

**MATERNAL AND NEWBORN HEALTH AND EMERGENCY
TRANSPORT IN SUB-SAHARAN AFRICA**

By

Prof. Valentino M. Lema
Honorary Faculty
The Aga Khan University,
Nairobi. Kenya.

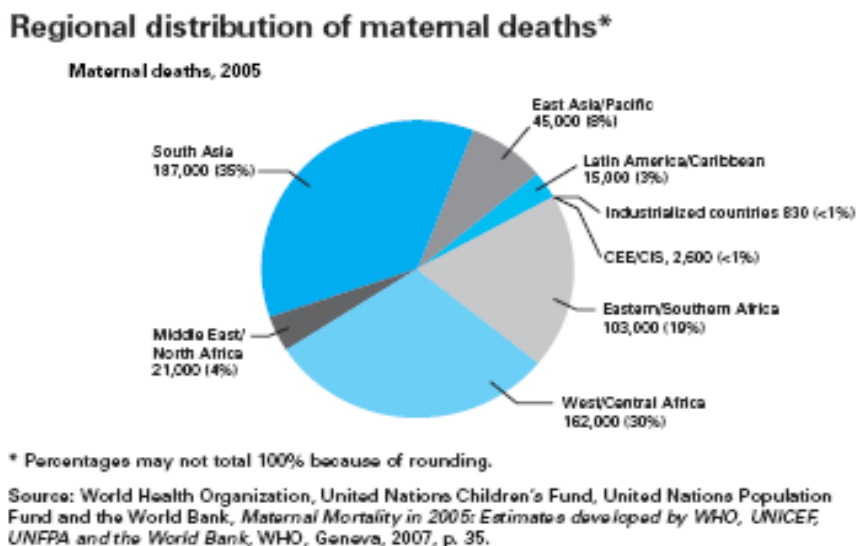
Consultant
International Forum for Rural Transport Development
(IFRTD)

BACKGROUND:

Maternal and child health, the latter of which includes newborn health, are considered a major public health problem especially in the low and middle-level income countries, which bear the largest burden of morbidity and mortality thereof. They represent the well-being of a society and its potential for the future.

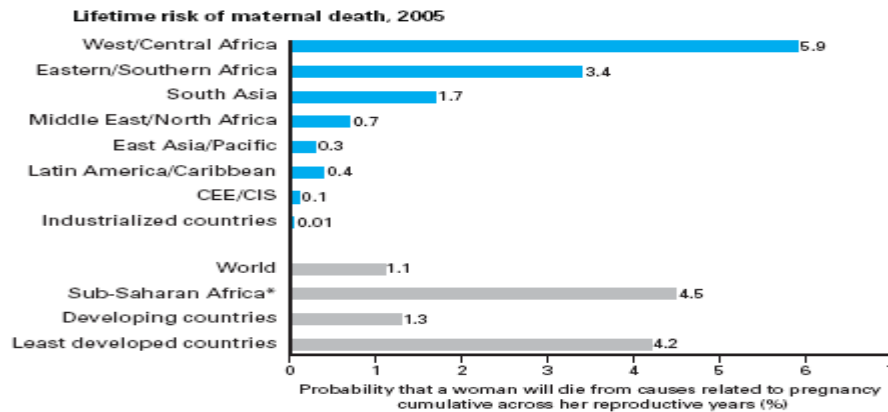
Every year over 500,000 women die due to pregnancy related conditions globally, of which 99% occur in developing countries, which constitute 85% of the total global population (1, 2). (Figure 1)

Figure 1: Regional Distribution of Maternal Deaths:



The risk of maternal death is particularly high in sub-Saharan Africa (SSA) and South-East Asia (SEA) (Figure 2). In SSA the life-time risk of maternal death is 1:26 with Niger having the highest globally at 1:7 (1). Pregnancy and childbirth and their consequences are the leading causes of death, disease and disability among women of reproductive age in SSA, most of which is avoidable.

Figure 2: Life-time risk of MM



*Sub-Saharan Africa comprises the regions of Eastern/Southern Africa and West/Central Africa.

Source: World Health Organization, United Nations Children's Fund, United Nations Population Fund and the World Bank, *Maternal Mortality in 2005: Estimates developed by WHO, UNICEF, UNFPA and the World Bank*, WHO, Geneva, 2007, p. 35.

Maternal mortality is a measure of the standard or quality of health care system of a given society or community **(3, 4)**. Women die from a wide range of complications arising during pregnancy, childbirth or the postpartum period due to the pregnancy status itself or aggravation of pre-existing conditions by the pregnancy, as well as lack of access to quality health care services. Maternal deaths are clustered around labour, delivery and the immediate postpartum periods **(1, 2)**.

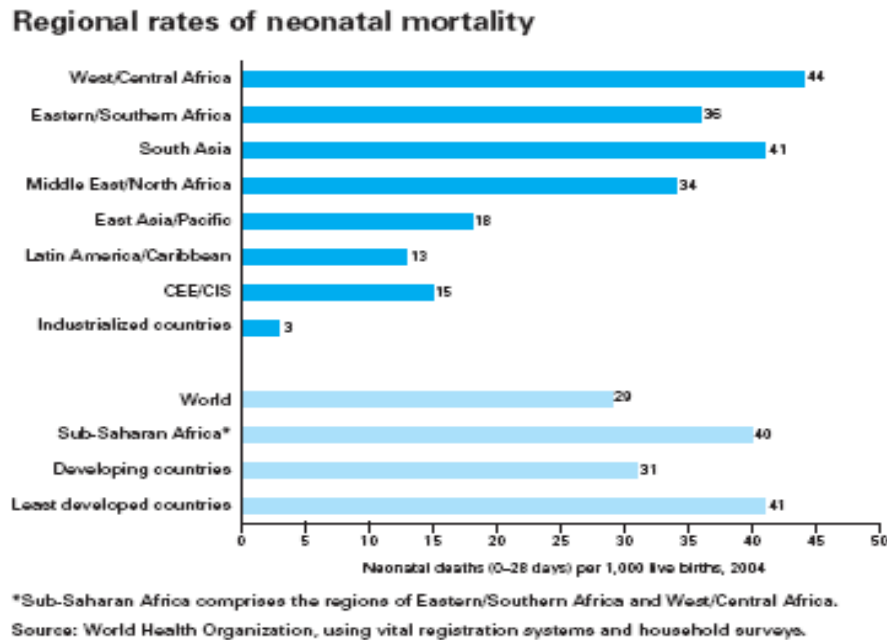
An estimated 4.0 million newborn babies die within the first 28 days of life (the neonatal period) globally every year. Almost all of them occur in low and middle-level income countries (Figure 3). Many of the deaths are due to complications their mothers sustain during pregnancy, labour or childbirth **(5)**. There is therefore close inter-relationship between maternal health and newborn health. Countries with high maternal mortality have also got high neonatal mortality **(1, 5)**. Neonatal deaths constitute about 40% of the under-five mortality globally **(5)**.

Healthy children are the core of the formation of human capital and the health of their mothers is a major determinant of the health of their children and therefore indirectly affects the formation of human capital. Children are the future of the society and their mothers the guardians of that future.

Maternal and child health have been the subject of many international forums over the past two decades or so and there have been numerous efforts at both the international and national (local) levels to address them for a good part of the past half a century or so. They have received greater focus though after being included as the Millennium Development Goals (MDGs) in 2000 as the international community and each signatory country pledged to ensure their

attainment by 2015 (6). There is also requisite regular measurement and reporting of progress towards their attainment (7, 8).

Figure 3: Regional Rates of Neonatal Mortality:



The number of research studies and publications either review articles or results of original research have also increased tremendously after the safe motherhood conference in Nairobi (1987) but much more so after the Millennium Summit (2000). Equally so too are the global and national efforts to address them and document progress.

Current evidence indicates that SSA countries have made little, if any, progress especially in addressing maternal health. Most of the neonatal mortality documentation which is also quite limited has been from health facilities and tertiary ones where there are specialists with interest in newborn health. It has also often been lumped under perinatal mortality. While a few countries have reported some reduction in mortalities others have not and in some cases there has been an increase in the numbers thereof (1, 8, 9). There is great disparity between countries as well as large disparities between the high and low-income groups and between urban and rural populations (1, 4, 10). Maternal and newborn mortality and morbidity remain unacceptably high in SSA.

In recent times, especially leading up to the Millennium Summit, a lot of questions have been asked and explanation sought, as to why, despite all the efforts the situation remains so in SSA in particular, while others with equally or even weaker economies, have registered impressive successes in reducing maternal and child mortality (1, 6). As observed in Colombo, Sri Lanka (1997)

some of the reasons for the scenario included the fact that the interventions were not focused or the most effective; some strategies had too broad approaches; information on what works was inadequate; some strategies were too ambitious and priorities not always clearly defined (11).

Evidence shows that at least 70% of newborn deaths and 75% of maternal deaths could be prevented if proven interventions are implemented (1, 2, 5). The broad strategies that have made it possible to reduce maternal and perinatal (neonatal) mortality in some areas of the world including developing countries are well known, i.e. prenatal care, management of labour and delivery by a qualified and skilled health worker, availability of emergency obstetric care (EmOC) and universal access to quality sexual and reproductive health care (1, 11, 12, 13, 14). Implementation of these strategies remains a major challenge for the majority of countries in SSA due to the fragile and under-developed health systems among other factors. Service availability and quality of care in SSA are heterogeneous and most often inadequate (Figure 4).

Figure 4: Access to Obstetric Care by Socio-Economic Strata in Sub-Saharan Africa and South Asia

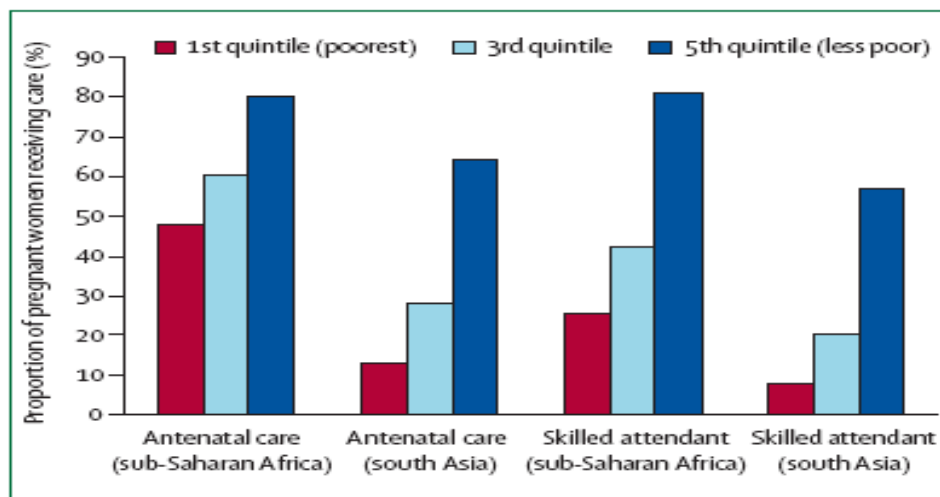


Figure 1: Variation across quintiles of socioeconomic status in regional average coverage for antenatal care (≥ 3 visits) and skilled attendance at birth
 Analysis of DHS data in 53 countries. Based on data in *The Wealth Gap in Health*. Washington: Population Reference Bureau, 2004.

Cognisant of the foregoing, it is obvious that much more needs to be done to accelerate attainment of MDG4 and 5 in SSA by 2015. Targeting interventions which have been shown to be successful with adaptation to local situations to the most vulnerable groups as such rural populations, and the poor is essential for achievement of substantial progress by 2015 as envisaged in the Millennium Declaration.

There is renewed interest and urgency to address the challenges faced by countries in SSA in reducing maternal and newborn mortality. While a number of countries have put in place national policies and programmes to implement the recommended strategies, they are unable to operationalise them due to resource-constraints. The international donor community is working with the most affected SSA countries to design and/or implement evidence-based interventions or to identify appropriate and cost-effective interventions.

The European Commission (EC), through its Research Framework Programme, (FP7) is inviting proposals from partner developing countries for research projects that may address some of the challenges. The research is aimed at focusing on effectiveness and feasibility of strategies and related interventions to promote the health of mothers and their newborns in Africa.

It is acknowledged that poor rural access plays a significant role in maternal and neonatal deaths. A number of interventions have been implemented at the local community level to try and address the role of transport in maternal mortality in SSA. These have however not been robustly evaluated and/or disseminated. Some have been implemented as donor-funded short-term pilot projects, with no provisions for sustainability or roll-out to other areas in the countries. There is also little research or policy guidance for the transport sector to address MDG 4 and 5.

This review of literature on maternal and newborn health and contributing factors such as emergency transport is aimed at facilitating development of an appropriate research proposal in response to the EC-FP7-CALL-FOR-AFRICA-2010-HEALTH.2010.3.4.2: **“Feasibility and community effectiveness of innovative intervention packages for maternal and newborn health in Africa”**.

The review looked at:

- i) The International Efforts Addressing Maternal and Child Health over the past 50 years or so.
- ii) The Current Status
 - i. Maternal Mortality
 - ii. Neonatal Mortality
- iii) The Causes thereof
- iv) The Operational (Predisposing) Factors
 - Highlighting the role of emergency transport,
- v) The interventions/strategies that have been tried and/or shown to be successful in various countries in SSA or elsewhere in the developing world.

EFFORTS TO ADDRESS MATERNAL AND CHILD HEALTH:

There have been several international forums and/or efforts aimed at addressing maternal and child health and well-being over the past 50 or so years. They are mentioned here so as to show the various efforts made to improve maternal and child health especially in the developing countries which bear the greatest burdens thereof and the recommended strategies/interventions. It will help in identifying and designing appropriate interventions at national, district or community levels which can be evaluated and or replicated in other areas with similar situations. Notable among these are:

i) The Maternal and Child Health (MCH) programme

- Started in the late 1960's, to which Family Planning (FP) was later added and more recently repositioned as Maternal, Newborn and Child Health (MNCH) Programme in recognition of the specific needs of the newborns and its contribution to under-five mortality and morbidity especially in the developing countries (15).

i) The Alma-Ata Declaration (1978)

- It underlined the importance of Primary Health Care (PHC), which was adopted by the majority of developing countries as key to achieving the goal of "Health for All" by year 2000
- Maternal and child health was recognised as a major public health concern that needed priority action.
- It affirmed access to basic health services as a fundamental human right (16).

ii) The Safe Motherhood Initiative (SMI) (1987)

- The international community made a call to reduce maternal mortality ratio (MMR) by 50% between 1990 and 2000.
- The launch of the initiative was seen as major milestone in the race to reduce the burden of maternal mortality throughout the world, in particularly the developing countries.
- The main strategies for the implementation of the initiative focused on prevention and detection of risk factors.
- Strategies and interventions for the reduction of maternal morbidity and mortality often referred to as "The Pillars of Safe Motherhood" were outlined by the Inter-Agency Group (Figure 5).

Figure 5: The Pillars of Safe Motherhood:



It recognized that good-quality maternal health services by trained health workers must be available and must be used and that the limiting factors such as social, economic and cultural needed to be addressed (17).

- A review of progress made in 1997 showed that:
 - Every pregnancy carries a risk.
 - Some causes of maternal deaths are sudden and unpredictable.
 - Presence of skilled attendant at every birth is critical, and was considered the single most effective intervention for reducing maternal mortality (11).

iii) The UN World Summit for Children (1990)

- Attended by 71 Heads of State and Government and 88 other Senior Officials at Ministerial Level.
- Adopted a Declaration on the Survival, Protection and Development of Children and a Plan of Action for Implementing the Declaration, which:
 - Noted that survival, protection and development of children is a pre-requisite for the future development of humanity
 - Noted the inter-relationship between maternal health and child health and called for special attention to the former.

- Called for a concerted national action and international cooperation to strive for the achievement by year the 2000 of:
 - Reduction of the 1990 under-five child mortality by one-third or to a level of 70/1,000 live births whichever was the greater reduction.
 - Reduction of 1990 MMR levels by 50% **(18)**.

iv) The International Conference on Population and Development – Programme of Action (ICPD PoA) (1994)

- Reiterated the Alma-Ata Declaration – on maternal and child health
- Reaffirmed the Safemotherhood Initiative (SMI) call – on reduction of maternal and child mortalities
- Called for further reduction of MMR by 50% between 2000 and 2015, thus making it a total reduction of 75% between 1990 and 2015.
- A commitment was made to implement a “comprehensive national strategy to ensure universal access to full range of high quality, affordable sexual and reproductive health (SRH) through the PHC with particular attention to emergency obstetric care (EmOC), and establishment and strengthening of safe motherhood programme (SMP) within the context of PHC **(19)**.

v) The Fourth World Congress on Women (FWCW) – Declaration and Platform for Action (1995)

- Reiterated the ICPD PoA with regards to SRH and ensuring universal access to quality health services for women and girls, reduce ill-health and maternal mortality among others **(20)**.

vi) The Millennium Declaration (2000)

- Was endorsed by 189 heads of state and government, in which they resolved to create an environment to eliminate poverty.
- The Declaration was translated into 8 MDGs to be achieved by 2015 and the Heads of State and Government pledged to meet all of them.
- Improvement of maternal health and reduction of child mortality were identified as two of the 8 fundamental goals for furthering human development.
- Each of the MDG has targets to be attained and indicators upon which progress will be measured.

- i. MDG 4 – Reduce Child Mortality.
 - Reduction of child mortality rate by two-thirds between 1990 and 2015.
 - . Under-five mortality rate
 - . Infant mortality rate
 - . Proportion of 1 year-old children immunised against measles

- ii. MDG 5 – Improving maternal health.
 - A second target and four indicators were added in 2005.
 - Reduction of Maternal Mortality by 75%
 - MMR
 - Proportion of women receiving skilled attendance at birth
 - Provide universal access to RH
 - CPR
 - Adolescent birth rates
 - ANC coverage
 - Unmet need for FP,

The MDGs underlined the importance of improving maternal and child health as an integral part of poverty reduction and placed them at the core of the struggle against poverty and inequality as a matter of human rights (6, 21).

vii) The WHO Making Pregnancy Safer Initiative (2000)

- Access to EmOC is a key element thereof.
- The referral system was considered essential in ensuring access to EmOC, and among the activities for strengthening the system were:
 - . Identification of communication and equipment needs for referral at the community and district levels
 - . Procurement and installation of appropriate communication equipment including 2-way radios and emergency transport.
 - . Establishment of community emergency committees (12).

viii) The AU Abuja Declaration (2001)

- At which Heads of State committed their governments to increase health financing to at least 15% of national budgets, so as to address the health challenges including maternal and child morbidity and mortality, HIV/AIDS, Malaria and Tuberculosis (22).

ix) The WHO Road Map for Accelerating the Attainment of MDGs Related to Reduction of Maternal and Newborn Morbidity and Mortality (2004)

- Developed in response to a recommendation by the African Regional Reproductive Health Task Force – (2003) **(23)**
- The objectives of the Road Map were:
 - . To provide skilled attendance at birth (SBA) and postnatal period at all levels of the health care delivery system.
 - . To strengthen the capacity of individuals, families and communities to improve maternal and newborn health
- Formed a framework for planned activities for improving maternal and newborn health services at the institution and programme levels.
- Among key components thereof are:
 - . Strengthening of the referral systems
 - . Effective involvement of individuals, families and communities **(24)**

x) The African Union (AU) Maputo Plan of Action (2006)

- Heads of State reaffirmed their commitment in Abuja (2001) with regards to budgetary allocation for health.
- The Plan of Action seeks to take the continent forwards towards the goal of universal access to comprehensive SRH Services in Africa by 2015
- Access to quality safe motherhood and child survival services by developing systems for rapid transport and strengthening referral systems is one of the key strategic actions within the Plan of Action for Implementing the Continental Sexual and Reproductive Health and Rights Framework **(25)**

CURRENT STATUS:

Progress towards attainment of the MDGs is monitored with a framework of measurable targets and indicators as defined in 2001. The international community committed itself to reducing MMR and child mortality and progress is measured using the indicators with the statuses obtaining in 1990 used as baseline.

i) Improving Maternal Health:

a) Maternal Mortality:

It is agreed that measuring MMR is problematic especially in settings with the highest ratios due to poor documentation and that most women do not deliver within health facilities, among other factors.

There have been several studies on MM over the past 10-15 years in a number of countries in SSA but these have been mainly facility-based and not necessarily tracking progress. Some have shown increasing MMR within facilities e.g. Malawi (**26-28**). Whereas these are facility-based and not necessarily a reflection of the national situation, they nevertheless give a glimpse of what may be happening nationally.

The global estimates by WHO, UNICEF, UNFPA and the World Bank (2005) (1), which compared progress between 1990 and 2005, revealed that,

- . Globally there was a drop in the MMR of about 1% annually between 1990 and 2005, as opposed to the expected 5.5% (to realize MDG5)
- . In SSA the decline was a paltry 0.1% annually only between 1990 and 2005. (Table 1)

Table 1: Annual MMR Reduction by Region (1990 to 2005)

Globally	<1.0%
East Asia	4.2%
Northern Africa	3.0%
SEA	2.6%
LAC	2.0%
SSA	0.1%

There were 536, 000 maternal deaths in 2005 compared to 576,000 in 1990.

- Of these 50.4% (270,000) were in SSA.
- 11 countries comprised 65% of the global total, of which six were in SSA. These are:
 - . Nigeria - DRC
 - . Ethiopia - Niger
 - . Niger - Tanzania
 - . Angola.

14 countries had MMRs of $\geq 1000/100,000$ live births. Of these 13 were in SSA, namely,

- | | | | |
|----------------|-------------------------------|------------|--------|
| - Sierra Leone | - 2100 | - G/Bissau | - 1100 |
| - Niger | - 1800 | - Burundi | - 1100 |
| - Chad | - 1500 | - DRC | - 1100 |
| - Somalia | - 1400 | - Nigeria | - 1100 |
| - Angola | - 1400 | - Malawi | - 1100 |
| - Rwanda | - 1300 | - Cameroon | - 1000 |
| - Liberia | - 1200 (Figure 6 and Table 2) | | |

Figure 6: Maternal Mortality Ratio by Country.

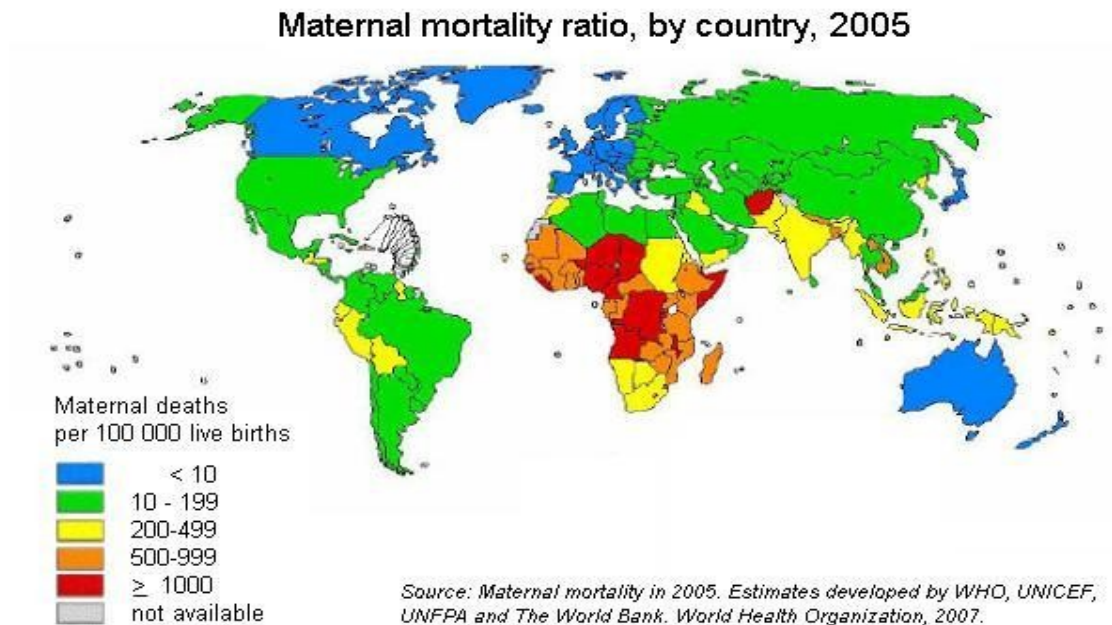
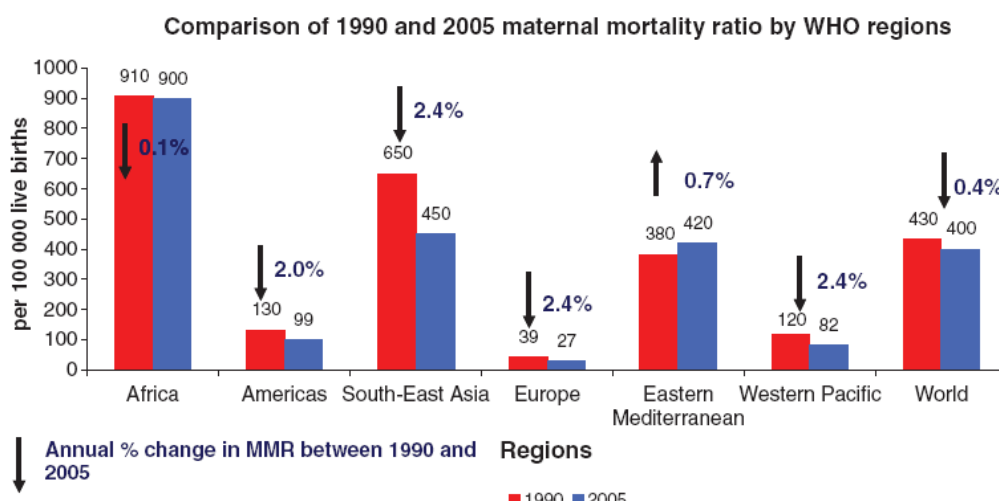


Table 2: Comparison of 1990 and 2005 Maternal Mortality by MDG Regions:

Region	1990*		2005*		% change in MMR between 1990 and 2005	Annual % change in MMR between 1990 and 2005
	MMR	Maternal deaths	MMR	Maternal deaths		
WORLD TOTAL	430	576 000	400	536 000	-5.4	-0.4
Developed regions**	11	1 300	9	960	-23.6	-1.8
Countries of the commonwealth of independent states (CIS)***	58	2 800	51	1 800	-12.5	-0.9
Developing regions	480	572 000	450	533 000	-6.6	-0.5
Africa	830	221 000	820	276 000	-0.6	0.0
Northern Africa****	250	8 900	160	5 700	-36.3	-3.0
Sub-Saharan Africa	920	212 000	900	270 000	-1.8	-0.1
Asia	410	329 000	330	241 000	-19.7	-1.5
Eastern Asia	95	24 000	50	9 200	-47.1	-4.2
South Asia	620	241 000	490	188 000	-21.1	-1.6
South-Eastern Asia	450	56 000	300	35 000	-32.8	-2.6
Western Asia	190	8 500	160	8 300	-16.2	-1.2
Latin America and the Caribbean	180	21 000	130	15 000	-26.3	-2.0
Oceania	550	1 000	430	890	-22.2	-1.7

Source: Maternal Mortality 2005. Estimates by WHO, UNICEF, UNFPA, and World Bank. The World Health Organisation 2007

Figure 7: Comparison of MMR by WHO Regions



There are differences in maternal mortality within individual countries and much more so between urban and rural areas within poor countries. There are differences from one urban and/or rural community to another even within the same country. The communities in one urban or rural community are not necessarily homogenous. Figure 8 below shows data from selected population-based studies in sub-Saharan Africa with urban-rural patterns.

The differences may be explained partly by the patterns of physical access to obstetric care. Conversely, the existence of high mortality levels in some urban areas suggests that other mechanisms might be involved, such as high prevalence of HIV, unsafe abortion, or as mentioned earlier, the poor quality of emergency obstetric care in hospitals

Figure 8: Maternal mortality ratios in urban and rural areas in selected countries

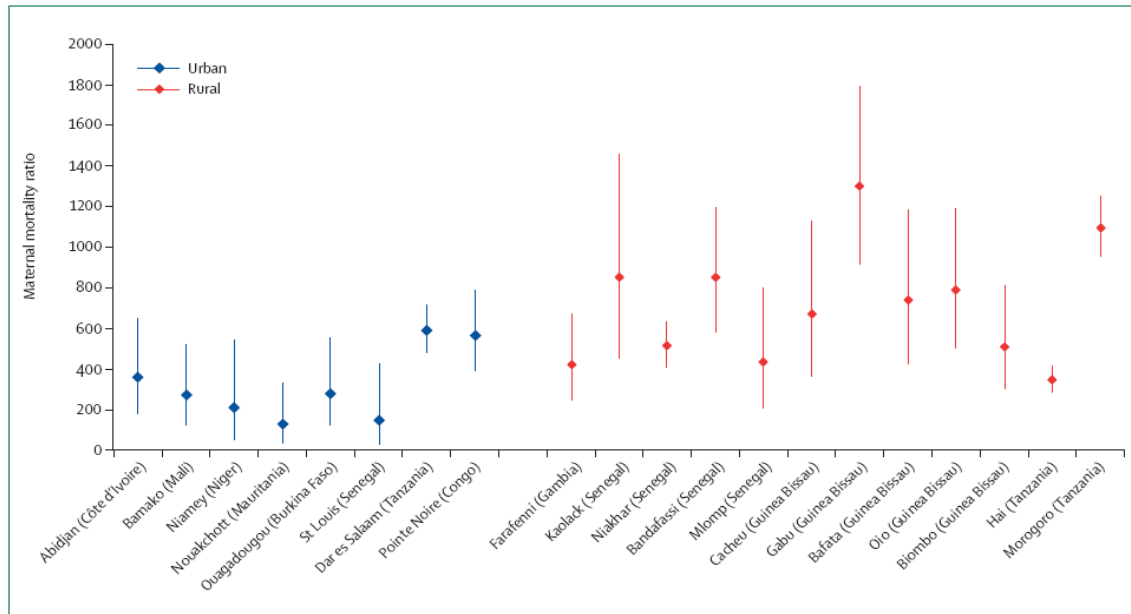


Figure 7: Maternal mortality ratios in urban and rural sites in sub-Saharan Africa

Source: Maternal Mortality 2005. Estimates by WHO, UNICEF, UNFPA, and World Bank. The World Health Organisation 2007

b) Skilled attendance at Birth:

Although the proportion of mothers who received skilled attendance during labour and childbirth, improved slightly in SSA, between 1990 and 2005, it is still far below the expected level as agreed at the UN General Assembly (1999) (29).

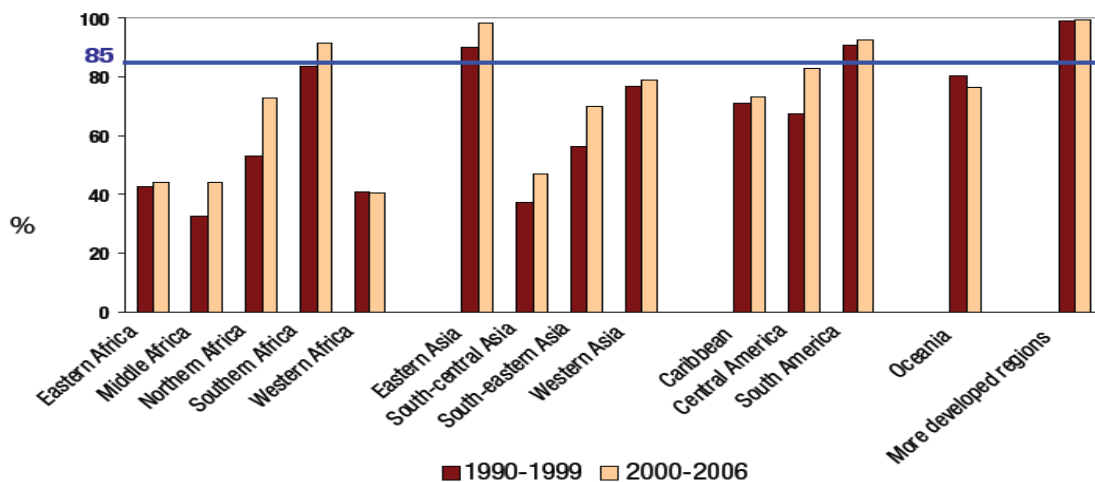
During the 2000–2007 period, skilled health workers attended 61 per cent of the total number of births in the developing world. The proportion of women with SBA in 2007 was <46.5% in Africa. East Africa had the lowest at 33.7%, West Africa 41.2%, Middle Africa 55.0%, Northern Africa 70.5% and Southern Africa 89.4% (1) (Figure 9). There are inter-country and intra-country variations the proportion being higher in urban than rural areas.

The expected levels are:

2005	-	80%
2010	-	85%
2015	-	90%

Trained health personnel should not only be able to assist with a normal delivery or a delivery with moderate complications, but should also be able to recognize serious complications that require referral for more specialized emergency care. Timely care in a medical facility is sometimes necessary to save the life of a woman experiencing complications during childbirth. Studies have shown that around 15 per cent of live births are likely to need emergency obstetric care and caesarean sections may be required in 5–15 percent in rural areas of sub-Saharan Africa, where rates of caesarean section are around 2 per cent (30, 31). However there are wide variations in what constitutes SBA among the countries. The training, competence and skills of the “skilled birth attendants” are not necessarily comparable across countries.

Figure 9: Skilled attendance at birth



Source: *Maternal Mortality 2005. Estimates by WHO, UNICEF, UNFPA, and World Bank. The World Health Organisation 2007*

The low proportion of mothers receiving SBA may be due to:

- Socio-cultural factors
- Lack of or limited qualified personnel with requisite skills
- Lack of access to health care facilities due
 - Transport constraints
 - Financial constraints
 - Distance
 - Geographical location of facilities

Table 3: Proportion of Mothers receiving SBA

Global, regional and sub-regional estimates of the proportion of births attended by a skilled health worker

Region/sub-region	% skilled health worker (doctors, nurses, midwives and other cadres)	Coverage of estimates*
World total	65.7	99.2
More developed regions	99.5	93.5
Less developed regions	61.9	99.8
Least developed countries	35.3	100.0
Africa	46.5	99.9
Eastern Africa	33.7	99.9
Middle Africa	55.0	100.0
Northern Africa	70.5	99.8
Southern Africa	89.4	100.0
Western Africa	41.2	100.0
Asia	65.4	99.8
Eastern Asia	98.0	100.0
South-Central Asia	46.9	100.0
South-Eastern Asia	70.1	100.0
Western Asia	79.2	97.1

Source: Maternal Mortality 2005. Estimates by WHO, UNICEF, UNFPA, and World Bank. The World Health Organisation 2007

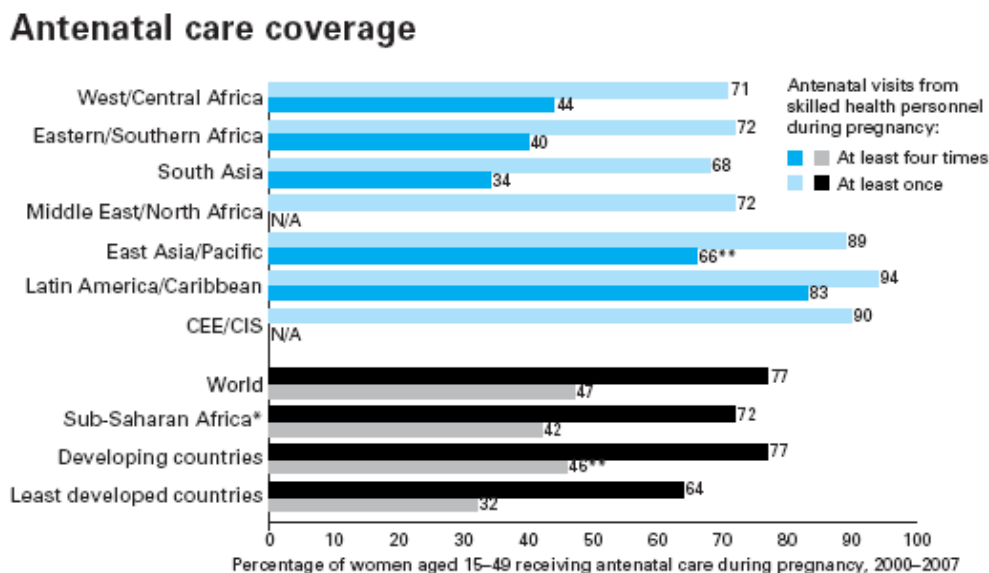
TABLE 4: SKILLED ATTENDANCE BY COUNTRY IN AFRICA

Country	Proportion of women receiving SBA	Year
1. Angola	44.7	2001
2. Benin	74.0	2006
3. Botswana	98.5	2000
4. Burkina Faso	54.0	2006
5. Burundi	34.0	2005
6. Cameroon	63.0	2006
7. Cape Verde	88.5	1998
8. CAR	53.5	2006
9. Chad	14.4	2004
10. Comoros	61.8	2000
11. Congo	83.4	2005
12. Cote d'Ivoire	56.8	2006
13. DRC	60.7	2001
14. Djibouti	93	2006
15. Equatorial Guinea	63.4	2000
16. Eritrea	28.3	2002
17. Ethiopia	5.7	2005
19. Gabon	85.5	2000
20. Gambia	56.8	2006
21. Ghana	49.7	2006
22. Guinea	38.1	2005
23. Guinea Bissau	38.9	2006
24. Kenya	41.6	2003
25. Lesotho	55.4	2004
26. Mozambique	47.7	2003
27. Namibia	75.5	2000
28. Niger	17.7	2006
29. Nigeria	35.2	2003
30. Rwanda	28.4	2005
31. Senegal	51.9	2005
32. Sierra Leone	43.2	2005
33. Somalia	33.0	2006
34. South Africa	92.0	2003
35. Sudan	49.2	2006
36. Swaziland	74.0	2002
37. Togo	62.0	2006
38. Tunisia	89.9	2000
39. Uganda	42.2	2006
40. United Republic of Tanzania	43.4	2004-05
41. Zambia	43.4	2001-02
42. Zimbabwe	68.5	2005-06

c) Antenatal Care Coverage:

Antenatal care is essential for the prevention, detection and treatment of pregnancy-related complications. UNICEF and WHO recommend a minimum of four well scheduled antenatal visits (31, 32). During these women are able to receive key interventions, such as tetanus immunization, screening and treatment for infections, as well as discuss plan for delivery mode and place. Antenatal care is an essential safety net for healthy motherhood and childbirth, where the well-being of both the prospective mother and her offspring can be monitored. In the developing world as a whole, three quarters of pregnant women received antenatal care from a skilled health provider at least once. Many do not receive the recommended four visits. The proportion of pregnant women in the developing world who had at least one antenatal care visit increased from slightly more than half at the beginning of the 1990s to almost three fourths a decade later. While that is an improvement, in Africa, only 42 per cent of women met the UNICEF-WHO recommended four visits at least (1) (Figure 10).

Figure 10: Antenatal Coverage across regions and within sub-regions in Africa:



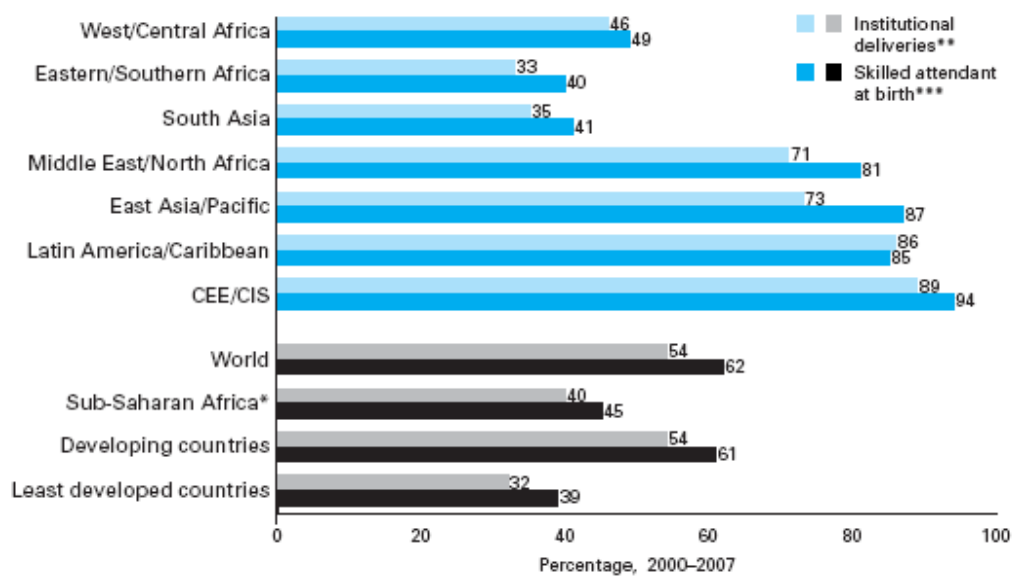
* Sub-Saharan Africa comprises the regions of Eastern/Southern Africa and West/Central Africa. ** Excludes China.

Source: Demographic and Health Surveys, Multiple Indicator Cluster Surveys and other national household surveys.

Institutional deliveries remain very low also in SSA, which obviously contribute to the low SBA. This is much lower than antenatal coverage (Figure 11).

Figure 11: Delivery Coverage by Regions:

Delivery care coverage



* Sub-Saharan Africa comprises the regions of Eastern/Southern Africa and West/Central Africa.
 ** *Institutional deliveries* refers to the proportion of women aged 15–49 years who gave birth in the two years preceding the survey and delivered in a health facility.
 *** *Skilled attendant at birth* refers to the percentage of births attended by skilled health personnel (doctors, nurses and midwives).
 Source: Demographic and Health Surveys, Multiple Indicator Cluster Surveys, World Health Organization and UNICEF.

ii) Reducing Child Mortality:

Each year an estimated four million babies die in the first 4 weeks of life (the neonatal period). Almost all of these deaths (99%) occur in low- and middle-income countries, and approximately half occur at home, often unnamed and uncounted. Currently about 40% – of global under-five mortality occurs in the first 28 days of life **(5)**. (Figure 12)

Since 1990, child mortality after the first month of life (i.e. from the age of 1 to 59 months) has declined by one-third, while the neonatal mortality rate (NMR) has declined by only about one-quarter, due mainly to progress in the world’s richest countries and in transitional countries in South East Asia and Latin America. The survival gap between rich and poor countries is such that a newborn in West Africa is over 15 times more likely to die in the neonatal period than a newborn in Western Europe (NMRs of 46 vs 3 per 1000 live births respectively). While the actual number of deaths is highest in Asia, the rates for neonatal deaths are greatest in sub-Saharan Africa. Of the 20 countries with the highest neonatal mortality rates, 16 are in SSA **(1)** (Figures 12, 13, 14)

Figure 12: Neonatal mortality rate per 1000 live births in 2000

Figure 1.6 Neonatal mortality rate per 1000 live births in 2000^a

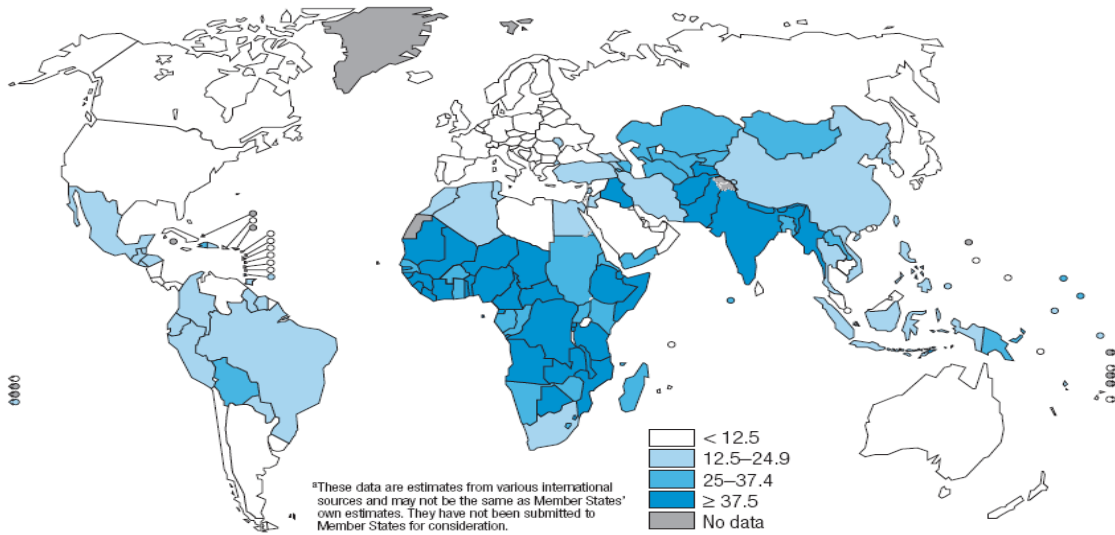
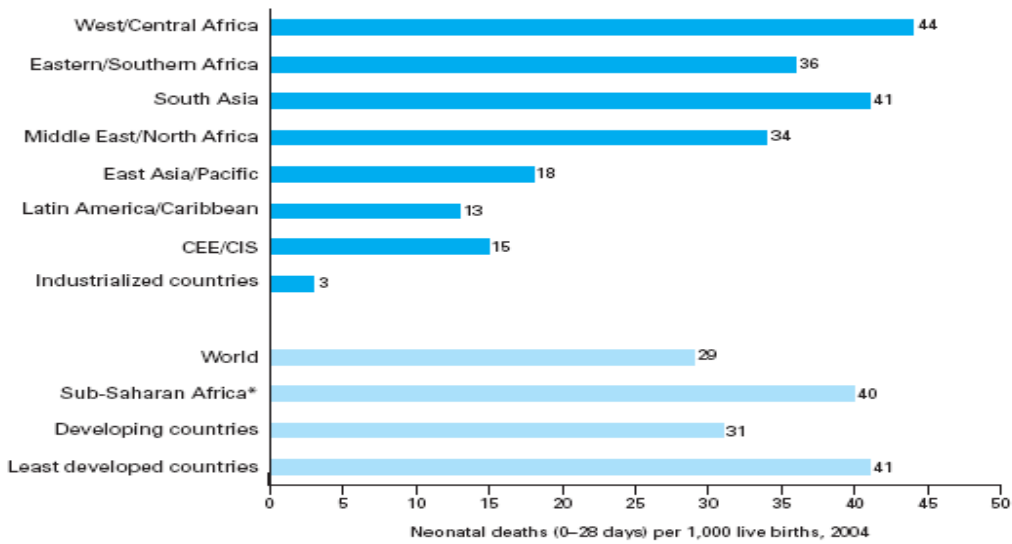


Figure 13: Regional Rates of Neonatal Mortality

Regional rates of neonatal mortality



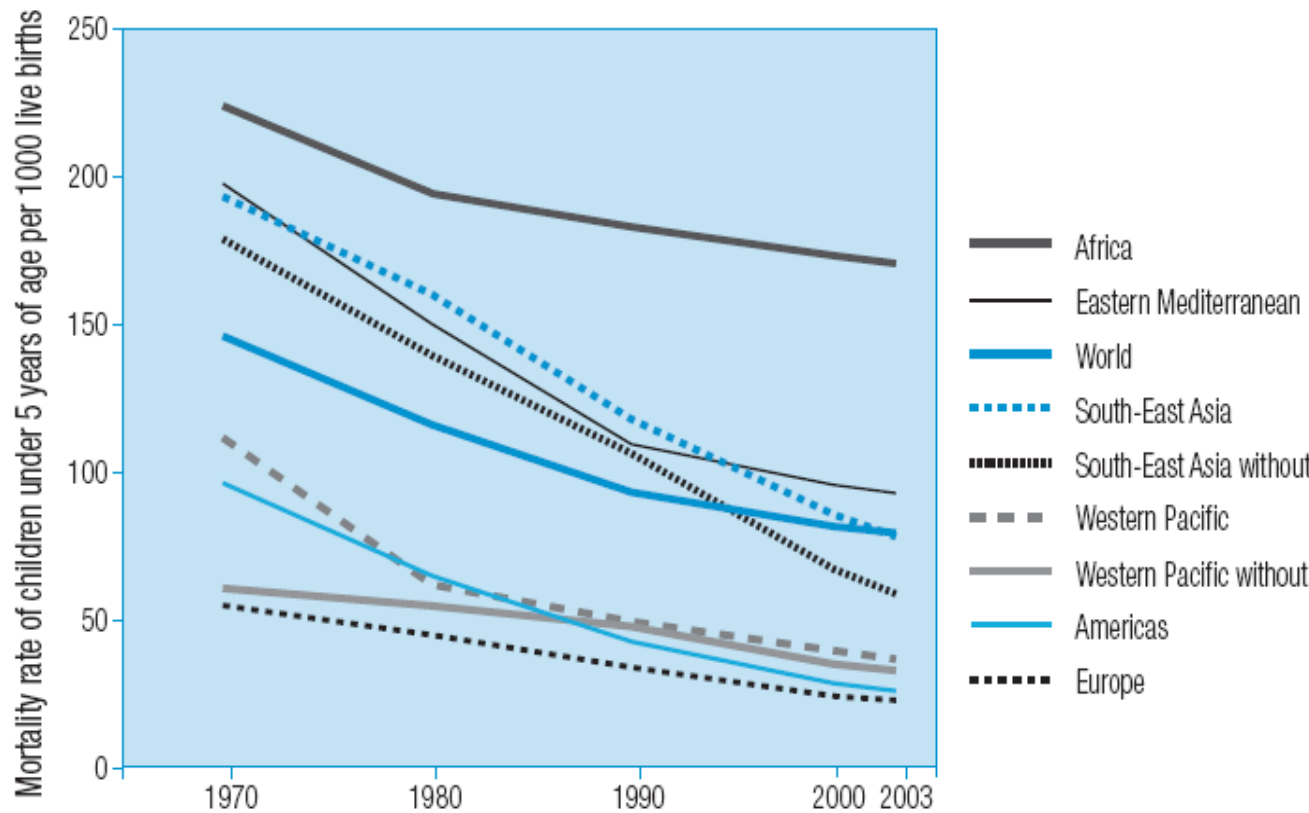
*Sub-Saharan Africa comprises the regions of Eastern/Southern Africa and West/Central Africa.
 Source: World Health Organization, using vital registration systems and household surveys.

Three quarters of neonatal deaths take place during the first 7 days, the early neonatal period. The risk of mortality is greatest during the first day after birth, when it is estimated that between 25 and 45 per cent of neonatal deaths occur. Disparities across social groups within countries also remain high, especially in relation to poverty. Demographic and Health Surveys conducted

between 1995 and 2002 show that within regions, neonatal mortality is 20–50 per cent higher for the poorest 20 per cent of households (1, 2, 5, 33)

Figure 14: Child Mortality in SSA Compared to other Regions

Figure 1.1 Slowing progress in child mortality: how Africa is faring worst



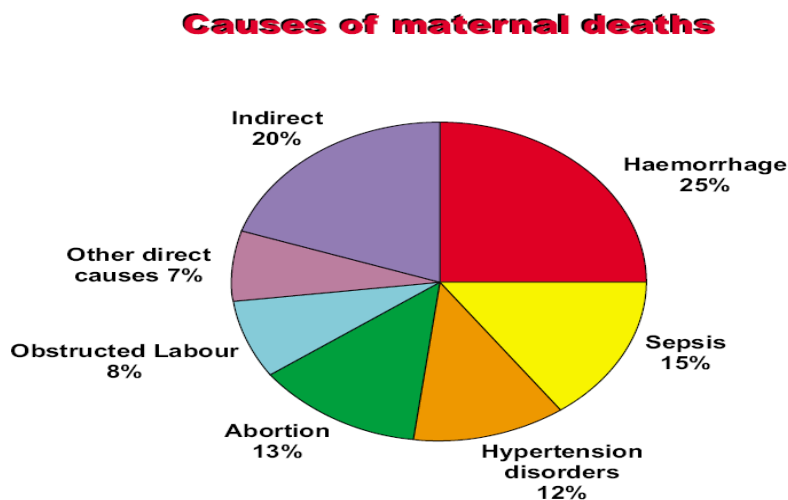
CAUSES OF MORTALITY AND MORBIDITY:

i) Maternal Mortality and Morbidity in SSA:

While there are differences among the countries or even from one region of a country to another in terms of the order of causes or their respective contribution, the causes of maternal mortality and therefore morbidity are fairly similar in Africa.

Obstetric haemorrhage, sepsis and obstructed labour may be more common in rural poor populations, while unsafe abortion and hypertensive disease may be more common among the urban populations (26, 27, 33-52)

Figure 15: Causes of Maternal Deaths:



ii) Neonatal Mortality and Morbidity in SSA:

Figure 16: Number of Neonatal deaths by cause, 2000-2003

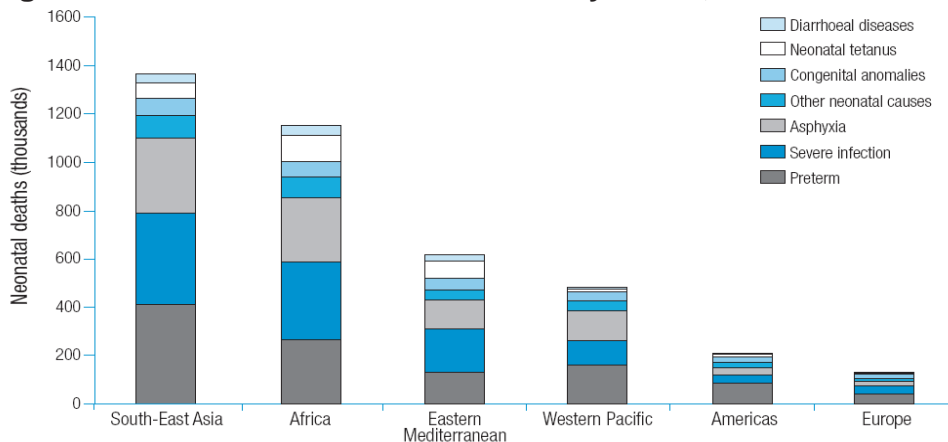
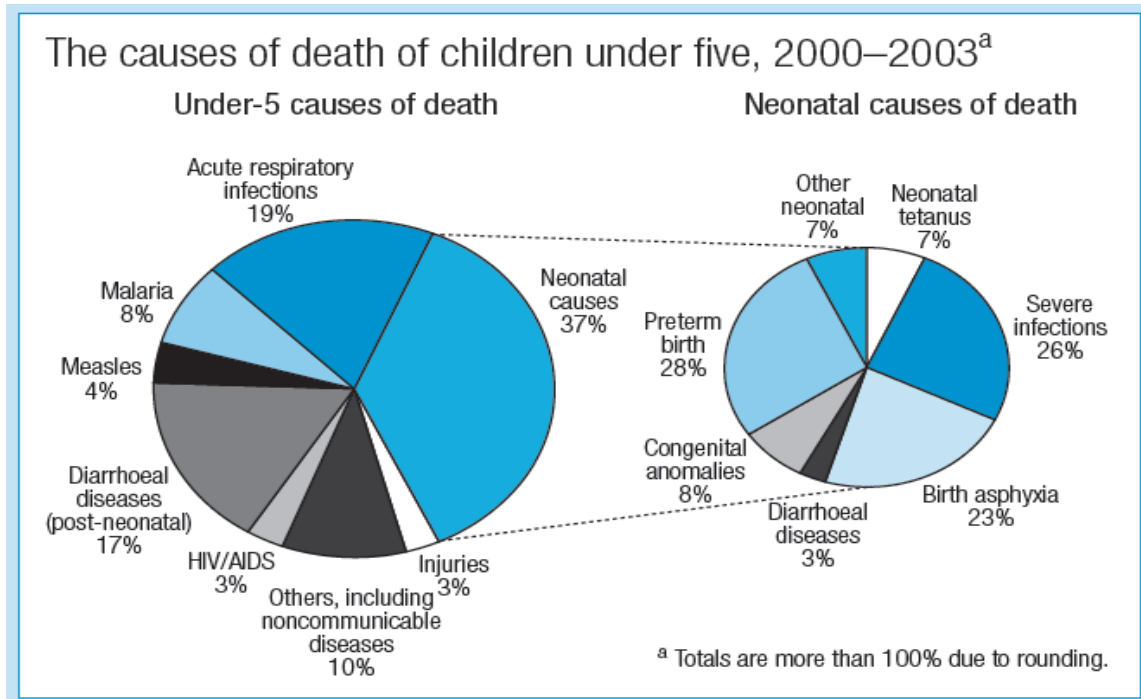


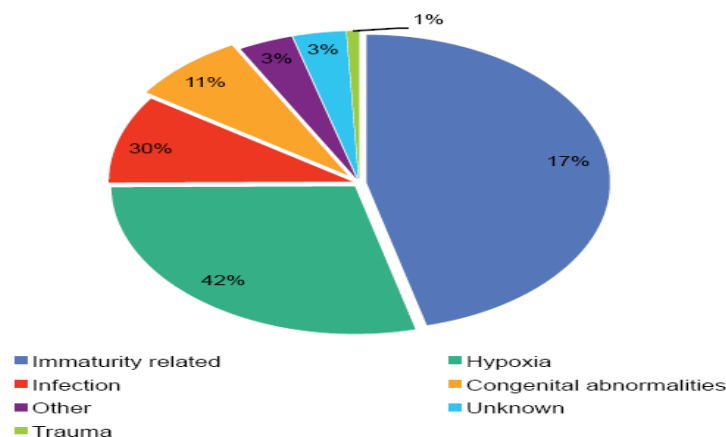
Figure 17: Causes of Child mortality:



Pre-term birth, severe infections, and birth asphyxia are the major causes of neonatal deaths in Africa. These are often related to maternal conditions and/or complications in pregnancy, during labour and delivery. Studies in various countries in SSA have shown more or less similar patterns, though with differences in proportion of causes and order depending on settings (53-63). Figure 18, shows causes of perinatal and neonatal in South Africa.

Figure 18: Causes of Neonatal Deaths in South Africa:

Causes of neonatal mortality



OPERATIONAL FACTORS FOR MATERNAL AND NEONATAL MORTALITY AND MORBIDITY

There has been a lot of interest as to why, when and where maternal and newborn deaths occur in SSA in effort to addressing the problem. As stated earlier, majority of maternal deaths are clustered around labour, delivery and the immediate postpartum periods. The first 24 hours is the most critical period. Likewise majority of neonatal deaths occurs in the first 7 days of life with a sizeable proportion of them occurring in the first 24 hours of birth. It is clear therefore that majority of maternal and newborn deaths could be avoided if the mothers receive appropriate and quality emergency obstetric care during this critical period.

Delay in accessing and receiving appropriate care is a major predisposing factor to maternal and newborn deaths. Table 6 below shows the time interval between onset of major obstetric complication and death if no action is taken. The longer the distance and delay in getting transport the higher is the risk of maternal and newborn death. Postpartum haemorrhage seems to have the lowest safety, hence the fact that it is the major cause especially in rural areas due to delays in getting appropriate care.

Table 6. Estimated average interval between onset of major obstetric complications and death, in the absence of medical interventions

Complication	Hours	Days
Haemorrhage <ul style="list-style-type: none">• Postpartum• Antepartum	2 12	
Ruptured uterus		1
Eclampsia		2
Obstructed labour		3
Infection		6

From Maine, D. *Prevention of Maternal Deaths in Developing Countries: Program Options and Practical Considerations, in International Safe Motherhood Conference. 1987. Unpublished data: Nairobi.*

Delay in accessing appropriate care when an obstetric complication occurs, is the main predisposing factor. Three phases of delays to access care have been described:

- Delay in making decision to seek care
 - Delay in arrival at a health facility
 - Delay in receiving appropriate treatment after arrival at the health facility
- (64)**

Each phase is equally important, but awareness of the danger symptoms and signs of obstetric complications among pregnant women and their families/communities is critical to seeking and accepting appropriate and timely referral to essential obstetric and newborn care, thus reducing the first and second phases of delay.

Describing the factors as done above, i.e. phases of delay masks a number of subtle operational factors, which are important and may go un-noticed and therefore unaddressed

Others have categorized the factors into:

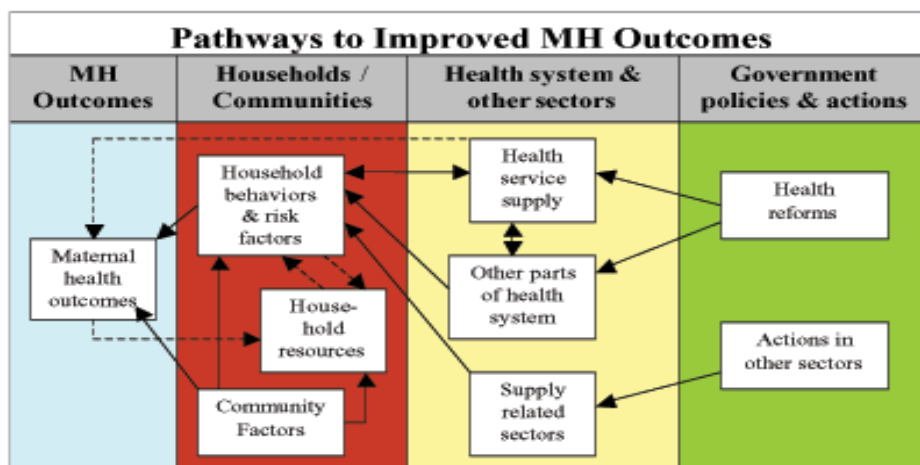
- Household factors
 - Low status of girls and women
 - Educational level of women and even men in some cases
- Community factors
 - Cultural norms and practices which may hinder utilization of health services
- Health systems factors
 - Affordability due to formal and informal user fees (among other constraints)
 - Accessibility –
 - due to poor coverage of health facilities especially in rural areas
 - Long distances to health facility
 - Poor road infrastructure and networks
 - lack of or unreliable public transport
 - Geographical location
 - Lack of skilled human resources
 - Poor quality of services in most public facilities.
 - Lack of or limited coverage of EmOC
 - Weak referral systems
 - Lack of blood, drugs, equipment and other supplies
- Policy constraints
 - Lack of policies – on education; health care services; transport; energy, on human resources, financing of services etc.
 - Lack of political will and commitment.

A number of studies in SSA have identified the above factors with varying degrees of importance. Studies in Tanzania found that maternal age, low education of woman and her spouse, ones religious affiliation, parity, availability of health facilities and trained health personnel and socio-economic status to be associated with increased risk of maternal deaths (37, 59, 62, 64). Distance to a health facility and lack of transport have been reported as major obstacles to accessing EmOC in several countries (41, 42, 45, 46, 50, 54). Transport options and costs; and distance especially in rural areas. A study in Burkina Faso showed that every extra 10 kms from the hospital led to a 17% reduction in the probability of a woman having an institutional delivery and therefore increased risk of complications and death (65). A study in Ethiopia showed that women in rural areas were x40 less likely to receive skilled attendance at birth than urban dwellers). Where women have to cross ferries or use boats, this may not be working on a 24 hour basis. Poor roads, lack of public transport and high transport costs were cited as major problems by members of the public in a number of focus group discussion studies in Niger, Ghana and Nigeria (46). Poor quality of care provided at health facilities either because of lack of trained and skilled professionals, blood, drugs and other supplies have been reported in several studies as main contributing factors (26, 35, 39, 40, 66).

In most cases there is more than one operational factor. For example a pregnant woman from a poor family in a remote village will have low education, may have socio-cultural issues, may not have or be able to afford transport to a health facility and therefore will not have access to skilled birth attendant. When and if she gets to a facility she may not have quality services such as blood due to lack of donors or appropriate drugs or intervention such as surgery as she may not be able to afford the requisite fee. Such scenarios have led some to think of “Pathways to Maternal and Newborn Deaths” and therefore “Pathway Framework” to addressing the challenges or obstacles. (Figure 19)

Figure 19: Pathways to improved Maternal Health Outcomes:

Figure 1: Pathways to Improved Maternal Health Outcomes



Source: PRSP Sourcebook, Claeson, et al.

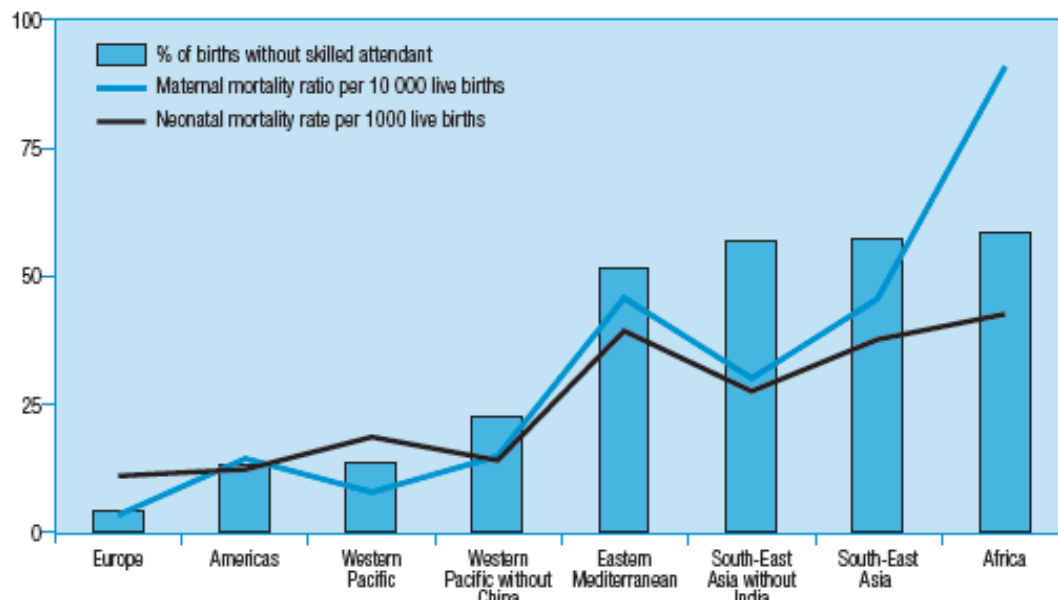
INTERVENTIONS:

It has been stated that there is no “silver bullet” strategy for addressing maternal and newborn health especially in the developing countries, considering the myriad of challenges and inter-relationship of obstacles to accessing and receiving appropriate and quality care. Addressing the challenges or obstacles is not an easy task and often requires multi-sectoral approach, e.g. health, finance, planning, economic development, local government, public works, transport, education, social services, security, etc, and wide partnerships including community involvement and participation for success and sustainability.

Cognisant of the fact that each pregnancy carries a risk and that the complications leading to maternal and newborn deaths are often sudden and unpredictable, it has been stated, based on studies and observations, that accessibility to and availability of skilled attendant at every birth is the single most important intervention in reducing maternal and newborn mortality and morbidity (1, 67).

Figure 1.2 show relationship between maternal and newborn deaths and lack of skilled birth attendant.

Figure 1.2 Neonatal and maternal mortality are related to the absence of a skilled birth attendant



Of course with for SBA to be successful there are many other factors which facilitate or contribute to it. For example it must be accompanied by functional referral system and quality EmOC services, availability of requisite supplies, drugs, blood transfusion, and the patient must arrive in good time etc. One can not talk of SBA in the absence of these other critical components.

Successful approaches to improving maternal and newborn health can be summarized as follows:

- ▶ Strengthening of outreach services and community based approaches
 - Public awareness and education
 - Maternity waiting homes
- ▶ Improving literacy levels
 - Girls and women
 - Boys and men.
- ▶ Developing effective referral systems
 - Policy development and political commitment
 - Funding by the state (Abuja Declaration)
 - Community partnerships with local transport systems
 - Loans/financing systems to offset out-of-pocket expenses
 - Infrastructural development and improvement
 - Roads – to be all weather,
 - Health facilities close to where people are
- ▶ Improving quality and availability of EmOC
 - Policy
 - Capacity building
 - Training and retention of human resources
 - Availability of drugs, blood, equipment, and supplies
- ▶ Strengthening of monitoring and evaluation
 - Improve health information managements systems (HIMS)
 - Institutionalise maternal death audits/reviews (MDA/R)
 - Confidential Enquiries into maternal deaths (CEMD)
 - Conduct cost-effective studies, dissemination of findings widely

Studies that have specifically looked at the issue of emergency transport for maternal and newborn health in SSA have come up with various models. These include:

- ▶ Establishment of community loan funds, cost-sharing, insurance schemes, etc **(35, 68, 69, 70, 71, 72)**
- ▶ Motorised ambulances either motor vehicles or motorbikes or in some cases bicycle ambulances, supported by two-way radio communication systems. **(68, 73, 74, 75)**
- ▶ Community partnerships with local private transport owners, supported by effective communication system **(64, 76, 77)**
- ▶ Increased access to EmOC **(78, 79)**
- ▶ Removal of user fees **(80, 81, 82)**
- ▶ Establishment of maternity waiting homes **(83)**

The writer has just had the privilege of witnessing a program addressing maternal and newborn health in Western Kenya and area with some of the highest MMR and NNMR in the country. The programme has several strategies in a number of communities and facilities. The communities in which this programme is being implemented report that they are beginning to see more women receiving ANC in formal facilities, SBA, and drop in the number of pregnancy related deaths. These include community empowerment through creation of community health committees, raising awareness and their involvement in decision making, community health workers visiting homes and providing health education and information, as well as to ensure mothers are attending antenatal clinics, improvement of infrastructure at the facility level both at the BEOmC and CEOmC to respond to the 6 and 8 EOC signal functions respectively, strengthening the referral systems and training of health workers. In one of the districts, a motorbike ambulance has been provided and it has improved referral of patients from the peripheral units to the hospital. It is also acceptable to the local community as they did not have an ambulance before. Others include establishment of maternity waiting homes, institutionalization of maternal death reviews and verbal autopsies **(84)**. Evidence from this programme supports the notion that for reduction of maternal and newborn mortality and morbidity we require multi-faceted approach(es).

One strategy may be appropriate in specific locations, but not in others. There is need therefore for locally appropriate operational research to identify what strategy is acceptable and cost-effective in a particular setting. Whatever the strategy community involvement and participation will be critical for acceptability and sustainability considering the current government funding for health and non-reliability of donor funding.

REFERENCES:

1. WHO/UNICEF/UNFPA/The World Bank. Maternal mortality in 2005. Estimates developed by WHO, UNICEF, UNFPA and The World Bank. Geneva: World Health Organization, 2007,
2. Ronsmans C, Graham WJ; *Lancet* Maternal Survival Series steering group. Maternal mortality: who, when, where, and why. *Lancet* 2006; **368**: 1189–200.
3. Gibbs N. Confidential enquiry into maternal deaths. *Br. J. Obstet. Gynaecol.* 1990; 97:97-99,
4. United Nations. World Health Organisation and World Bank partner to combat maternal mortality. The World Bank Group News Release No 2000/080/S
5. Lawn JE, Cousens S, Zupan J. 4 million neonatal deaths: When? Where? Why? *Lancet* 2005; **365**:891–900.
6. United Nations. *United Nations millennium declaration*. New York: UN, 2000
7. Kerber KJ, de Graft-Johnson JE, Bhutta ZA, Okong P, Starrs A, Lawn JE. Continuum of care for maternal, newborn, and child health: from slogan to service delivery. *Lancet.* 2007 Oct 13;370(9595):1358-69.
8. Bryce J, Daelmans B, Dwivedi A, Fauveau V, Lawn JE, Mason E, Newby H, Shankar A, Starrs A, Wardlaw T. Countdown Coverage Writing Group; Countdown to 2015 for maternal, newborn, and child survival: the 2008 report on tracking coverage of interventions. *Lancet.* 2008 Apr 12;371(9620):1247-58.
9. AbouZahr C.; Wardlaw T. Maternal mortality at the end of a decade. Signs of progress? *Bull. World Health Organ.* 2001; 79:561-68,
10. Hill K; Thomas K.; AbouZahr C; Walker N; Say L; Suzuki E. Maternal mortality Working Group. Estimates of maternal mortality worldwide between 1990 and 2005: an assessment of available data. *Lancet* 2007; 370,
11. Starrs A. The Safe Motherhood Action Agenda: Priorities fir the Next Decade.Report on the Safe Motherhood Technical Consultation. Colombo Sri Lanka 18-23, October, 1997. New York. Family Health International, 1998

12. World Health Organization. Making pregnancy safer: the critical role of the skilled attendant. A joint statement by WHO, ICM and FIGO. Geneva: World Health Organization, 2004.
13. Van Lerberghe W; De Brouwere V. Of blind alleys and things that have worked: history's lessons on reducing maternal mortality. *Studies Health Serv. Organ. Policy* 2001; 17:7-33,
14. Campbell OM, Graham WJ: Strategies for reducing maternal mortality: getting on with what works. *Lancet* 2006, 368(9543):1284-1299.
15. World Health Organization. The World Health Report: 2005: Make Every Mother and Child Count. WHO Geneva, 2005.
16. Alma Ata Declaration 1978
17. World Health Organisation. Report of the International Safe Motherhood Conference. Nairobi, Kenya, 1987.
18. United Nations. World Summit for Children, 29-30, September 1990. New York. 1990.
19. World Health Organization. Report of the International Conference on Population and Development, Cairo, 5–13 September 1994. New York: United Nations; 1994. (A/CONF.171/13; [www.un.org/popin/icpd/conference/offeng/poa.html]).ICPD
20. United Nations (1995). Report of the FWCW, Beijing China 4-15, September 1995. UN doc. A/Conf.177/20
21. Sachs JD; McArthur JW; The Millennium Project: a plan for meeting the Millennium Development. *Lancet* 2005; 365-347-53,
22. Organisation of African Unity. Abuja declaration on HIV/AIDS, Tuberculosis, and other related infectious diseases. Addis Ababa. Organisation of African Unity. 2001. Available at http://www.un.org/ga/aids/pdf/abuja_declaration.pdf
23. WHO – AFRO. Regional Reproductive Health Task Meeting, Dakar Senegal. October 2003. World Health Organisation, Beazzaville, Congo.
24. WHO. The Road Map for Accelerating the attainment of MDGs related to Maternal and newborn health. World Health Organisation. Geneva, 2004.
25. African Unity. Maputo Plan of Action for operationalisation of the Continental Framework on Sexual and Reproductive Health and Rights. Addis Ababa. African Unity. 2006,

26. Lema VM, Changole J, Kanyighe C, Malunga EV. Maternal mortality at the Queen Elizabeth Central Teaching Hospital, Blantyre, Malawi. *East Afr Med J.* 2005 Jan;82(1):3-9.
27. Kanyighe C, Channon A, Tadesse E, Madise N, Changole J, Bakuwa E, Malunga E, Stones RW Determinants of post-partum maternal mortality at Queen Elizabeth Central Hospital, Blantyre, Malawi: a case-control study 2001-2002. *Afr J Reprod Health.* 2008 Dec;12(3):35-48.
28. Adamson SM, Phiri A. Did maternal mortality ratio increase in Malawi between 1992-1998? Review of Malawi Demographic and Health Surveys and other data sources. *Trop Doct.* 2003 Jul;33(3):182-5.
29. United Nations. Report of the Ad Hoc Committee of the Whole of the Twenty-first Special Session of the General Assembly. New York: United Nations, 1 July 1999 (General Assembly document, No. A/S-21/5/Add.1).
30. Paxton A, Maine D, Freedman L, Fry D, Lobis S. The evidence for emergency obstetric care. *Int J Gynaecol Obstet.* 2005 Feb;88(2):181-93.
31. Bailey PE, Paxton A: Program note. Using UN process indicators to assess needs in emergency obstetric services. *Int J. Gynaecol Obstet* 2002, 76(3):299-305.
32. UNICEF, WHO, UNFPA. Guidelines for monitoring the availability and use of obstetric services. New York, United Nations Children Fund, 1997.
33. Lawn JE, Lee AC, Kinney M, Sibley L, Carlo WA, Paul VK, Pattinson B, Darmstadt GL. Two million intrapartum-related stillbirths and neonatal deaths: Where, why, and what can be done? *Int J Gynaecol Obstet.* 2009 Aug 28.
34. Bell JS, Ouédraogo M, Ganaba R, Sombié I, Byass P, Baggaley RF, Filippi V, Fitzmaurice AE, Graham WJ. The epidemiology of pregnancy outcomes in rural Burkina Faso. *Trop Med Int Health.* 2008 Jul;13 Suppl 1:31-43.
35. Bates I, Chapotera GK, McKew S, van den Broek N. Maternal mortality in sub-Saharan Africa: the contribution of ineffective blood transfusion services. *BJOG.* 2008 Oct;115(11):1331-9
36. Moodley J. Maternal deaths associated with hypertensive disorders of pregnancy: a population-based study. *Hypertens Pregnancy.* 2004;23(3):247-56

37. Urassa E, Massawe S, Lindmark G, Nyström L. Operational factors affecting maternal mortality in Tanzania. *Health Policy Plan.* 1997 Mar;12(1):50-7
38. Oyieke JB, Obore S, Kigundu CS. Millennium development goal 5: a review of maternal mortality at the Kenyatta National Hospital, Nairobi. *East Afr. Med. J.* 2006 Jan;83(1):4-9.
39. Kongnyuy EJ, Mlava G, van den Broek N. Facility-based maternal death review in three districts in the central region of Malawi: an analysis of causes and characteristics of maternal deaths. *Womens Health Issues.* 2009 Jan-Feb;19(1):14-20.
40. Fawcus S, Mbizvo MT, Lindmark G, Nystrom L. A community based investigation of causes of maternal mortality in rural and urban Zimbabwe. Maternal Mortality Study Group. *Cent Afr J Med.* 1995 Apr;41(4):105-13.
41. Menéndez C, Romagosa C, Ismail MR, Carrilho C, Saute F, Osman N, Machungo F, Bardaji A, Quintó L, Mayor A, Naniche D, Dobaño C, Alonso PL, Ordi J. An autopsy study of maternal mortality in Mozambique: the contribution of infectious diseases. *PLoS Med.* 2008 Feb;5(2):e44.
42. Garenne M, Mbaye K, Bah MD, Correa P. Risk factors for maternal mortality: a case-control study in Dakar hospitals (Senegal). *Afr J Reprod Health.* 1997 Mar;1(1):14-24.
43. Li XF, Fortney JA, Kotelchuck M, Glover LH.. The postpartum period: the key to maternal mortality. *Int J Gynaecol Obstet.* 1996 Jul;54(1):1-10.
44. Rutgers S. Two years maternal mortality in Matebeleland north Province, Zimbabwe. *Cent Afr J Med.* 2001 Feb;47(2):39-43.
45. Martey JO, Djan JO, Twum S, Browne EN, Opoku SA. Maternal mortality and related factors in Ejisu District, Ghana. *East Afr Med J.* 1994 Oct;71(10):656-60.
46. Bouvier-Colle MH, Ouedraogo C, Dumont A, Vangeenderhuysen C, Salanave B, Decam C; MOMA group. Maternal mortality in West Africa. Rates, causes and substandard care from a prospective survey. *Acta Obstet Gynecol Scand.* 2001 Feb;80(2):113-9.
47. Kodio B, de Bernis L, Ba M, Ronsmans C, Pison G, Etard JF. Levels and causes of maternal mortality in Senegal. *Trop Med Int Health.* 2002 Jun;7(6):499-505.

48. Mills S, Williams JE, Wak G, Hodgson A. Maternal mortality decline in the Kassena-Nankana district of northern Ghana. *Matern Child Health J.* 2008 Sep;12(5):577-85. Epub 2007 Oct 23.
49. Walraven, G; Telfer, M; Rowley, J; Ronsmans, C. Maternal mortality in rural Gambia: levels, causes and contributing factors. *BULLETIN OF THE WORLD HEALTH ORGANIZATION* 78 (5):603-613 2000
50. Nkata, M. Maternal deaths in Zambia. *Afr Health* 21 (1):2 1998
51. Campbell, M; Abu S. Z. Sudan: Situational analysis of maternal health in Bara District, North Kordofan. *World Health Statistics Quarterly* 48 (1):60-66 1995
52. Ziraba AK; Madise N' Mills S; Kyobutungi C; Ezeh A. Maternal mortality in the informal settlements of Nairobi city: what do we know? *Reproductive Health* 2009, 6:6 doi:10.1186/1742-4755-6-6
53. Kerber K, Lawn JE, Bamford L, Moodley J, Pattinson R, Patrick M, Stephen C, Velaphi S. Every death counts: use of mortality audit data for decision making to save the lives of mothers, babies, and children in South Africa. *Lancet.* 2008 Apr 12;371(9620):1294-304.
54. Onayade AA, Sule SS, Elusiyan JB. Determinants of neonatal mortality at Wesley Guild Hospital, Ilesa, Nigeria. *Niger J Med.* 2006 Jul-Sep;15(3):271-6.
55. Edmond KM, Quigley MA, Zandoh C, Danso S, Hurt C, Owusu Agyei S, Kirkwood BR. Aetiology of stillbirths and neonatal deaths in rural Ghana: implications for health programming in developing countries. *Paediatr Perinat Epidemiol.* 2008 Sep;22(5):430-7.
56. Edmond KM, Quigley MA, Zandoh C, Danso S, Hurt C, Owusu Agyei S, Kirkwood BR. Diagnostic accuracy of verbal autopsies in ascertaining the causes of stillbirths and neonatal deaths in rural Ghana. *Paediatr Perinat Epidemiol.* 2008 Sep;22(5):417-29.
57. Lawn JE, Wilczynska-Ketende K, Cousens SN. Estimating the causes of 4 million neonatal deaths in the year 2000. *Int J Epidemiol.* 2006 Jun;35(3):706-18. Epub 2006 Mar 23.
58. Baiden F, Hodgson A, Adjuik M, Adongo P, Ayaga B, Binka F. Trend and causes of neonatal mortality in the Kassena-Nankana district of northern Ghana, 1995-2002. *Trop Med Int Health.* 2006 Apr;11(4):532-9.

59. Hinderaker SG, Olsen BE, Bergsjø PB et al. (2003) Avoidable stillbirths and neonatal deaths in rural Tanzania. *British Journal of Obstetrics and Gynaecology* 110, 616–623.
60. Leach A, McArdle TF, Banya WA et al. (1999) Neonatal mortality in a rural area of The Gambia. *Annals of Tropical Paediatrics* 19, 33–43.
61. WHO. Perinatal and Neonatal Mortality for the Year 2000: Country, Regional and Global Estimates. Geneva: WHO, 2006.
62. Walraven GE, Mkanje RJ, Roosmalen J, van Dongen PW, Dolmans WM. Perinatal mortality in home births in rural Tanzania. *Eur. J. Obstet. , Gyne. Reprod. Biol.* 1995; 58:131–134.
63. Tlebere P, Jackson D, Loveday M, Matizirofa L, Mbombo N, Doherty T, et al. Community-based situation analysis of maternal and neonatal care in South Africa to explore factors that impact utilization of maternal health services. *J. Mid. Women's Health* 2007; 52:342–350
64. Evjen-Olsen B, Hinderaker SG, Lie RT, Bergsjø P, Gasheka P, Kvåle G. Risk factors for maternal death in the highlands of rural northern Tanzania: a case-control study. *BMC Public Health*. 2008 Feb 8;8:52.
65. Maine D, Rosenfield A. The Safe Motherhood Initiative: why has it stalled? *Am J Public Health*. 1999 Apr;89(4):480-2.
67. Graham WJ, Bell J, Bullough CHW. Can skilled attendance at delivery reduce maternal mortality in developing countries. *Studies Health Serv Organ Policy* 2001; 17: 97–130.
68. Fournier P, Dumont A, Tourigny C, Dunkley G, Dramé S Improved access to comprehensive emergency obstetric care and its effect on institutional maternal mortality in rural Mali. *Bull World Health Organ*. 2009 Jan;87(1):30-8.
69. Ensor T, Ronoh J. Effective financing of maternal health services: a review of the literature. *Health Policy*. 2005 Dec;75(1):49-58.
70. Richard F, Ouédraogo C, Compaoré J, Dubourg D, De Brouwere V. Reducing financial barriers to emergency obstetric care: experience of cost-sharing mechanism in a district hospital in Burkina Faso. *Trop Med Int Health*. 2007 Aug;12(8):972-81.

71. Fofana P, Samai O, Kebbie A, Sengeh P. Promoting the use of obstetric services through community loan funds, Bo, Sierra Leone. The Bo PMM Team. *Int J Gynaecol Obstet.* 1997 Nov;59 Suppl 2:S225-30.
72. Essien E, Ifenne D, Sabitu K, Musa A, Alti-Mu'azu M, Adidu V, Golji N, Mukaddas M. Community loan funds and transport services for obstetric emergencies in northern Nigeria. *Int J Gynaecol Obstet.* 1997 Nov;59 Suppl 2:S237-44.
73. Krasovec K. Auxiliary technologies related to transport and communication for obstetric emergencies. *Int J Gynaecol Obstet.* 2004 Jun;85 Suppl 1:S14-23.
74. Samai O, Sengeh P. Facilitating emergency obstetric care through transportation and communication, Bo, Sierra Leone. The Bo PMM Team. *Int J Gynaecol Obstet.* 1997 Nov;59 Suppl 2:S157-64.
75. Hoffman JJ, Dzimadzi C, Lungu K, Ratsma EY, Hussein J. Motorcycle ambulances for referral of obstetric emergencies in rural Malawi: do they reduce delay and what do they cost? *Int J Gynaecol Obstet.* 2008 Aug;102(2):191-7. Epub 2008 Jun 16.
76. Inegbenebor, U . Conceptual model for the prevention of maternal mortality in Nigeria. *TROPICAL DOCTOR* 37 (2):104-106 2007.
77. Bhutta ZA, Darmstadt GL, Hasan BS, Haws RA. Community-based interventions for improving perinatal and neonatal health outcomes in developing countries: a review of the evidence. *Pediatrics.* 2005 Feb;115(2 Suppl):519-617.
78. Mbonye AK, Asimwe JB, Kabarangira J, Nanda G, Orinda V. Emergency obstetric care as the priority intervention to reduce maternal mortality in Uganda. *Int J Gynaecol Obstet.* 2007 Mar;96(3):220-5. Epub 2007 Feb 8.
79. Shehu D, Ikeh AT, Kuna MJ. Mobilizing transport for obstetric emergencies in northwestern Nigeria. The Sokoto PMM Team. *Int J Gynaecol Obstet.* 1997 Nov;59 Suppl 2:S173-80.
80. Otchere SA, Kayo A. The challenges of improving emergency obstetric care in two rural districts in Mali. *Int J Gynaecol Obstet.* 2007 Nov;99(2):173-82. Epub 2007 Sep 27.
81. Borghi J, Ensor T, Somanathan A, Lissner C, Mills A; Lancet Maternal Survival Series steering group. Mobilising financial resources for maternal health. *Lancet.* 2006 Oct 21;368(9545):1457-65.

- 82.** Asante F.A.; Chikwama C.; Daniel A. S; Armarkulemesu M; Evaluating the economic outcomes of the Policy of fee exemption for maternal delivery care in Ghana. GHANA. Ghana Med. J. 2007; Volume 41 (3): 110
- 83.** Wilson JB, Collison AH, Richardson D, Kwofie G, Senah KA, Tinkorang EK. The maternity waiting home concept: the Nsawam, Ghana experience. The Accra PMM Team. Int J Gynaecol Obstet. 1997 Nov;59 Suppl 2:S165-72.
- 84.** Lema VM. Unpublished Report. 2009.