

Prevalence and Factors Associated with Neonatal Mortality Among Neonates Admitted at Kigeme District Hospital, Rwanda

Author: KWIZERA Patience Vainqueur (Department Public Health, Mount Kenya University)

Co Authors: 1. Dr. Rosemary Okova (Department, Public Health, Mount Kenya University)

2. Dr. Michael Habtu (Department, Public Health)

Abstract: The neonatal period is the most vulnerable time for child survival and it is considered a global public health concern. However, the contributing factors are not well acknowledged. The global neonatal mortality rate is 17 deaths per 1000 live births in 2020 and even Rwanda faces this crisis with a neonatal rate of 18 deaths per 1000 live births in 2022. The method was a cross-sectional study through responding to the questionnaires given prospectively to patients including neonates who were admitted from July 2022 to September 2022. Furthermore, their mothers have been consulted. The sample size was 298 neonates. The analysis of results has been performed in SPSS Version 20.0. The findings revealed that the prevalence of neonatal mortality is 4.4% seen at Kigeme District Hospital within the study period. Variables have been summarized using frequencies for univariate, bivariate, and multivariate data analysis. The findings from multivariate logistic regression showed that the factors associated with neonatal mortality rate include the level of education of illiterate mothers (AOR=0.25, 95% CI: 0.11-0.53, P=0.037), Occurred birth asphyxia (AOR=0.37, 95% CI: 0.18-0.79, P<0.001), maternal gestation about pre-term (AOR=2.53, 95% CI: 1.12-5.73, P=0.040), use of herbal medicine (AOR=7.47, 95% CI: 0.22-1.71, P<0.001). The health of the mothers and the neonates should be sustained mainly in delivering periods ensuring the reduction of the patients' and health professionals' delays. This study gave recommendations towards the National level (MOH, RBC), Kigeme District Hospital to strengthen preventive strategies to fight against the increase of neonatal mortality rate in the population besides empowering the workforce as implicating the community in the preventive measures of plummeting the neonatal mortality rate. This study has been a source of information, data, and reference for further studies to get related information.

Background: The first twenty-eight (28) days of life as the neonatal time is the most susceptible time for a youngster to be alive. Worldwide, children have the advanced possibility of dying within their first month of life at an average rate of ten (17) deaths per one thousand (1,000) live births. (UNICEF, 2021). The region of sub-Saharan Africa has the highest neonatal mortality of 27 deaths per 1000 live births followed by central and southern Asia which has 23 deaths per 1000 live births with 36% of global newborn deaths (WHO, 2022). (WHO, 2022). Rwanda's neonatal mortality rate changed from 58.8 deaths per 1,000 live births in 1969 and the Rwanda Demographic Health Survey 2019-20, 2021 stated that the neonatal mortality rate was 39 deaths per 1,000 live births in 1992, 44 deaths per 1,000 live births in 2000, 37 deaths per 1,000 live births in 2005, 27 deaths per 1,000 live births in 2010, 20 deaths per 1,000 live births in 2014-2015, 19 deaths per 1,000 live births in 2019-2020 to 18 deaths per 1,000 live births in 2021 (UNICEF, 2023). This diminution in child death rate happened from aggregate crosswise national and localized interventions planned to gain accession to effective care (Gupta, 2018). Despite many attempts, there are still many challenges concerning neonatal well-being whereby the proportion close to 3/4 of neonatal deaths passes off in the 1st seven days of life (Lawn J. E. et al., 2005).

Methods: The design of the research makes clear the basic approaches for embracing compulsory information. This study used a cross sectional study. Concerning informations from the population at one explicit point in a period of time. The target population was 1323 with 298 neonates accompanied by their mothers as sample size. It has been conducted using quantitative approach through responding to questionnaires concerning the challenges faced by mothers and neonates causing occasionally new-born bereavements in a community related factors that are variables, they are also found in the international classification of diseases ICD-10.

Results: *The findings showed that the number of babies who passed away were 13(4.4%) and the healthy babies who survived to live were 285(95.6%). Concerning the maternal age most respondents are between 18 and 35 years old. They were 245 with a percentage of 82.21%, Furthermore, 280 rural resident respondents are more numerous than urban respondents with a percentage of 93.96%. This shows that mothers who are young have little knowledge about factors affecting neonatal death that the community health workers should help them after getting pregnant and the government should continue to improve the promotion of health through teaching the community because they are also illiterate. There are sociodemographic-related factors that are associated with neonatal death as exemplary; level of education with a p-value of 0.04, and gestation with a p-value less than 0.001, they have been found to have a statistically significant correlation between mothers and neonatal death. There is also an effective association between gestation and neonatal mortality rate (AOR=2.53, 95% CI: 1.12-5.73, P=0.04) inferring that the mothers who used pre-term gestation were about 3 times at risk of having new-born death compared to mothers who used a near term gestation. Findings showed an association between neonatal jaundice and neonatal mortality rate (AOR=1.62, 95% CI: 0.45-5.89, P=0.99) implying that neonates with neonatal jaundice were about 2 times more at risk of having neonatal death compared to neonates without neonatal jaundice. Some mothers believe in bad spirits that they can protect their babies or harm them. That is why they used to go to consult local traditional healers for help who used to manipulate herbs mixing with bad spirits and provide their medicines to mothers. So many neonates suffer complications from the herbs consumed as herbal medicines.*

Conclusion: *Based on findings of this research, the prevalence of neonatal mortality rate among neonates admitted in Kigeme district hospital is 4.4%. The related factors found after the bivariate analysis are prematurity, birth asphyxia, history of hygiene, health services and patient delay. Those results will help as a contribution in the provision of recommendations to health establishment at national, regional level for better formulation of new future plans, approaches, policies against the increase of neonatal mortality rate, eventually ensuring their implementation.*

Keywords: *Prevalence and Factors, Neonatal Mortality, Kigeme District Hospital, Rwanda.*

1.0. Introduction

The probability of dying in the first month is known as neonatal mortality (2019-20 RDHS, 2021). The number of deaths that happened in the period of the first twenty-eight (28) accomplished days of life per 1 000 live births in the granted period of a year is known as the neonatal mortality rate. This is reasoned as a help for the mother and their babies' health care services. It has two main parts: early neonatal deaths, which go on in the first week of newborn life, and late neonatal deaths, which go on after that week till to the end of this period of 28 days. Globally, the first country in having an elevated neonatal mortality rate is India with 490 (425-558) deaths per 1000 live births, the first in Africa is Nigeria with 271 (199-374) neonatal deaths per 1000 live births (WHO, 2022).

The first twenty-eight (28) days of life as the neonatal time is the most susceptible time for a youngster to be alive. Worldwide, children have the advanced possibility of dying within their first month of life at an average rate of ten (17) deaths per one thousand (1,000) live births, 2.3 million children just about 6400 neonatal deceases every day, consequently close to three quarters (3/4) dying within the first week, with one third (1/3) dying on the first day in 2019. (UNICEF, 2021).

The region of sub-Saharan Africa has the highest neonatal mortality of 27 deaths per 1000 live births followed by central and southern Asia which has 23 deaths per 1000 live births with 36% of global newborn deaths (WHO, 2022). 2/3 of neonatal deaths were liable for causes that can be prevented. The poorness of families and low educational levels continue to play an operative function in causing child mortality. A newborn from sub-Saharan Africa has 10 times more likely to die than a child born in high-income developed countries in the first month (WHO, 2022).

Save the children federation, 2023 stated that the current neonatal mortality rate in Rwanda is 18 deaths per 1000 live births, 4.4% was the ratio mentioning the annual reduction in newborn mortality rate 2000-2020, and 45% was the proportion of under-5 newborn child deaths. There are also 17 deaths per 1000 births of stillbirths. In 2019, they were many leading causes and factors associated with neonatal in Rwanda whereby they constituted 1% of diarrhea, 5% of pneumonia, 48% of preterm birth complications, 22% of intrapartum-related events, 5% of sepsis and other infections, and 11% of congenital abnormalities. Rwanda's neonatal mortality rate changed from 58.8 deaths per 1,000 live births in 1969 and the Rwanda Demographic Health Survey 2019-20, 2021 stated that the neonatal mortality rate was 39 deaths per 1,000 live births in 1992, 44 deaths per 1,000 live births in 2000, 37 deaths per 1,000 live births in 2005, 27 deaths per 1,000 live births in 2010, 20 deaths per 1,000 live births in 2014-2015, 19 deaths per 1,000 live births in 2019-2020 to 18 deaths per 1,000 live births in 2021 (UNICEF, 2023). This diminution in child death rate happened from aggregate crosswise national and localized interventions planned to gain accession to effective care (Gupta, 2018).

But unfortunately, neonatal death remains a perilous prevailing health problem in the country whereby newborn demises attack babies even after the first month of their life. That is why the current situation of Rwanda's post neonatal mortality rate is 14 deaths per 1,000 live births in 1969 (RDHS, 2021). Afterward, there are considerable mechanisms that are being put in place to manage the reduction of this neonatal mortality by the World Health Organization, Ministry of Health making hope that this predicament will end through all political, economic, social, educational, medical, personal will, efforts, labors, interventions. The Millennium Development Goal Four was to reduce infant mortality by two-thirds (2/3) by the end of 2015 resulting in an exceptional focus on child health and between 1990 and 2015 there should be a reduction of 52% in sub-Saharan Africa, from 179 to 86 deaths per 1000 live births (Gupta, 2018). The children confront the utmost risk of death within the first 28 days after birth (WHO, 2020).

Dissimilar-aged children, who frequently die of infections, neonates almost often undergo complications of preterm birth in addition to congenital conditions. There are many other factors contributing to neonatal deaths as low birth weight, HIV, infections, inadequate birth separation intervals, malaria, miserable motherly nutrition, the age of the mothers (below age 18 or above age 34), smoky attitude and alcoholic beverage abuses.

Neonatal death occurs in the region as well as a global health burden confront whereby nurses, doctors, and scientists work day and night to rummage around for the reduction of the new-born death rate, the treacherous bad effects of neonatal mortality are that there are some cases whereby we lose the children in consort with the mother otherwise one of them, this means that this provides orphans in the family and abortion, this canister causes many depressions, various psychological harms. Despite many attempts, there are still many challenges concerning neonatal well-being whereby the proportion close to 3/4 of neonatal deaths passes off in the 1st seven days of life (Lawn J. E. et al., 2005).

As ideal, after the first hour of life, newborns ought to obtain eye care suggested immunization for instance birth dose of OPV, vitamin K and Hepatitis B vaccine. Generally, they are inclined to infections, malnutrition, asthma, and so forth. The majority of all neonatal deaths (75%) happen during the first week of life; roughly universally annually around one million newborns die within the first 24 hours. (WHO, 2022). As actual, the main problem is that there are still factors that contribute to neonatal death that have been resistant to being eliminated in society for example pneumonia, diarrhea, birth defects, and malaria. Even many newborns suffer from malnutrition in their mother's womb (WHO, 2022).

Some actions could be implemented to avoid neonatal mortality including making use of the Rapid SMS system in the presence of newborn danger signs; equipping along with improving neonatal health units in referral hospitals in addition to district hospitals moreover, instructive training and preparation of community health workers, midwives plus neonatal nurses to ensure the enhancement of their ability in offering vital new-born care. (MOH, 2018). From my concern, neonatal death should be reduced, and the initiative of protecting the neonates should start from the family. This implicates to increase healthcare workforce, advanced communication, and medical types of equipment for instance to upsurge ambulances as Dr. Tharcisse Mpunga who were the Minister of state in charge of Primary Healthcare at the Ministry of Health told the New Times that there were only 277 ambulances in Rwanda (Ntirenganya, 2020). The main objective of the study is to identify the prevalence and factors associated with neonatal mortality among neonates admitted at Kigeme district hospital, Rwanda. The study sought to assess ensuing specific objectives:

- i. To identify the prevalence of neonatal mortality among neonates admitted at Kigeme district hospital, Rwanda.
- ii. To establish factors associated with neonatal mortality, neonates admitted at Kigeme district hospital, Rwanda.

2. Review of Related Literature

The world has undergone considerable growth in infant survival ever since 1990, from 5.0 million to 2.4 million neonatal deaths in 2019. Each year in Africa, about ¼ of a million women pass away for gestation for connected reasons and roughly 1 million offspring are deceased; among them, at least 300,000 die through obstetrics labor services (WHO, 2021). On the other hand, there is the theory of change that is used in mentioning the manner and the rationale of how the initiative works; to define reasonable and testable paths to achieve given goals. Moreover, it is involved in planning interventions, evaluation and monitoring, engagement of stakeholders, analysis of lessons learned to inform future directions, and rising policy-based practices in the initiated works. This theory is used in neonatal health to improve health outcomes concerning mothers' and newborns' health, reducing stillbirths and measuring progress towards preceding targets. (Marek Lalli et al, 2018).

However, there should be activities in decreasing inequities in agreement with the doctrines of worldwide health coverage, together with concentrating on the requirements of neonates in humanitarian and delicate situations, empowering and strengthening mothers, and societies to partake in, requiring eminence neonatal care; reinforcing measurement plus responsibility to take care every neonate then plummeting stillbirths. (WHO, 2021) The majority of neonates pass away throughout the 1st day afterward delivery caused by circumstances such as prematurity, asphyxia, and infections that can be prohibited or cured through prevailing involvements. The 1st day is taken as the riskiest stage period for both the mother and the baby. (Samara Aboubaker et. Al, 2014).

World Health Organization works with ministries of health of different nations and partners fortifying in advance within particularly neonatal health care, developing the eminence of motherly and infant care as of pregnancy to the whole postnatal stage, counting intensification of midwifery, enlarging prominence services for short and ill neonates, throughout escalation of neonatal nurture. The factors that led to neonatal deaths are female diagnosis as age range; educational level; wealth, income; occupation; matrimonial status; the number of prenatal cares, kinds of delivery, and birth weightiness. (Rosângela Aparecida Pimento Ferrari, 2013). Children die after being born concerning some malformation for example prematurity and practices that can stimulate infections. Syphilis and malnutrition can induce cretinism and around 1% of infants have congenital abnormalities, most neonates at a proportion of 15% are underweight (WHO, 2006). Ever since reasons for newborn deaths show a discrepancy by nations depending on the accessibility besides the impact of health care, it is important to understand the relationship between neonatal mortality and these factors. (Jehan I., 2009)

Infant death during the first 28 days of life is known as neonatal mortality (WHO, 2019). In the world, there are about 5 million in each year among them 98% in developing nations. Different conditions may affect neonates that can cause stunting and disablement through neurological and psychological feature damage (Adnan A. Hydra, 2003).

2.1 Prevalence of neonatal mortality

The first country in the world in neonatal mortality rate is India with 490 (425-558) deaths per 1000 live births, the second worldwide and the first in Africa is Nigeria with 271 (199-374) neonatal deaths per 1000 live births and globally they are followed by Pakistan 244 (198-298) deaths per 1000 live births, Ethiopia 97 (77-123) deaths per 1000 live births, Democratic Republic of Congo 96 (56-163) deaths per 1000 live births, China 56 (49-64) deaths per 1000 live births, Indonesia 56 (45-70) deaths per 1000 live births, Bangladesh 51 (45-57) deaths per 1000 live births, Afghanistan 43 (32-55) deaths per 1000 live births, United Republic of Tanzania 43 (30-62) deaths per 1000 live births (WHO, 2022).

In Dil Chora Referral Hospital neonatal units have been surveyed whereby 376 newborns were selected aiming to find out the neonatal death determinants. The prevalence has been 11.4 % (95% CI: 9.44, 13.36). They admitted neonates with different medical complications, nearly 40.4% of the mothers of new-borns experience index pregnancy complications, premature rupture of the membrane (AOR=5.79,95% CI=2.08-16.1), birth weight of 2500g (AOR=3.96,95% CI=2.08-16.1), hypothermia (AOR=2.54,95% CI=1.1-6.02), induced labor (AOR=4.45, 95% CI=1.53-12.94) (Gelila Thomas et al, 2022)

In Ethiopia, the prevalence of neonatal mortality was 57% within 391 medical records of newborns retrieved from 403 neonates admitted. The results presented that 23.5% of neonates had prematurity, 30.2% had a low birth weight, and 2.6 % had HIV-positive mothers. Antenatal care, cesarean section delivery, birth asphyxia, and fever are factors contributing to neonatal demises. They stated that health facilities should improve antenatal care services, intrapartum and standardized care for admitted neonates. (Abay Woday Tadesse et al, 2021). The study done on the prevalence and factors associated with neonatal mortality among neonates hospitalized at the National Hospital Nouakchott, Mauritania, used a cross-sectional study. They have found that 332 neonates died from 669 neonates (34.7%), and 159 neonates deaths occurred within the 1st six days of life (Abdellahi Weddih et al, 2019).

2.2 Socio-demographic factors

Health promotion involves education which is the key to knowledge and skills including awareness of the effectiveness of accession to prenatal care, and economic and societal resources (Tiffany Green et al., 2019). In seeking to benefit, requesting, and using health services well-read mothers compete with educated women. This will enable educated mothers to use modern drugs rather than traditional drugs to be independent to the extent of spending enough money on caring for their children (Girmay et al., 2019).

The economic development of the family contributes to the well-being of the members mainly neonates in accessing enough hygiene, enough nourishment, and health services. In poverty, there are many risks for neonates to suffer from diseases, stunting, death, and lack of medication services because their costs are not affordable to those families. In 1980, half of the millions of babies died for the reason of poverty. Therefore, economic improvements could lead to child

survival in a major way. (Stella T. Lartey et al., 2016). The residence is a crucial feature of the generative well-being of the neonates and this can help to get qualified medical services.

To live so far, from the health facility, there are circumstances exposing to infections and diseases and even home delivery which by the way have high risks of abortion, birth complications, and neonatal death because they lack a sanitary environment, equipment, and skilled health provider so there is a high mortality rate than the baby born at the health facility (Justice Ajaariet et al., 2012). Elderly women undergo a rise of inborn difficulties such as hypertension, diabetes (Naoki Kozuki et al., 2013). There have been ages of advanced peril gestation; a strategy has been done with and without antepartum care surveillance for advanced-age mothers. There have been few deaths for the mothers with antenatal care as they have got 4 deaths per 1000 live births when there were 5 deaths per 1000 live births. In conclusion, antenatal care services are so substantial in reducing neonatal death regardless of the age of the person (Chaudhary et al. 2017). Multiple pregnancies such as twins, and triplets' pregnancy are connected with a larger risk to die or being born preterm at higher rates for together the fetus and the mother when matched up employing singleton pregnancy. In less developed countries, this was six times elevated in neonates. In Nigeria, throughout the survey of 38 months, the neonatal mortality was 166 (19.4%), and the total is 854 entrances. Sepsis, prematurity, and birth asphyxia peaked on the list of reasons for death at 30.7%, 19.3%, and 24.1%. Correspondingly in addition to the fact that post maturity was at least 1.2% as well as intrauterine growth restriction. (Ezechukwu C. C., 2004).

2.3 Health factors

Parity can alternate neonatal birth results, such as intrauterine growing limitations, and premature delivery. Null parity can affect the mother to get straightforwardly barricaded labor, whereas upper parity can influence the mother to get hypertension and uterine injuries (Naoki Kozuki et al., 2013). The placenta is the body part linking female parents and fetuses during maternity used in feeding the baby and for removal of body wastes, so placental hurt, and injuries often cause fetal death. The broken placental running can have leading implications for the surviving infant (Annemiek M. Roescher, 2014), After knowing that the placenta influences fetal growth and as its alteration can elicit a fetal death this shows placental factors that are associated with fetal bereavement and suddenly death occurring after a short period after being born (Johanne Dypvik et al., 2019).

When female parents are undernourished, have unhealthy suffering illnesses, or receive deficient antepartum and nativity care, most of their babies are born with low birth weight, and even suddenly have premature unplanned death (Satrinawati et al., 2014). Keeping the mother so safe can improve her life and her newborn whenever she gets enough adequate food, antenatal, postnatal care, and anodyne delivery period care as it has been shown by many studies (Anne Tinker & Elizabeth Ransom, 2002). Another problem causing many babies' death is preeclampsia occurring mostly at the 20th week of gestation or accurately after pregnancy. Some clues of pre-eclampsia reckon some proteins in the urine, modification in sight, and terrible headaches (March of Dimes, 2021). Premature delivery, underweight, sepsis, and birth asphyxia caused by a deficiency in oxygen during birth, there are other neonatal problems including also intraventricular bleeding, Necrotizing gastroenteritis, unhealthiest lung or heart defects, and genetic and brain bad conditions. (March of Dimes, 2021).

2.4 Maternal obstetric factors

Innocuous maternity aspects can raise aid during labor considering the increase in the exigency of obstetric labor services. Self-same pivotal interventions are serving for maintaining a safe mother and her baby as to have the attendance of a community health worker associated with nurses and midwifery skills health providers. (Renay Weiner et al., 2003). There are a few prevailing health issues that impact female parents and new-born infants called antenatal care visits which assist in determining as well as treating mothers, new-borns' illnesses such as hypertension, bleeding, and diabetes (Tesfalidet Tokelau et al., 2019). This involves working with community health workers. They help a lot in following every step needed by nurses. They have been trained to intervene in any case the pregnancy can be anxiety, they can guide the mother on how to follow antenatal care visits that normally amend the aliveness of new-borns straight omitting to drop down to neonatal deaths. Step-up, the pregnancy with adverse consequences to be acknowledged before. (Amsalu Taye Wondemagegn et al., 2018).

Birth control reduces unplanned pregnancies mainly because it helps birth spacing (Cleland, 1992). There is a linkage between above birth spacing and infant aliveness recognized for decades. (Jean Christophe Fatso et al., 2013). In add-on, women with numerous infants can more easily undergo maternal mortality as well as new-borns death (Anne Tinker et al., 2002). Different conditions may affect neonates that can cause stunting and disablement through neurological and psychological feature damage (Adnan A. Hydra, 2003).

2.5 Sister Callista Roy Adaptation Model (Alligood, M.R., & Fawcett, 2017)

This model was initiated by Sister Callista Roy in 1976. She defined the human being as a set of interconnected systems (social, biological plus psychological). The model stated that the person is a biopsychosocial being in a progressive interaction with environmental change. Furthermore, this study presents the usefulness of this model in the care of persistently ailing patients preparing them to get complications caused by the scrupulous disease. This study used this model principally for the physiological mode of adjustment with the intent to enlighten the factors associated with neonatal death prevalence because this was instigated following Roy's scrutiny of the aptitude of neonates to cope with situations and showed that stimuli from the external and internal environments that are employed to the peripheral and central nervous system as inputs, and affect electrolytes and acid-base balance. (Sieloff et.al, 2014). This model stated that a human being has a regulator system and the cognitive system in addition to 4 adaptive models including role function mode, self-concept mode, interdependence mode, and physiological mode. The cognition system explains a prime coping progression linking 4 cognitive-emotive channels: emotion, judgment, perceptual and information processing, and learning. She has been involved in the regulator system as an essential kind of adaptive progression responding reluctantly through chemical, neural, and endocrine coping channels that can be affected by contextual, residual, and focal stimuli. The physiological mode is the most relevant to neonatal death and it elucidates the physiological procedures concerned with the utility of living human beings and their activities. The essential requirements of this mode are activity, rest, protection, and oxygenation, The uncertain procedure explained that the systems and mode are not sufficient to meet the environmental confrontations, for instance, dropped off oxygen in birth asphyxia conditions that auxiliary lead to numerous organ failure that can cause even new-born death.

3. Research Methodology

3.1. Research Setting

This study has been carried out at Kigeme district hospital which is located in Nyamagabe district, among the best 5 ranked district hospitals in service delivery. According to the hospital records between July 2022 and September 2022, about 441 births are delivered every month. It is also accessible.

It serves a large population from the Nyamagabe district and guests. As a district hospital, it supervises 10 health centers. The neonatal unit is well-equipped for giving qualified clinical health care services. There are doctors, nurses, and midwives working day and night to comfort the newborn and the mother.

3.2. Target population

The population of the study was composed of the births ensue during the year 2022 (July 2022 up to September 2022) in the hospital signifying the neonates admitted with medical complications, according to Rwanda Health Management Information System (HMIS), the annual hospital reports recorded that about every month 441 births are delivered (MOH, 2021), where approximately in every 37 new-borns who are received per day 5 of them have medical complications that lead to deaths so that the estimated population was 1323 in 3 months.

3.3. Sampling size determination (Cochran, 1977)

$$n_0 = \frac{Z^2 pq}{e^2}$$

Z refers to statistic corresponding to level of confidence that aimed at 95%

p refers to the expected prevalence **n** refers to the sample size **e** refers to level of the precision

that P is the (estimated) ratio of the population that has the traits in question above. So, p= 0.05, we used the 95% as the confidence level which gives in normal tables the z values of 1.96 in normal tables. This shows that the sample size was 298 neonates.

3.4. Data collection methods

A designed data collection sheet was developed as a questionnaire helped by a literature review as well as taking into consideration objectives. Each section transcription form has been filled. Neonates' files and their relevant mothers' files

have been explored to come across information and therefore a piece of data has been collected using registers of nurses from the time of admission towards discharge. The first section encompasses gathering information concerning maternal age, gravida, antenatal visits, birth weight, gestation, gender of the newborn, residency, the temperature of admission, length of stay, maternal BMI, fetal presentation, and place of delivery. The second section restrains the information about the mother-associated factors to neonatal death such as differences in labor duration, APGAR (<5 Min), APGAR (>5 min), parity, maternal education level, delivery assistance, number of pregnancies, maternal infection during pregnancy, iron consumption during pregnancy, history of preeclampsia, maternal illness, contraceptive use, the birth interval at least two years, placental hurts, injuries, obstetrics service complications, comorbidities, cyanosis.

The third section continues with other factors such as new-born associated factors including resuscitation of the neonates, heart impediments, immediate breastfeeding, pre-lacteal breastfeeding, neonatal illnesses, prematurity complications, birth injury, neonatal infections neonatal cry after birth, and environmental factors.

3.5. Procedures and data collection

To systematically attain the needed information, data has been collected in our district hospital, comprising birth weightiness, age, birth spacing, marital status, habitation, absenteeism or occurrence of infection for both the mother and the baby, size, anemia, sex of the new-born, number of pre-birth care visits, pantographs, and other important information.

After consulting previous hospital reports and other developed data collection grids. These included data related to economic status indicators; awareness of risky gestation; danger symptoms in neonates; postnatal care, and usage of traditional medicine. This focused also on factors available from tedious neonatal health care systems problems being responded to by midwives, and mothers (Fauste, 2017).

4. Research Findings And Discussion

4.0. Characteristics of study population

The respondents were mothers and their neonates. They have socio-demographic, obstetric, and gynecologic, clinical characteristics. Using many variables affecting the neonatal and maternal normal operative lifestyle of the body.

4.1. Socio-demographic characteristics of respondents

The socio-demographic characteristic of respondents is classified in the table below using different variables including mother-related factors such as maternal age, residence, marital status, level of education, employment, services admitting units, and alcohol consumption during pregnancy (Table 4. 1.1.). There are also neonatal related factors as the gender of the newborn, birth weight, APGAR, gestation, fetal presentation, breastfeeding (Table 4. 1.1.2).

Table 4. 1.1.: Sociodemographic characteristics of mothers

Variables	Frequencies (N=298)	Percentages (%)
The maternal age		
15-17	52	17.45
18-34	245	82.21
≥ 35	1	0.34
Residency		
Rural	280	93.96
Urban	18	6.04
Marital status		
Married	227	76.20
Single	71	23.80
Level of education		
Primary	196	65.80
≥Secondary	76	25.50
None	26	8.70

Parents employment		
Employed	31	10.40
Self-employment	22	7.38
Unemployed	245	82.21
Use of alcohol beverages		
Yes	35	11.70
No	263	88.30
Hospital admitting units		
Maternity	185	62.08
Neonatology	113	37.92

Source: Primary data, 2023

Concerning the maternal age most respondents are between 18 and 35 years old. They were 245 with a percentage of 82.21%, Furthermore, 280 rural resident respondents are more numerous than urban respondents with a percentage of 93.96%. Regarding marital status, most respondents were married with a frequency of 227 (76.2%) followed by single respondents who were 71(23.8%). Relating to the level of education most respondents had primary level followed by secondary level and their respective frequencies are 196 (65.8%), and 76 (25.5%), unfortunately, 26 respondents didn't get a chance of studying at a percentage of 8.7%. This shows that mothers who are young have little knowledge about factors affecting neonatal death that the community health workers should help them after getting pregnant and the government should continue to improve the promotion of health through teaching the community because they are also illiterate.

Table 4.1.2.: Sociodemographic characteristics of neonates

Variables	Frequencies (N=298)	Percentages (%)
Gender of new-born		
Female	123	41.3
Male	175	58.7
Birth weight/Grams		
<2500g	102	34.2
2500-4500	194	65.1
>4500	2	0.7
Temperature of Admission		
<36.5	109	36.58
36.5-37.5	171	57.38
>37.5	18	6.04
APGAR at 5 Min		
>3	7	2.35
4-6	276	92.62
>7	15	5.03
Gestation		
Pre- term	221	74.2
Term	77	25.8
Fetal Presentation		
Normal	232	77.9
Abnormal	66	22.1
Immediate Breastfeeding		
Yes	162	54.4
No	136	45.6

Source: Primary data, 2023

The majority of respondents were male 58.7 % with birth weight between 2500g to 4500g at 65.1% and neonates who had

a normal presentation. Regarding the temperature of admission 109 (36.58%) neonates had less than 36.5 Celsius degree, 171 (57.38%) neonates were the most predominate with a temperature that is between 36.5 and 37.5 Celsius degree and 18 (6.04%) had above 37.5 Celsius degree. Concerning fetal presentations most babies were normal with a good appearance, 232 (77.9%) neonates had a normal presentation.

4.2. Maternal and neonatal factors characteristics of respondents

Maternal and neonatal factors characteristics of respondents comprise labor duration, history of preeclampsia, maternal illness, contraceptive use, the birth interval of at least two years, gravida, resuscitation of the neonate, the baby with asphyxia, cyanosis, neonatal sepsis, neonatal jaundice, respiratory disease, seizure, neonatal cry after birth, use of herbal medicines, history of poor hygiene.

Most mothers use to give the immediate breastfeeding that keeps more babies healthy after being born, there is also quality of services given at health centers as there is enough number of babies with normal birth weight that indicates that the mothers didn't undergo malnutrition when she was pregnant.

Table 4.2.1.: Distribution of obstetric/gynaecological factors

Variables	Frequencies (N=298)	Percentages (%)
Antenatal visits		
1	45	15.1
2-4	246	82.6
>4	7	2.35
Mode of birth		
Vaginal	236	79.2
Caesareans	61	20.5
Vacuum extraction	1	0.3
Labor duration		
No labor	4	1.34
Normal (<18h)	221	74.16
Prolonged(>18h)	73	24.50
History of Preeclampsia		
Yes	11	3.7
No	287	96.3
Maternal illness		
Yes	26	8.72
No	272	91.28
Contraceptive use		
Yes	136	45.6
No	162	54.4
Birth interval at least two years		
Yes	133	44.63
No	165	55.37
Gravida		
1	110	36.91
2-4	159	53.36
>5	29	9.73
History of poor hygiene		
Yes	219	73.49
No	79	26.51

Source: Primary data, 2023

Table 4.2.1 indicates that the majority of respondents used visits from 2 up to 4 visits. They were 246 (82.6%) and a few numbers of them used vacuum extraction of 1 (0.3%) as a mode of birth. For the labor duration, most of them used normal labor of 221 (74.16%) which is less than 18 hours. The main problem was that a huge number of 219 (73.49%) were mothers with poor hygiene. There are still some diseases that can affect pregnant women such as maternal infections, cancer, HIV, small interval between babies, bad use of contraceptive methods, poor hygiene. Even though this is not wide-ranging for all mothers, a few numbers of them with those cited complications increase the rate of newborn deaths.

Table 4.2.2.: Distribution of neonatal clinical factors

Variables	Frequencies (N=298)	Percentages (%)
Resuscitation of the neonate		
Routine care	241	80.9
Ventilated	53	17.8
Cardiac message	4	1.3
Baby with asphyxia		
Yes	46	15.4
No	252	84.6
Cyanosis		
With Cyanosis	63	21.1
Without cyanosis	235	78.9
Neonatal sepsis		
Yes	45	15.1
No	253	84.9
Neonatal jaundice		
Yes	75	25.1
No	223	74.8
Respiratory disease		
Yes	51	17.1
No	247	82.9
Seizure		
Yes	26	8.7
No	272	91.3
Neonatal cry after birth		
Yes	208	69.8
No	90	30.5
Use of herbal medicines		
Yes	43	14.4
No	255	85.5

Source: Primary data, 2023

Resuscitation of the neonate was found on many newborns as routine care for 241(80.9%), a lot of babies were born without asphyxia they were 252(84.6%) and they had no cyanosis at a percentage of 78.9%, without seizure 272(91.3%). Interestingly 208 babies cried after birth representing 69.8% of respondents.

4.3. Presentation of findings

4.3.1. Prevalence of neonatal mortality rate among respondents

The findings below are related to the prevalence of neonatal mortality rate among respondents rendering the first objective as they are presented in the figure below:

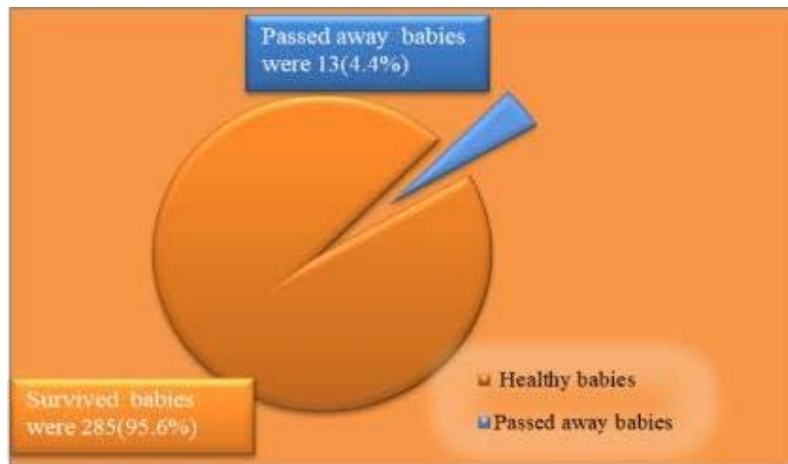


Figure 4.3.1.: Prevalence of neonatal mortality rate among respondents

Source: Researcher, 2023

This figure shows that the number of babies who passed away were 13(4.4%) and the healthy babies who survived to live were 285(95.6%).

4.5. Factors associated with neonatal mortality rate among respondents

The findings below are related to factors associated to neonatal mortality rate among respondents rendering to sociodemographic (Table 4.5.1.), maternal (Table 4.5.2), neonatal (Table 4.5.3) related factors.

Table 4.5.1.: Sociodemographic factors associated with neonatal mortality

Variable	Dependent variable		X ² -value	P-value
	Alive n (%)	Died n (%)		
Maternal age			0.27	0.59
15-35	52 (17.45)	1(0.34)		
≥ 35	233(78.19)	12(4.03)		
Level of education			9.87	0.04
Primary	189(63.42)	7(2.35)		
Secondary	75(25.17)	1(0.34)		
No	24(8.05)	5(1.68)		
APGAR (at 5 Min)			0.05	0.98
>3	4(1.34)	3(1.01)		
4-6	272(91.28)	4(1.34)		
No	9(3.02)	6(2.02)		
Gestation			3.78	<0.001
Term	222(73.52)	4(1.34)		
Pre-term	63(21.14)	9(3.02)		

Source: Primary data, 2023

There are sociodemographic-related factors that are associated with neonatal death as exemplary; level of education with a p-value of 0.04, and gestation with a p-value less than 0.001, they have been found a statistically significant correlation between mothers and neonatal death. The researcher found that maternal age with a p-value of 0.59, and APGAR with a p-value of 0.98 that looks on appearance, pulse, grimace response, activity, and respiration having 10 as the highest score possible were not significant in the bivariate analysis. Prematurity, low level education resist as a pertinent delinquent public matter causing neonatal complications that can even lead straight forward to death.

Table 4.5.2.: Obstetric factors associated with neonatal mortality

Variables	dependant variables for neonates		X ² -value	P-value
	Alive n (%)	Died n (%)		
Antenatal visits			0.17	<0.001
1	39(13.09)	6(2.01)		
>2	246(82.55)	7(2.35)		
Birth interval at least two years			0.19	0.67
Yes	124(41.61)	9(3.02)		
No	161(54.02)	4(1.35)		
Parity			0.25	0.13
Nulliparous	111(37.25)	1(0.34)		
Multiparous	155(52.01)	12(4.03)		
Others	19(6.38)	0(0)		
Infection during pregnancy			0.98	<0.001
Yes	33(11.07)	6(2.01)		
No	252(84.56)	7(2.35)		
History of preeclampsia			0.25	0.87
Yes	10(3.36)	1(0.34)		
No	275(92.38)	12(4.03)		
History of hygiene			2.88	0.33
Yes	210(70.47)	9(3.02)		
No	75(25.17)	4(1.34)		

Source: Primary data, 2023

About antenatal visits findings presented that their p-value is less than 0.001 implicating that this is statistically extremely significant. The birth interval of at least two years variable has been significant with a p- value of 0.67 and parity that is the number of times the mother gave birth to a fetus whether the baby is alive or died has been also statistically significant with p- value of 0.13. Lack of baby hygiene and adequate follow up of their each and every step of growth or guidance given by the nurses. Some babies are cared by other people rather than their mothers that why there are significant as there is enough number of babies suffering from neonatal sepsis. This requires doing enough repeating laboratory examinations as the baby grow at the hospital or health center.

Table 4.5.3.: Neonatal clinical factors associated neonatal deaths

Variables	Dependent variable for neonates		x ² - Value	P- Value
	Alive n (%)	Died n (%)		
Baby cry after birth				
Yes	205(68.79)	2(0.67)	1.19	0.56
No	80(26.85)	11(3.69)		
Baby with asphyxia			6.9	<0.001
Yes	41(13.76)	5(1.68)		
No	244(81.88)	8(2.68)		
Neonatal sepsis			16.53	0.06
Yes	248(83.22)	4(1.34)		
No	37(12.42)	9(3.02)		
Neurological disorders				

Yes	12(4.03)	2(0.67)	4.36	<0.001
No	273(91.62)	11(3.69)		
Use of herbal medicine				
Yes	40(13.42)	3(1.01)	0.36	0.96
No	245(82.22)	10(3.36)		

Source: Primary data, 2023

There are neonatal-related factors that are associated with neonatal death as exemplary Baby cry after Birth with a p-value of 0.56, and neonatal sepsis with a p-value of 0.06. had no relationship with neonatal death according to the bivariate analysis but fortunately, babies with asphyxia with a p-value less than 0.001 and neurological disorders with a p-value that is less than 0.001 can affect the brain, spinal cord, and the whole body in general that have shown a statistical significance correlation with neonatal death.

Table 4.5.4.: Multivariable analysis for maternal predictors of neonatal mortality

Variable	Adjusted odd ratios	95% Confidence Interval Lower-Upper	P-value
Maternal age			
15-35	1.16	0.32-4.26	0.99
≥ 35	Ref.		
Gestation			
Pre-term	2.53	1.12-5.73	0.04
Term	Ref.		
Gender of new-born			
Male	1.37	0.6-3.13	0.98
Female	0.84	0.57-1.22	0.99
Birth asphyxia			
Occurred	0.37	0.18-0.79	<0.001
None	Ref.		
Neonatal jaundice			
Yes	1.62	0.45-5.89	0.99
No	Ref.		
Use of herbal medicine			
Yes	7.47	0.22-1.71	<0.001
No	1.12	0.83-1.51	0.98
Others	Ref.		

Source: Primary data, 2023

Table 4.5.4 indicates that there is an association between maternal age and neonatal mortality rate (AOR=1.16,95% CI: 0.32-4.26, P=0.99) implying that neonates of mothers who were young were about 1.16 times more at risk of having neonatal death compared to neonates whose mothers are mature. There is also an effective association between gestation and neonatal mortality rate (AOR=2.53, 95% CI: 1.12-5.73, P=0.04) inferring that the mothers who used pre-term gestation were about 3 times at risk of having new-born death compared to to mothers who used a near term gestation.

Findings showed an association between neonatal jaundice and neonatal mortality rate (AOR=1.62, 95% CI: 0.45-5.89, P=0.99) implying that neonates with neonatal jaundice were about 2 times more at risk of having neonatal death compared to neonates without neonatal jaundice. There is also an effective association between the use of herbal medicine and neonatal mortality rate (AOR=7.47, 95% CI: 0.22- 1.71, P<0.001) inferring that new-borns with infections were about 8 times at risk of having new-born death compared to mothers who don't use herbal medicines.

Some mothers believe in bad spirits that they can protect their babies or harming them that is why they use to go to consult local traditional healers for help who use to manipulate herbs mixing with bad spirits and provide their medicaments to mothers. The problem of those medicines is that there are not scientifically tested in medical laboratory to prove that they don't carry any additional concern that can damage either the mother or the babies. So many neonates suffer complications from the herbs consumed as herbal medicines.

4.6. Discussion

4.6.1. Objective one: Identify the prevalence of neonatal mortality rate among neonates admitted in Kigeme District Hospital, Rwanda

Among results with regard to prevalence, the mothers who had low level of education underwent the high odd ratio than educated mothers. These findings are related to the study done in Ethiopia where Yaya Y et al, 2014 stated that neonatal mortality was prominent in unfortunate families likened to the richest (AOR: 2.62 95% CI:1.65-4.15), led by illiterates compared toward better educated families (AOR: 3.54 (95% CI: 1.11-11.30)). As people are educated as their level of knowledge and decision making is advanced. Furthermore, better education generates opportunity for improved economic standing. (Yaya Y et al, 2014). 4.4% proportion of passed away babies is shows that there is still newborn who dies within 28 days after birth. That is a problem should be addressed to the community to find out all measures possible to have this number reduced to 0.

The odds of new-borns death were lower in girl neonates likened to male neonates who were male. This finding is related to the study done in Ghana, Nigeria, Indonesia. Male gender was at high risk than female gender. Female new-born had 1.73 upper odds of survival (OR = 1.73, CI = 1.48, 2.63) equaled to males (Annan GN, 2018). According to Titaley CR et al, 2008 males add neonatal death were 49% significant and increased compared to females 28. There are factors that help female babies to survive than boys such as different protein, gene expression due to variation in Placenta according to altered conditions. In intrauterine milieu the extracellular micro-RNA is regulated in females than males' fetuses.

4.6.2. Objective two: Establish the factors associated to neonatal mortality rate among neonates admitted in Kigeme District Hospital, Rwanda

Concerning mother-associated factors we mentioned that term pregnancy has lower odds of neonatal deaths compared to preterm birth. This finding is related to the study done in Ghana, Ethiopia, and Indonesia. Poor lung maturation can incite preterm to adapt to the extra uterine life causing difficulties in breathing, and hypoxia resulting in occasional death. Often betamethasone is recommended for fetal lung maturation. (Noben L et al, 2019) Preterm newborns use to have a risk of vitamin D deficiency that causes respiratory distress that results sometimes in death. This study advised that focusing on pre-term deliveries rather than on post-term deliveries is essential to lessen neonatal mortality rate. (Phukan D et al, 2018)

To lack of antenatal care visits increases the odds of neonatal deaths compared to a mother who used to attend antenatal care visits appropriately. This result was held by the research done in Nigeria, sub-Saharan, and Iran. The mothers who acquired antenatal visits gave their children a higher survival chance (OR = 0.95, 95% CI = 0.93-0.98). (Amouzou A et al, 2017) ANC helps the mother to have early detection of pregnancy complications, early initiation of breastfeeding for the sustainability of neonatal immunity, and giving birth with a skilled birth attendant. Those roles of ANC aid in newborn survival. Mothers who used to attend antenatal visits had a virtuous vital neonatal care practice for their babies ($X^2 = 31.668$, $p < 0.00$). (Phukan D et al, 2018). Neonatal sepsis occurred (15.1%), and prematurity complications (7.4%) were the most prominent of neonatal premises.

This is similar to the study done in Ghana where neonatal sepsis (29.2%), and prematurity/low birth weight (26.9%) patients were among the utmost admitted in the neonatal unit (Walan W et al, 2016). Even this prevalence was increased in Gonder (67, 9%) as stated by Demisse AG et al, 2017. And according to Hoque M et al, 2011 in South Africa, neonatal results were found at 21%. And even Ali SR et, 2013 where established that neonatal sepsis was at 20.3% in a study done in Pakistan. This high rate of neonatal sepsis is used to be found in developing countries than in developed countries caused by many factors including low socioeconomic status, low hygiene and the presence of other high-risk factors like low birth weight, prematurity, prolonged labor, rupture of membrane, prematurity. This problem of neonatal infection should be prevented by following the neonates many times checking his her polymerase chain reaction (PCR) testing the laboratory so that they can get antibiotics early before complications that can lead to death.

This study has clinical and public assistance. Determinants of mortality give data for clinicians to take new interventions so that the high burden of neonatal deaths can be halted. It increases awareness of causes of neonatal death in the public health environment and warns them to take new decisions for the promotion of health and fight against the mortality rate.

5.4. Recommendations

National level (Ministry of Health, Rwanda Biomedical Center)

- Strengthen preventive strategies to fight against the increase in neonatal mortality rate in the country.
- Empowering the workforce by implicating the community in the preventive measures of reducing the neonatal mortality

rate.

-Provision aid of ambulances in hospitals, health centers along with the increase in the number of health posts in the country.

Kigeme district hospital

-Develop new strategies to fight against the increase in neonatal mortality rate.

-Develop outreach activities in the community, health centers, and health posts for the detection, and treatment of mothers, and neonates' illnesses.

-Increase awareness about factors associated with neonatal death in the community through the promotion of health standards, and sensitization of the role of having a vigorous, sanitary family.

-Increase in technology, medical equipment, and material for advanced treatment leading to sustainable, quality, quick health services.

Suggestion for further studies

It is suggested to conduct also qualitative studies to assess knowledge, attitudes, and practices among mothers, neonates, and community and health professionals toward neonatal mortality rate. Extended, longitudinal studies in other hospitals over years on neonatal mortality rate and its risk factors.

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