. The mean height of Ethiopian women aged 15-49 was 156.5 centimetres, and about 3.2 percent were shorter than 145 centimetres in 2005 (CSA and ORC Macro, 2006) suggesting a high level of stunting in women. Among 17 sub-Saharan African countries included in the DHS from 1998 to 2002, Ethiopia has the second highest level of stunting among women of reproductive age.

In general, the level of malnutrition among women of childbearing age is very high in the country. However, there is some decline between 2000 and 2005. BMI declined by more than 10 percent between 2000 and 2005. Nevertheless, more than a quarter of the women still have a BMI below the cutoff point of 18.5. The decline in the percentage of women with chronic energy deficiency was somewhat higher in urban than rural areas and among women with secondary and higher level of education than women with little or no education (figure 3).

Figure 3. Percentage of women age 15-49 with a low body mass index, by residence and education



Reproductive Health Status

The relationships between maternal mortality and certain reproductive characteristics are among the best documented in the literature (Maine, 1981). These characteristics include age, space between pregnancies and

pregnancy order, which are known to have a classic "J-shaped" relation with maternal mortality ratio, with risks that are high for very young women, older women, and women with many children and when short intervals exist between pregnancies usually less than 2 years; the risks are lower for women in between. Age, especially very young age, is also associated with disability that results from pregnancy and childbirth (Abdullah, 1992; Carthy and Maine, 1987). The timing of pregnancy, whether it is wanted or not is also an important variable, especially since women who have an unwanted pregnancy are more likely than others to seek abortion, even if the only procedure available is unsafe and illicit, which greatly increases the risk of death and disability (Kwast and Liff, 1988).

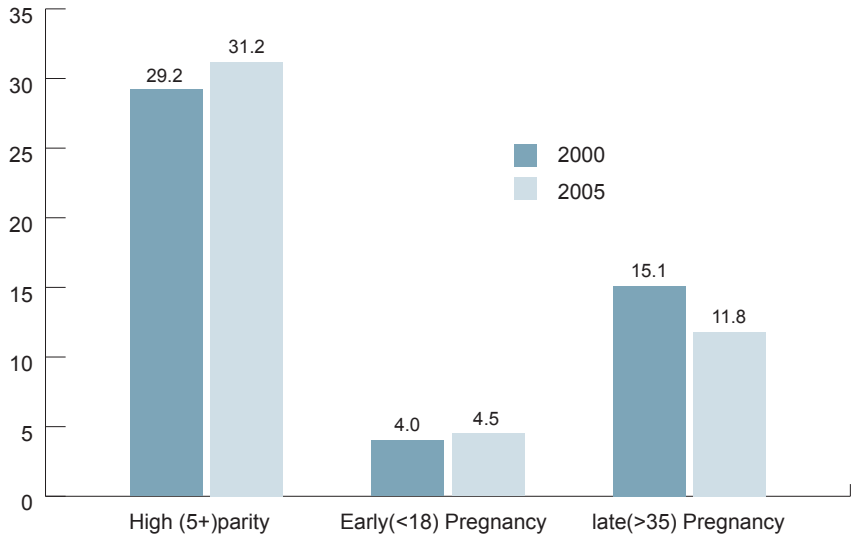
Ethiopia is one of the developing countries with high fertility. According to the EDHS total fertility was 5.4 children per woman. The high fertility is the result of early age at marriage, desire for many children and extremely low contraceptive use. However moderate increase in CPR is being observed (from 6% in 2000 to 14% in 2005) and slight decline in fertility has occurred (TFR declined from 6.4 to about 5.4 from 1990 to 2005) (CSA and ORC Macro, 2006).

Other Risky Pregnancy Outcomes

It is already mentioned that pregnancy carries an extra risk if it is too early, too late, too many, or too close. Analysis of the 2000 and 2005 DHS data shows that there is slight increase in percentage of pregnant women in the high birth order (5+) and early pregnancies (before age 18) in 2005 as compared to 2000. However, the percentage of late pregnancies (above 35) declined in the same period (figure 4).

Moreover, analysis of birth interval in the same period shows that the proportion of short birth interval (<2 years) increased slightly in 2005 as compared to 2000 (19.7 % versus 21.3%).

Figure 4. Percentage of pregnant women, by risky pregnancy outcomes



Health Care Seeking Behavior/Use of Health Services

For services to be effective, women have to use them. The use of prenatal care (to diagnose either pre-existing health problems or to detect certain complications) and the use of care during and after labour and delivery (to treat complications that may arise then) are particularly important in the case of maternal mortality. Other health care behaviours are also likely to have important influences on the outcome of pregnancy for women. Obvious examples include the use of illicit abortionists and harmful but traditional practices during pregnancy and childbirth. In some areas, traditional practices include the improper use of drugs, pushing on the abdomen to hasten delivery, and even the use of certain surgical procedures (Carthy and Maine, 1987).

Previous studies have clearly demonstrated that the utilization of available maternal health services is very low in the country. Several studies in the 1990s have shown that about 25 percent of Ethiopian women received antenatal care and less than 10 percent received professionally assisted delivery care (CSA, 1993; Mengistu and James, 1996). The lower coverage for delivery and postnatal care has often been attributable to the unpredictability in the onset of labour and the difficulty of travel, particularly for long distances, during labour, delivery, and even within a few days after delivery. Moreover, the relatively high cost of delivery care is often blamed for the low rate of utilization of delivery services (Yared and Asnakech, 2002).

Moreover, according to the qualitative study in the Somali Region, it is not customary to go to health care facilities for antenatal care, delivery and postnatal care services. It is primarily because of lack of awareness of

the use of health service facilities and the community's belief in getting better treatment, whenever the need arises, from traditional health practitioners and traditional birth attendants than that of the health practitioners in the health institutions.

Women in Ethiopia often resort to home delivery assisted by a traditional birth attendant or a relative as their first option. A qualitative study conducted in the Somali Region also indicated that some mothers in Jijiga town prefer to go to skilled attendants than to traditional birth attendants. However, there are a significant number of mothers who still prefer to be assisted by traditional birth attendants. This is mainly because of strong traditional practices and low awareness and perception about the use of modern health care.

Similarly, the findings of the study in SNNPR indicated that in the rural areas, those who have given birth more than once prefer to be assisted by traditional birth attendants than by trained health professionals. Here and there, there are women who prefer to be attended and followed up by trained health personnel as a result of the expansion of health posts. In urban areas, the educated ones, those who do not depend much on their husbands' income and those who are first time mothers prefer to be attended and cared by skilled health officials rather than by traditional birth attendants. Equally, there are women who do not give any attention to health care from skilled health workers.

Sundari (1992) identified unfamiliar setting at the health facility, being attended to by strangers, lack of family support, attendant being a male care provider, reduced autonomy, lack of sympathy and understanding on the part of the health care personnel, and not seeing the need for care as some of the factors contributing to non-utilization of health services during labour and childbirth.

Regular antenatal checkups by trained health providers are necessary to monitor the progress of a pregnancy and identify early on if a woman shows signs of complications. It is commonly recommended that a woman see a trained health provider at least four times during her pregnancy (USAIDS, 2007). The findings of the qualitative study in Somali Region also show that in relation to preparation of a woman and her family members, there is no special preparation made for childbirth. However, mothers are taking few days rest and eat what the family has (these include milk and meat). In most cases, women are not aware of the consequences of obstetric complications. As a result, they do not make any conscious preparation. However, when the need arises, women usually suggest the need to reach health facilities. Unless the situation is out of control, they are advised to go to traditional health practitioners.

Findings from SNNP Region also indicated that women know about obstetric complications through learning from women who had earlier experience of the complication. They often go to the proper place (health

centre) whenever they face obstetric emergencies. Educated and economically independent women can make decision on seeking care and reaching the facility when the need arises. But those women who are economically dependent on income from their husbands make no decision on seeking care and reaching the facility when the need arises.

In Ethiopia, utilization of antenatal services has been very low. Figure 5 shows a slight improvement in the utilization of antenatal care services by pregnant women in the five years between the 2000 and 2005 surveys. The data show that there was little change in the percentage of women who did not go for an ANC visit. The percentage of women who made four or more ANC visits increased from 10 percent to 12 percent during the same period. However, there was a marked improvement in the percentage of women who had two or more doses of tetanus toxoid injections.

For example, the Prevention of Maternal Mortality Program's (PMM) approach taken by CARE International's Safe Motherhood Initiative in West Hararghe showed that major renovations were done in maternity units of two hospitals with repair to water supply systems, provision of small generators, repair of waste management systems and replenishment of equipment and supplies with a special focus on operating rooms. A new system for record keeping and data collection was introduced. TBAs were trained and the referral system was strengthened (Kayongo et al., 2006:312). This project brought about a significant change to the UN process indicators: doubling the Caesarean section rate overall by 50 percent; increasing the met need for EmOC from 2.0 percent in 2001 to 4.5 percent in 2004; the case fatality rate declined by 35 percent (Kayongo et al., 2006: Alemayehu, 2005).

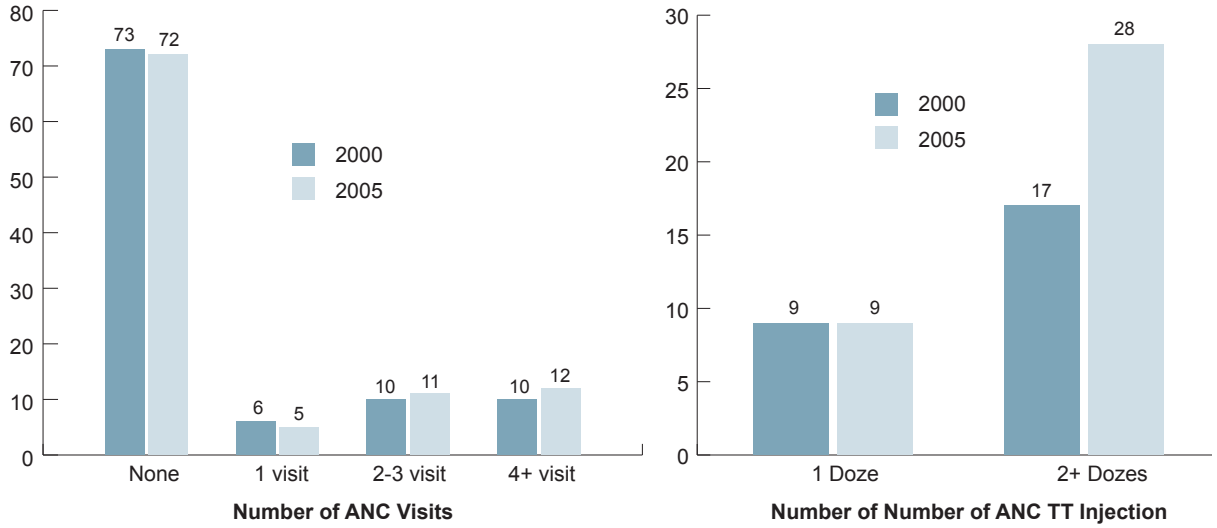
The practice of using health facilities, in general, is low. The major reasons responsible for this are:

- Limited access to health services, specially in relation to distance;
- Lack of awareness about the use of health services;
- Poverty;
- Fear of contracting HIV and other diseases from other patients or during treatment, losing their children, etc.; and
- Thinking that better treatment is found from traditional health practitioners than modern health service providers and the life style of the community (like in the Somali and Afar regions, people move from place to place and the current health service arrangement does not pay adequate attention to the life styles of the communities);

In SNNPR, it was stated in FGDs that many women make household preparations like food items that can be used during delivery and thereafter. Those women who make prenatal visits to health centres do not exceed 40 percent of the total pregnant women. Those who go to health centres are women who have the first pregnancy. They go to the centres because they lack experience and are afraid of what would happen to them during delivery. Those who have the experience and have given birth more than once don't go to health centres for delivery. In rural areas on average, about 25 percent of the women go to health centres since the opening of health posts in peasant associations and the awareness created by extension workers.

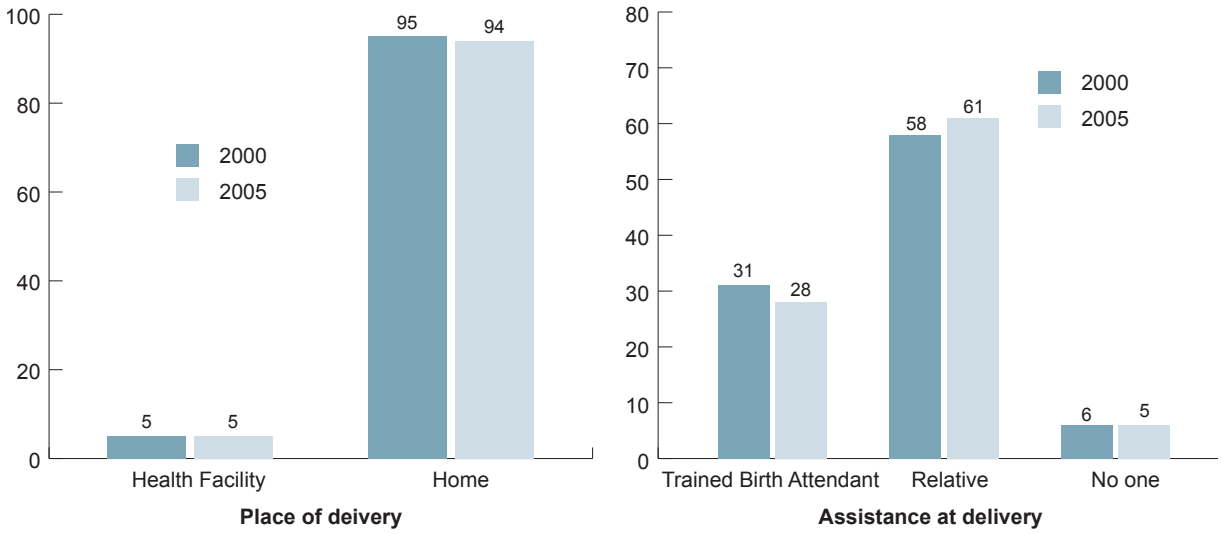
Most of the women in the regions do not save money for use for antenatal care. Very few women especially those living in urban areas who have their own income and those who can discuss major issues with their husbands can save money for such purposes. For most women, the preparation gears towards making household preparations (food and drinks) for special ceremony during delivery and after giving birth.

Figure 5. Percentage of women who had a live birth in the five years preceding the survey by number of ANC and ANC TT vaccination taken for the most recent pregnancy



An important contributor to lowering the health risks to mothers associated with pregnancy is increasing the proportion of babies delivered in health facilities and under the supervision of health professionals. Figure 6 presents trends in the percentage of live births in the five years preceding the survey by place of delivery and type of person providing assistance.

Figure 6. Percentage of live births in the five years preceding the survey, by place of delivery and person assisting at delivery



An overwhelming majority of live births in Ethiopia continue to take place at home and without the assistance of a trained health professional, that is, a doctor, nurse or midwife. The data show that the percentage of live births delivered under the supervision of a trained health professional has remained at around 6 percent in the last five years, while the percentage of live births delivered with the assistance of a traditional birth attendant (TBA) decreased by 10 percent from 31 percent in 2000 to 28 percent in 2005 (figure 6).

Postnatal checkups are also strongly associated with mortality of mothers. It is well known that within the 11 months spanning pregnancy and the postpartum period, the greatest risk of death is experienced during the peripartum period, that is, between the onset of labour and the first 48 hours following delivery (Stanton et al., 1997). Among women worldwide, who die of pregnancy-related causes, about a quarter die during pregnancy, about 15 percent at delivery, and 61 percent after delivery (Stars, 1998). Care during the postpartum period enables health workers to check that the mother and baby are doing well and, if not, to detect and manage any postpartum problems early.

However, a qualitative study in the Somali Region shows that it is not customary, during the immediate postpartum period to be checked up in the health facilities unless unusual health related problems occurred. In SNNPR the practices during the immediate postpartum period are abstaining from sexual intercourse. The attitude of seeking facility based checkups during this period is uncommon. Even those in the urban areas do

not go to health centres much. Especially if they have given birth more than once, they only go to the health centres for vaccination of their newly-born babies and not for themselves. As for women in rural areas, those near health extension areas have started going to health centres during the immediate postpartum period. Abstaining from immediate postpartum sex is a cultural requirement and it is respected in all communities.

Like that of antenatal care service, utilization of postnatal care service is extremely low. As can be observed from figure 6, very few women used the service in 2000 and 2005. However, in 2005, postnatal check-up from health professionals increased by twofold from 2.7 to 5.5 percent. Postnatal checkups by trained and untrained traditional birth attendants also increased slightly in DHS 2005 as compared to 2000 (figure 7).

Figure 7. Percentage of live births in the five years preceding the survey, by person providing postnatal check-up

The Three Delays

The decision to seek care is influenced by a range of factors which are more often 'barriers' or 'constraints' to the utilization of health services: distance, cost, quality of care and socio-cultural factors. As in many other developing countries, the three delays have important influence on maternal mortality in Ethiopia. There is delay before making the decision to seek health care due to lack of knowledge about pregnancy and childbirth related complications or due to local people's habits and customs in choosing to take care of the woman at home or take her to a health care provider. There are several instances where women suffer in labour before a decision is made to take her to a health service provider. Previous experience of uncomplicated pregnancies

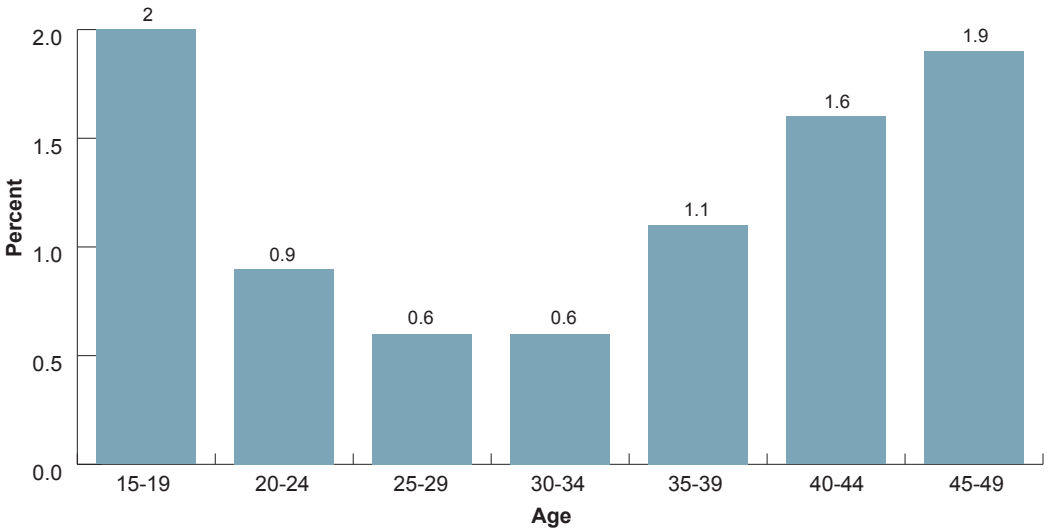
may also influence the decision about the current pregnancy. Women or their relatives use previous pregnancy outcomes as a risk-predicting tool.

Even after making the decision to take her to a health facility, there is a delay in reaching a health facility due to long distance, poor roads or lack of transportation or lack of money. In remote rural areas of Ethiopia, it is not uncommon to see women in labour being carried on men's shoulder for several hours to a health facility. Once the woman has arrived at a health facility, she may not be given essential treatment on time due to difficulties within the health facility, such as shortage and quality of professional health workers and lack of emergency medical equipment and medicine. All these delays lead to prolonged labour and rapture of the uterus, which negatively influence maternal mortality. For example, in Kafa Zone distance is a significant barrier to health care facilities as over 90 percent of the population live in rural areas. For instance, for a fit person to reach the Deckia clinic from Bonga requires a one-day travel. Depending on the season and the route, it will take five to eight hours by road and then by walking or riding a mule. These estimates are based on how muddy the road is, the fitness of the person, the route taken and whether or not a patient is carried. According to Jackson (2007), people waited to be seen at the health facility. They waited for a baby to come. No one seemed to try and hurry things along because waiting seemed part of life.

According to WHO (1993) prolonged obstructed labour and ruptured uterus may account for up to 70% of all maternal deaths. Vesico-vaginal fistula, a sever consequence of prolonged labour, occurs at a rate of 55-80 per 100,000 in developing countries (WHO, 1994).

Analysis of EDHS 2005 data shows that 1 percent of women who ever had a live birth reported experiencing obstetric fistula. The proportion of women who ever had a live birth and who experienced obstetric fistula forms a 'U' shape as can be seen from figure 8. It is highest for teenage mothers, gradually declines until age 30-34 and then starts increasing with advancing age. This shows that the risk is higher for teenage mothers and for those with high parity.

Figure 8. Percent of women who experienced obstetric fistula among women who ever had birth, by age



Access to Health Services

The medical technology to prevent almost all deaths from common obstetric complications has been available for decades. This technology falls into two major categories: treatments for women who want to have a safe and successful birth, and options for women who want to avoid pregnancy and childbirth. The former category includes blood transfusions, antibiotics and other drugs, and caesarean sections; the latter includes use of contraceptives and safe abortion procedures. But access to preventive and curative health services that can provide this technology is limited in developing countries. In many settings, the physical distances between services and women in need of reproductive health care are considerable. A number of studies show that maternal mortality is strongly associated with physical distance from health facilities (Fortney, 1985; Walker, 1985). Access, however, is a much broader concept than physical distance. It includes financial access and access to adequate care. There is ample evidence that financial barriers, shortages of trained personnel, especially in rural areas, and poor performance on the part of trained personnel all contribute to high levels of maternal mortality in developing countries (Ekwempu, 1990; Omu, 1981; WHO, 1985). For instance, in Kaffa Zone, the cost of service at the health centre is most important. Because the majority is living in the countryside, very far away from health facilities, the cost of transportation is enormous and when they arrive at the facility, they may not have any money, even for food. They usually transport these type of mothers on Isuzu (truck), which are not made for such purpose and yet charge 500 or 600 Birr to transport a woman from somewhere like Chena to the hospital (Jackson, 2007).

In Ethiopia, the majority of live births occur at home where women deliver without the assistance of trained personnel. A reliable referral system, appropriately trained personnel at all levels, and effective communication and transport systems are part of the essential obstetric services. However, such services are not readily accessible for the rural population and most are not well equipped with facilities or personnel (Yemane et al., 1999). In addition to these, scarcity of vehicles, especially in remote areas, and poor road conditions can make it extremely difficult for women to reach even relatively nearby facilities. Lack of motorized transport forced families to opt for alternative means of transport such as using a cart (donkey, ox or horse) or walking in extreme instances, even for women in labour.

Moreover, high fees reduce women's use of maternal health services and keep tens of thousands of women from having hospital-based deliveries or from seeking care even when complications arise. Even when formal fees are low or nonexistent, there may be informal fees or other costs that pose significant barriers to women's use of services. These may include costs of transportation, drugs, food, or lodging for the woman or for family members who help care for her in the hospital (Yared and Asnakech, 2002).

Quality of care is also a determining factor for consideration in deciding to seek health care. Facilities may be understaffed and under-equipped, and have a 'reputation for unfriendly staff, rude service providers and humiliating treatment' (Thaddeus and Maine, 1994:1096). Corruption may delay the process. Women may also be uncomfortable with hospital policy about the positions of childbirth and they may fear surgical intervention such as Caesarean section and episiotomy. Understaffed or under-equipped facilities mean that women will be reluctant to go there. Giving quality care is also a great frustration for health practitioners who feel their care is inadequate but they are unable to do anything about it (Jackson, 2007).

Inadequate care may result from shortage of staff, essential equipment, supplies, drugs and blood as well as inadequate management. Late or wrong diagnosis and incorrect action by the staff are other factors that contribute to delays in the timely provision of needed care. Insufficient number of medical and nursing staff… is not only a matter of staff numbers, it is also a matter of competence…there is a shortage of trained, qualified personnel in many facilities (Thaddeus and Maine, 1994:1102).

One of the challenges is the lack of human resource in each woreda, in health centres and in health posts. Actually, if there happens to be a health officer or a nurse who can attend the situation, women will not come to the hospital. One of the problems is still the understanding and knowledge of health professionals about the danger signs, particularly the vital signs, like headache, swelling of the legs. All these danger signs might not be detected….Some of the professionals know some of the danger signs, some may not. Or, they look at

the mother simply without neither checking the vital nor the danger signs. For example, if you talk to a nurse, she/he can tell you about these things, but they may not put them into practice (Jackson, 2007).

Female Genital Mutilation/Cutting

Female circumcision is the partial or complete removal of female genitalia. Female genital mutilation causes immediate and long-term health complications. The immediate effects include pain, shock, haemorrhage, retention of urine, infection and fever. Delayed complications include painful scars, urinary tract infections, cyst, and difficulty in passing menses, among others. Moreover, circumcised women are likely to face problem during labour because their vagina cannot dilate due to scar tissues.

Ethiopia is among the countries with the highest prevalence of FGM in the Horn of Africa. According to the study conducted in 1985 by the Ministry of Health, 85 percent of respondents had undergone female genital mutilation. The 2000 EDHS also found a high but slightly lower level of FGM, about 80 percent, and in 2005, it was 74.3 percent. Moreover, the percentage of women who supported the practice declined from 60% in 2000 to 31.4 percent in 2005. This shows that there was a significant change in the prevalence of the practice as well as the support for the continuation of FGM within the five years period between 2000 and 2005 (CSA and ORC Macro, 2001; 2006).

Early Marriage

Ethiopia is known for one of the severest crises of child marriage in the world. According to the EDHS 2005, among the married girls 15-19 years of age, 13 percent got married before their 15th birthday, while among those aged 20-24, 24 percent got married by exact age 15 and 61.7 percent at exact age 18 (CSA and ORC Macro, 2006). This indicates a very high prevalence of early marriage nationwide. Early marriage affects women's sexual and reproductive health. Women who marry early encounter premature and mostly forced intercourse, which often results in harm to the uterus and/or the body in general, such as prolonged and obstructed labour due to early pregnancy and delivery. Girls aged 10–14 are five times more likely to die in pregnancy or childbirth than women aged 20–24, while girls aged 15–19 are twice as likely to die than women aged 20-24 (UNICEF, 2001).

Other Harmful Practices

Food taboos are among the harmful traditional practices commonly experienced in Ethiopia. During pregnancy and after childbirth, mothers are often prohibited from taking some food items. A study by Birhan Research and Development Consultancy in 2007 shows that more than a quarter (25.7 percent) of women experienced food taboos.

Conclusion and Policy Implications

Data quality assessment showed that the data are of reasonably good quality. There is no apparent difference in reporting of respondent's age, age of sibling at death or year since death of sibling. There is also no evidence of omission to bias the estimates considerably. On the other hand, time of death relative to pregnancy, childbirth, and the postpartum period was missing for about 7 percent of the subjects. Nevertheless, this is unlikely to have a significant downward bias on the estimates of maternal mortality, as the number is too small. Hence, the data quality assessment confirms that the estimates are accurate and free of any major data flaw.

The question is, therefore, "Is there any strong evidence to conclude that maternal mortality has indeed declined as the estimates suggest?" The existence of a large degree of overlap between the two sets of estimates casts doubt to accept the decline of such a high magnitude as there is no strong evidence to attribute the change observed in the two data sets to actual reduction in maternal death. In other words, even though there have been slight changes in health seeking behaviour of pregnant women and some harmful traditional practices such as FGM, generally there is no considerable improvement on factors which could significantly improve the pregnancy outcome of women to bring a reduction in the level of maternal deaths from 871 to 673 per 100,000 live births, i.e. a 22.7 percent decline in such a short period.

Nevertheless, the effort being made in recent years to control the malaria vector, the provision of chemoprophylaxis to pregnant women living in malaria endemic areas, the slight improvements in health seeking behaviour such as the increase in tetanus toxoid vaccination among pregnant women from 16% in 1990 to 28% in 2005 and the increase in the utilization of postnatal care from 2.7 percent in 2000 to 6 percent in 2005 are likely to have some effect on maternal mortality. As a high percentage of maternal deaths occur within the six weeks after delivery, the increase in the use of postnatal care is likely to have a significant effect on maternal mortality. Moreover, the increase in contraceptive use from 3.9 percent in 1990 to 14 percent in 2005 might also have some impact on the reduction of maternal deaths over the period.

Whether maternal mortality has declined or not, it matters little as the estimates indicate that maternal mortality is still the highest by any standard, which may be due to lack of access to health services, low utilization of services, delays in seeking treatment, harmful practices such as FGM and early marriage, frequent and short interval live births, malnutrition of women and other adverse pregnancy outcomes.

Recommendations

- The difficulties of measuring MMR should not be interpreted to mean that maternal mortality is not a problem. Special studies throughout this past decade have shown that the burden of maternal ill health is high, and is amenable to reduction. Such studies of maternal mortality and severe morbidity remain valuable tools for advocacy and maintaining political commitment.
- Women understand the benefits of delivering their babies in a health facility and the importance of antenatal care. Yet the majority of women do not go to health facilities for delivery even in places where such facilities are accessible. Research needs to be conducted to learn why women do not use health facilities for ANC, delivery and postnatal care services.
- Because of the high percentage of unintended pregnancies among older women – and the potential for unintended pregnancies among younger women – family planning programs should pay special attention to providing information on effective use of contraceptive methods, increasing access to quality family planning services and addressing the challenge of unsafe abortion.
- Maternal mortality does not appear to be preventable with 'quick technological fixes'. Rather it appears to require services that integrate several levels of care from the community health post to the nearest hospital. Sustained efforts are needed to provide this service. Health care providers, policy makers, and donors should not hide behind methodological problems to justify inaction.
- Live births at home can be safe, provided a woman's family members and attendants can recognize the signs of complications and, if complications occur, move her to a facility where trained professionals can provide care. Regrettably, very few live births are attended by persons who are able to recognize the signs of complications and who can provide the needed care. Hence, in order to improve maternal morbidity and mortality, it is critically important to increase:
    - Public awareness about the benefits of ANC, delivery and postnatal care; and
    - Training of persons in midwifery skills and deploy them to underserved areas.
- Both historical and contemporary evidence show that reducing maternal mortality requires a national strategy to bring about three essential changes:
    - A commitment to the special needs of girls and women throughout their lives. Particular attention should be paid to the nutritional and educational needs of girls and women, broadening the scope for women to make decisions about the number and timing of children and use of healthcare services and fostering at all levels a sense of shared responsibility and solidarity with women, particularly at such vulnerable times as pregnancy and childbirth

- A societal commitment to ensuring safe pregnancy and birth:
    - Decision-makers at all levels of political, economic, social, religious, and household, must foster the perception that pregnancy and childbirth can and should be made safer. A long-term commitment is needed to fuel sustainable change and ensure that the necessary inputs are maintained over the several years needed to reduce maternal mortality significantly
    - Involving communities and decision-makers in the regular analysis of maternal deaths and ``near misses'' and promoting mechanisms for local accountability help to ensure that commitment is maintained over the long-term and that resources are allocated as needed.
- Improvements in access to, and quality of, health cares, i.e. the aim must be to ensure that all pregnant women have access to a skilled attendant at the time of delivery and to the necessary care for obstetric complications when they arise.

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