



A Decade of Trends and Multilevel Determinants of Early Neonatal Mortality in Tanzania, 2010-2022

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Abstract

Background: Newborn death account for nearly half of under-five mortalities. The highest rates of deaths occurs during the first week of life. Tanzania has made progress in reducing under-five mortality, but the share of neonatal mortality, especially early neonatal deaths remain unacceptably high.

Methods and Materials: Cross-sectional study using 2010, 2015/16, and 2022 Tanzania Demographic and Health Surveys data, multilevel binary logistic regression was fitted to identify determinants of early neonatal mortality.

Results: Trends of early neonatal mortality rate declined slightly from 23 to 20 death per 1000 live birth from 2010 to 2022. Low birth weight neonates, maternal age above 40 years, multiple pregnancies were independently associated with early neonatal mortality.

Conclusion: The decline in early neonatal mortality rates has been gradual. Findings underscore the importance of tailored interventions in reducing early neonatal mortality among neonates with low birth weight, mothers with advanced age and with multiple pregnancies.

Keywords

early neonatal mortality, individual factors, community factors, multilevel analysis

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Background

The first day after birth and the first week of life are the most critical periods for newborn survival, with a significantly higher risk of death compared to any other stage of childhood globally.¹ Globally, in 2022, 2.3 million children died during the neonatal period. Of these deaths, approximately 75% occurred within the first week of life, and around 1 million newborns died within the first 24 hours after birth.¹ However global initiatives to reduce early neonatal challenges have been undertaken, including Every Newborn Action Plan (ENAP) is a strategy which is based on evidence-based solutions to prevent newborn deaths.²

To strengthen and unify these efforts, a global target has been established under the Sustainable Development Goals (SDGs), calling for every country to reduce

neonatal mortality to 12 or fewer deaths per 1000 live births by 2030.¹ Despite these efforts, a high number of early neonatal deaths continue to be observed in low- and middle-income countries, including Tanzania.³ The leading causes of these high numbers of deaths include premature birth, birth complications such as asphyxia and trauma, neonatal infections, and congenital anomalies.⁴

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Furthermore Many factors also have been reported to predict the survival of early neonates, including respiratory distress, low birth weight, gestational age.^{5,6} Additionally, other factors such as birth interval, poor antenatal care (ANC), poor early breastfeeding initiation practice, maternal age, maternal parity, health status (both during and before pregnancy), educational status of mother, income condition, maternal health care services and obstetric related factors have also been associated with increased risk of early neonatal mortality.⁷

Tanzania has made specific attempts to address problems of newborn deaths. In 2008 to 2015 National Road Map Strategic Plan was launched to address neonatal challenges and strengthened the Integrated Management of Childhood Illness (IMCI) to promote healthy behaviors and key newborn health interventions like routine postnatal care and Kangaroo Mother Care (KMC).⁸ Additionally, Helping Babies Breathe (HBB) program was launched in Tanzania in 2009, that teaches neonatal resuscitation and newborn care skills to help babies who don't breathe on their own after birth.⁹

Despite ongoing efforts, the rate of neonatal deaths within the first week of life remains unacceptably high, with the latest national report indicating 24 deaths per 1000 live births,¹⁰ therefore to reduce avoidable newborn death it is essential to understand factors associated with early neonatal death in Tanzania. Understanding these factors is critical to help in developing targeted programs and strategies to reduce the burden of newborn deaths during the first week of life and immediately after birth. While researchers in Tanzania have identified factors associated with newborn deaths, but they have overlooked the importance of community-level characteristics. Moreover, increasing evidence from studies in various countries indicates that community-level factors significantly influence neonatal mortality, even after accounting for individual factors.¹¹⁻¹³ They demonstrated the determinants of neonatal mortality extend beyond individual characteristics therefore, the current study aimed to analyze the trends, individual and community level factors associated with early neonatal mortality in Tanzania using data from the Tanzania Demographic and Health Survey (TDHS).

Methodology

Study Area, Design and Study

Analytical cross-sectional design conducted using Tanzania demographic and health surveys (TDHS) of 2010, 2015/2016, and 2022. The sampling technique used in TDHS was 2-stage stratified sampling, the first stage involved a selection of a stratified sample from a

list of enumeration areas (EAs) that have been obtained from the recent census conducted in Tanzania, these EAs are the clusters. The EAs is selected with considerations to probability proportional to size (PPS) that takes into account the size of the enumeration area using simple random procedure. At the second stage, after a complete list of households available in each of the selected EAs, a fixed number of households is selected by equal probability systematic sampling technique.

Study Population

The study population was restricted to a pair of mothers aged 15 to 49 and their babies who are reported born alive since they were at risk of early neonatal mortality were selected and interviewed in the 2010-2022 TDHS 5 years prior the survey. Woman who deliver still birth, got miscarriage were excluded. A total weighted sample from the 3 TDHS; 8023 pair of woman and newborn in 2010 (8176 weighted cases), 10033 pair of woman and newborn in 2015/16 (10052 weighted cases) and 6574 pair of woman and newborn in 2022 (6596 weighted cases; Figure 1).

Study Variables

The study measured early neonatal mortality as the outcome variable, categorized as "yes" (1) which was defined as neonates who died within 7 days of life (first week), and "no" (0) for those who survived beyond the first week. In this study, the early neonatal mortality rate (ENMR) was calculated following the approach outlined in the DHS-8 Guide to Statistics. Specifically, all live-born infants within the 5 years preceding the survey were identified, and among them, those who died within the first 7 completed days of life were counted. The ENMR was then computed by dividing the number of these early neonatal deaths by the total number of live births during the same period and multiplying the result by 1000. This provides an estimate of the number of early neonatal deaths per 1000 live births.

The independent variables since the TDHS data are hierarchical, 2-level of explanatory variables: individual level factors such as maternal age, maternal education level, maternal occupation, wealth quintile, maternal marital status, birth order, types of pregnancy, gender of child, birth weight, breast feeding initiation, antenatal visit, delivery place, mode of delivery, and preceded birth interval. Community level factors such as place of residence, geographical zones, community level of poverty, women's educations, community media exposure were taken into account to identified determinants of early neonatal mortality in Tanzania.

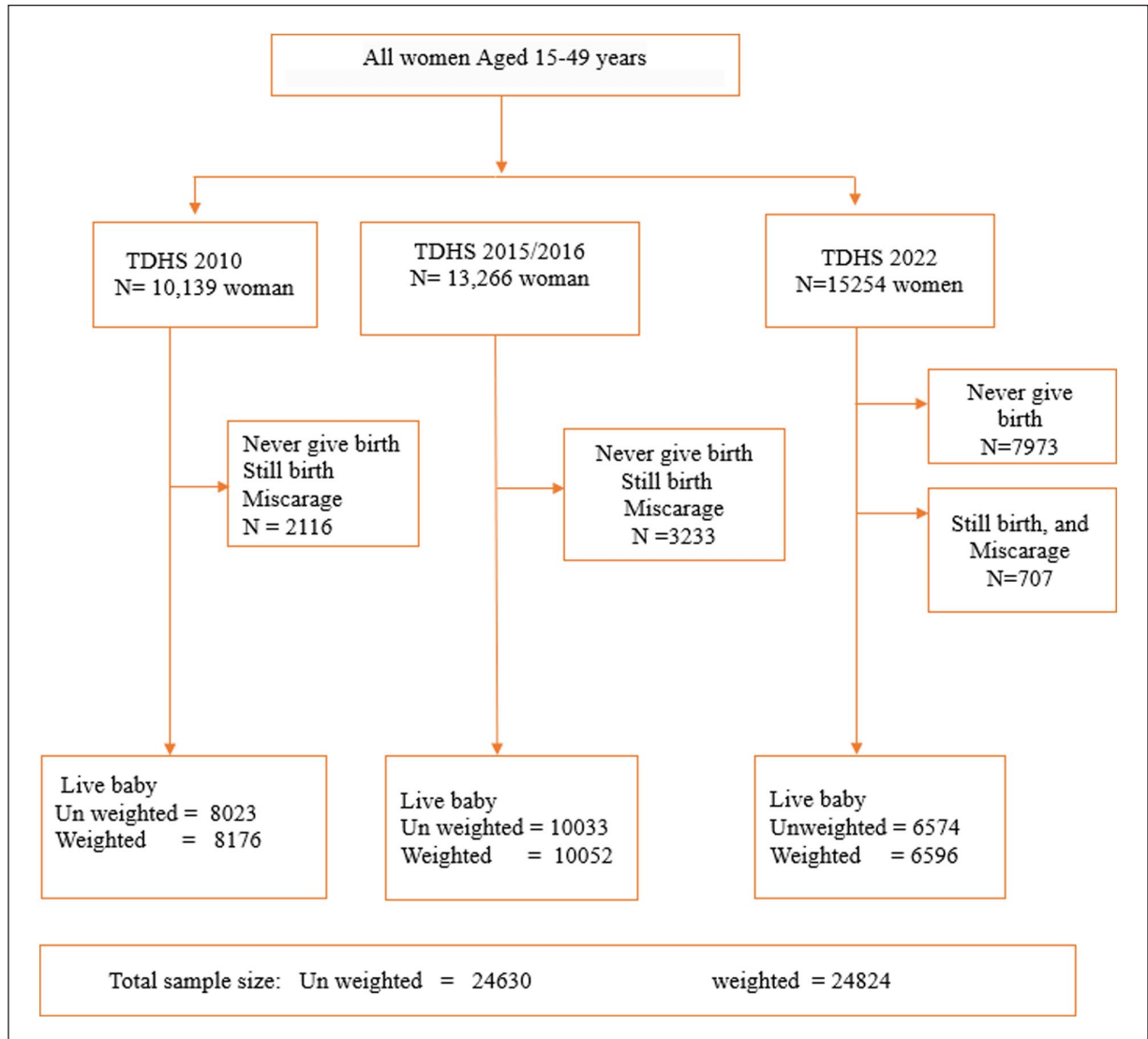


Figure 1. Flow chart for selection of study participants.

Statistical Analysis

Data analysis was performed using STATA version 16. Data was set to account for the complex nature of survey design through application of weights, primary sampling unit (cluster) and strata, descriptive analysis was done stratified across the 3 surveys 2010, 2015-2016, and 2022. Only the last survey (TDHS 2022) was used to examine factors associated with early neonatal mortality to reflect the current situations.

Multilevel Regression Analysis

Since the TDHS sampling employs a multistage stratified cluster technique, the data is hierarchical, with

participants nested within households and households nested within clusters. Consequently, a multilevel logistic regression model was used to account for this structure. The analysis considered 2 levels, individual and cluster. Three multilevel models were fitted to estimate fixed effects of individual- and community-level factors and the random variability between clusters. The null model was fitted without explanatory variables used to estimate between-cluster variability, Model I was fitted to estimate individual-level factors on early neonatal mortality. Model II was fitted to estimate community level factors and Model III combined model was constructed to assess the simultaneous effects of individual and community-level characteristics. Odds ratios (OR) with a 95% confidence interval, where a *P*-value of

$\leq .05$ indicated statistical significance. A model with lower deviance and AIC values and a higher log likelihood ratio was considered the best fit.

Results

Individual-Level Characteristics of Study Participants

The percentage of women aged 20 to 29 years has increased over the survey years: from 5.3% in 2010 to 6.8% in 2015/16, to 52.1% in 2022. Conversely, the proportion of women who completed primary education has decreased from 68.1% in 2010 to 64.8% in 2015/16, and further to 56.3% in 2022. Similarly, the proportion of married women has steadily declined from 84.5% in 2010, to 82.8% in 2015/16, and to 58.1% in 2022. The proportion of women who reported attending antenatal visits is slightly decreases from 98.2% in 2010, to 98.0% in 2015/16, and then decreased to 89.6% in 2022 (Table 1).

Community-Level Characteristics of the Study Participants

The proportion of clusters in rural area decreases across the survey years from 97.7% in 2010, to 72.9% in 2015/16 and 72.5% in 2022. The proportion of clusters that has high level of poverty has slightly increases at 46.3% in 2010 to 46.7% in 2015/16 to 50.9% in 2022. Also proportion of clusters that has high media exposure increases from 47.3% in 2010 to 54.6% in 2015/16 than decreases to 45.9% in 2022 (Table 2).

Trends of Early Neonatal Mortality in Tanzania

Early neonatal mortality rate has appeared to be stagnated from 23 deaths per 1000 live births in 2010 (95% CI: 20.1-26.7), 22 death per 1000 live birth in 2015/16 (95% CI: 18.9-24.7) and 20 deaths per 1000 live births in 2022 (95% CI: 17.4-24.6). The trends period was categorized into 3 phases; 2010-2015/16 (phase 1), 2015/16-2022 (phase 2) and 2010-2022 (phase 3/overall phase) to detect the difference in the decline of early neonatal mortality rate over time. The overall early neonatal mortality declined by 3, with the largest decline observed in phase 2 at 2 compared with 1 decline during phase 1 (Figure 2).

Distribution of Early Neonatal Mortality by Individual Level Factors

Distributions of early neonatal mortality according to individual characteristics are shown in Table 3. Some

factors such as type of pregnancy ($P < .001$), initiation time of breastfeeding ($P < .001$), antenatal visit during pregnancy ($P < .001$), and birth weight of the child ($P < .001$) were significantly associated with early neonatal mortality.

Distribution of Early Neonatal Mortalities by Community-Level Characteristics

The distribution of early neonatal mortality by community-level characteristics are shown in Table 4. Exposure to community media was significantly associated with early neonatal mortality ($P = .006$).

Determinants of Neonatal Mortality

In the multivariable multilevel analysis (Table 5); Maternal age 40 years and above were 2.4 times (AOR 2.4; 95% CI: 1.13, 5.24) higher compared to their counterparts aged 20 to 29 years, mothers who never married had 2 times (AOR 2.08; 95% CI; 1.30, 3.12) higher odds of experiencing early neonatal mortality compared to the married, Mothers who delivered low birth weight babies had 2.8 times (AOR 2.81; 95% CI; 1.39 5.70) higher odds of experiencing early neonatal mortality compared with normal babies, mothers with multiple pregnancy had 6-fold (AOR 5.74; 95% CI; 2.43 13.57) higher odds of neonatal mortality as compared to singletons counterparts, additionally communities with low media exposure had nearly 2-fold (AOR 1.82; 95% CI; 1.14 2.84) higher odds of experiencing early neonatal mortality compared to communities with high media exposure.

Model Comparison

The final model was the best-fitted model since it had the lowest deviance, AIC and had a highest log likelihood ratio. The ICC in the null model was 8.5% indicated that 8.5% of the variability of early neonatal mortality in Tanzania is attributed by the differences between communities in which the participants were residing and PCV for the final model was 74%, indicated 74% of the variability in early neonatal mortality was explained by the full mode.

Discussion

The present study demonstrate flattening trends of early neonatal mortality rate from 23 death to 20 death per 1000 live birth in 2010 and 2022 respectively. Both individual and community level factors such as low birth weight of neonates, advanced maternal age (>40 years),

Table 1. Individual-Level Characteristics (Weighted) of Study Participants in the TDHS 2010, 2015/2016 and 2022 Surveys (N = 24824).

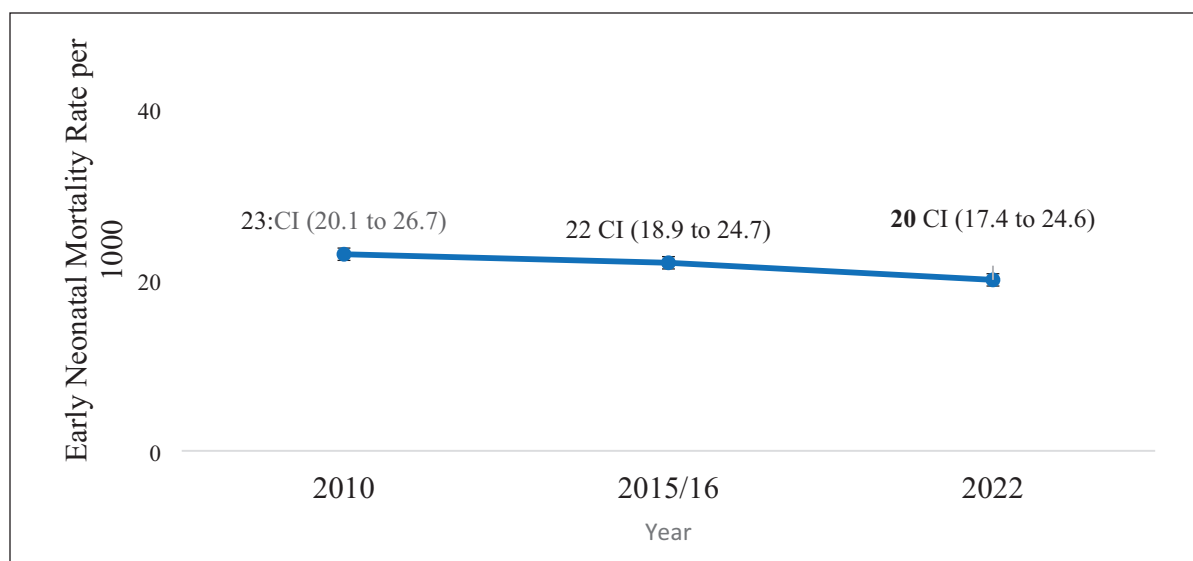
Variables	2010 (n=8176)	2015/16 (10052)	2022 (6596)
	n (%)	n (%)	n (%)
<i>Individual variable</i>			
Maternal age			
Below 20	4201 (51.4)	4974 (49.5)	503 (7.6)
20-29	429 (5.3)	688 (6.8)	3436 (52.1)
30-39	2841 (34.7)	3373 (33.5)	2146 (32.5)
40-49	705 (8.6)	1017 (10.2)	511 (7.8)
Maternal education level			
No education	2090 (25.6)	2103 (20.9)	1351 (20.5)
Primary	5569 (68.1)	6517 (64.8)	3711 (56.3)
Secondary or higher	517 (6.3)	1432 (14.3)	1534 (23.2)
Maternal occupation			
Not working	873 (10.7)	1602 (15.9)	2339 (35.5)
Working	7303 (89.3)	8450 (84.1)	4257 (64.5)
Wealth quintile			
Poor	3657 (44.7)	3562 (35.4)	2797 (42.4)
Middle	1836 (22.5)	1929 (19.2)	1285 (19.5)
Rich	2683 (32.8)	4561 (45.4)	2514 (38.1)
Maternal marital status			
Married	6908 (84.5)	8321 (82.8)	3832 (58.1)
Never married	1268 (15.5)	1731 (17.2)	2764 (41.9)
Birth order			
1	1687 (20.6)	2475 (24.6)	1499 (22.7)
2-3	2892 (35.4)	3423 (34.6)	2547 (38.6)
4+	3597 (44.0)	4153 (41.3)	2550 (38.7)
Types of pregnancy			
Single	7939 (97.1)	9690 (96.4)	6383 (96.8)
Multiple	237 (2.9)	362 (3.6)	213 (32.2)
Gender of child			
Male	4097 (50.1)	5098 (50.7)	3405 (51.6)
Female	4079 (49.9)	4954 (49.3)	3191 (48.4)
Birth weight			
Normal weight	3900 (47.7)	5631 (56.0)	4544 (68.8)
Low weight	256 (3.1)	416 (4.1)	219 (3.4)
Macrosomia	297 (3.6)	442 (4.4)	439 (6.7)
Don't know	3723 (45.6)	3563 (35.5)	1394 (21.1)
Breast feeding initiation ^a			
Beyond first 1 hour (late)	2619 (48.8)	3663 (52.6)	1537 (24.5)
Within first 1 hour (early)	2748 (51.2)	3304 (47.4)	4724 (75.5)
Antenatal visit ^a			
No	100 (1.8)	142 (2.0)	609 (10.4)
Yes	5419 (98.2)	6937 (98.0)	5262 (89.6)
Delivery place			
Health facility	4241 (51.9)	6567 (65.3)	5324 (80.7)
Home	3935 (48.1)	3485 (34.7)	1272 (19.3)
Mode of delivery			
Vaginal	7811 (95.5)	9457 (94.1)	5905 (89.5)
Cesarean	365 (4.5)	595 (5.9)	691 (10.5)
Preceded birth interval ^a			
<24 months	1010 (15.6)	1424 (18.9)	815 (16.1)
>24 months	5461 (84.4)	6132 (81.1)	4270 (83.9)

^aVariables with missing.

Table 2. Percent Distributions of Clusters by Community-Level Characteristics in the TDHS 2010, 2015/2016 and 2022 (N= 1712).

Community level variables	2010 (n= 475)	2015/16 (608)	2022 (629)
	Percentage	Percentage	Percentage
Place of residence			
Urban	2.3	27.1	27.5
Rural	97.7	72.9	72.5
Geographical zones			
Western	21.1	12.2	10.6
Northern	12.6	9.3	10.8
Central	9.3	11.1	9.9
Southern Highland	13.8	5.4	5.2
Southern	7.8	3.9	3.9
Southern West	11.8	9.7	9.4
Lake zone	20.9	31.8	34.4
Eastern	11.8	14.1	12.9
Zanzibar	2.7	2.6	3.0
Community level of poverty			
High	46.3	46.7	50.9
Low	53.7	53.3	49.1
Women's educations			
High	60.4	52.7	55.4
Low	39.6	47.3	44.6
Community media exposure			
High	47.3	54.6	45.9
Low	52.7	45.4	54.1

Abbreviation: n, cluster number.

**Figure 2.** Trend of early neonatal mortality rate (TDHS, 2010-2022).

during the index pregnancy, multiple pregnancies being unmarried/single mother and communities with low exposure to media were independently associated with early neonatal.

The third SDG aims to “ensure healthy lives and promote well-being for all at all ages.” However, the current trends in early neonatal mortality indicate that Tanzania is falling behind the global targets set for 2030,

Table 3. Distributions of Early Neonatal Mortality in Tanzania According to Individual-Level Characteristics, TDHS2022 (N= 6596).

Variables	Total	ENM		P-value
		n (%)		
<i>Individual variable</i>				
Maternal age				
Below 20	503	14 (2.8)		.469
20-29	3436	62 (1.8)		
30-39	2146	46 (2.1)		
40-49	511	14 (2.6)		
Maternal education level				
No education	1351	26 (1.9)		.897
Primary	3711	76 (2.0)		
Secondary or higher	1534	34 (2.2)		
Maternal occupation				
Not working	2339	57 (2.4)		.208
Working	4257	79 (1.9)		
Wealth quintile				
Poor	2797	50 (1.8)		.483
Middle	1285	26 (2.1)		
Rich	2514	60 (2.4)		
Maternal marital status				
Married	3832	69 (1.8)		.191
Never married	2764	67 (2.4)		
Birth order				
1	1499	38 (2.6)		.415
2-3	2547	47 (1.8)		
4+	2550	51 (1.9)		
Type of pregnancy				
Single	6383	120 (1.9)		<.001
Twin	213	16 (7.4)		
Gender of child				
Male	3405	77 (2.3)		.338
Female	3191	59 (1.9)		
Birth weight ^a				
Normal weight	4544	58 (1.3)		<.001
Low weight	439	15 (3.5)		
Macrosomia	219	9 (4)		
Breast feeding initiation				
Beyond first 1 hour	1649	18 (1.1)		<.001
Within first 1 hour	4625	47 (1.1)		
Antenatal visit ^a				
No	623	13 (2.9)		<.001
Yes	5202	76 (1.4)		
Delivery place				
Health facility	5324	109 (2.1)		.771
Home	1250	28 (1.9)		
Mode of delivery				
Vaginal	5905	114 (1.9)		.083
Cesarean	691	22 (3.2)		
Preceded birth interval ^a				
<24 months	815	15 (1.8)		.982
>24 months	4270	76 (1.8)		

^aVariables with missing.**Table 4.** Distributions of Early Neonatal Mortalities in Tanzania According to Community Characteristics (N= 629).

Community level variables	ENM		P-value
	n (%)		
Place of residence			
Urban	49 (2.7)		.109
Rural	87 (1.8)		
Geographical zones			
Western	12 (1.7)		.521
Northern	12 (1.7)		
Central	12 (1.9)		
Southern Highland	9 (2.6)		
Southern	1 (0.4)		
Southern West	13 (2.1)		
Lake zone	47 (2.1)		
Eastern	26 (3.1)		
Zanzibar	4 (1.9)		
Community level of poverty			
High	79 (2.5)		.082
Low	57 (1.7)		
Community women's educations			
High	72 (1.9)		.649
Low	64 (2.2)		
Community media exposure			
High	54 (1.5)		.006
Low	82 (2.7)		

Abbreviation: N, number of cluster.

This findings are consistent with studies conducted in Ethiopia, and Nigeria^{12,14} which demonstrated a sluggish decline in the early neonatal mortality despite of several initiatives aimed to improve accesses to health care services, the persistent of health system challenges, socio-economic inequalities, high rates of preterm birth, low birth weight infants, inadequate access to quality neonatal care, shortages of skilled birth attendants, and weak referral systems contribute to preventable newborn deaths in developing countries.¹⁴

Finding from this study showed neonates who born with low birth weight had a higher risk of dying within the first 7 days of life compared with neonates born with normal weight, this is supported by evidenced research conducted Uganda, Kenya,¹⁵⁻¹⁷ and also in line with the study conducted in Ghana¹⁸ this similarities of the result because both studies conducted in African countries where access to advanced technology and specialized care for low birth weight neonates is limited. The findings can be explained by the fact that underweight babies often encounter obstacles such as feeding difficulties, increased vulnerability to infections, physically immature, often experiencing complications such as underdeveloped

Table 5. Multilevel Regression Analysis of Individual and Community-Level Factors Associated With Early Neonatal Mortality in Tanzania 2022 (N = 6596).

Variables	Null model	Model I	Model II	Model III
		Individual level AOR (95% CI)	Community level AOR (95% CI)	Individual and community AOR (95% CI)
<i>Individual variable</i>				
Mother' age				
20-29				
Below 20		0.60 (0.22, 1.64)		0.75 (0.24, 1.77)
30-39		1.35 (0.75, 2.45)		1.38 (0.71, 2.31)
40-49		2.63 (1.21, 5.68)		2.43 (1.13, 5.24) **
Maternal marital status				
Married				
Never married		1.97 (1.27, 3.06)		2.08 (1.30, 3.12)*
Type of pregnancy				
Single				
Multiple		6.10 (2.58, 14.47)		5.74 (2.43, 13.57) *
Child weight at birth				
Normal				
Low birth weight		2.93 (1.45, 5.94)		2.81 (1.39, 5.70) **
Neonatal sex				
Male				
Female		0.72 (0.47, 1.11)		0.72 (0.47, 2.11)
Antenatal attendance				
Yes				
No		1.29 (0.70, 2.50)		1.35 (0.73, 2.50)
Birth order				
2-3				
I		1.49 (0.73, 2.67)		1.42 (0.73, 2.67)
4+		0.85 (0.47, 1.56)		0.94 (0.52, 1.73)
Community media				
High				
Low			1.4 (0.87, 2.13)	1.82 (1.14, 2.84) **
Random effect				
ICC%	8.5%	6%	5%	2.4%
PCV%	Reference	32.3%	35%	74%
Model fitness				
LLR	- 665.063	- 428.60	- 658.09	- 425.42
Deviance	1330.13	857.20	1316.19	850.84
AIC	1334.13	885.20	1342.20	880.84

Abbreviations: CI, confidence interval; AOR, adjusted odds ratio; Model II, adjusted for individual-level factors; Model III, adjusted for community-level factors; Model IV, adjusted for both individual and community level factors; ICC, intra-class correlation, coefficients; PCV, Proportional Change in Variance; AIC, Akaike Information Criterion; LLR, log likelihood ratio.

* $P < .001$. ** $P < .05$.

lungs, and maintaining body temperature due to their limited body fat¹⁹ which increase the risk of neonatal death.

The finding of this study confirmed risk of mortality within the first week of life is higher for twins or multiple births compared to single births, similar finding reported from previous studies²⁰⁻²³ which showed multiple pregnancies is a significant determinants of early

neonatal mortality. Multiple births are often linked to premature birth, low birth weight, and biological immaturity²⁴ premature babies manifest with greater risks of infection, hypoglycemia, and hypothermia²⁰ the conditions often result in critical illness which increase the likelihood of adverse outcomes, including early newborn mortality.

Being un-married increases the odds of early neonatal mortality, this could be explained by the fact that married mothers receive psychological and material support from their partners, which facilitates easier access to healthcare services and reduces stress during pregnancy, resulting in better pregnancy outcomes. Additionally, married mothers are reported to have higher levels of birth preparedness as compared to unmarried counterparts.²⁵ This finding is in line with the result found in Brazil.²⁶ However, a study conducted in Nepal did not find statistical significance when analyzing the marital status of pregnant women in relation to neonatal death.²⁷

Additionally, there is a positive association between advanced maternal age and early neonatal mortality, and this could be because older age mothers require appropriate birth preparedness to ensure neonatal survival due to an increased risk of congenital malformations. In addition, advanced maternal age is associated with antenatal and delivery complications where both of these complications are known risk factors for early neonatal deaths.^{20,28} The findings are in line with previous studies conducted in Korea and Ethiopia^{7,29} but also study done in Pakistan where the authors reported maternal age above 40 years was associated with an increased risk of early neonatal death.²⁸

Determinants of early neonatal mortality extend beyond individual level factors, the finding of this study showed community media exposure is a significant predictor for early neonatal mortality in Tanzania, mothers who residing in communities with low media exposure had nearly 2-fold higher odds of experiencing early neonatal mortality, this finding aligns with the reported study conducted in Ethiopia,¹³ the similarity of the finding because the studies used similar study design (DHS) and analytical approach (multilevel regression). However, the results contrast with a study conducted in Bangladesh where media exposure was not found to be a significant predictor for early neonatal mortality,³⁰ this difference of the result may be attributed by difference analysis approach. Community with low media exposure predominantly found in area where socioeconomic activities are limited, leading to poor access to media, consequently lower awareness about childhood illnesses, precautions, utilization of antenatal care (ANC) and institutional delivery which is potentially contributed to the observed higher risk of child mortality in the present study.

Strengths and Limitations

This study has several notable strengths include the use of the nationally representative 2022 TDHS dataset,

ensuring its findings are applicable across Tanzania and accurately reflect current circumstances. It used large sample size that further enhances the generalizability of the results. However, the study has several limitations. Early neonatal mortality estimates relied on self-reported data from surviving women, which may have introduced reporting bias and led to underestimation. Additionally, some stillbirths might have been misclassified as neonatal deaths, slightly inflating the estimates. Recall bias is another potential issue, as data were collected retrospectively. The reliance on secondary data excluded important factors such as preterm birth. Finally, the cross-sectional design prevents the establishment of causal relationships, limiting the conclusions to associations.

Conclusions

There was slight decrease in neonatal mortality over the past decade. Key determinants of neonatal mortality included multiple pregnancies, low birth weight, unmarried mothers, maternal age, and limited media exposure.

Recommendations

These findings underscore the importance of tailored interventions in reducing early neonatal mortality particularly among neonates with low birth weight, those born to mothers with advanced age and those with multiple pregnancies. Efforts to reduce early neonatal mortality require urgent attention to both individual and community-level factors. Promoting antenatal care (ANC) and birth preparedness for mothers with multiple pregnancies and older women also encouraging hospital deliveries with specialist care and universal access to essential newborn care (ENC) are vital. Strengthened maternal education, awareness of neonatal risks, and policies aimed at social support systems for vulnerable mothers, including those facing socio-economic disadvantages, may help mitigate risk factors associated with early neonatal mortality.

Abbreviations

ANC, Antenatal Care; CS, Cesarean section; DHS, Demographic and Health Surveys; EmONC, Emergency obstetric and neonatal care; ENMR, Early Neonatal Mortality Rate; IMCI, Integrated Management of Childhood Illness; KMC, Kangaroo Mother care; LBW Low birth weight; MDG, Millennium Development Goals; NICU, Neonatal intensive care unit; NMR, Neonatal Mortality Rate; PNC, Post-Natal care; PSU, Primary Sampling Unit; SDG, Sustainable Development Goals; SPA, Service Provision Assessment;

SSA, Sub-Saharan Africa; TDHS, Tanzania Demographic and Health Survey; WHO, World Health Organization.


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Ethical Consideration

Ethical approval to conduct the current study was obtained from Kilimanjaro Christian Medical College Clinical Research Ethics and Review Committee (KCMU-CREC) with clearance number PG 126 /2023. Additionally, as this study used secondary DHS data, ethical permission for the survey was obtained in advance.

Consent to Participate

Informed consent was secured from all participants. For respondents under 18, written consent was provided by their parents or guardians. Additional details on data and ethical guidelines are available on the DHS program website (<https://dhsprogram.com/methodology/Protecting-the-Privacy-of-DHS-Survey-Respondents.cfm>).

Author Contributions

Shemsa Said Khatib, Michael J. Mahande: Conceptualization. Shemsa Said Khatib, Sanun Ally Kessy and Michael J. Mahande: Formal analysis. Shemsa said Khatib, Sanun Ally Kessy and Michael J. Mahande: Methodology. Michael J. Mahande, Nassra Is-hak Yussuf and Ephrasia Hughho: Supervision. Shemsa said Khatib: Writing – original draft. Nassra Is-hak Yussuf, Ephrasia Hughho, Jovin R Tibenderana, Hindu Ibrahim Hussein, and Michael J. Mahande: Writing – review & editing.

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Declaration of Conflicting Interests

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Data Availability Statement

The datasets used and/or analyzed during the current study available from the corresponding author on reasonable request.

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