Risk factors associated with neonatal deaths at Kericho county referral hospital, kericho county, Kenya

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Abstract
An estimated 2.8 million neonatal deaths occurred globally, accounting for 40% of under 5 deaths and more than 50% of infant deaths. The burden of neonatal death is still high in developing countries where most of the causes could be prevented. Sub-Saharan Africa had the highest neonatal mortality rate in 2018 at 28 deaths per 1,000 live births, followed by Central and Southern Asia with 25 deaths per 1,000 live births. From previous studies, there is slow progress in reducing neonatal death in low- and middle-income countries. The broad objective of the study was to investigate the risk factors associated with neonatal deaths at Kericho County Referral Hospital. It was guided by the following specific objectives: to establish low birth weight in relation to the neonatal deaths at Kericho County Referral Hospital, identify failure to establish breathing at birth in relation to neonatal deaths at Kericho County Referral Hospital and to determine neonatal infection in relation to neonatal deaths at Kericho County Referral Hospital. This was a retrospective cohort study for the period 2018 that employed a descriptive correlation design. A transcription form was used to transfer the required data from neonatal death records, while interview checklist was applied to the health workers. Data collection was from 110 neonatal records and 12 health workers in newborn unit at Kericho County Referral Hospital. Simple random sampling was employed for neonatal records and purposive for health workers. Data was analyzed using descriptive and inferential statistics and disseminated to concern authorities. The findings from this study will guide in policy formulation that will improve on the survival of neonates at Kericho County Referral Hospital and nationwide.

Keywords: neonatal deaths, risk factors, correlation design, kericho county referral hospital

I.   Introduction

An estimated 2.8 million Neonatal Deaths occurred globally, accounting for 40% of under 5 deaths (Wardlaw *et al*., 2014) [18] and more than 50% of infant deaths (Chuatpa *et al*., 2016). Globally, there is an increase in the number of NDs and a very slow decline as compared with the post neonatal period (WHO, 2016). The worldwide NMR decreased from 36 to 19 deaths per 1000 LB between 1990 and 2015, equivalent to a decline from 5.1 million to 2.7 million NDs (WHO, 2016). The NMR in developed countries is 4 deaths per 1000 LB and 23 deaths per 1000 LB in developing countries (UNICEF, 2016) [42]. In 2018, Sub- Saharan Africa had the highest NMR of 28 deaths per 1,000 live births, followed by Central and Southern Asia with 25 deaths per 1,000 live births (Liu L *et al*., 2015). Ethiopia reported the highest with 37 deaths per 1000 live births (Debelew *et al*., 2014) while Kenya has 21 deaths per 1000 live births (WHO, 2016). At Moi Teaching and Referral Hospital, early NMR was found to be 68 per1000 LB at (Yego *et al*., 2013) [13] and 30.1 per1000 LB in 2018 at Kericho county referral hospital (DHIS, 2018). Worldwide, the most causes of NDs are preterm birth, birth asphyxia, sepsis, and pneumonia (Liu L *et al*., 2012) [27, 28]. In Iran, LBW had increased risk of NDs by 32 times as compared to other factors such as passive smoking during pregnancy, pregnancy interval < 3 years, multiple pregnancy, gestational age, abnormality and birth asphyxia. (Ghotbi N*et al*., 2017) [15].

Ethiopia reported the highest NMR of 37 deaths per 1000 live births (Debelew *et al*., 2014) while Kenya has 21, above the SDG3 target of 12 deaths per 1000 live births (LB) to be achieved by 2030 (WHO, 2016). Yego *et al* (2013) [13] did a study at Moi Teaching and Referral Hospital and found a NMR of 68 per1000 LB occurring during the first week of life. Nevertheless, NMR for Kericho county referral hospital (KCRH) in 2018 was found to be 30.1 per 1000 live births (DHIS 2018). This shows that KCRH is one of the hospitals that is increasing the country's NMR despite inadequate information on the associated factors. Therefore, the researcher is interested in studying the risk factors associated with NDs at KCRH in order to identify preventive interventions to reduce neonatal morbidity and mortality. In order to prevent NDs in Kenya, the Ministry of Health has scaled up the following strategies countrywide: Emergency Obstetrics and New-born care, free maternity services, the Beyond Zero campaign, initiating Maternal and Perinatal Death Surveillance and Response and Linda Mama

services among others.

Kenya abolished delivery fees in all public health facilities through a presidential directive signed into effect on June 1, 2013 (Bourbonnais, N. 2013), a move to make maternity services accessible and affordable in order to reduce maternal and NDs (MOH, 2015). The Kenya demographic health survey 2014 report indicates that maternal and NDs have been associated with lack of transport, long distances to health centers, poorly equipped and low quality health facilities, and traditional and cultural practices (Gitobu,

C.M. *et al*., 2018) [18]. Knowledge from this study will guidein formulation of policies to be used by the hospital management and other service providers in reducing neonatal deaths at Kericho County Referral Hospital. The findings will also help the county and national government to devise strategies that will reduce neonatal deaths, For instance, planning trainings on neonatal resuscitation, as a result improving the sustainable development goal 3 target. Therefore, this study will serve as a tool for any possible intervention that will aim in reducing neonatal morbidities and mortality rates at Kericho County Referral Hospital. There was limited research done on risk factors associated with neonatal deaths in Kenya. This means that the study could be generalized to all other counties in Kenya. This is a retrospective study where data was collected from neonatal death records. Therefore, such a study is subject to data incompletion, inconsistency and lack of clarity. This study focused on neonatal death records and health workers' interview. The variables to be captured were: to establish low birth weight in relation to the neonatal deaths at Kericho County Referral Hospital, to identify failure to establish breathing at birth in relation to neonatal deaths at Kericho County Referral Hospital and to determine neonatal infection in relation to neonatal deaths at Kericho County Referral Hospital. The assumption was that the respondents selected to participate in the study cooperated and gave honest responses to research questions. Also respondents were assumed to understand the risk factors of neonatal deaths in the hospital.

II.   Material and Methods

This section provides a review of literature published on the risk factors associated with neonatal deaths (NDs) globally and regionally. The source materials include: related studies on the topic, research text books, paediatric and midwifery text books, Nurses' dictionary and medical journals. Neonatal death is defined as death that occurs within the first 28 days of life (WHO, 2016). Neonatal period which is from birth to the first 28 days of life has been noted to be the most challenging period of life because neonates are more predisposed to various problems (Kliegman RM *et al*.,2016) [22]. 75% of all NDs occur during the first week of life, and about 1 million newborns die within the first 24 hours (WHO, 2018). The main causes of NDs are complications of preterm birth, neonatal infections and failure to establish breathing at birth (Ndombo *et al*., 2017) [36].Risk factors associated with neonatal deaths include: multiple births due to premature birth (Ko *et al*., 2018), passive smoking during pregnancy, pregnancy interval < 3 years, multiple pregnancy, gestational age, low birth weight, abnormality, failure to establish breathing at birth (birth asphyxia), male child and caesarian deliveries (Ghotbi N *et al*., 2017) [15]. Overweight babies and those born from mothers with higher education were found to be at a higher risk of NDs (Etambuyu & Charles, 2015) [12]. Interventions to reduce neonatal deaths include provision of quality focused ANC, delivery and neonatal care services including availability of the doctor at every delivery and emergency (Yego, F. *et al*., 2014) [52]. Community based approaches such as improved nutrition for pregnant mothers, prevention of teenage pregnancies, proper use of mosquito nets during pregnancy, focused ANC, adequate skilled care during birth to prevent birth asphyxia among LBW babies and enhanced quality of postnatal care among others could effectively reduce the mortality rates (Arunda, M.O. *et al*., 2018) [3]. Resuscitation of neonates with 100% oxygen delays early recovery; increases NDs and oxidative stress at least 4 weeks after birth as compared to resuscitation with room air. Minimizing exposure to high concentrations of oxygen reduces the risk of these complications (Saugstad, 2005) [35].Low birth weight baby is a baby born with a birth weight less than 2500 grams regardless of gestation age (WHO, 2016). A low birth weight baby may either be preterm or small for gestational age (term baby with birth weight less than 2500 grams). LBW babies are more vulnerable to illness than normal birth weight and term babies (WHO, 2016). According to WHO (2016), LBW categories are: LBW (babies weighing below 2500 grams at birth); very low birth weight (babies weighing below 1500 grams); extremely low birth weight (babies weighing less than 1000 grams).In China, the incidence of LBW has increased from 5.9 in 2000 to 6.1% in 2013. Quality ANC and management of high-risk factors for LBW may reduce the incidence of LBW and the death rate of LBW infants (Chen Y, *et al*., 2013). In Korea, data of live births, infant deaths and stillbirths were obtained from the Korean Vital Statistics from 2009 to 2015. Neonatal mortality rate, infant mortality rate, and fetal mortality rate in singleton, twin and triplet pregnancies were analyzed based on the gestation age. MBR increased by 36.4%, twin birth rate increased by 34.5%, triplet birth rate increased by154.3%. In 2015, NMRs and IMRs were nine and six times respectively higher in twin births and thirty seven and nineteen times respectively higher in triplet births, than in singleton deliveries. This was associated with premature births, hence emphasis is on close fetal monitoring to prevent fetal death in triplet pregnancies as from 32 weeks of gestation (Ko *et al*., 2018). Also a study by Wagura (2018) [38] at Kenyatta National Hospital revealed that mothers with twin pregnancy were four

times likelihood of delivering a preterm baby. In Kurdistan province, Northwest of Iran, a population-based case- control study was conducted from October to December 2013. The study revealed that passive smoking during pregnancy, pregnancy interval < 3 years, multiple pregnancy, gestational age, low birth weight, abnormality and birth asphyxia were the main factors related to the NDs. Also NMR was higher in males and in cesarean section deliveries. In this study, LBW had increased risk of death in the neonates by 32 times as compared to other factors. The study recommended devolvement of maternal and neonatal services, proper planning and development of strategies that will help reduce the above risk factors. In addition, it emphasizes on encouraging mothers to have natural childbirth in health centers and eliminating unnecessary caesarean as the priority intervention in the healthcare system (Ghotbi N *et al*., 2017) [15]. Etambuyu & Charles (2015) [12] did a study in Zambia using a cross-sectional design, where data were collected from the 2007 Zambia DHS. Target population was women who reported having delivered a live baby within the five years before the survey. Only records of those infants who could have lived through the first 28 days were assessed. Among the 6435 LB, 49.8% were males, 3.4% died during neonatal period. LBW, overweight and those born from mothers with higher education had a higher risk of NDs. The researchers reveal that future strategies need to account for varying setting of specific epidemiological contrasts. According to Chatupa *et al* (2016) [26] in a study done in Zambia, 41% of neonatal deaths were due to prematurity in 2014, and 27% in 2015, prematurity was the main factor as compared to infections and sex of the neonate. A study in Ethiopia employed a community-based mixed-method approach between September and October 2016. From the study, about 11% of neonates died before reaching five months of life, mainly during the first week. The risk of dying from LBW during the neonatal period was found to be nearly four times the current estimated national NMR (Eshete *et al*., 2019) [2]. Seid SS *et al* (2019) [40] found out that LBW was a major cause of NDs in Ethiopia representing 8% of NDs. The same picture was noted in Uganda by Arunda, M.O. *et al* (2018) [3] where about 75% of all LBW died during the neonatal period by 2011. This shows that the health system has been inadequate in its efforts to save LBW babies. Emphasis is on provision of focus ANC and quality PNC services among others to reduce the mortality rates.

Failure to establish breathing at birth is characterized by failure of the baby to cry at birth or having Apgar score of six and below at one, five and ten minute after birth (Apgar V, 1953). The Apgar score is a method that is used to determine the health of neonates against infant mortality(Apgar V, 1953). According to Ehrenstein (2009) [45], Apgar score of seven and above is considered as normal, while six and below calls for immediate resuscitation measures.

Roy Adaptation model: The compromised process explains that the modes and subsystems inadequately meet the environmental challenge. For example failure to establish breathing at birth may lead to deficient oxygen supply to the brain cells resulting in brain damage. In this study, the risk factors (described in contextual stimuli) acting as external factors may influence the physiological adaptation of the neonate for instance causing the inability of the baby to establish breathing at birth.

III.   Method used in the study

This section provides the description of the process andmethod used in carrying out the research study. The chapter has the following sub-headings: research design, research locale target population, sample size and sampling technique, research instruments, instrument validity, instrument reliability, data collection procedure and dataanalysis techniques.

This retrospective cohort study adopted a Descriptive Correlation design. Correlation design involves measuring two variables; low birth weight in relation to neonatal deaths (Mugenda &Mugenda, 2003) [32]. Retrospective review of files was conducted for neonates who died before 28 days oflife for the period 1st Jan 2018 to 31st Dec 2018 using a medical abstraction tool and interview checklist for key informants in order to achieve the objectives of the study. The events that had already occurred that led to NDs were collected and analyzed.

Kericho County Referral Hospital (KCRH) is a referral hospital for other health facilities in Kericho County and a teaching hospital for medical students and interns. It is a government tier 3 health facility located in Township location of Ainamoi constituency, 300 metres from town. It has a bed capacity of 350, and situated in a 22 acre piece of land. It has a catchment population of 92,396, with majority of the patients from rural areas. It provides comprehensive services; curative, promotive, preventive and rehabilitative services. The hospital constitutes various service providers with nurses being the majority. Newborn unit is confined within the maternity ward, and admits both term and preterm babies. It has 8 bed cots, 5 incubators, 2 phototherapy equipment, 2 suction units, 1 oxygen set and 5piped oxygen, all of which are operational. The facility reports an average of 430 LB per month, and a monthly admission of about 17 neonates in NBU, more than three quarter are preterm babies. This comprised of files of totalneonates who died at KCRH before 28 days of life thatoccurred during the study period (= 154 cases). The choiceof this population is important because they

contribute to 69% of infant mortality in the hospital (DHIS report 2018). These covered records of neonates admitted during the study period at the facility and should have died within 28 days of life. Also staffs working in newborn unit that were present during the study period. Apgar score of six and below at five minutes after birth will be included in the study. Cover the records of all stillbirths and infants who died after 28 days of life, and neonates who died outside of the study period or at home. Apgar score of six and below at one and ten minutes after birth will be excluded. Also, staffs working in newborn unit who were not present during the study period. A sample is a sub-set (part) of the population(Kothari & Garg, 2012).

In this study, sample size (n) was determined by using Yamane (1967:886) formula = N/1+N (e) ^{2}, where; N = Total population; 154 neonatal death records and 14 HCWs e = desired precision / margin error; 0.05 for neonatal death records / Files: n= 154/1+154 (0.05*0.05) n= 112 records/files For HCWs: n= 14/1+1 (0.05*0.05) n= 14 HCWs

The tool that was used in this study was developed by the researcher based on the literature on risk factors associated with neonatal deaths in low and middle income countries. The transcription form and interview checklist were designed in English, to be used by the researcher and 2 research assistants. Part of the audit tool was adopted from the following study on risk factors or causes of failure to establish breathing at birth; in Kakamega by Kiptui (2017). The transcription form had 3 sections where qualitative (secondary) data was collected: first section captured low birth weight in relation to neonatal deaths, second section was on failure to establish breathing at birth in relation to neonatal deaths; and third section was on neonatal infections in relation to neonatal deaths. These sections were filled by extracting data from neonatal records. The interview checklist had structured questions based on the study objectives, data was gathered quantitatively (primary data) from the relevant staffs. Both open and closed questions were employed in this mixed study.

After data collection, the researcher checked the instruments for completeness and clarity. Data was analyzed both quantitatively and qualitatively according to the study objectives. Descriptive statistics was used to summarize qualitative data. Analysis involved editing, tabulating and coding the responses. Data was processed using the Statistical Package for Social Science (SPSS) computer software version 21.0.Frequency distribution, percentage, means scores and standard deviation were computed and entered into a table. In quantitative analysis, data was processed by first categorizing and discussing response for each item according to themes (thematic analysis), before editing, coding, and reporting through descriptive narrative of the views, experience and opinions of the respondents. Descriptive statistics namely frequency distribution and percentages were used to analyze the coded response. Chi- square was used to measure the association of the variables. Correlation coefficient was used to measure the strength of the relationship.

IV.   Results

This section gives a preview of how the transcription form and interview checklist distributed were returned for analysis. According to Mugenda and Mugenda (2003) [32], response rate of 50% and above is deemed as satisfactory and 70% and above is excellent. This study according to Mugenda and Mugenda (2003) [32], therefore, met the threshold to be considered above excellent for analysis. The first objective of the study was to establish low birth weight in relation to neonatal deaths at Kericho County Referral Hospital. To achieve this, the researcher interrogated various aspects from both the transcription tool and the interview schedules administered to the health worker who worked in the year 2018. The findings of this study are in agreement with the findings of Lawn, Cousens & Zupan, (2010) [25], who in the study found out that more of the neonatal births in NBU are preterms. The findings also found out that there were 4 newborns that had missing data on birth weight. The findings of this study are in line with the findings of Zile, Ebela & Rozenfelde, (2017) [54], whose study concluded that low birth weight is not responsible for neonatal deaths. Further finding sought to find the relationship between preterm birth and neonatal deaths, the study found out that preterms normally have underdeveloped organs hence are at a higher risk of experiencing complications.

V.   Discussion

It was found out that preterm birth and neonatal deaths relate together since preterms normally have underdeveloped organs hence are at a higher risk of experiencing complications. Also, preterms are at higher risk of respiratory distress, severe birth asphyxia, infections, hypothermia. Also small gestation age and neonatal deaths relate together in that small gestation age are prone to complications such as infection, feeding problems whichmay result to neonatal deaths.

On matters of weight, 57% of the newborns were not admitted due to low birth weight which shows that admission of newborns due to low birth weight were because of multiple births, 56.36% of the findings were due to; prematurity, polyhydramnios, pre-eclampsia, HIV exposed infants, induced abortion, Placenta praevia, inevitable abortion. The most common factor associated with low birth weight was prematurity. However, low birth weight is not the main cause of neonatal deaths since 90% of the findings exhibit it. The underlying causes for these death not caused by low birth weight were found to being second twin, 3rd triplet,

jaundice, 1st twin, birth defect and delay referrals in some cases. Health workers argued that low birth weight was a common cause of admission in the newborn unit and factors commonly associated with low birth weight include; poor nutritional status during ANC, pre-eclampsia, diabetes, preterm labour, malnutrition, anaemia, antepartum hemorrhage, severe hyperemesis, poor support system. On whether low birth weight babies receive quality care in Kericho Referral Hospital, majority of the health workers agreed to that. Low birth weight is associated with neonatal death because it causes complications ranging from feeding problems resulting in hypoglycaemia, apnea, bleeding, hypothermia, sepsis, hypoxemia and jaundice. Furthermore, it was realized that during birth. However, babies who fail to establish breathing during birth are given quality care in the hospital in Kericho Referral Hospital and that failure to breath during birth is associated with neonatal deaths. The reasons for failure to breath during birth are; severe respiratory distress syndrome, hypothermia, meconium aspiration syndrome, which lower the oxygen levels hence causing deaths.

VI. Conclusion

The results support that low birth weight, breathing failure at birth and neonatal infections are risk factors that cause neonatal deaths in Kericho Referral Hospital. Majority of newborns were admitted due to low birth weight because of multiple births and it was common cause of admission in the newborn unit. On how low birth weight relates with neonatal death, the study concluded that 10% of the neonatal deaths were due to low birth weight complications. However, low birth weight is not the main cause of neonatal deaths since there are other underlying causes. Low birth weight is associated with neonatal death because it causes complications ranging from feeding problems, underdeveloped organs and risk of hypothermia among others. Low birth weight babies receive quality care in Kericho Referral Hospital

Majority of newborns were found to have an Apgar score of 6 and below in 5 minutes after birth and had resuscitation done on them. Majority of the newborns died due to failure to breathe during birth however there are other underlying causes of deaths that did not necessarily happen due to failure to establish breathing. The study further concluded that failure to breathe at birth is a common cause of admission and there are commonly associated conditions with failure to establish breathing at birth. Finally, the study concluded that babies who fail to establish breathing problems at birth are given quality care in the hospital in Kericho Referral Hospital.

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