Factors Associated with Increased Neonatal Deaths at a Regional Hospital in Namibia

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Abstract

The increased neonatal mortality rate in a regional hospital in Namibia is a concern. According to the 2013 records of the hospital, there were 333 neonatal deaths from 1 January to 31 December 2013. The aim of the study was to investigate the causes of the increased neonatal deaths at this regional hospital in Namibia. A retrospective descriptive survey design was employed to conduct the study. Data were collected from 231 record files of neonates that died from 1 January to 31 December 2013 while admitted at the regional hospital before 28 completed days of life. The results shows that 67.1 per cent (n = 155) neonates that died in the regional hospital were during the first 7 days of life, and 32.9 per cent (n = 76) died after 7 days of life but before 28 completed days of life. Five causes accounted for the early neonatal deaths: respiratory distress syndrome, 24.2 per cent (n = 56), congenital abnormalities, 14.7 per cent (n = 34), neonatal sepsis, 12.1 per cent (n = 28), birth asphyxia, 11.7 per cent (n = 27), and haemorrhagic diseases of newborns, 3.9 per cent (n = 9). The late neonatal deaths were mainly caused by neonatal sepsis accounting for 17.7 per cent (n = 41), followed by respiratory distress syndrome, 7.4 per cent (n = 17), congenital abnormalities, 3.9 per cent (n = 9), and birth asphyxia, 3.1 per cent (n = 7). The results also indicated poor record-keeping as an associated factor in this regional hospital. About 19.9 per cent (n = 46) of cases with Apgar scores at birth were not recorded, 66.7 per cent (n = 154) of resuscitations were not recorded, and 47.6 per cent (n = 110) of the administering of drugs were not recorded. It was unknown whether resuscitations were performed, except for 26.8 per cent (n = 62) that were

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recorded as no resuscitation needed. The study finally concluded that the majority of neonatal deaths that occurred in 2013 at the regional hospital were associated with multiple factors such as respiratory distress syndrome, neonatal sepsis, asphyxia, and congenital abnormalities. However, the majority of these factors could have been avoided.

Keywords: contributing factors, early neonatal deaths, late neonatal deaths, regional hospital, avoidable factors

Introduction and Background

Globally, 2.5 million infants died in the first month of life in 2017 alone – approximately 7 000 neonatal deaths every day – most of which occurred in the first week of life, with about 1 million dying on the first day of life and close to 1 million dying within the next six days of life (UNICEF 2018). It is documented that globally around 60 per cent of neonatal deaths (which occur within the first 28 days of life) are associated with birth asphyxia, which is a failure to initiate spontaneous respiration at birth (Ersdal et al. 2012). In 2016, about 2.6 million infants died in the first 28 days of life (neonatal period) (UNICEF 2017). It was highlighted that if the present situation continues in all countries, it will still be impossible for the world to accomplish the target of cutting neonatal deaths by two-thirds by 2026 (UNICEF 2017). Neonatal death was defined by the World Health Organization(WHO) as deaths among live births during 28 days of life (classified into early neonatal deaths from 0 to 7 days of life and late neonatal deaths occurring between 7 and 28 completed days of life) (Pathirana, et. al. 2016).

In sub-Saharan Africa, about 1 in 36 neonates dies within the first 28 days of life, compared to 1 in 333 in high-income countries (UNICEF 2017). Living beyond the first 28 days of life is still a major challenge, specifically in most of Southern Asia and sub-Saharan Africa, with Namibia included (Liu et al. 2014). UNICEF reported that neonatal mortality declined by 49 per cent, while the mortality in children aged 1–59 months declined by 62 per cent from 1990 to 2016. This progress of reducing neonatal mortality rates is slower than the reduction of mortality rates in children aged 1–59 months (UNICEF 2017). If the current trends continue with more than 50 countries falling short of the UN's Sustainable Development Goal (SDG) of child survival, some 60 million children under the age of 5 will die between 2017 and 2030 – and half of them will be newborns (UNICEF 2017).

Literature reviews show that neonatal mortality is the outcome of complex factors, which include neonates, maternal, and healthcare-related factors as well as the long distances and delays in seeking care (UNICEF 2018). The main direct causes of early neonatal deaths – or deaths that occur within the first seven days – are preterm births, severe infections, and asphyxia (Bhutta et al. 2012). Other studies discovered that the three leading causes of neonatal deaths, preterm births, intrapartum asphyxia, and

infections, are the same during the early and late neonatal periods (Oza et al. 2014). However, their distribution varies between the two periods, since infections generally take more time to develop and are therefore common during the late neonatal period (Oza et al. 2014).

Other known factors that contribute to the high rate of neonatal deaths are respiratory distress syndrome (RDS) and birth trauma, and are the key roots of neonatal mortality in less developed countries. Buchmann (2014) asserted that the major causes of neonatal deaths included fetal distress that went unnoticed during the intrapartum period – this being one of the most avoidable factors contributing to neonatal deaths in sub-Saharan Africa. Liu et al. (2014) indicated that most neonatal deaths were caused by health worker-related factors. In the literature, health worker-related factors that are mentioned include fetal distress monitored but not detected; for example healthcare providers might be unable to read and interpret the cardiotocograph (CTG), have poor clinical skills, and not record clinical findings on the CTG (MoHSS 2014).

Generally, one of the most essential ways to deal with some of the key factors associated with neonatal deaths is guaranteeing skilled birth attendants during antenatal care, at the time of delivery and during the postpartum period (WHO 2018). Skilled birth attendants are also required to have skills needed for the identification, management and referral of complications in women and newborn babies (WHO 2018). There is strong evidence that births attended by skilled birth attendants have a high chance of neonatal survival (Tura, Fantahun, and Worku 2013). Neonatal survival is associated with a range of socio-economic and cultural factors, such as basic antenatal and postnatal healthcare, poor knowledge and attitudes in terms of healthcare, and the inability to pay for transportation and services (Paudel et al. 2013). It is also determined by the structure, availability, distribution and motivation of adequate resources, including competent human resources for the reduction of neonatal deaths (Khan, Zahidie, and Rabbani 2013).

In Namibia, improving newborn health is a priority for the Ministry of Health and Social Services (MoHSS). However, as Namibia is part of the sub-Saharan region, it has recorded both an ascending and descending trend in the neonatal mortality rate. The neonatal death rate has increased from 27/1 000 live births to 29/1 000 live births in 2007 and declined minimally in 2013 to 21.8/1 000 live births (MoHSS 2014). Namibia's roadmap to achieve the Millennium Development Goal (MDG) 4 was to reduce the neonatal mortality rate from 29/1 000 live births in 1990 to 9/1 000 live births by 2015 (MoHSS 2010). However, Namibia as a country is still facing challenges in reducing neonatal deaths and thus did not achieve MDG 4 by 2015. Currently, the report of UNICEF (2018) indicated that Namibia's neonatal death rate is standing at 19/1 000 live births and is accounting for 42 per cent of less than 5 years mortality. This report indicates that neonatal mortality still represents a larger share of total deaths in those aged less than 5 years.

Like other developing countries, Namibia reported that the common causes of early and late neonatal deaths in Namibia were mainly due to birth asphyxia (49.4%), followed by prematurity (12.7%), congenital abnormalities (10.8%), neonatal sepsis (10.8%), RDS (7.2%), and healthcare-related factors (MoHSS 2014). In addition, another factor reported in literature that contributed to the neonatal deaths was healthcare providers who fail and delay to refer patients to save the lives of pregnant women and neonates. The unavailability of experts or the delay in calling for expert assistance and not paying attention to early rupture of membranes is another healthcare provider factor (Liu et al. 2014). There were about 333 neonates that died in 2013 at the regional hospital in Namibia, however, there was no investigation conducted to ascertain the causes for the increased neonatal deaths in the regional hospital in 2013.

Problem Statement

The rates of neonatal deaths in Namibia declined from 29/1 000 live births in 2007 to 21.8/1 000 live births in 2013 (MoHSS 2014). However, the records of the Khomas regional hospital in Namibia show that there were n = 333 neonatal deaths from 1 January to 31 December 2013 (MoHSS 2014). This was the highest death record in the last decade that occurred in the Khomas region compared to that of the other four regions in the country (MoHSS 2014). This high rate of neonatal deaths was particularly a concern in light of the roadmap developed to increase births in health facilities, rather than at home. Namibia's roadmap to achieve MDG 4 was to reduce the neonatal mortality rate from 29/1 000 live births in 1990 to 9/1 000 live births by 2015 (UNICEF 2018). Therefore, this study investigated factors that contributed to the increased neonatal deaths in 2013 at the Khomas regional hospital in Namibia.

Purpose of Study

The purpose of this study was to investigate the causes of the increased neonatal deaths in 2013 in the Khomas regional hospital in Namibia.

Research Methodology

A hospital-based retrospective survey was conducted to audit the records for factors that contributed to the increased neonatal deaths at the Khomas regional hospital in Namibia. All the newborns admitted to the Khomas regional hospital that died from January to December 2013 within 28 days of life were reviewed by the principal investigator and two trained midwives.

Population and Sampling

The study population consisted of the records of all neonates that died while admitted to the regional hospital before 28 completed days of life from 1 January to 31 December 2013. A total of 333 neonatal deaths were recorded during this year. However, the neonatal death records retrieved during the study period were only n = 246, and of these n = 231 neonatal death records were eligible for data collection. This period was selected because of the highest rates of neonatal deaths recorded during the last decades.

Inclusion and Exclusion Criteria

The inclusion criteria for selecting the records were that the neonates should have been admitted to the regional hospital and should have died within 28 days of life. The exclusion criteria covered the records for all stillbirths and infants who died after 28 days of life, and neonates that died outside of the study period or at home.

Instrument Development

The data collection instrument used in this study was partly developed from the literature on the causes of neonatal deaths in less developed countries and from training modules on neonatal resuscitation developed by the American Heart Association (Kattwinkel et al. 2010). Other instruments were adapted from a tool used to investigate the causes of neonatal deaths in South Africa by Ndlovu (2013), and Ramaboea (2014). The structure, content and face validity of the instrument were checked by the biostatistician in the field. The reliability of the instrument was pilot tested before data collection. Two midwives were trained on data collection. The inter-rater liability of the review process was tested by conducting a test-retest before the data collection, and this ensured that the instrument was stable and consistent. The test-retest result was 0.895, which is within the range of good reliability. The instrument consisted of information on demographic data, and causes of neonatal deaths including avoidable and unavoidable factors.

Data Collection

Archival records were retrieved with the assistance of the clerks in the archives department and the notes from the recorded cases subsequently assessed. A total of 231 eligible records of the neonatal deaths were reviewed out of the 246 accessible records. The data were collected from 2 February to 25 March 2016. Data were collected on the mode of delivery, complications during delivery, the Apgar scores, resuscitation, birth weight, causes of early and late neonatal deaths, and avoidable and unavoidable factors.

Ethics Considerations

The study was reviewed and approved by the Biomedical Ethics Committee of the University of the Western Cape (No. 15/7/272), and permission to conduct the study was obtained from the MoHSS in Namibia. The records were not removed from the records section to maintain confidentiality. The identifiable details of the records were not used to collect the data and codes were used instead to maintain anonymity. All the information obtained from the patients' record files remained confidential. To ensure participants' confidentiality the hard copy of the data is kept in a locked filing cabinet with only the researcher having access to it and the soft copy of the data is password-protected on the computer with only the researcher and supervisors having access to it.

Data Analysis

The collected data were checked for inconsistencies, missing data and completeness. The data extracted from the records were analysed using the Statistical Package for Social Sciences (SPSS), version 24. Frequencies and percentages were computed to describe categorical data, and the mean and standard deviation for continuous data. The frequency of a particular response such as age at death, gender, mode of delivery of birth, and causes of death as recorded was also determined. Complications presented during delivery, causes of early neonatal death, causes of late neonatal death, and avoidable and unavoidable factors were analysed using percentages and presented using tables and figures.

Findings

Socio-demographic Characteristics of Neonatal Deaths

A total of 231 records of neonatal deaths were reviewed. This yields about 69.4 per cent of the initial plan to review the records, which constituted adequate stands for statistical analysis as more than the minimum recommended number was achieved.

Table 1 shows that the majority of the neonates that died (67.1 per cent, n = 155) were during the first 7 days of life, while 32.9 per cent (n = 76) were late neonatal deaths (death after 7 days of life but before 28 completed days of life). The male proportion of neonatal deaths was 50.6 per cent (n = 117), while the female proportion was 48.5 per cent (n = 112), and 0.9 per cent (n = 2) of the neonatals had ambiguous genitalia.

Table 1 also shows that 55.0 per cent (n = 127) of the neonates were delivered by normal vertex delivery (NVD), 33.3 per cent (n = 77) were delivered by caesarean section, about 6.1 per cent (n = 14) were breech deliveries, vacuum deliveries constituted 0.9 per cent (n = 2), and for about 4.7 per cent (n = 11) the mode of delivery was not recorded. The majority, 75.8 per cent (n = 175), of the mothers faced

complications during delivery. These complications included preterm labour, 30 per cent (n = 70), eclampsia, 18.2 per cent (n = 42), prolonged labour, 18.7 per cent (n = 20), antepartum haemorrhage, 3.9 per cent (n = 9), fetal distress, 6.9 per cent (n = 16), twin pregnancy, 3.5 per cent (n = 8), diabetes, 2.2 per cent (n = 5), a cardiac condition, 1.7 per cent (n = 4), and cord prolapse, 0.4 per cent (n = 1). A total of 6.1 per cent (n = 14) had no complications. About 18.2 per cent (n = 42) of the records did not indicate whether there were complications or not.

Table 1: Age at death, gender, mode of delivery and types of complications

Socio-demographics of neonatal deaths	**(f)**	**%**
Age at death		
Less than 7 days	155	67.1
8 days to 28 days	76	32.9
Total	231	100
Gender		
Male	117	50.6
Female	112	48.5
Ambiguous genitalia	2	0.9
Total	231	100
Delivery mode		
NVD	127	55
C/S	77	33.3
VD	2	0.9
BD	14	6.1
Not recorded	11	4.7
Total	231	100
Types of complications		
Preterm labour	70	30.3
Eclampsia	42	18.2
Not recorded	42	18.1
Prolonged labour	20	8.7
Fetal distress	16	6.9
No complications	14	6.2
APH	9	3.9
Twin pregnancy	8	3.5
Diabetes	5	2.2
Cardiac condition	4	1.7
Cord prolapse	1	0.3
Total	231	100

NVD = normal vertex delivery, BD = breech delivery, CS = caesarean section, VD = vacuum delivery, APH = antepartum haemorrhage

Causes of Early and Late Neonatal Deaths

As shown in Table 2, neonatal deaths decreased with increasing birth weight. The lowest birth weight range of 500–999 g had 32.5 per cent (n = 75) neonatal deaths, while the range of 1 000–1 499 g had 21.6 per cent (n = 50) neonatal deaths, those weighing between 1 500–1 999 g had 12.6 per cent (n = 29) neonatal deaths, and those weighing between 2 000–2 499 g had 4.8 per cent (n = 11) neonatal deaths. The birth weight of the rest, 1.7 per cent (n = 4), was not recorded. However, the findings for those neonates within the birth weight range from 2 500 g and above had higher deaths at 26.8 per cent (n = 62).

Table 2 also shows the major causes of early and late neonatal deaths. The causes of the early neonatal deaths included RDS, 24.2 per cent (n = 56), congenital abnormalities, 14.7 per cent (n = 34), neonatal sepsis, 12.1 per cent (n = 28), and birth asphyxia, 11.7 per cent (n = 27). On the other hand, the late neonatal deaths were caused by neonatal sepsis that accounted for 17.7 per cent (n = 41), RDS, 7.4 per cent (n = 17), and congenital abnormalities, 3.9 per cent (n = 9). Neonatal deaths caused by birth asphyxia were 3.1 per cent (n = 7), which is much lower than that of the early neonatal deaths.

Table 2: Birth weight and causes of early and late neonatal deaths

Birth weight and causes of neonatal deaths	**(f)**	**%**
Babies' weight at death (g)		
500–999	75	32.5
1 000–1 499	50	21.6
1 500–1 999	29	12.6
2 000–2 499	11	4.8
2 500 and above	62	26.8
Not recorded	4	1.7
Total	231	100
Causes of early neonatal deaths		
RDS	56	24.2
Neonatal sepsis	28	12.1
Birth asphyxia	27	11.1
Congenital abnormalities	34	14.7
Haemorrhagic diseases	9	3.9
Unknown	1	0.4
Causes of late neonatal deaths		
Neonatal sepsis	41	17.7
RDS	17	7.4
Congenital abnormalities	9	4.0
Birth asphyxia	7	3.1
Birth trauma	1	0.4

Birth weight and causes of neonatal deaths	(f)	%
Unknown	1	0.4
Total	231	100

RDS = respiratory distress syndrome

Types of Intervention

The results in Table 3 indicate that 16.9 per cent (n = 39) of the neonates had a low Apgar score of < 3/10 at 1 minute and maintained a similar Apgar score of < 3/10 at 5 minutes. It was observed that 35.1 per cent (n = 81) of the neonates that died had a low Apgar score of 3–6/10 at 1 minute and with no improvement (3–6/10) at 5 minutes after birth. However, 28.1 per cent (n = 65) of the neonates that died had a normal Apgar score of > 7/10 at 1 minute and 5 minutes after birth. In about 19.9 per cent (n = 46) of the cases the Apgar scores at birth were not recorded.

As also shown in Table 3, out of the total number of neonates that died (n = 231), 35.1 per cent (n = 81) were resuscitated but could not be saved; resuscitation was not done for 27.3 per cent (n = 63) of the neonates, and in 37.6 per cent (n = 87) of the neonatal deaths the intervention was not recorded, therefore, it is unknown whether intervention was performed or not.

For about 24.2 per cent (n = 56) of the neonates suction, positive pressure ventilation (by using a bag valve mask (ambubag)) and mask ventilation were attempted, for 8.7 per cent (n = 20) suction and intubation were used, for 1.7 per cent (n = 4) ventilation and cardiac massage or chest compression were used, for 23.8 per cent (n = 55) no intervention was performed, and for 41.6 per cent (n = 96) the types of intervention performed were not recorded. Furthermore, the results indicate that the duration of resuscitation in the neonates varied, with 1.3 per cent (n = 3) of the neonates being resuscitated for < 5 minutes, 2.2 per cent (n = 5) resuscitated for 5–10 minutes, and 3.0 per cent (n = 7) resuscitated for > 10 minutes. In 66.7 per cent (n = 154) of the cases the resuscitation was not recorded, so it is unknown whether resuscitation was done or not, while in 26.8 per cent (n = 62) of the cases it was recorded that no resuscitation was needed.

The results show that 10.8 per cent (n = 25) of the neonates were given adrenaline, 41.6 per cent (n = 95) of the neonates were not given adrenaline, and in 47.6 per cent (n = 110) of the cases it was not recorded whether drugs were administered or not.

Table 3: Types of interventions

Interventions	(f)	%
Apgar score		
< 3/10 – < 3/10	39	16.9
3–6/10 – 3–6/10	81	35.1
> 7/10 – > 7/10	65	28.1

Interventions	**(f)**	**%**
Not recorded	46	19.9
Total	231	100
Drugs administered		
Yes	25	10.8
No	95	41.6
Not recorded	110	47.6
Total	231	100
Resuscitation		
Yes	81	35.1
No resuscitation needed	63	27.3
Not recorded	87	37.6
Total	231	100
Steps for resuscitation		
Suction, ventilation	56	24.2
Suction, intubation	20	8.7
Ventilation, cardiac massage	4	1.7
Not recorded	96	41.6
No steps taken to resuscitate	55	23.8
Total	231	100
Duration of resuscitation		
< 5 minutes	3	1.3
5–10 minutes	5	2.2
>10 minutes	7	3.0
Not recorded	154	66,7
No resuscitation needed	62	26.8
Total	231	100
Types of drugs administered		
Adrenaline	25	10.8
No drugs administered	95	41.6
Not recorded	110	47.6
Total	231	100

Unavoidable Factors

Table 4 shows the types of congenital abnormalities which contributed to early and late neonatal deaths. These types included multiple abnormalities, 4.8 per cent (n = 11), congenital heart disease, 5.1 per cent (n = 12), hydrocephalus, 2.6 per cent (n = 6), gastroschisis, 2.6 per cent (n = 6), duodenal atresia, 0.9 per cent (n = 2), and spina bifida, 0.9 per cent (n = 2). In 1.2 per cent (n = 3) of the cases these abnormalities were not recorded. A total of 81.0 per cent (n = 187) of the neonates had no congenital abnormalities.

Table 4: Congenital abnormalities present at birth

Types of abnormalities	**(f)**	**%**
Multiple abnormalities	11	4.8
Congenital heart disease	12	5.1
Hydrocephalus	6	2.6
Gastroschisis	6	2.6
Duodenal atresia	2	0.9
Down syndrome	2	0.9
Spina bifida	2	0.9
Not recorded	3	1.2
No abnormalities	187	81.0
Total	231	100

Discussion of Research Results

Causes of Early and Late Neonatal Deaths

The study demonstrated that there were various common causes of early neonatal death, which is the death of a neonate between 0 and 7 days of life. In this study, 24 per cent of early neonatal deaths were caused by RDS. RDS is defined as an acute lung disease which affects newborns and that is caused by the lack of surfactant, which causes the alveoli to collapse and become non-compliant. RDS is common in preterm infants as the result of surfactant deficiency (Banerjee et al. 2019). Hole et al. (2012) in their study identified that RDS is mostly caused by prematurity. The highest proportion of early neonatal deaths caused by RDS might be related to those neonates weighing less than < 2 500 g at birth as seen in the current study. Although neonatal deaths may not be avoidable even in high technological environments, most of the causes of neonatal deaths, such as respiratory distress, can be significantly reduced with effective intervention.

This study was conducted at a regional hospital that has an intensive care unit (ICU) and equipment and medicine such as surfactant, which enhances lung maturity when administered immediately after birth; with the effective use of such resources the neonatal deaths could have been reduced. The survival of neonates under such conditions mostly depends on the immediate neonatal care in the delivery room and in the neonatal ICUs, mainly in the first week of life – the period of utmost vulnerability. The findings of this study correlate with those of Jain et al. (2013) where RDS due to prematurity was the leading contributing factor to early neonatal deaths. Previous studies identified that 27 per cent of early neonatal deaths are caused by preterm births (Harrison and Goldenberg 2016; Mengesha and Sahle 2017).

In this study, birth asphyxia was responsible for 11 per cent of early neonatal deaths, which is similar to the finding of a study done by Kouame et al. (2015), where birth asphyxia caused 11.1 per cent of early neonatal deaths. Similarly, in a study done by Manandhar et al. (2010) birth asphyxia caused 37 per cent of early neonatal deaths; more than three times higher than in the findings of this current study. According to Andreasen, Backe, and Oian (2013), birth asphyxia is mostly due to complications of birth, for instance obstructed labour or a prolonged first and second stage of labour, inadequate fetal monitoring, and lack of skills of the health personnel. Birth asphyxia is an indication of the absence of good quality obstetric care (Andreasen, Backe, and Oian 2013). The results of birth asphyxia of the present study were lower than those of the study by Singh and Sengar (2016) which documented that 23 per cent of neonatal deaths in low-income countries are due to birth asphyxia.

Over the years the number of neonates that died from sepsis has decreased significantly owing to the introduction of a combination of antibiotics and hygiene techniques (Oza et al. 2014). However, in the current study neonatal sepsis caused around 17 per cent of the late neonatal deaths, and requires more attention in the neonatal management unit. In the study setting, many neonates were accommodated in one room, which might have put them at risk of spreading infection from one neonate to another through the care givers. Although this study was not aimed at collecting data to identify the factors that influence the high rate of infections among neonates, the literature review indicates that neonatal infections are often a result of a poor hospital environment (Saugstad 2011). Pertaining to neonatal sepsis, the findings were lower compared with the findings of Chadha (2010) which discovered that neonatal sepsis was responsible for nearly half of the late neonatal deaths, many of which are blamed on inadequate hygiene.

Avoidable Causes of Neonatal Deaths

This study has shown that 16 per cent of neonates that died in the hospital under study had an Apgar score of 3–6/10 at 1 minute and remained the same at 5 minutes. This means that these neonates may have had a chance of surviving if proper intervention and care, such as proper resuscitation, were rendered to them. More than a quarter of the neonates that died in the current study had normal Apgar scores of > 7/10 at both 1 minute and 5 minutes; in other words, they were healthy neonates and could have had a high rate of survival. The analysis in this study was based solely on what was recorded in the neonatal death files. Therefore, this study did not look at whether the neonates were given a correct Apgar score at birth or not. However, the researchers are of the opinion that perhaps some neonates were accorded incorrect Apgar scores. Failing to ascertain the correct Apgar score for neonates at birth could negatively influence their outcomes.

It is worth noting that in this study 35.1 per cent (N = 81) of the neonates that had an Apgar score of < 3/10 at 1 minute and remained the same at 5 minutes were neonates

weighing > 2 500 g. According to the records, most of the neonates that died developed brain injury before death due to asphyxia, and presented with hypoxic ischaemic encephalopathy. These findings are consistent with those of Lansky et al. (2014) who found that intrapartum asphyxia in Brazil caused 18 per cent of neonatal deaths; the neonates that died were full-term neonates and 40.9 per cent had an Apgar score < 7 at 5 minutes.

Analysis of the documents revealed that the only resuscitative drug administered was epinephrine. The findings of this study are consistent with those of the study by Sepeku and Kohi (2011) that 45 per cent of asphyxiated neonates had not received the required medicines during resuscitation. The same study found there was insufficient knowledge on how to administer drugs, when to administer them, and which drug to administer. A total of 24 per cent of the records indicate that a combined intervention of neonates suction and bag and mask ventilation was used. About 8.7 per cent of the neonates received suction and intubation together, and 1.7 per cent of the neonates received ventilation and cardiac massage or chest compression. A meta-analysis review showed a reduction in the neonatal mortality rate and no harm in the infants' resuscitation in room temperature than with 100 per cent oxygen (Chadha 2010).

Unavoidable Factors

The current study demonstrated that around 19 per cent of neonates died of congenital abnormalities. In many cases in developing countries congenital abnormalities are unavoidable factors that are difficult to control, and as a result most neonates with congenital abnormalities die within 24 hours following birth. A survey conducted by Indongo (2014) in Namibia, reported that 11.3 per cent of neonatal deaths were caused by congenital abnormalities. A possible explanation for such a difference might be that the survey targeted many hospitals around the country while the current study targeted one regional hospital to which all neonates with severe abnormalities are referred from other regions. Thus, the results of the two studies should be compared with caution.

Record-keeping

The study identified that there were record-keeping problems. There were many causes of neonatal deaths and interventions given that were left unrecorded. This study identified that whether the required drugs were administered during resuscitation or not for 44 per cent (n = 47) of the neonates that subsequently died was not recorded. It further emerged that closer to 38 per cent of these neonates were not on record whether they needed resuscitation during birth or not. The duration of resuscitation of more than 66 per cent of the neonates that died in the regional hospital was not recorded. In general, the study results show that the types of intervention performed in about 42 per cent of the neonates that died were not recorded, and that intervention was performed in closer to 48 per cent of the neonatal deaths was not recorded, therefore, it is unknown whether intervention was performed or not. This distressing

finding revealed that it is difficult to determine how adequate the resuscitation procedures of the hospital were to prove that the required care was offered.

However, with 35 per cent of the neonates being resuscitated, it could be assumed that with proper resuscitation the neonates could have a 10 per cent survival rate. This assumption is supported by the findings of Lloyd and De Witt (2013) which identified that neonatal deaths caused by intrapartum asphyxia were the result of factors that could have been avoided had the healthcare providers been competent in 44 per cent of the cases. A retrospective record review conducted in 5 developing countries indicates that more than 20 per cent of the records for caesarean section deliveries could not be located (Landry et al. 2014). The key aspects of the care given were not recorded in the patient folders (for instance the timing of drug treatment, decision to perform a caesarean section, administering of prophylactic antibiotics, maternal complications, and maternal and fetal outcomes) (Landry et al. 2014).

Mode of Delivery

Pertaining to the mode of delivery, the study identified that 55 per cent (n = 127) of the neonates that died were delivered via NVD, while around 33 per cent were delivered by caesarean section. This reveals that NVD was more common than caesarean section in the regional hospital where this study was conducted. The possible interpretation is that NVD outnumbered other modes of deliveries and that the NVD might happen after prolonged first and second stages of labour, hence it might lead to respiratory complications, such as birth asphyxia. However, this higher rate of the neonates' deaths after being born via NVD is contrary to the findings of Thavarajah, Flatley, and Kumar (2018) who found that women who gave birth via NVD have a low rate of neonatal admission compared to those delivered by emergency caesarean section, which is associated with more complications. A similar finding from a neonatal ICU at a referral hospital in Southern Ethiopia revealed that neonates delivered via caesarean section had a 66 per cent self-protective effect on the risk of neonatal mortality compared to NVD. The possible reason might be a well-timed decision rather than waiting for vaginal delivery; delivering by caesarean section can lessen the risk of neonatal death by lessening the complications owed to prolonged labour (Orsido, Asseffa, and Berheto 2019). In contrast, Abdulhameed, Aljammas, and Ramzi (2016) identified that in Iran the neonates that died were born via caesarean section.

In the case of vacuum-assisted vaginal delivery, this study demonstrated that less than one per cent was used. No forceps delivery was used at the regional hospital under study. The researchers feel that the lack of using instrument delivery might point to deficiency of knowledge and experience among healthcare providers. However, the justification for this was not investigated. Vacuum and forceps deliveries are some of the nine emergency obstetrical and neonatal care techniques that can save the life of a woman and her neonate during a complicated delivery, for instance a prolonged

second stage of labour. A study done by Nolens et al. (2016) identified the vacuum extraction delivery rate as 0.6 per cent owing to the inability of healthcare providers to use the vacuum. However, it increased from 0.6 per cent to 2.4 per cent of deliveries when training of healthcare professionals was implemented (Nolens et al. 2016). An audit of a programme to increase the use of vacuum extraction that was carried out at the Mulago Hospital in Uganda, revealed that there was a decline in intrapartum stillbirths from 34 to 26/1 000 births when vacuum extraction was implemented (Nolens et al. 2016). However, it was not the focus of this study to find out why emergency instruments such as vacuum extraction and forceps were not being used in the regional hospital where this study was conducted.

Complications of Delivery

Another critical issue that emerged from this study was that 75 per cent of the women presented with complications before delivery. These complications varied, with 30 per cent having preterm labour, and 18 per cent having eclampsia. These findings are consistent with the findings of a study conducted in Iraq on perinatal mortality types, which found preterm labour and hypertension-related conditions such as pre-eclampsia to be the most common maternal risk factors associated with neonatal deaths (Abdulhameed, Aljammas, and Ramzi 2016). In the current study, the possible interpretation of the high number of complications might be that this regional hospital is a referral hospital. It can also be argued that the study setting is the only regional hospital for high-risk pregnancies and severely premature neonates from the southern and central regions. This might be the reason for quite a number of women and neonates referred from peripheral hospitals who might have received suboptimal care prior to their being referred.

Conclusion

The study concluded that the majority of neonatal deaths that occurred in 2013 at the regional hospital related to multiple factors such as RDS, neonatal sepsis, asphyxia, congenital abnormalities and healthcare-related factors. These are avoidable factors which can be reduced significantly with effective interventions and healthcare systems. The study identified that record-keeping was also one of the major challenges, as many causes of neonatal deaths and interventions were not recorded.

Limitations

The study was conducted in one hospital, therefore the findings could not be generalised to other similar areas. The hospital was under reconstruction during the data collection period and some of the files were misplaced or missing. Record-keeping on documents was poorly done, both by medical and nursing staff. As the data were taken from hospital records retrospectively, there was a possibility that the cause

of death of some neonates was not properly diagnosed, or the intervention given was not properly recorded. These limitations might have influenced the findings of the study.

Recommendations

It is recommended that healthcare professionals involved in neonatal care be given more training on neonatal resuscitation, policy compliance, and the types and duration of interventions. Furthermore, healthcare professionals have the responsibility of accurate record-keeping of the causes of neonatal deaths and the type of interventions provided. The implementation of neonatal resuscitation and the importance of accurate patient record-keeping should be emphasised in the training.

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