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Full Length Research Paper

A five-year neonatal mortality trend in a Ghanaian Teaching Hospital after the implementation of strategies to achieve the Millenium Development Goal (MDG) 4

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Various strategies have been put in place in Ghana to achieve the United Nations millennium development goal 4 (MDG 4) on reducing childhood mortality rates by two-thirds by 2015. Global under-five mortality rate is declining but the proportion of death due to neonatal deaths is still high. We, therefore, examined the trend in neonatal mortality in a tertiary hospital from 2008 to 2012 to ascertain whether the strategies have been effective. Data were analysed using SPSS v 20.32. Neonatal mortality rates decreased steadily from 32 per 1000 live births in 2008 to 14 in 2011, but increased drastically to 39 per 1000 live births in 2012. The overall neonatal mortality rate was 27 per 1000 live births. Majority, 1434 (83%) of the neonates died within 24 hours of birth and 28 (2%) occurred after 2 weeks. The five topmost causes of neonatal deaths within the period were: prematurity, birth asphyxia, neonatal sepsis, neonatal jaundice, and respiratory distress. In furtherance, neonatal mortality decreased gradually in the first four years but turned upward in the fifth year. Improvement in employee incentives and adequate preparation of care providers for early neonatal care was recommended.

Key words: Neonatal, mortality, prevalence, demography, aetiology, Ghana.

INTRODUCTION

Despite the decline in global under-five mortality rate, an estimated six million children still die within the first month of birth, also known as the neonatal period (Black et al., 2010). In Ghana, under-five mortality has decreased by about 40%, from 119 per 1000 live births in 1990 to 80 per 1000 live births in 2008 (Ghana Demographic and Health Survey, 2008) but there has not been much decline in the proportion of under-five mortality attributable to the death of new born. The Ghana health service in 2008 reported that “neonatal death in Ghana keeps the MDG 4 at the crossroads”.

Over two-thirds of the global neonatal deaths occur in developing countries, particularly in Asia and Africa (Baltimore, 2003; Lawn et al., 2005; World Health Organisation, 2006; Onyedibe et al., 2011). This is more than the number of deaths caused by malaria and HIV/AIDS combined (Lopez et al., 2006), and regional estimates show that countries in sub Saharan Africa have the highest neonatal mortality rates (NMRs) in the world (Lawn et al., 2005). These rates are likely to be underestimated as NMRs are often estimated using complex statistical modelling, small hospital based studies or national representative demographic and health surveys that use cluster level sampling techniques (Lawn, Shibuya and Stein, 2005; Stanton et al., 2006).

Neonatal mortality is decreasing worldwide but the rate of decline is slower in Africa.

Achieving MDG 4 of reducing under-five mortality by two thirds by 2015 would only be possible through significant reduction in neonatal deaths in sub Saharan Africa. Currently, there is reason to believe that the post 2015 agenda would include goals to reduce child mortality, Parti-

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cularly neonatal mortality (World Health Organisation, 2014).

Published data on NMRs in Ghana have ranged from about 17 per 1000 live births (Oestergaard et al., 2011) to more than 40 per 1000 live births (Edmond et al., 2008), but the national average remains at 30 per 1000 live births (Ghana Demographic and Health Survey, 2008). Regional estimates indicate that the Ashanti region, the second most populated region in the country, has one of the highest NMRs at 35 per 1000 live births (GDHS, 2008). The last published data on the national NMR is at least 6 years old (GDHS, 2008) and regional studies following that have all been based in the Northern region (Baiden et al., 2006; Engmann et al., 2012; Welaga et al., 2013).

Majority of neonatal deaths occur in the first week of birth and are often due to preventable causes. Globally, the top three causes of neonatal mortality are infection (29%), preterm (29%) and birth asphyxia (27%). In Ghana the top three causes of neonatal mortality are asphyxia (41%), sepsis (15%) and low birth weight and pre term birth (15%) (Ghana Health Service and UNICEF, 2010).

But a greater proportion of the causes of neonatal death remains unknown, which is often classified as 'other' (19%). It is likely that causes of neonatal deaths may differ by region due to differences in cultural practices, availability of medical resources and other social determinants of health.

Without a clearer understanding of the true burden of neonatal deaths and the aetiology of those deaths, planning and appropriate interventions to improve neonatal health in Ghana may be hampered. The study, therefore, examined trends of neonatal mortality, determined the neonatal mortality rate, the timing of death and also identified the leading causes of death, at KATH using institutional neonatal mortality data from the Hospital.

METHODOLOGY

Study setting: This study was conducted in the Komfo Anokye Teaching Hospital (KATH) in the Ashanti region of Ghana. The Ashanti region is the second most populated region in Ghana and Kumasi is its regional capital. Kumasi is typical of a sub-Saharan urban area. KATH is located in Kumasi, and is the only tertiary health care facility and largest hospital in the region. It is also the most sophisticated hospital in the region and with the highest number of paediatricians in the country. KATH has a well-equipped neonatal intensive care unit and it provides many specialist care services. KATH serves as the main referral centre for cases in the Ashanti region, Brong Ahafo and the three Northern regions in Ghana. As the largest hospital in the Ashanti region, KATH receives the highest number of cases and medical practice is up to the national standards.

Registration of Pregnancies, Deliveries and Deaths:

In the KATH, like all Ghanaian hospitals, it is mandatory to record any admission in the various wards of the hospital into an Admission and Discharge book. This entry is completed by recording the outcome of the admission process, death or discharge. In the Delivery Suite, this includes the number of deliveries conducted and outcome of delivery process and in the Paediatric and Neonatal Intensive Care Units, this refers to the number of admissions and outcome of admission process. The various statistics on the number of admissions, discharges and deaths are collated by the ward in-charges on quarterly basis and submitted to the Biostatistics department of the hospital. The Biostatistics department is responsible for compiling the reports from the various wards to calculate several statistics, including annual mortality rate. This helps with writing of hospital reports and also monitoring progress towards national and regional goals regarding key indicators such as maternal and neonatal mortality, which are central to the Millennium Development Goals.

It is not a common practice in any Ghanaian hospital that an autopsy is conducted to ascertain the exact cause of death for every death in the hospital. This is largely due to lack of resources, financial and personnel. Autopsies are often conducted for 'unexplained' causes of death or where criminality is suspected or upon the request of family members, which is rare. Thus cause of death is often determined by the attending physician based on presenting signs and complications. It is a legal requirement that the cause of death is recorded in the death certificate before the deceased is sent to the morgue. These death certificates are handed over to family members but the patient folders of the deceased are kept in the hospital, a place called record room.

In this study, the researchers reviewed folders of all children aged less than a month and who died between 2008 and 2012. Information collected from these folders included sex, age at time of death and cause of death using a researcher's developed checklist.

Data Analysis: Data were extracted from the checklist and entered into the Statistical Package for Social Sciences version 20.32 for analyses. Frequencies and percentages were used to record the proportion of neonatal death by sex, age and cause of death. Mortality rate was calculated for each year.

$$Mortality\ Rate = \frac{number\ of\ neonatal\ deaths}{total\ number\ of\ live\ deaths} \times 1000$$

All deaths determined to be of infectious origin were summed together as neonatal infections. A child who weighed less than 2.5 kg was classified as having low birth weight and a premature infant was a child born before 37 weeks of pregnancy. A neonate with an Apgar score less than 3 in the first 5 minutes from delivery was classified as asphyxiated.

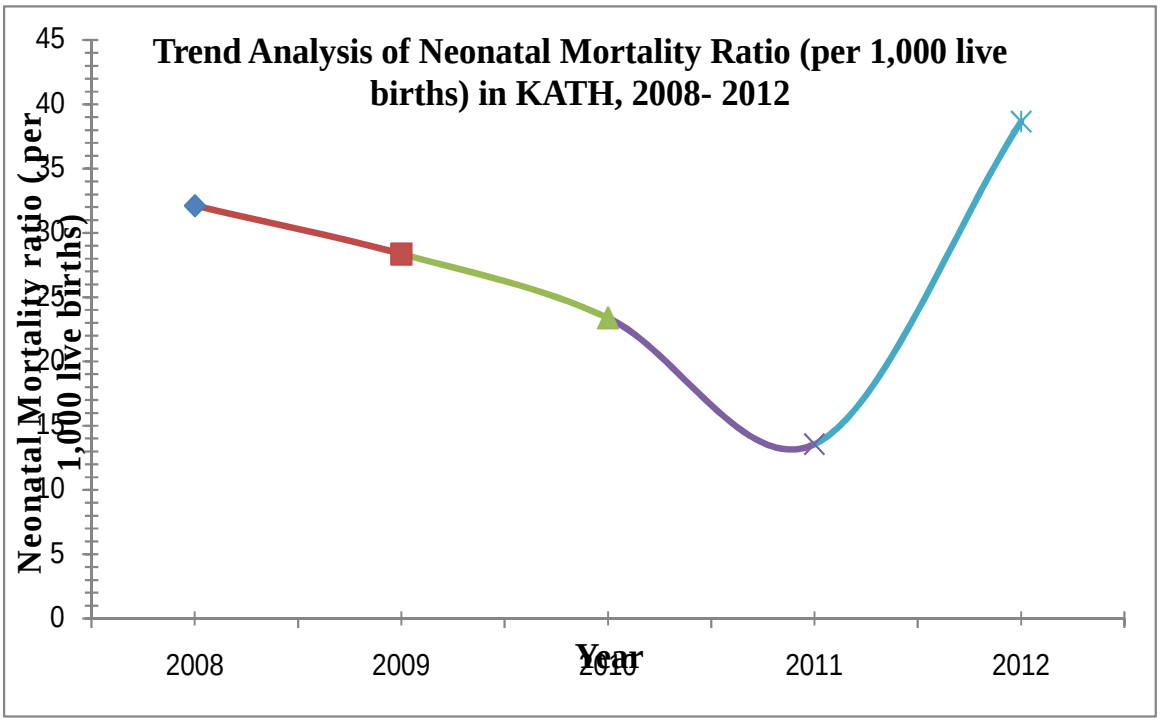
Ethical considerations: This study had approval from the Institutional Review Board of the Komfo Anokye Teach-

Table 1. Number of deliveries, live births, Neonatal deaths and Neonatal Mortality Ratio in KATH from 2008 to 2012.

Year	Deliveries	Live Births	Neonatal Deaths	NMR*
2008	12807	12863	413	32.11
2009	12166	12232	347	28.36
2010	14014	14026	328	23.38
2011	12679	12683	172	13.56
2012	12142	12108	468	38.65
TOTAL	63808	63912	1728	27.04

*NMR: Neonatal Mortality Ratio (per 1000 live births).
Source: Child Health Directorate, KATH, 2013

Figure 1. Trend analysis of neonatal mortality ratio per 1, 000 live births from 2008 to 2012.



Source: Child Health Directorate, KATH, 2013

ing Hospital, Kumasi. The authors collected the data using a checklist which was identified by codes rather than patient name. The authors also agreed not to share data with any third party and also to use the data for the intended purpose only.

RESULTS

There were 1,728 reported cases of neonatal death out of 63, 912 live births from a total of 63, 808 deliveries conducted in the KATH from January, 2008 to December, 2012.

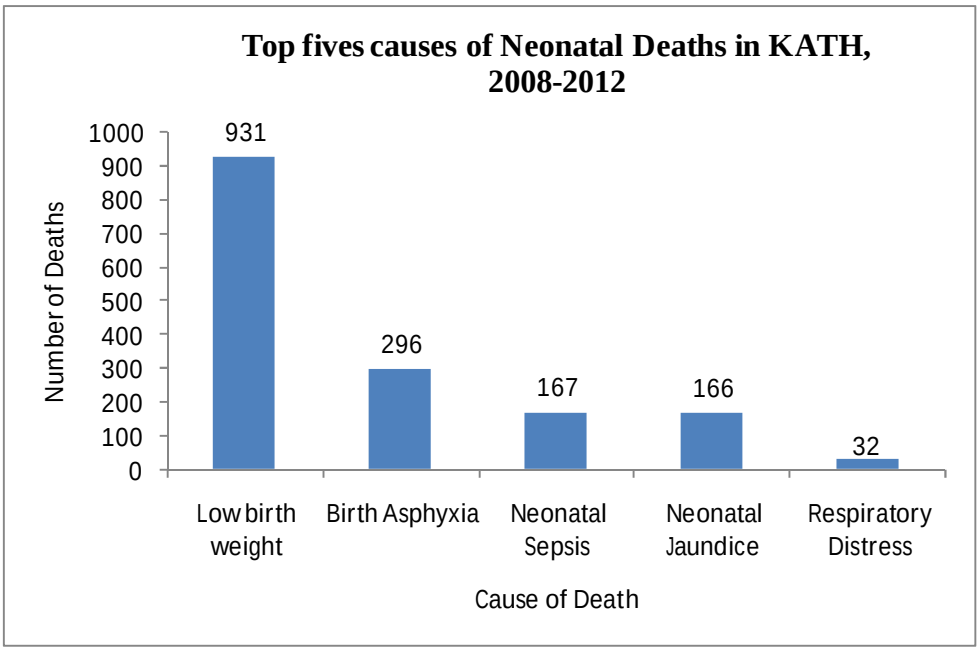
Table 1 shows that the year 2012 recorded highest neonatal deaths of 468 and the highest neonatal mortality ratio of 38.65 per 1000 live births while year 2011 recorded the least neonatal deaths of 172 and the least neonatal mortality ratio of 13.56 per 1, 000 live births.

Figure 1 shows that neonatal mortality rate dropped steadily from 32.1 per 1000 live births in 2008 to 13.56 per 1000 live births in 2011. However, in 2012, the neonatal mortality ratio was almost triple of that of 2011.

The top five causes of neonatal death at KATH between January 2008 and December 20012 in descending order is; Low birth weight, birth asphyxia, neonatal sepsis, neonatal jaundice and respiratory distress. Low birth weight singularly contributed over 50% of the total neonatal mortality burden within the period and birth asphyxia contributed about 20 percent.

Table 2 shows the distribution of neonatal mortality by sex over the period from January 2008 to December 2012. Overall males recorded the majority [878 (51%)] of

Figure 2. Top Five Causes of Neonatal Mortality in KATH, 2008-2012.



Source: Child Health Directorate, KATH, 2013

Table 2. Distribution of Neonatal mortality by sex- KATH, 2008-2012.

	Year					
	2008	**2009**	**2010**	**2011**	**2012**	**Total**
Male	171	193	178	83	253	878
Female	242	154	150	89	215	850
Total	413	347	328	172	468	1728

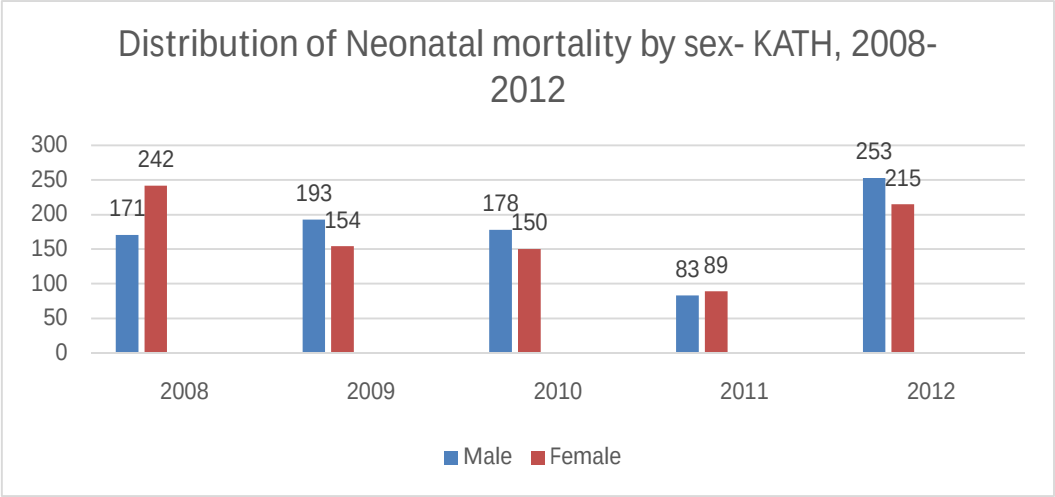


Figure 3.

the neonatal deaths. However when the data is studied by year, it is observed that in the years 2008 and 2011, the greater proportion of neonatal deaths were females.

Figure 3 is a histogram of the distribution of neonatal mortality over the study period by sex (Shown in Table 2). The graph shows that with the exception of the year 2008,

Table 3. Age Distribution of neonatal mortality-KATH, 2008 – 2012.

Age (Days)	Year						Percentage (%)
	2008	2009	2010	2011	2012	Total	
1 Day	351	297	269	123	394	1434	82.98
2-7 days	44	39	53	38	57	231	13.37
8-14 days	9	5	4	6	11	35	2.03
15-28 days	9	6	2	5	6	28	1.62
Total	413	347	328	172	468	1728	100

Source: Child Health Directorate, KATH, 2013.

males had the highest number of neonatal mortality in all the years over the period.

Table 3 shows the distribution of neonatal deaths in KATH by age of neonate (in days). It is observed that the neonatal mortality rate decreased as the number of days after birth increased. Over 80% of all cases of neonatal deaths occurred on the day of birth. Moreover, the number of deaths decreased sharply from 1434 to 231 for 1 day and 2-7day olds, and from 231 to 35 for 2-7 day olds and 8-14day olds respectively.

DISCUSSION

The study examined trends in NMR at KATH over a period of five years using medical records of 1, 728 neonatal death recorded out of 63, 912 live births from a total of 63,808 deliveries conducted. A researcher's developed checklist was used to gather information on cause of death, sex and age at death of neonates. The result of our study observed a gradual decline in NMR from 32.1 per 1000 live births in 2008, to 13.56 per 1000 live births in 2011. There was however, a steep rise in neonatal mortality from 13.56 per 1000 live births in 2011 to 38.65 per 1000 live births in 2012, which was also the highest recorded over the study period. The rise could be linked to the absence of health care providers from work when they embarked on a strike to demand better salaries in 2012. Similar findings were noted at Moi Teaching and Referral Hospital in Kenya in 2010 and 2011 where increases in early neonatal mortality rates and maternal mortality ratios were reported when employees of the hospital embarked on an industrial strike (Yego et al., 2013). The overall NMR determined in this study was 27 per 1000 live births.

It is not surprising that the NMR observed in this study is lower than the national average of 30 per 1000 live births and lower than the Ashanti region rate of 35 per 1000 live births (GHDS, 2008) considering measures put in place to achieve MDG 4. Neonatal mortality rate in Ghana, and indeed across the globe, has seen a decreasing trend over the past decade (GDHS, 2003 and GDHS, 2008; WHO, 2011). Factors that may have contributed to the decline in mortality rate over the time are wide ranging, from improvements in medical technology to the discovery of new treatments and general improvements in public health. However, NMR of 27 per 1000 live births is still considered high especially at KATH, a sophisticated tertiary hospital with a well-equipped neonatal intensive care unit. This high NMR could however, be attributed to the fact that KATH serves as a referral centre for the northern sector of Ghana. A previous study conducted in Kenya found that more than half of early neonatal deaths were referred admissions (Yego et al., 2013). It is therefore, likely that a high number of neonates who were critically ill, may have arrived late at the facility. Mckinnon et al. (2014) demonstrated that closer proximity to EmONC services were associated with lower early neonatal mortality. The results of this study indicated that most of the deaths occurred on the first day of birth.

Our study and two previous studies found that early neonatal deaths accounted for the highest proportion of all neonatal deaths (Baiden et al., 2006 and GDHS, 2008). Early neonatal death has been defined as neonatal deaths which occur within the first seven days of birth (Baiden et al., 2006). However, the GDHS (2008) classified neonatal death which occurred within the first seven days as perinatal death. Results of this study revealed that over 80% of the neonatal deaths occurred on the day of birth, about 15% within a week after birth and 2% between the first week and second week. Our results conflict with previous studies: Lawn et al. (2005) determined that worldwide, 35% to 45% of neonatal deaths occurred on the first day of birth about 75% occurred in the first week after birth. A study conducted early on in Northern Ghana found that 28% of neonatal deaths occurred on the first day of life, 53% first three days and 65% during the first week (Welaga et al., 2013). Globally, it is estimated that 4 million out of 130 million babies born yearly would die during the neonatal period, but 75% of these neonatal deaths would occur in the early neonatal period (WHO, 2005). The most plausible explanation as to why neonatal deaths may be highest in the early neonatal period is decreased adaptation of the neonate to extra uterine life. The physiologic processes which occur in the immediate post natal period are many and yet critical. A compromise in any of these could lead to a fatality. The high number of neonatal deaths which occurred on the first day of birth in this study could be likely due to the high number of preterm births. The commonest cause of death in this study was prematurity.

In a review of the literature Sananes et al. (2014) concluded that prematurity was the chief cause of neonatal morbidity and mortality. Our findings indicated that 54% of neonatal deaths were due to prematurity. These findings corroborate the findings of earlier studies; Jain et al. (2013), suggested that the major predisposing causes of death were prematurity and low birth weight. They explained further that these causes of neonatal deaths were related to major basic aspects of health such as hygiene and nutrition. These could be the situation at KATH since most of their clients come from the poorest parts of Ghana and probably could not meet their basic needs. Other causes of death found in this study included, birth asphyxia (17%), neonatal sepsis (10%), neonatal jaundice (10%), and respiratory distress (2%). A previous study in Ghana revealed the top three causes of neonatal death as asphyxia 41%, sepsis 15% and prematurity 15% (GHS and UNICEF 2008). This finding conflicts with our findings in that the rate of birth asphyxia was found to be rather lower in this study. A direct comparison between findings in this study to previous studies may not be too easy largely due to difference in methodologies employed in these studies. Some studies depended on verbal responses of respondents to determine cause of death without verification, and this is unlikely to be accurate (Baiden et al., 2006 and GDHS, 2008). It could also be explained in part by skilled persons such as doctors and nurses who are adequately prepared to manage birth asphyxia in the hospital. In Sri Lanka, only 7% of birth asphyxia resulted in the death of neonates because a paediatrician competent in neonate resuscitation attended to asphyxiated neonates (Rajindrajith et al., 2009).

Previous studies have found that infections, prematurity, and birth asphyxia were leading causes of neonatal death (WHO, 2005; Shiffman, 2010; Diallo et al., 2012). Estimated proportions rating these cause-specific causes of neonatal mortality is wide ranging. Thus some of these studies suggest that infections may contribute between 29% (Countdown 2015 MNCH) to 67% (GHS and UNICEF, 2008) of neonatal deaths. In addition to these, the proportion of neonatal deaths attributable to birth asphyxia ranges from 27% (Countdown 2015 MNCH) to 41% (GHS and UNICEF, 2008) and prematurity or low birth weight contributed to 29% (Countdown 2015 MNCH) to 34% (GHS and UNICEF, 2008).

Other propositions have, however, not maintained a consistent language for defining the cause of neonatal deaths. For example, some studies used the terms prematurity and low birth weight interchangeably whereas other studies distinguished between the two.

As far as major causes of global neonatal mortality are concerned, three top causes are predominantly persistent. These are infection, prematurity and birth asphyxia (Countdown 2015- MNCH, 2014). In Ghana, national data on the top causes of neonatal mortality is not easily accessible but regional and district level analysis have identified infections, low birth weight, and birth asphyxia as the top three causes of deaths among children less than one month of age. In the famous Emergency Obstetric and New-born Care (EMONC) case reviews in Ghana, birth asphyxia, infections and low birthweight were the top three causes of neonatal mortality contributing 41%, 15% and 10% respectively (Ghana Health Service Annual Report 2007). A case in point is a prospective study conducted in the Kassena-Nankana District in Northern Region of Ghana (Baiden et al., 2006) where prematurity (38%) and birth injuries (19%) were identified mainstay causes of early neonatal death whereas infectious diseases contributed 66% of late neonatal deaths. Overall, four leading causes of neonatal deaths were observed in the said Kassena-Nankana District of Northern Ghana between 1995 and 2002 thus: infections (39.2%), prematurity (26%), birth injuries (14%) and neonatal infanticide (5%) (Baiden et al., 2006).

Based on this study, an analysis of the 2008-2012 neonatal mortality data in KATH showed that overall, boys had higher proportion of neonatal deaths than girls. However, the annual proportion of deaths by sex varied over the years, with boys dominating the proportion of neonatal deaths in 2009, 2010 and 2012 but not in 2008. The high overall neonatal deaths of boys observed in this study are inconsistent with data from developed countries (WHO, 2005) while maintaining consistency with data from Southern Asia and Sub-Saharan Africa, including findings from previous studies in Ghana (GDHS, 1998; Baiden et al., 2006; Rosenstock et al., 2010). Most studies addressing sex differences in neonatal mortality conducted in developed countries showed that boys are at 20% greater risk of neonatal mortality than girls.

It is still not clear why male neonates dominate the proportion of neonatal deaths in Ghana and sub Saharan Africa at large. A potpourri of possible mechanisms or explanations extending from the basic biologic process of life to the broader socio-cultural context surrounding the birth of male children in Africa could be assigned as possible reasons for the sex differences in mortality. In Ghana, and Africa for that matter, the birth of a male child is much regarded than that of a female. As a consequence the birth of a male child signifies the birth of a ‘family successor’ because they are able to carry on the family name and continue one’s lineage, unlike females who are married off in the future. The joy and pride surrounding the birth of the male child is thus likely to cause parents to bring out their male children to show everyone, a process by which they are likely to expose them to several hazards. Yet the most plausible reason in our view is infections, specifically neonatal infections. As shown in this study and also supported by many previous studies, the proportion of neonatal deaths attributable to infections is overwhelming (Baiden et al., 2006; Ghana Health Service Annual Report, 2007; GHS and UNICEF,

2008; GDHS, 2008; Countdown 2015 MNCH). Many studies have shown that the male gender is a significant risk factor for neonatal sepsis (Soman, Green and Daling, 1985; Mary and David, 2007; Thermiany et al., 2008; Al-Dasoky et al., 2009; Gargi et al., 2010; Onyedibe et al., 2011 and Chandan et al., 2012). While the biological mechanism to explain why male babies are at higher risk than female in developing neonatal sepsis may not be clearly understood, some authors have suggested that circumcision could be a possible factor contributing to sepsis in males. Other authors suggest that since the male gender is a risk factor for prematurity and low birth weight (Utomo, 2010) and as these factors have also been associated with neonatal sepsis, it is likely that the relationship between sex and neonatal sepsis is mediated by birth weight and prematurity. Some people however, hold on to the myth that female babies may have stronger immunity than males, but evidence supporting this claim is scanty.

CONCLUSION

Five most important causes of neonatal mortality have been revealed by this retrospective study. These include prematurity, birth asphyxia, neonatal sepsis, neonatal jaundice, and respiratory distress. Remarkably, a majority of neonates died on the day of birth while NMR was higher among boys than girls. One other striking finding of utmost importance to policy makers particularly is the fact that the year 2012 recorded the highest NMR with 2011 recording the lowest NMR. Moreover, a trend analysis of NMR indicated a steady decline from 2008 until 2011, but a correspondingly drastic rise in 2012, the result of which was a major Ghanaian industrial strike involving health care professionals. Employee incentives and conditions of service are thus critical for policy makers while care providers must be adequately prepared to provide care during the prenatal, intrapartum and postpartum periods since these would undoubtedly yield the intended goals of the MDG-4.

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