Tengeru Community Development Journal
ISSN 1821-9853(Print) ISSN 2665-0584(online)
Vol. 7, No.1, 2020

Factors forPersistence of Neonatal Mortality in Rural Areas: Experience fromNewala District, Mtwara Region, Tanzania

Shauri Timothy[1*], Peter Elia Mosha[2],Hassan Maokola[3]

[1,3*]*Department of Rural Development and Regional Planning of the Institute of Rural Development PlanningDodoma, P.O Box 138, Dodoma, Tanzania.*

[2]*Department of Population Studies of the Institute of Rural Development Planning, P.O Box 138, Dodoma, Tanzania.*

**Corresponding author: Email: stimothy@irdp.ac.tz*

Abstract: Like many other SSA countries, Tanzania has been experiencing a high rate of neonatal mortality for many years. In southern regions of Tanzania, neonatal mortality has been among the leading deaths, estimated to be 43 per 1000 live birth, whereby majority being from Mtwara and Lindi regions.This study was conducted in Newala District, Mtwara region with aim of assessing factors for persistence of neonatal mortality among women of reproductive age (15-49 years) tracking the information of mothers who delivered from January 2017 to December 2018. Specifically, the study examined the current status of neonatal mortality, examined the factors associated with neonatal mortality, and determined strategies for reducing neonatal mortality in the study area.Study design involved a cross-sectional survey that involved a total of 192 individual mothers, of which 144 mothers were randomly selected from the District Health Information System (DHIS). Substantiated by 48 FGDs and key informant interview, making a total of 192 individuals who gave relevant responses for this study. Data from respondents were collected using a structured questionnaire with closed-ended and open-ended questions. While Checklist was used as a guide during discussions. Descriptive statistics (Frequencies, Percentages, figures, tables and graphs), as well as inferential statistics (Logistic Regression Analysis), were used to come up with the required information to address the objectives of the study.This study found that; pattern and trend of neonatal mortality increased from 11 to 27. 2 per 1,000 live births in 2015-2018 period, this increase was mainly caused by birth asphyxia, preterm and infections. There is a likelihood of neonatal mortality to decrease; with distance to the nearest health facility, birth weight, postpartum depression, female newborn and mothers residing near district headquarters. Pregnant mothers should continue emphasizing nutrition aspect, individuals at community level should make sure that they are making necessary efforts to access health facilities, also there should be proper programs to create awareness of importance and roles of

Keywords: Neonatal Mortality Rate, Neonatal Mortality, Child Mortality

1.0 Introduction

Neonatal mortality is defined as the number of deaths during the first 28 completed days of life per 1,000 live births in a given year or period(World Health Organization, 2006). Globally, 2.5 million children died in the first month of life with an average global rate of 18 deaths per 1,000 live births(Hug et al., 2018). UNICEF (2016)declared that, for Sustainable Development Goal (SDG)no. 3 target 3.2 to be achieved, strategies for reducing neonatal mortality (0-28 days) at least as low as 12 deaths per 1,000 live births deaths must be put in place.Sub-Saharan Africa accounts for 38% of global neonatal deaths and records the highest neonatal mortality rate in the world (Akombi and Renzaho, 2019; Engmann, 2011; Ogbo *et al*., 2019; Usman *et al.*, 2019).Like many other SSA countries, Tanzania has been experiencing a high rate of neonatal mortality for many years(Afnan-Holmes *et al*., 2015; Ajaari *et al.*, 2012; Boco, 2014; Ogbo *et al*., 2019).

In Tanzania, the most leading causes for neonatal death in the county include; complications from preterm births with (25%), birth asphyxia (31%) and infections–sepsis, pneumonia and meningitis (25%) (Afnan-Holmes *et al*., 2015). The mentioned causes of NMR have highly associated with poor access and low utilization of health services during pregnancy and childbirth(URT, 2016). Since 2008, the government of Tanzaniahas taken several initiatives that focused on general primary health care and specifically to reduce the neonatal mortality rate (NMR). These included the establishment of; Healthy Policy (2007); formulation of Primary Health Care Service Development Programme (2007-2017); Health Sector Strategic Plan III (2009-2015); National Road Map Strategic Plan to Accelerate Reduction of Maternal, Newborn and Child Death in Tanzania-One Plan I (2008-2015); The sharpen One-Plan to Accelerate Progress (2014-2015); National Nutrition Strategy (2011-2016); Health Sector Strategic Plan IV (2015-2020), and; later One-plan II(2016-2020).

In southern regions of Tanzania, many of birth and death are reported to occur out of reach of health facilities, neonatal mortality being among the lead deaths, estimated to be 43 per 1000 live birth, whereby majority being from Mtwara and Lindi regions. Like many other rural districts in Tanzania, Newalahas been receiving NMR-interventions for over two decades. These interventions included;Baby-Friendly Hospital Initiatives (BFHI) and Vitamin A Supplementation, National Package of Essential Reproductive and Child Health Intervention (NPERCHI), Prevention of Mother to Child Transmission (PMTCT) of HIV and Malaria,

Reproductive, Maternal, Newborn and Child Health Intervention (RMNCAH), Family Planning (FP) and Integrated Management Childhood Illness (IMCI). Little time has remained to endgovernment plan II,but still the neonatal mortality rate of national and particular of the rural areas including Newala district still averagefar above SDG's target(Hug et al., 2018).This study, therefore, shed light on the causes responsible for the persistence of neonatal mortality provide a significant implementation of several maternal, new-born, and child-heaths' care. This paper is seeking to contribute knowledge on the various dynamics that are behind the persistence of high neonatal mortality in Newala district, that will be used not only as a lesson to related areas but also being used by decision-makers for NMR related policy and strategies improvements.

2.0 Methodology

2.1 Study Area, Data Sources and Sampling

Newala district is located between Latitude 10º 56′ South and Longitude 39º 18′ East. The district occupies an area of 2439 square kilometers, with 28 wards, 155 registered villages and 482 sub-villages(URT, 2013). Newala is reported with high neonatal mortality persistence among all districts in Mtwara region (DHIS[1], 2016). Both primary and secondary data were collected; Primary data were collected through a structured interview and focus group discussions using questionnaire and checklist, respectively. These type of data were collected from women who had delivered within last two years (January 2017 to December 2018); While secondary data were mainly gathered from District Reproductive and Child Health Coordinator (DRCHCo) office, and District Health Information System (DHIS) records and few being substantiated from published documents.

The study's sampling unit was an individual woman who delivered within the last two years (January 2017 to December 2018).The required sample size was determined using the following formula:

$$n = \frac{(Z\alpha/2)^2 pq}{d^2}$$

Whereby n is the sample size, $Z\alpha/2$ critical value which is 1.96 based on 95% confidence interval (2.5%) is a marginal error, p is proportional of the population having the analyzed characteristic, for this case is mothers with neonate death in 2017, (obtained by NMR, 2017*100%) which is (24/1000*100%=2.4%) thus p = 0.024 and q is the population that having no characteristic, i.e.

[1] DHIS, 2016; Newala District Health Information System Report of 2016

1-0.024=0.976. Therefore p=0.024, q=0.976. Plugging into the formula, the required sample size was 144 individual mothers who delivered in the period January 2017 to December 2018.The list of respondents was extracted from Newala District Health Information System (DHIS 2) in December 2018. Random sampling was used to get the 144 respondents (those with and without experienced neonatal death) for interviewing.The study also carrieddiscussions with DRCHCo as a key informant, as well as anin-depth verbal autopsy discussion with 15women, and four Focus Group Discussions (8 participants each group) with women who delivered in last two years.The Focus Group Discussion (FGDs) were conducted selecting women based on their reproductive age regardless of whether there was or no death occurred (maternal age in years <19, 20-29, 30-39, 40-49).All these people make a total of 192 individuals who used to give relevant information for the study.

2.2 Analytical Processes

Descriptive and inferential statistics were used to analyse various variables used in this study. Descriptive statistics were used to determine the percentages and frequency distributions for the general characteristic of respondents, the current status of neonatal mortality and strategies that have been done in reducing neonatal mortality according to various categories of the study variables. These distributions provide the preliminary findings of the study.Binary logistic regression was employed toidentify factors associated withpersistence of neonatal mortality in the study area. A statistical model below was used in this analysis.

$$P_i^* = \ln\left(\frac{P_i}{1-P_i}\right) = \alpha + X_i\beta_i + \mu_i \qquad [1]$$

$$P_i = 1 \;\; if P_i^* > 0,$$

$$P_i = 0, Otherwise$$

Whereby$P_i$is the estimated probability for neonatal mortality; α is a regression constant, β is a vector for estimated regression coefficients, and$X$ is a vector for explanatory variables. Whilst the dependent variable will be neonatal mortality “binary “(1 = Death, 0= Alive). The explanatory variables included in the model were; Maternal age in years; Maternal education (1=none, 2= primary, 3=secondary, 4=tertiary); Maternal occupation (1=Peasants, 2=Government-employed,3= Self-employed, 4=Unemployed); Birth interval in hours; Birth weight in cm; Birth order (1=first, 2=second, 3=third or 4=higher); Distance to the nearest health

facility; Postpartum depression (1=yes, 0=no); Sex of neonate (1=male, 0=female) and location of residence (1=near district headquarters, 0=outside district headquarters).During analysis, the first category for each categorical explanatory variable was used as a reference category. To easy interpretation, odds-ratios of independent variables were determined and presented.

3.0 Results and Discussion

3.1 Characteristics of Respondents

Most mothers (62.5%) who were interviewed were in a good childbearing age of 20-29 years, with very few 7(4.9%) who were 40-49 years. This age grouping is in-line with another study conducted in Tanzania which reported that many neonates were born with young mothers (Ajaari *et al*., 2012; Lahaseh, 2012).Also, results in Table 1 indicate that, most of mothers interviewed had attained secondary education 67 (46.5%) and few of them had tertiary education 14 (9.7%). Further, results show that 70 (48.6%) of the respondents were peasants, majority 103 (71.5%) were married, while very few 39 (27.1%) are attending the nearest health facility on foot. In additional, Table 1 shows that only 32 (22.2%) of sampled respondents had high annual household income. The mothers from low annual household income have had a tendency tostruggle in accessing quality health services to their newborns compared to newborns from mothers with medium annual household income *(*Kojo Edeme, 2014; Mohamoud *et al.,* 2019; Ogbo *et al*., 2019).

Table 1: General Ccharacteristics of the Rrespondents (n=144)

Variables	Frequency	Per cent
Maternal age (Years)		
< 19	15	10.4
20-29	90	62.5
30-39	32	22.2
40-49	7	4.9
Maternal education		
None	15	10.4
Primary	48	33.3
Secondary	67	46.5
Tertiary	14	9.7

Variables	Frequency	Per cent
Maternal occupation		
Peasant	70	48.6
Government employed	14	9.7
Self-employed	24	16.7
Unemployed	36	25.0
Marital status		
Never married	38	26.4
Married	103	71.5
Divorced	1	0.7
Widow	2	1.4
Means of transport to the health facility		
On foot	39	27.1
By bicycle	31	21.5
By motorcycle/car	74	51.4
Annual household income		
Low	87	60.4
Medium	25	17.4
High	32	22.2

3.2 Current Status of Neonatal Mortality

The number of children born, number of survived, number of those who died, deaths per 1,000 live births and causes of death were the variables used to assess the current status of neonatal mortality in Newala (Figure 1, 2 and 3). Data collected from Newala district from 2015 to 2018 showed that out of 24,229 neonates born, 23,803 (98.2%) have survived. However, the estimated linear trend for those survived in the period 2015 to 2018 was declining (Figure 1).

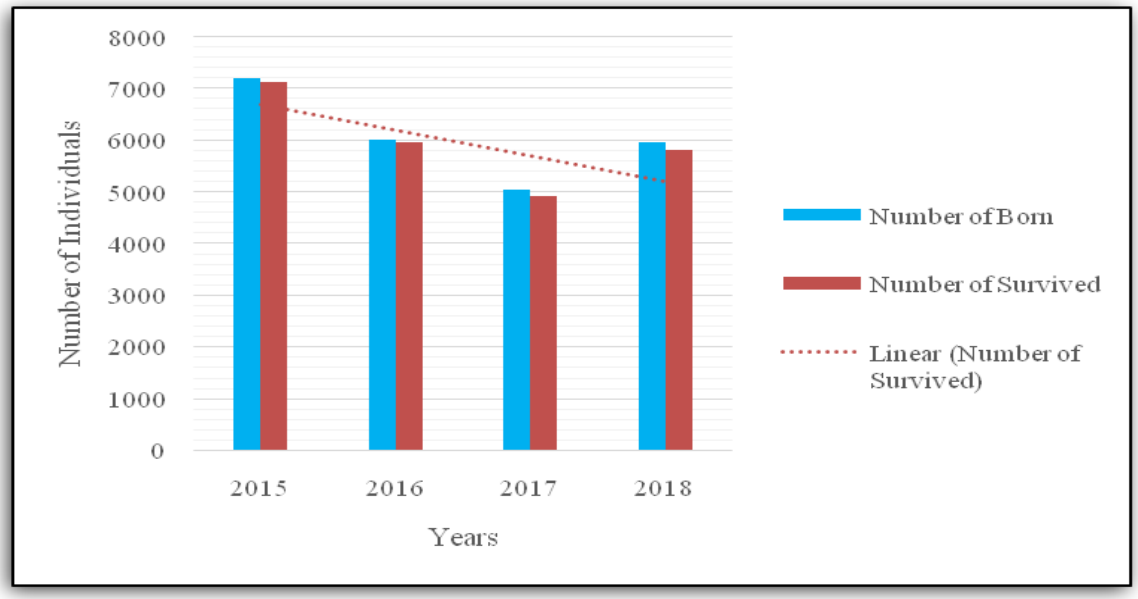

Figure1: Current Status of NeonatalMortality

The increase in neonatal motility rate (NMR) in Newala district as evidently seen in Figure 2, as there was increased in the NMR from 11 per 1,000 live births in 2015 to 27.2 per 1,000 live births in 2018. This was supported by the estimated polynomial trend, which increased sharply in the year 2016 toward 2018. The respondents during focused group discussions argued that this increase of newborn death was due to poor health infrastructure and inadequate health personnel in the district.

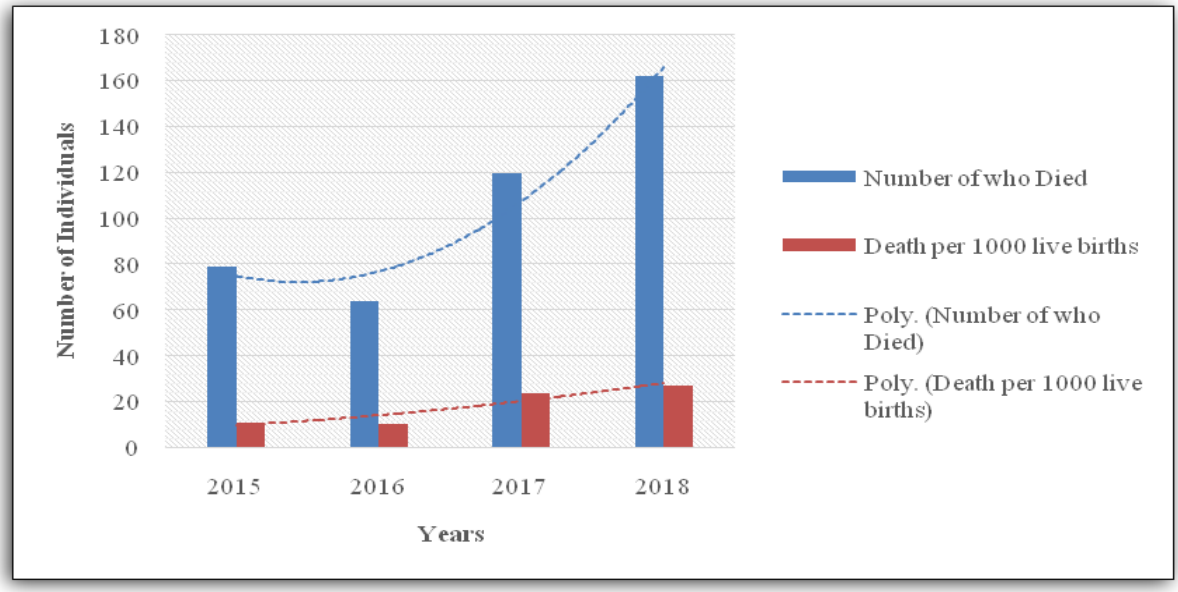

Figure2: Neonatal Mortality Rate

Data from Newala DRCHCo in 2018, revealed that the major causes of neonatal mortality were; Birth asphyxia (33%); Preterm (22%), and; infections (20%), while remaining percentages are for other minor defects (25%) (Figure 3).In regarding to the sampled individuals, birth asphyxia was still leading cause of neonate death. The results are similar to what has been observed in the study conducted in Tanzania (Afnan-Holmes *et al*., 2015). Based on the discussion with DRCHCo, the reasons behind why birth asphyxia was the leading cause of newborn death, is; little oxygen in mother's blood before or during birth, the problem with placenta separating from the womb too soon, very long or difficult delivery, and the problem with the umbilical cord during delivery. The similar claim was raised by one mother who suffered from neonatal mortality. She illustrated;

"Ooh!! My God, I remember very far and am feeling to cry. I was very sad about what happened. My baby she died half an hour after delivery, I saw tough yellowish mucus which made her difficult to inhale air and suddenly died."(IDI #3 aged19 years old).

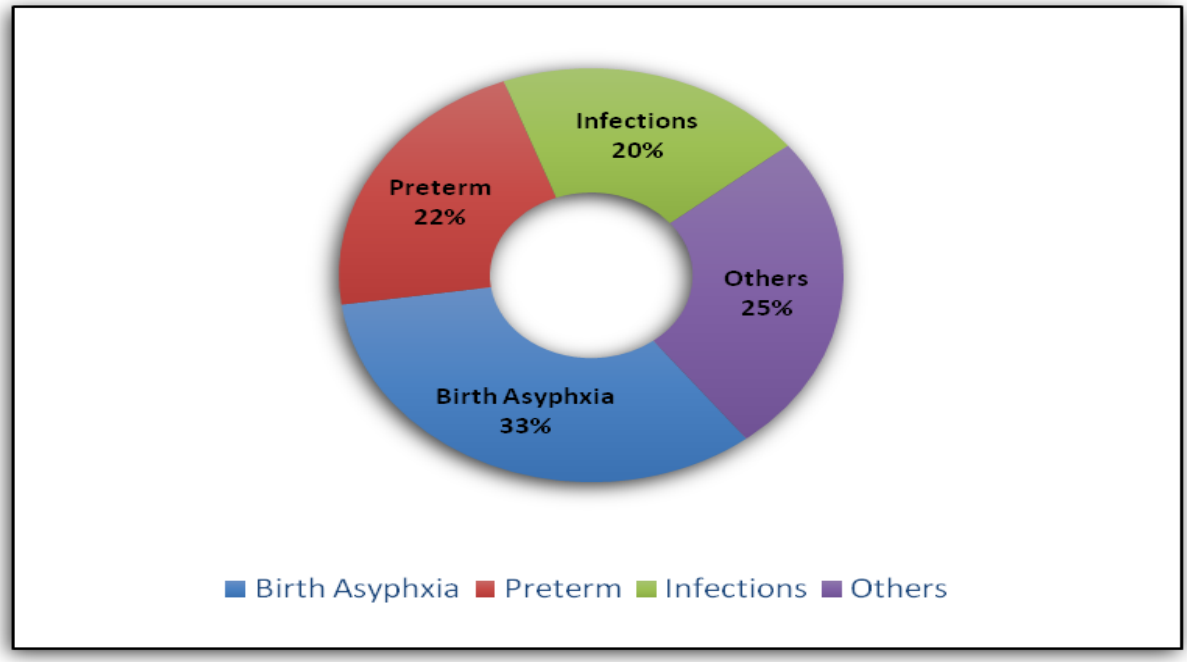

Figure 3: Estimated Causes of Death

3.3 Factors Associated with the Neonatal Mortality

Binary Logistic Regression analysis was used to analyze the factors associated with neonatal mortality in the study area. The results show that the variable included in the model was a good predictor for reporting the probability of neonatal mortality events among mother's who had delivered the last two years before survey (Negelkerke$R^2 = 0.755$).Based on Wald Chi-square test, distance to the nearest health facility, birth weight, postpartum depression, neonate sex and location of residence were significantly associated on the probability of death event of the neonate in study population (Table 2).

Mothers with no Post-Partum Depression was found to be associated with reduced odds for reporting neonate death compared to their counterpart those with such depression (OR=0.154, 95%C.I =0.036-0.654). This finding is in line with the report from a study done in Taiwan which noted that mothers with no postpartum depression lack mental disorder which could be associated with adverse effects on neonatal development(Chen et al., 2011). Also, results indicate that mothers living nearest to the health facilities were associated with reduced chances for reporting neonate death (OR=0.639). This observation is consistent with earlier findings on the study conducted in Southern Tanzania, whereby mothers who are near health facilities have observed to have more frequencies of attending maternal and health services during pregnancy period than those who stayed far from health facilities, thus be in less risk of facing neonatal mortality. Further, it was observed that, increase in birth weight by one kilogram was associated with a decrease in the likelihood of reporting neonate death (OR=0.231, 95% C.I=0.056-0.951). Optimal body weight (above 2500 grams) signals good health for the new-born, which is a result of good health care during the pregnancy period, thus the child can overcome neonatal death (Andegiorgish *et al*., 2020; Black *et al*., 2013; Memiah *et al*., 2020).

Moreover, a female newborn was found to be associated witha decrease in the likelihood of neonatal death compared to their male counterpart (OR=0.044, 95% C.I=0.011-0.0170). Although there is no specific data for neonatal mortality, it has observed that there is high infant mortality (under one year death) for male compared to female. Literature reporting that the situation was contributed during the first part of the twentieth century when infectious diseases declined made the prevalence of perinatal conditions and congenital anomalies, which did not favors male new-born (United Nations, 2011). Moreover, in Sub-Saharan Africa, the poorer health of boys compared to girls at birth, reflecting biological defects including; low resistance

to infections, higher risk of premature birth, and larger average birth weight and head circumference leading, which lead to low infant survival (Boco, 2014; Van Malderen *et al*., 2013). Result in Table 2 shows that neonates born from mothers residing in urban-centres decrease chances of neonatal mortality (OR=0.098, 95%CI=0.026-0.368).In most of Sub-Saharan Africa countries including Tanzania, there is a huge disparity between health facilities available in cities, urban, as well as near district headquarters, and those located in the remote areas (far from the district headquarters). The disparities are in forms of quality of equipment, the number of experts, quality of service level, and as far as the number of facilities them-selves (Oloyede, 2017; Spasojevic *et al*., 2015; Yaya *et al*., 2017). Thus, most of the women residing near urban centres were having less likelihood of neonatal death due to access to good health facilities (Ajaari *et a*l., 2012).

Table 2: Multivariate Analysis for BinaryLogisticRegression Indicating Odds-Ratio (OR) for NeonatalMortalityAgainstPredictorVariables

Predictor variable	**B**	**S.E.**	**Odds-Ratio**	**95% C.I**
Maternal age at birth	-0.018	0.618	0.982	0.293-3.299
Education level of mother	1.024	0.688	2.783	0.723-10.716
Government employed	-1.221	0.988	0.295	0.042-2.045
Distance to health facility	-0.447	0.167	0.639	0.461-0.887***
Birth order				
Second Born	2.107	1.809	8.219	0.237-285.093
Third Born and Higher	0.362	1.251	1.436	0.124-16.665
Birth interval	0.314	0.205	1.369	0.916-2.047
Birth weight	-1.466	0.723	0.231	0.056-0.951***
Postpartum depression	-1.868	0.736	0.154	0.036-0.654***
Sex of neonate	-3.122	0.688	0.044	0.011-.0170***
Location of residence	-2.326	0.677	0.098	0.026-0.368***
Constant	6.785	3.356	884.488	

Negelkerke$R^2 = 0.755$; ***Significant at P<0.05

3.4 Strategies Done in Reducing Neonatal Mortality

Ante-Natal Care (ANC)regarded as important practice to detect and treat maternal related illness such as malaria and HIV/AIDS, in which early detection and treatment of such diseases have been proved to decrease the risk of infant mortality including neonatal death (Gebresilassie *et al*., 2019; Geta and Yallew, 2017). This study was also interested to ascertain antenatal care (ANC) visits among sampled individual mothers. Majority 84 (58.3%) were attended antenatal care more than four visits and 60 (41.7%) mothers attended antenatal-care who conducted less than four visits. The explanation regarding ANC visits was supplemented by mother with death episode, through her illustration;

"Mmmh!! To my side, I only attended ANC two times. During delivery, I felt more pains at the lower part of the abdomen, but the baby came out while shealready died" (IDI# 4, aged 26 years old).

Although postnatal period is not complicated for most women and babies, it is advised that, the post-natal careis important as it will address any variation from unexpected recovery after birth (Singh *et al*., 2017). Findings in Table 3 show a substantial proportion (73.6%) of mothers attended post-natal care (PNC) at day 7 while few 38 (26.4%) did not attend. Similar view was also noted by a study conducted by Ndayisenga (2016) in rural Rwanda, whichfound that mothers who had attended PNC at day 7 post-delivery decreased percentage of neonatal death over those who did not. The findings are also substantiated by one mother with death episode the illustration;

"*Aaah ok, I understood now, for sure after delivery I did not come back for a checkup even though my baby had severe diarrhea. I was not able to go hospital because of financial constraints hence my baby died"* (IDI # 13, aged 21 years old).

In the situation where the health facility is not accessible, in most rural areas in Sub-Sahara Africa, the Community Health Workers (CHWs) are used instead, to provide the necessary maternal and child care support (Namazzi *et al*., 2017). The study found that the majority (72.9%) of mothers were not visited by CHWs. Use of these CHWs was noted to be an important aspect to provide maternal and child care support in rural areas thus can help to reduce neonatal mortality.

The following quote from one participant in Focus Groups Discussions (FGDs) illustrates;

"*Inshallah!! In our community we have committed Community Health Workers (CHWs); they provide to us maternal health education on the importance of delivering to health facilities and visiting ANC. Also, they tell us the way on how to recognize danger signs which require early medical attention*" *(FGD # 3, aged 30-39 years old).*

Table 3: StrategiesDone in Reducing NeonatalMortality among Women Delivered in the Last Two Years

Variable	Frequency	Per cent
Antenatal care visit(ANC)		
<4	60	41.7
>4	84	58.3
Attending Postnatal care(PNC) at day 7	106	73.6
Community health workers (CHW)visit	39	27.1
OPV and BCG vaccination within 28 days post-delivery	134	93.1
Exclusive breastfeed practices	114	79.2

There is a inversely relationship between breast-feeding practices in the first month of life and neonatal mortality(Huffman *et al*., 2001). The result in Table 3 indicates that large number of mothers (79.2%) breastfed their new born. This indicating that, emphasizing on infant breastfeeding will reduced neonatal death. In addition, initiation of breastfeeding within one hour helps to prevent infections which could be the cause of neonatal mortality, this may be due to the fact that antimicrobial and anti-inflammatory factors in breast milk provide protection from infection (Edmond *et al*., 2007).

Furthermore, result in Table 3 indicates that most of newborns (93.1%) were vaccinated with Oral Polio Vaccine (OPV) and Bacillus Calmette - Guérin (BCG), with very few newborn (6.9%) were not vaccinated. The result is similar with previous studies which concluded that, vaccination against various diseases for pregnant mothers and children (newborn and infants), can improve newborns survival in various diseases and hence reduce mortality death including neonatal deaths (Bustreo et al., 2015; McGovern and Canning, 2015; Shann, 2013).

4.0 Conclusions and Policy Recommendations

This study found that; pattern and trend of neonatal mortality increased from 11 per 1,000 live births in 2015 to 27. 2 per 1,000 live births in 2018, this increase was mainly caused by birth asphyxia, preterm and infections.There is llikelihood of neonatal mortality to decreased; with distance to the nearest health facility, birth weight, post-partum depression, female newborn and mothers residing near district headquarters. It was also concluded that, many of surveyed mothers conducted antenatal-care more than four visits, majority attended postnatal-care at day seven post delivery, as well as majority of mothers were not visited by Community Health Workers. Moreover, substantial proportion of newborn were vaccinated and most of mothers were properly breastfed their newborns.

Study recommended that; pregnant mothers should continue emphasizing nutrition aspect, so as the infants should attain the proper weight and height. In case of inadequate nutrition education, responsible personnel at district level should have special education programs to enhance nutritional status of the pregnant mothers. Also, it has to be noticed that, when government is focusing on improving health facilities (in term of number and equipment) especially to remote areas, individuals at community level should make sure that they are making necessary efforts to access them. This including, improving road networks and transport facilities, as well as trying to reside in satellite, nuclear or compact settlements rather be isolated or spreading far apart (dispersed). Further, there is potential of reducing neonatal mortality though proper utilization of the CHWs. Therefore, proper programs to create awareness of importance and roles CHWs should be well understood by all at the grass-root.

References

Afnan-Holmes, H., Magoma, M., John, T., Levira, F., Msemo, G., Armstrong, C. E., Martínez-Álvarez, M., Kerber, K., Kihinga, C., Makuwani, A., Rusibamayila, N., Hussein, A., and Lawn, J. E. (2015). Tanzania's Countdown to 2015: An analysis of two decades of progress and gaps for reproductive, maternal, newborn, and child health, to inform priorities for post-2015. *The Lancet Global Health*, *3*(7), e396–e409. https://DOI.org/10.1016/S2214-109X(15)00059-5

Ajaari, J., Masanja, H., Weiner, R., Abokyi, S. A., and Owusu-Agyei, S. (2012). Impact of Place of Delivery on Neonatal Mortality in Rural Tanzania. *International Journal of MCH and AIDS* 1(1): 49–59.

Akombi, B. J., and Renzaho, A. M. (2019). Perinatal Mortality in Sub-Saharan Africa: A Meta-Analysis of Demographic and Health Surveys. *Annals of Global Health 85*(1): 106. https://DOI.org/10.5334/aogh.2348

Andegiorgish, A. K., Andemariam, M., Temesghen, S., Ogbai, L., Ogbe, Z., and Zeng, L. (2020). Neonatal mortality and associated factors in the specialized neonatal care unit Asmara, Eritrea. *BMC Public Health, 20*(1), 10. https://DOI.org/10.1186/s12889-019-8118-x

Black, R. E., Victora, C. G., Walker, S. P., Bhutta, Z. A., Christian, P., de Onis, M., Ezzati, M., Grantham-McGregor, S., Katz, J., Martorell, R., and Uauy, R. (2013). Maternal and child under nutrition and overweight in low-income and middle-income countries. *The Lancet*, 382(9890): 427–451.

Boco, A. G. (2014). mortality in sub-Saharan Africa: A cross-national. *Canadian Studies in Population*, 3, 39.

Bustreo, F., Okwo-Bele, J.-M., and Kamara, L. (2015). World Health Organization perspectives on the contribution of the Global Alliance for Vaccines and Immunization on reducing child mortality. *Archives of Disease in Childhood* 100(1): S34–S37.

Chen, Y.-H., Tsai, S.-Y., and Lin, H.-C. (2011). Increased mortality risk among offspring of mothers with postnatal depression: A nationwide population-based study in Taiwan. *Psychological Medicine* 41(11): 2287–2296.

Edmond, K. M., Kirkwood, B. R., Amenga-Etego, S., Owusu-Agyei, S., and Hurt, L. S. (2007).

Effect of early infant feeding practices on infection-specific neonatal mortality: An investigation of the causal links with observational data from rural Ghana. *American Journal of Clinical Nutrition* 86(4): 1126–1131.

Engmann, C. (2011). Improving neonatal mortality in sub-Saharan Africa: Any cause for optimism? *Journal of Perinatology* 31(12), 745–748.

Gebresilassie, B., Belete, T., Tilahun, W., Berhane, B., and Gebresilassie, S. (2019). Timing of first antenatal care attendance and associated factors among pregnant women in public health institutions of Axum town, Tigray, Ethiopia, 2017: A mixed design study. *BMC Pregnancy and Childbirth* 19*(*1): 340. https://DOI.org/10.1186/s12884-019-2490-5

Geta, M. B., and Yallew, W. W. (2017). Early Initiation of Antenatal Care and Factors Associated with Early Antenatal Care Initiation at Health Facilities in Southern Ethiopia. *Advances in Public Health* 2017: 1–6.

Huffman, S. L., Zehner, E. R., and Victora, C. (2001). Can Improvements in Breast-feeding Practices Reduce Neonatal Mortality in Developing Countries? *Midwifery* 17(2): 80–92.

Hug, L., Sharrow, D., Zhong, K., and You, D. (2018). *Levels and Trends in Chld Mortality-2018 Report*. UN Inter-Agency Group for Child Mortality-UNICEF, WHO, World Bank, UN.

Kojo Edeme, R. (2014). Relationship between Household Income and Child Mortality in Nigeria. *American Journal of Life Sciences 2*(6): 1. https://DOI.org/10.11648/j.ajls.s.2014020604.11

McGovern, M. E., and Canning, D. (2015). Vaccination and All-Cause Child Mortality From 1985 to 2011: Global Evidence From the Demographic and Health Surveys. *American Journal of Epidemiology* 182(9): 791–798.

Memiah, P., Bond, T., Opanga, Y., Kingori, C., Cook, C., Mwangi, M., Gitahi-Kamau, N., Mubangizi, D., and Owuor, K. (2020). Neonatal, infant, and child mortality among women exposed to intimate partner violence in East Africa: A multi-country analysis. *BMC Women's Health* 20(1): 10. https://DOI.org/10.1186/s12905-019-0867-2

Mohamoud, Y. A., Kirby, R. S., and Ehrenthal, D. B. (2019). Poverty, urban-rural classification and term infant mortality: A population-based multilevel analysis. *BMC Pregnancy and Childbirth* 19(1): 40. https://DOI.org/10.1186/s12884-019-2190-1

Namazzi, G., Okuga, M., Tetui, M., Muhumuza Kananura, R., Kakaire, A., Namutamba, S., Mutebi, A., Namusoke Kiwanuka, S., Ekirapa-Kiracho, E., and Waiswa, P. (2017). Working with community health workers to improve maternal and newborn health outcomes: Implementation and scale-up lessons from eastern Uganda. *Global Health Action* 10*(*4): 1345495. https://DOI.org/10.1080/16549716.2017.1345495

Ndayisenga, T. (2016). Maternal and Newborn Risk Factors Associated with Neonatal Mortality in Gitwe District Hospital in Ruhingo District, Rwanda. *International Journal of Medicine and Public Health* 6(2): 98–102.

Ogbo, F. A., Ezeh, O. K., Awosemo, A. O., Ifegwu, I. K., Tan, L., Jessa, E., Charwe, D., and Agho, K. E. (2019). Determinants of trends in neonatal, post-neonatal, infant, child and under-five mortalities in Tanzania from 2004 to 2016. *BMC Public Health* 19(1): 1243. https://DOI.org/10.1186/s12889-019-7547-x

Oloyede, O. (2017). Rural-Urban Disparities in Health and Health Care in Africa. *African Sociological Review* 21(2): 36–57.

Shann, F. (2013). Nonspecific Effects of Vaccines and the Reduction of Mortality in Children. *Clinical Therapeutics 35*(2): 109–114.

Spasojevic, N., Vasilj, I., Hrabac, B., and Celik, D. (2015). Rural—Urban Differences in Health Care Quality Assessment. *Materia Socio Medica* 27(6): 409. https://DOI.org/10.5455/msm.2015.27.409-411

UNICEF. (2016). Martenal and Newborn Health Disparities in Tanzania. *UNICEF DATA*. https://data.unicef.org/resources/maternal-newborn-health-disparities-country-profiles/

United Nations. (2011). Sex Differences in Childhood Mortality. *Department of Economics and Social Affairs, Population Dividion-United Nations Publications, ST/ESA/SER.A/314*.

URT. (2013). *2012 Population and Housing Census: Population Distribution by Administrative Units* (Volume I). National Bureau of Statistics, United Republic of Tanzania.

URT. (2016). *Tanzania Demographic and Health Survey and Malaria Indicator Survey (2015-2016).* Ministry of Health, Community Development, Gender, Elderly and Children Dar es Salaam, Ministry of Health Zanzibar and National Bureau of Statistics Dar es Salaam.

Usman, F., Imam, A., Farouk, Z. L., and Dayyabu, A. L. (2019). Newborn Mortality in Sub-Saharan Africa: Why is Perinatal Asphyxia Still a Major Cause? *Annals of Global Health 85*(1): 112. https://DOI.org/10.5334/aogh.2541

Van Malderen, C., Van Oyen, H., and Speybroeck, N. (2013). Contributing determinants of overall and wealth-related inequality in under-5 mortality in 13 African countries. *Journal of Epidemiology and Community Health* 67(8): 667–676.

World Health Organization. (2006). *Neonatal and Perinatal Mortality: Country, Regional and Global Estimates*. World Health organization. https://apps.who.int/iris/handle/10665/43444

Yaya, S., Bishwajit, G., Ekholuenetale, M., Shah, V., Kadio, B., and Udenigwe, O. (2017). Urban-rural difference in satisfaction with primary healthcare services in Ghana. *BMC Health Services Research 17*(1): 776. https://DOI.org/10.1186/s12913-017-2745-7