

REVIEW**PERINATAL MORTALITY TRENDS IN ETHIOPIA****Yifru Berhan¹, Asres Berhan²****ABSTRACT**

BACKGROUND: Although the magnitude of perinatal mortality in Ethiopia was among the highest in Sub Saharan Africa, there was no systematic review done to assess the trend and causes of perinatal death. The objective of this review was to assess the trend of perinatal mortality rate (PMR) and the causes attributed to perinatal deaths.

METHODS: Studies included in this systematic review were sixteen hospital and community based perinatal mortality studies, which were conducted between 1974 and 2013 using data concerning Ethiopia accessed either electronically or from local journals. The trend of PMR, stillbirth rate (SBR) and early neonatal mortality rate (ENMR) were given emphasis.

RESULTS: The PMRs reported from ten hospital based studies were in the range of 66 to 124 per 1000 births. The reports of the large scale community based PMRs were in the range of 37 to 52 per 1000 births. The proportion of stillbirths and early neonatal deaths reported from the hospital based and community based studies was very high (60-110 and 20-34/1000 births); the regression lines demonstrated that SBRs in the hospitals were mirror reflections of ENMRs in the community. The neonatal mortality rate (NMR), however, declined by more than 40% between 1990 and 2011.

CONCLUSION: The PMR of Ethiopia was among the highest in Sub Saharan Africa. Over the decades, both hospital based and community based studies did not show a reduction in perinatal mortality. The trend of perinatal mortality rate has been stable between 90 and 40 per 1000 total births in the hospital and community setting, respectively. The significant reduction in NMR was due to significant decline in late neonatal mortality.

KEYWORDS: causes, early neonatal mortality rate, Ethiopia, perinatal mortality, stillbirth rate, trend

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INTRODUCTION

The perinatal mortality rate (PMR) is determined by including all stillbirths and neonatal deaths in a given time period over the total number of births multiplied by thousand (1). For developing countries, where the survival rate of preterm newborns is very low, the numerator for PMR includes all fetal deaths with gestational age of 28 weeks and above and all neonatal deaths within 7 days of life. For developed countries, however, fetal deaths as low as 20 weeks of gestation and

neonatal deaths up to 28 days after birth will be counted for the estimation of the PMR (1).

Every year, more than 7 million perinatal deaths occur across the globe (3.5 million stillbirths and 4 million neonatal deaths), which is higher than the combined annual all age level deaths due to AIDS (2.1 million), tuberculosis (1.6 million) and malaria (1.3 million) (2-6). About 99% of these perinatal deaths occur in low and middle income countries (1, 7). Unfortunately, approximately half of these perinatal deaths usually occur at home, unnamed and unrecorded, and thus unaccounted for (7, 8). As a result,

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the reported high mortality figures may still have a chance to underestimate the actual magnitude of the PMR in countries where vital registration is not established.

For about a decade, ten countries accounted for 75% of all neonatal deaths. The top five were: India (27%), China (10%), Pakistan (7%), Nigeria (6%) and Ethiopia (4%). In the past decade, however, China dropped from second to fourth and Nigeria moved to second highest (2, 3). In Ethiopia, according to the 2004 WHO estimation, there were a total of 128,000 perinatal deaths, making the PMR to be 41/1000 births. Of these, 34,000 (27%) were still births and 94,000 (73%) were early neonatal deaths (ENNDs) (9). In 2006, however, the PMR estimated by WHO was 57/1000 total births with about 2:1 ENNDs to stillbirths ratio (1).

Because of the high magnitude of the problem and its direct linkage with the quality of health service during pregnancy, peripartum and in the first month of the neonates' life, PMR and neonatal mortality rate (NMR) are used as an important indicators of the health status of a country (1, 10). Furthermore, neonatal mortality is the major contributor to infant mortality rate (IMR), which is identified as one of the UN millennium development goal indicators (MDG 4). In other words, because more than three-quarters of infant death occur during the first 28 days of life (3, 11), reducing neonatal deaths in high infant mortality countries is taken as the major target of the MDG 4.

The importance of perinatal deaths reduction is also emphasized by describing its association with maternal mortality. Previous report has shown that for every maternal death, there are an estimated 10 perinatal deaths (12). Furthermore, because of the strong linkage of perinatal deaths with maternal deaths, about two-thirds of the causes of maternal deaths (obstructed labor, sepsis, hypertensive disorders of pregnancy, and antepartum hemorrhage) are also causes of perinatal deaths (13). Specific to neonates, the 2008 global estimation for the major causes of neonatal deaths were preterm birth (29%), infections (25%), and complication of asphyxia (22%) (14). But, in Sub Saharan Africa, the leading cause of neonatal mortality was asphyxia, which was in turn the consequence of poor obstetric care (15).

Without describing the possible causes, the 2011 Ethiopian demographic and health survey (EDHS) showed that the infant mortality has declined by 39% over the 15-year period, from 97 deaths per 1,000 live births to 59 deaths per 1,000 live births (16). However, it was noted that the significant decline in infant mortality was mainly due to more decline in post neonatal mortality than early neonatal mortality (54% vs 24%). There are other community based and hospital based studies in Ethiopia that reported the PMR with or without possible causes.

To the best of the authors' knowledge, however, there was no systematic review done in Ethiopia to assess the PMR trend and causes of death. The objective of this review was to assess the trend of PMR and common causes attributed to perinatal deaths from available community and hospital based studies in Ethiopia.

METHODS

Search strategy

The primary studies included in this review were retrieved from local journals (*Ethiopian Medical Journal*, *Ethiopian Journal of Health Development* and *Ethiopian Journal of Health Sciences*), MEDLINE, PUBMED, Measure DHS and WHO websites. Articles were searched using the following search terms in alternate combination with the help of the Boolean logic (AND, OR and NOT): perinatal mortality, perinatal mortality rate, stillbirths, stillbirth rate, neonatal mortality rate, neonatal mortality, early neonatal mortality, causes of perinatal mortality, causes of early neonatal mortality, obstructed labor, uterine rupture, malpresentation, hypertensive disorders of pregnancy, antepartum hemorrhage, infection, sepsis, prematurity, DHS, Ethiopia and Africa.

Inclusion criteria

Three types of studies were included in this review: small and large scale hospital based studies published between 1977 and 2012, small and large scale community based studies published between 2000 and 2013. Tadesse E et al's study on determinants of perinatal deaths at Tikur Anbessa Hospital, which was published in 1989 in *J Obstet Gynaecol East Cent Africa*, could not be retrieved from any of the electronic

databases. As a result, it was excluded from this review.

Data abstraction

After the eligible articles were selected, the following data were abstracted: name of authors, year of publication, study period, study design, target and data source. Primary study selection for this review was done by two authors (YB and AB) independently in two phases: 1) by reviewing the titles and abstracts of the retrieved articles on perinatal and early neonatal mortality, and 2) by reviewing the whole manuscripts which were initially categorized as “eligible for further screening”.

Operational definition

In this review, the perinatal mortality stands for stillbirths (fetal loss after 28 weeks of gestation) and neonatal deaths in the first 7-days of life after birth. Stillbirth rate (SBR) was defined as total number of fetal deaths per 1000 total births after 28 weeks of gestation. Early neonatal mortality rate (ENMR) was also used to mean total neonatal deaths in the first week of life per 1000 live births after being delivered in the age of viability (28 weeks of gestation and above).

Similarly, the denominator used for PMR determination was total births after 28 weeks of gestation. Since the majority of the studies included reported PMR as per 1000 total births, data presented in some primary studies with a denominator of total live births were changed into total births by determining new PMR taking into account the reported total deliveries, total still births and total early neonatal deaths.

Data synthesis

In some of the studies, since the authors reported only the actual number of total deliveries, total stillbirths and total early neonatal deaths in a specific period, we calculated the PMR. The causes of perinatal mortality were compiled by adding the actual number of total perinatal deaths

in each study as the denominator, and similarly, by adding the actual number of perinatal deaths due to a specific cause in each study as numerator. The review findings are presented in the form of Table, line and bar graphs.

RESULTS

Description of the studies

In this review, eleven hospital and five community based studies conducted in Ethiopia were included (16, 17-31). Table 1 shows the general characteristics of the studies included from Ethiopia. The majority of the included hospital based studies were retrospective medical chart reviews. These studies were reported either from Addis Ababa (17, 18, 22-24, 26, 27) or Jimma (19, 20) with two exceptions (21, 25). There was only one national representative health facilities based study that addressed partly the perinatal mortality by reviewing medical charts of 7366 stillbirths, and 522 very early neonatal deaths from 797 health facilities (25).

Methodological quality of the studies

The methodological quality of the studies included in the review was assessed using the Evers checklist as recommended by Cochrane collaboration (32). Each study was assessed for fourteen of the nineteen items in the checklist (five were not applicable for this study). Among others, the description of study population, objective/research question, outcome measures, and appropriateness of study design and analysis were up to standard. Furthermore, these studies described the ethical issues and discussed their limitations and strengths. The conclusions were made based on their results. However, the majorities of the studies, being retrospective by design, might have limited the investigators in assess for all potential confounders. Furthermore, the majority of the hospital based studies being from specific areas may not be representative of the nationwide PMR.

Table 1: General characteristics of studies included in this review

Authors	Year study reported	Study period	Study site	Study design	Setting
Central Statistics Agency/ORC Macro (31)	2000	1993-2000	National	Retrospective	Community based –household survey
Central Statistics Agency/ORC Macro (32)	2005	1998-2005	National	Retrospective	Community based –household survey
Central Statistics Agency/ORC Macro (16)	2011	2004-2011	National	Retrospective	Community based –household survey
Gaym A (20)	2000	1990-1999	Jima hospital	Retrospective	Hospital based – medical records
Ghidey et al (21)	1991	1985-1989	Jima hospital	Retrospective	Hospital based – medical records
Naeye RL et al (25)	1977	1974-1975	Addis Ababa	Retrospective	Hospital based – medical records
Frost O (18)	1984	1980	Addis Ababa	Retrospective	Hospital based – medical records
Sahlemariam Y et al (27)	1997	1994	Addis Ababa	Cohort	Hospital based – newborns
Getachew B et al (22)	2012	2008-2010	Hawassa hospital	Retrospective	Hospital based – medical records
Berhan Y et al (19)	2004	2001-2002	Tikur Anbesa hospital	Retrospective	Hospital based – medical records
Bisetegne D (23)	2008	2000-2001	Tikur Anbesa hospital	Retrospective	Hospital based – medical records
Tilahun S et al (24)	2008	2006	Addis Ababa	Retrospective	Hospital based – medical records
Andargie G et al (30)	2013	2009-2011	North West, Dabat district	Prospective longitudinal	Community based –Health and demographic surveillance
Gessesse M et al (28)	2009	Oct 2006- Sept 2007	Yekatit 12 hospital	Retrospective	Hospital based – medical records
Anderson T et al (29)	2002	1987-1996	Butajira, rural area	Monthly demographic surveillance	Community based –household survey
FMOH, UNICEF, UNFPA, WHO, AMDD (26)	2008	July 200- June 2008	National	Health facilities chart review	797 health facilities based-medical records

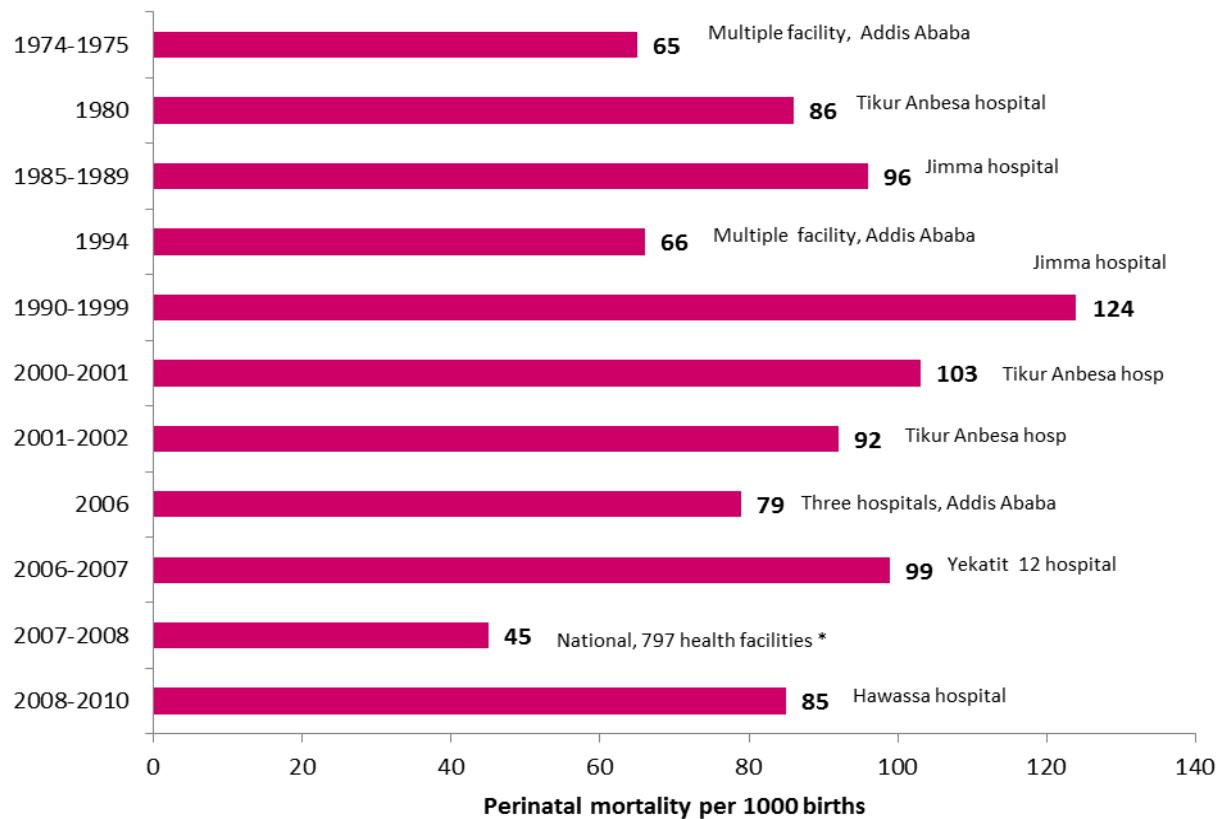
Findings of the review

With that limitation, in both hospital and community based studies, there was no evidence that support reduction of perinatal mortality in decades. The trend of the PMR has an intercept around 90 and 40 per 1000 births in the included

hospitals and community settings, respectively. The ever highest PMR was reported from a 10-year review (1990-1999) in Jimma (124/1000 total births or 139/1000 live births) (Figure 1). On the other hand, the ever lowest PMRs were reported in 1974/75 and 1994. The low stillbirths and very

early neonatal death rate from the nationally representative study (45/1000 births) in the year 2007-2008 (24) is questionable. This is because all

neonatal deaths in the first week of life were not included.



* Neonatal deaths that occurred only in the 1st 24 hours of life were included

Figure 1: Hospital based perinatal mortality rates (PMR) per 1000 births in Ethiopia. Each bar represents the PMR reported by a single study

Similarly, the EDHS data (16, 30, 31) revealed that the PMR remained stable in about fifteen years (Figure 2). Nearly 30% reduction in PMR was observed in 2005 from the 2000 EDHS. The 2011 EDHS, however, showed that the PMR was on the rise. Nevertheless, the PMRs in the national estimates (16, 30, 31) were about half of the majority of hospital based study reports (17-24).

The other community based PMR estimations were done in two specific rural areas (Butajira and Dabat district). The Butajira study (28) was done 13 years before the Dabat study; however, the PMR in Butajira study was the lowest ever reported and about half less than the Dabat study report (29). Because of the completely different setting, it may be difficult to make comparison between the two study areas.

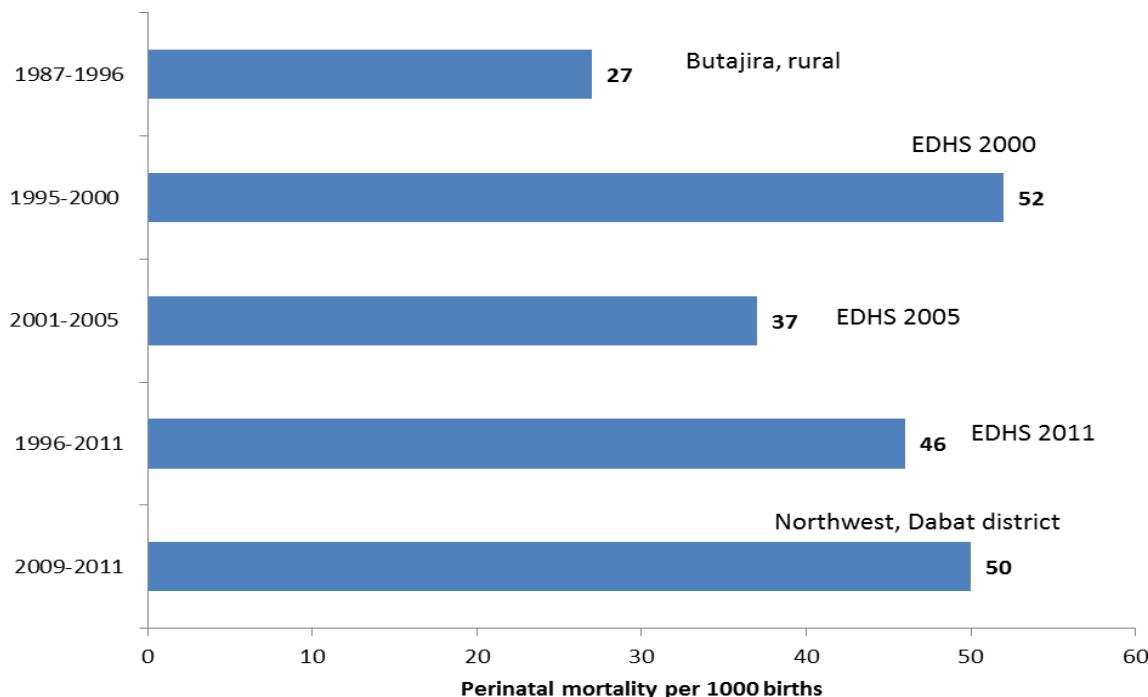
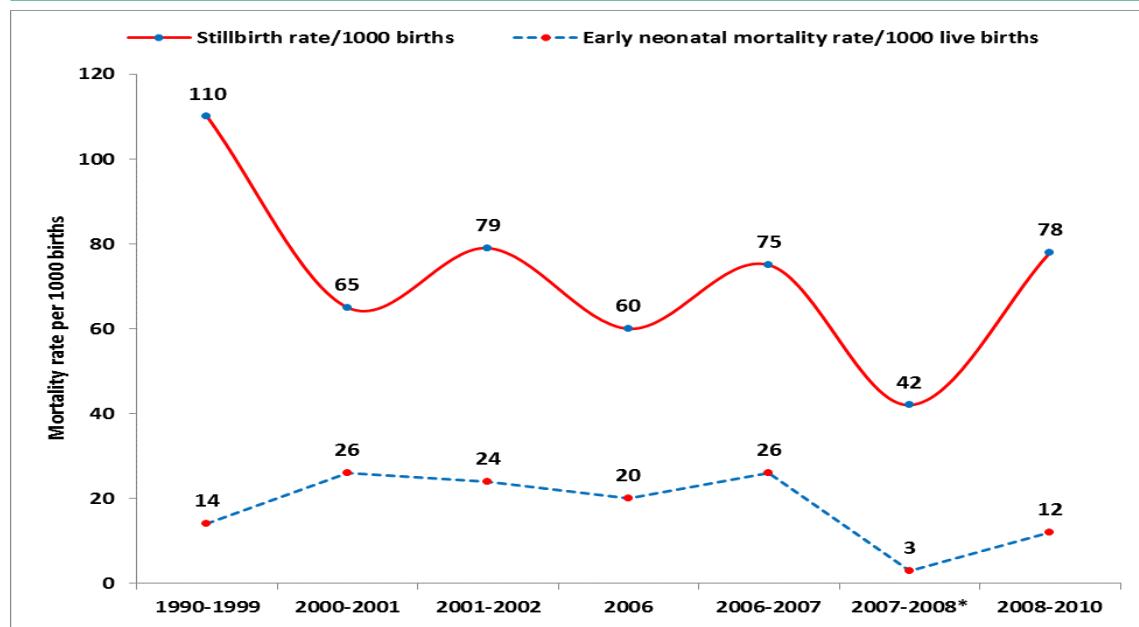


Figure 2: Community based perinatal mortality rates (PMR) per 1000 births in Ethiopia. Each bar represents the PMR reported by a single study

Figure 3 and 4 show the proxy trends of stillbirth rates (SBR) and early neonatal mortality rates (ENMR) in Ethiopia. With the exception of the national study (25), both hospital based (18, 19, 21-23, 25, 27) and community based (16, 28-31) studies have shown that the SBRs and ENMRs were stable over decades. Interestingly, the SBRs and ENMRs reported from the community based studies appeared as mirror image of the hospital based studies' SBRs and ENMRs reports. In other words, in the hospital based studies, the SBRs were significantly higher (nearly 3-to 7-fold) than the ENMRs. To the contrary, in the community

based surveys, the ENMRs were the major contributors for the high PMRs in the last decade. In the national health facility based study, however, the stillbirth rate (42/1000 total births) was the lowest ever reported. As presented in Figure 5, among obstetric complications attributed to perinatal mortality, obstructed labor with or without uterine rupture accounted for more than a quarter of perinatal deaths (27%) (18-21, 24). The second and third highest identified causes of perinatal mortality were malpresentation (11%), hypertensive disorders of pregnancy and prematurity (7% each).



* Neonatal deaths that occurred only in the 1st 24 hours of life were included

Figure 3: Hospital based stillbirth rates and early neonatal mortality rates per 1000 births in Ethiopia

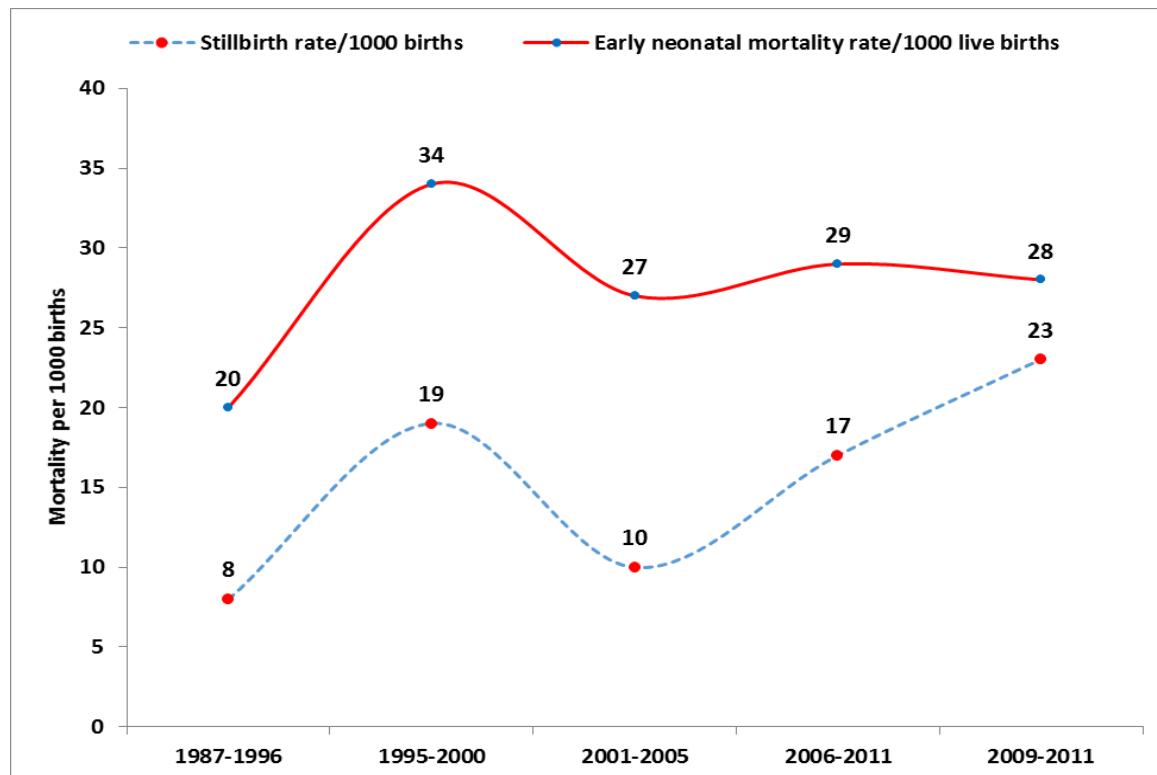


Figure 4: Community based stillbirth rates and early neonatal mortality rates per 1000 births in Ethiopia

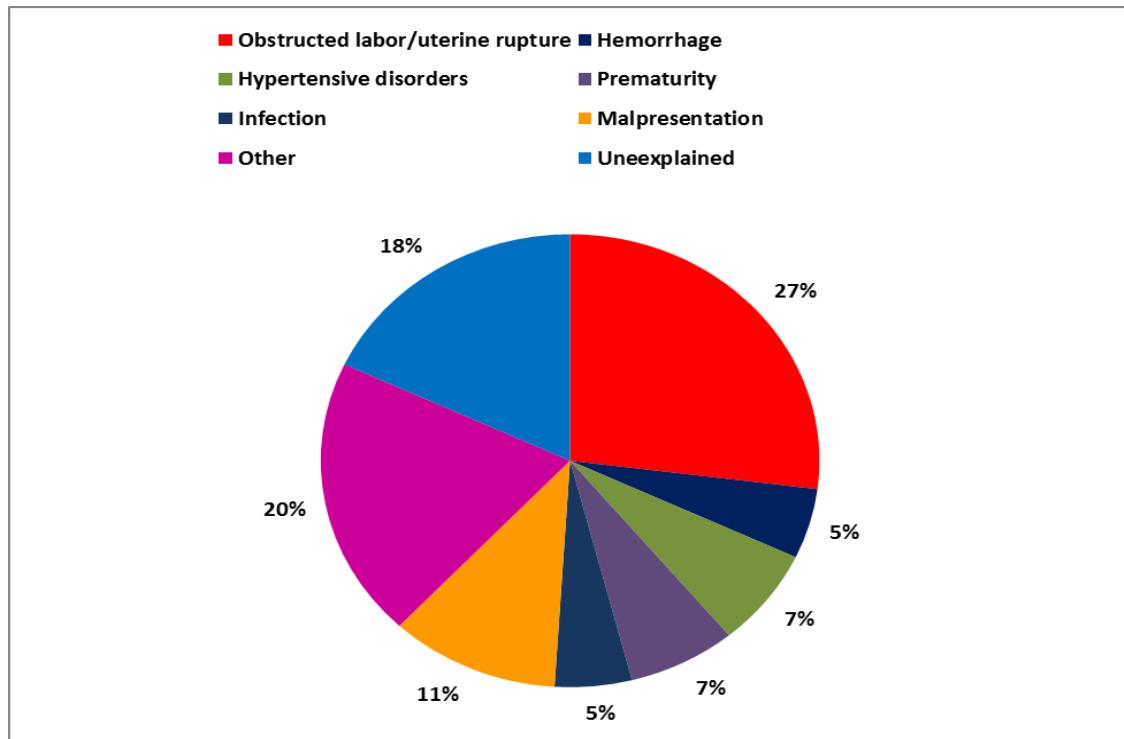


Figure 5: Causes of perinatal mortality in Ethiopia as compiled from hospital based data

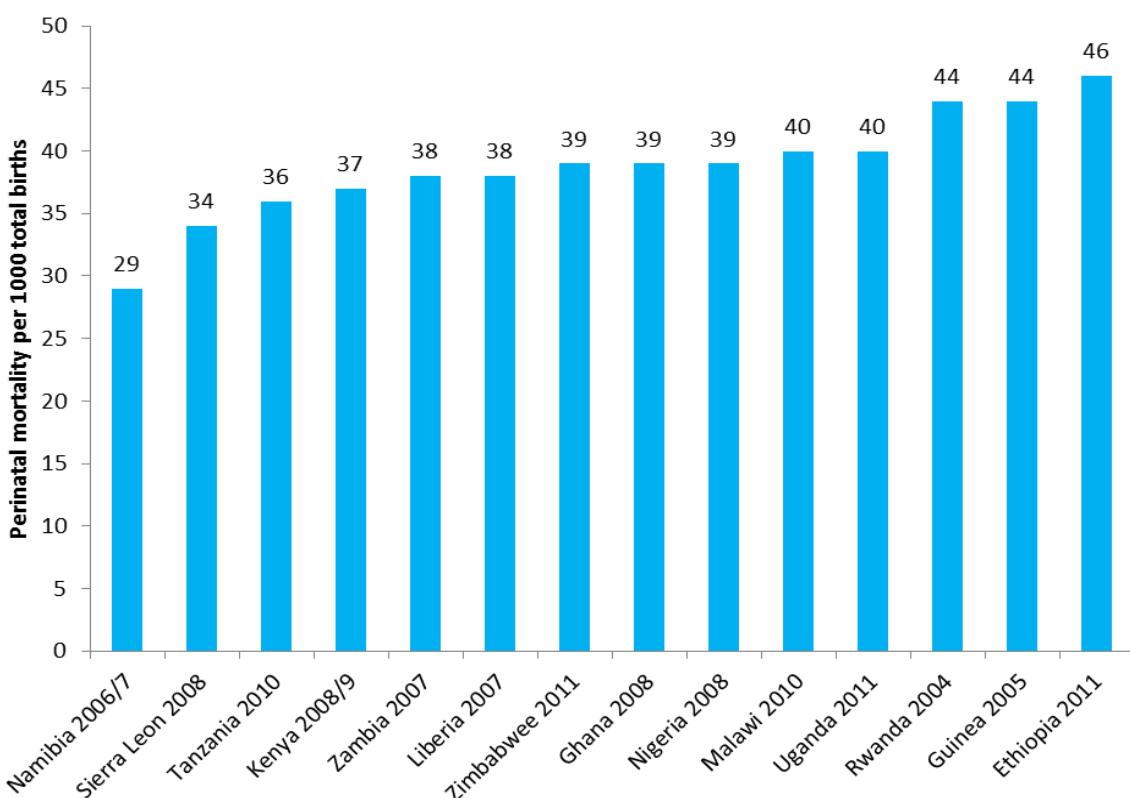


Figure 6: Perinatal mortality rates in selected Sub-Saharan African countries

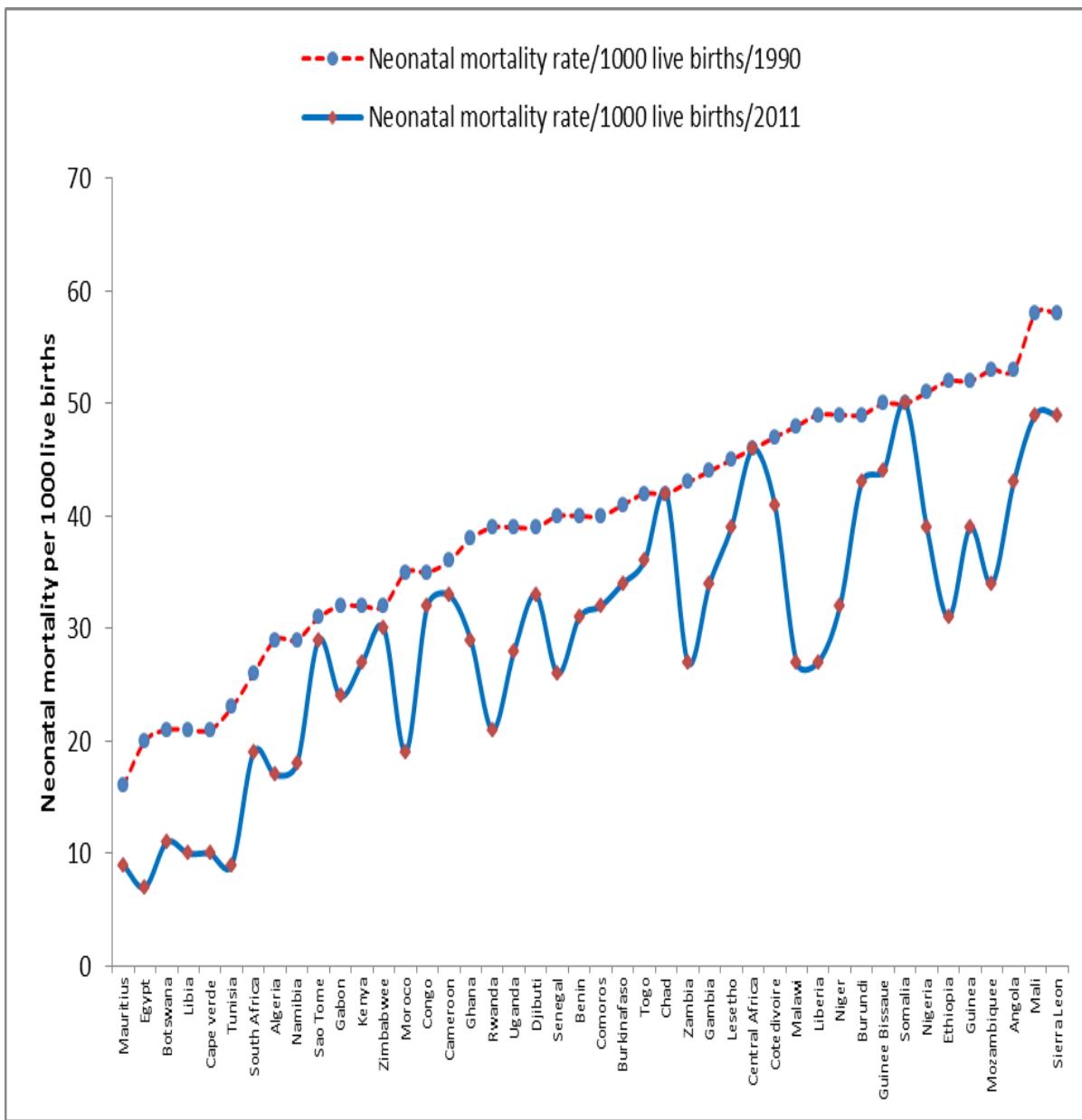


Figure 7: The change in neonatal mortality between 1990 and 2011 in 44 African countries

DISCUSSION

This review has reaffirmed that the significant decline in infant mortality rate in Ethiopia in the last two decades was because of the significant decline in late neonatal and post neonatal mortality (16, 33, 34). Otherwise, in both hospital and community based studies (EDHS), there were no evidences that support reduction of early neonatal mortality in particular and perinatal mortality in general. The early NMR in the community and SBR in the hospital setting

remained high over decades. Furthermore, although the hospital based data concentrated mainly in the capital, the PMRs remained in the high range for more than three decades.

The only hospital based study that demonstrated a significant decline in SBR and very early neonatal death rate was the national representative study (25). However, it is difficult to conclude to the overall reduction of PMR since all the neonatal deaths in the first one week were not included in the assessment. The ever lowest SBR reported in this study (25) is also probably

because of the effect of the denominator; a large number of health centers were included, where commonly normal deliveries are conducted. In the hospital setting, where no marked change in both SBR and ENMR was observed, it is known that the majority of the pregnant women were likely to come with complications including stillbirths.

The reason for both high SBRs in the hospitals and high ENMRs in the community can be the same. From about fifteen years' observation by the authors of this article, the majority of the stillbirths reported from hospitals actually occurs in the community (prior to arrival in the hospitals); mothers usually report to hospitals when they lost their fetal kick for some days or when the labor is complicated with obstructed labor or uterine rupture, in which in both conditions, the intrapartal fetal death is very high.

Furthermore, the report from Hawasssa University teaching hospital has shown that the adjusted PMRs were in the range of 80 to 86 per 1000 births. However, when the stillbirths that occurred before arriving in hospitals were excluded, the hospital based PMRs (deaths that occurred in the hospital) were usually in the range of 9 to 15 per 1000 births (21). One of the evidences that support this observation is a long cohort analysis in Central South Ethiopia among pregnant women admitted to the maternity waiting area and who were admitted as emergency cases, the SBRs were 18 and 191 per 1000 births, respectively (35). The low prevalence of antenatal care and the high fertility rate in Ethiopia (16, 30, 31) have might also have contributed to high SBRs. Similarly, because of the high prevalence of home delivery (90%-95%) (16, 30, 31, 36) and obstructed labor in Ethiopia (19, 21), the risk of neonatal death due to intrapartal asphyxia, infection and hypothermia is likely to be very high. These kinds of problems were also well observed by other investigators among mothers who had low access to skilled health personnel care (37, 38).

Probably linked with high prevalence of home delivery, it is also a tradition in Ethiopia not to seek medical care for neonatal health problems. Other investigators also pointed out that in several African and South-West Asian countries, the likelihood of early neonatal death is so high and they are not counted until they complete the early

neonatal age, and stillbirths may not be counted at all (7, 8, 39).

These may be some of the reasons why the SBRs and ENMRs in Ethiopia remain stable for decades. WHO and other UN agencies have also noted a promising progress towards achieving the MDG 4 through substantial reductions in under-five mortality. However, absence of decline in neonatal mortality, mainly in the low-income countries, remains a challenge to reach into the set target (40).

In short, the major reason for both high SBRs in the hospital and high ENMRs in the community is probably due to the big delay in health care seeking behavior of mothers and their family members during pregnancy, delivery and postnatal period. There are several literatures that showed the strong association of obstetric care with perinatal mortality. Interventions that save the lives of mothers were also shown to be effective in reducing perinatal mortality (11, 41-42).

This is because several of the causes of maternal mortality are also causes of perinatal mortality. As this review and several others showed, the leading causes of perinatal mortality were mechanical causes like obstructed labor, uterine rupture and malpresentations, which are also some of the major causes of maternal mortality in low income countries (42-44).

Otherwise, as shown in Figure 6, the recent PMR from EDHS 2011 was not as such far from several other SSA countries PMRs as estimated in their respective DHS (33), and was less than the mean PMR estimated for SSA for the year 2004 by WHO (56 perinatal deaths/1000 births) (45). The Ethiopian PMR in that specific period was relatively higher than all the other included countries' PMRs. However, the difference in PMs from the intercept (40/1000 births) was not high; it was swinging between \pm 6 perinatal deaths/1000 births in the year 2000s. However, it should be noted that the PMRs reported from EDHS were still about five-folds of the PMRs reported from the developed nations (46).

Furthermore, taking neonatal mortality as an indirect measurement of the early neonatal mortality, the change in neonatal mortality rate (NMR) of 44 African countries between 1990 and 2011 was not proportional (Figure 7). Three North African countries (Egypt, Tunisia, and Libya) achieved more than 50% reduction in neonatal

mortality. Among SSA countries, Botswana, Rwanda, Malawi, Liberia, and Ethiopia have achieved more than 40% reduction in neonatal mortality. In some African countries (Somalia, Chad, Central African Republic, Congo, Cameroon, Sierra Leone and Mali), however, there was no or little change in NMR in 20 years period. In short, according to WHO estimation, it was noted that the Ethiopian NMR showed significant reduction and the country was among the best achiever SSA countries NMR but it was still more than 3-fold higher than the North African countries (34).

In conclusion, the PMR of Ethiopia remained stable for decades and is still among the highest in SSA. Greater SBRs and ENMRs were reported from hospitals as compared to community based studies. The trend of perinatal mortality rate has been stable at about 90 and 40 per 1000 total births in the hospital and community setting, respectively. In the authors' opinion, the significant reduction in NMR was primarily due to significant decline in late neonatal mortality. Since the majority of perinatal deaths were attributed to mechanical causes of low levels of skilled attendance, improving access to obstetric care is the cornerstone to reduce perinatal mortality in Ethiopia.

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