Title: Trends and Determinants of Neonatal Mortality in Uganda: Analysis of the Uganda Demographic and Health Surveys

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Abstract:

Uganda's neonatal mortality has stagnated at 27 deaths per 1,000 live births over the past decade, and the UN Sustainable Development Goal for reducing neonatal deaths risks being missed. Studying consistent factors over time that are associated with neonatal mortality could inform policy to reduce it. We used Uganda Demographic and Health Surveys and applied complementary log-log model and controlled for complex survey design in analyses.

Children who were not put on breast milk immediately after birth and children of mothers with multiple maternal risk factors were associated with higher odds of neonatal deaths. There is a need to sensitize mothers about the importance of breastfeeding newborns immediately after birth. Interventions to reduce the number of teenage pregnancies and promotion of contraceptive use to help avoid higher-risk childbearing are critical to reducing neonatal mortality in Uganda.

Key words: Neonatal, mortality, Uganda, children, trends

Introduction

Globally, 8.2 million children under age 5 die each year, and more than 40% of these are neonatal deaths, occurring before 30 days of life. In sub-Saharan Africa alone, 1.2 million newborns die every year (Kananura, Tetui, Waiswa, and Kiwanuka, 2016), and sub-Saharan has the highest risk of neonatal deaths among 186 countries studied in 2013 (Oza, Cousens, and Lawn, 2014). In Uganda, one child in every 16 does not survive to the fifth birthday, and neonatal deaths account for 42% of under-five deaths (UBOS and ICF, 2018). The Millennium Development Goal on improving under-five survival, where neonatal mortality is a high proportion of all under-five deaths, was not achieved (UNDP, 2015). The current targets in Uganda for the UN Sustainable Development Goal for reducing neonatal mortality risks being missed, since neonatal mortality has stagnated over the last decade.

As Figure 1 shows, Uganda's neonatal mortality ratio declined from 33 deaths per 1,000 live births in 2001 to 27 deaths per 1,000 live births in 2006, but no change in the ratio occurred between 2006 and 2016. Therefore, identifying factors associated with neonatal mortality could help policymakers to improve early childhood survival.

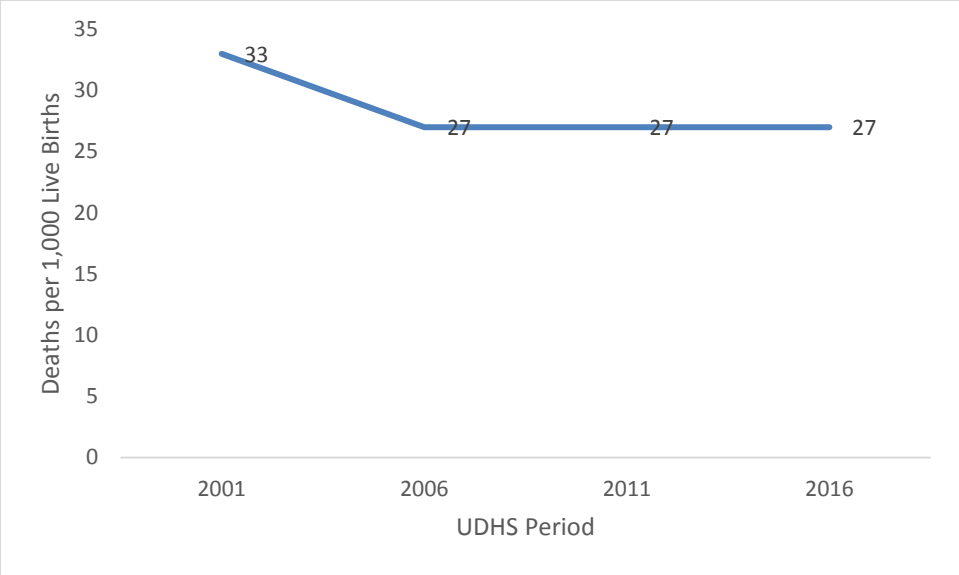

Figure 1: Trend in Uganda's Neonatal Mortality, 2001 to 2016

Source: Uganda Demographic and Health Surveys

(https://www.statcompiler.com/en/)

As cited in Kananura et al. (2016), the major causes of Uganda's neonatal deaths include sepsis/pneumonia, tetanus, diarrhea, prematurity, and birth asphyxia (Liu et al., 2012). Other studies show that poor access and utilization of health services during pregnancy and childbirth, especially the high number of deliveries that take place without skilled birth attendants, are also associated with neonatal deaths. Risk factors including mothers too young (below age 18), too old (age 35 and older), with short birth intervals, and with too many children have also been associated with high rates of neonatal mortality (GSS et al., 2004). Similarly, Ikamari, 2013 found maternal age at birth and preceding birth interval as risk factors to neonatal deaths. However, there is limited literature on the demographic and socioeconomic factors that have consistently over time been shown to be associated with neonatal

deaths in Uganda. The objectives of this paper were to explore demographic and socio-economic factors that have consistently over time been associated with neonatal mortality.

Conceptual Framework

We adapted the Mosley and Chen (1984) to come up with independent variables. The model was based on the premise that social and economic determinants of child mortality operated through proximate biological determinants, exerting an impact on mortality. Three levels were proposed: the socio-economic determinants of disease and survival, the proximate and biological determinants, and outcome expressed in terms of growth and death. An expanded framework incorporating five levels in a linear model: household characteristics (behavioral); intermediate variables (behavioral and biological); risk factors (biological); malnutrition-infection syndrome; and demographic outcome (Bengtsson, Campbell, Lee, 2009). We have conceptualized these factors and summarized them as in Figure 2.

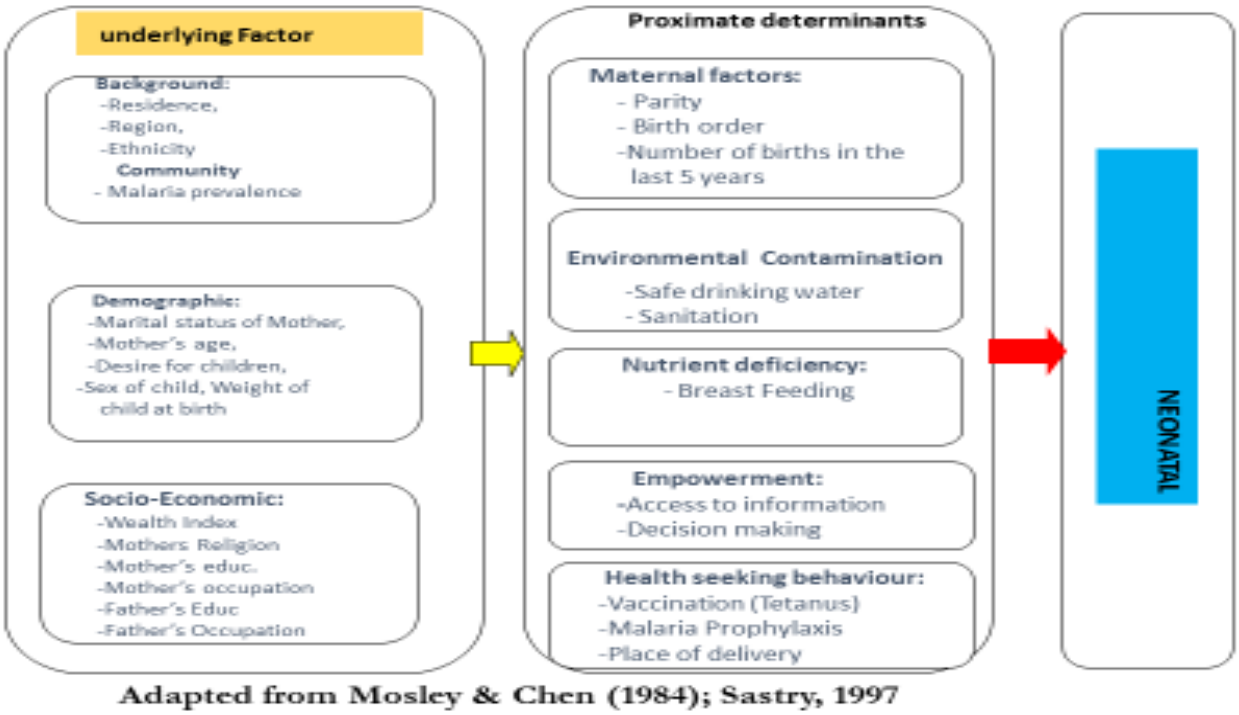

Figure 2: Pathways through which underlying and proximate factors may affect neonatal mortality

Data, methods and scope

Data used

The study used a series of data from the Uganda Demographic and Health Surveys (UDHS) for 2001, 2006, 2011, and 2016. Across these surveys, similar sampling designs were applied, using a two-stage cluster sampling to generate a nationally representative sample of households. In the first stage, clusters were selected from sampling frames using the most recent available census. In the second stage, households were selected from each cluster. In each of the surveys there was stratification of urban and rural areas for the different sampled clusters. This study

used data from women age 15-49 interviewed in the UDHS about their children born within the five years prior to the survey. Figure 2 shows the selection process for the number of children considered in our analysis.

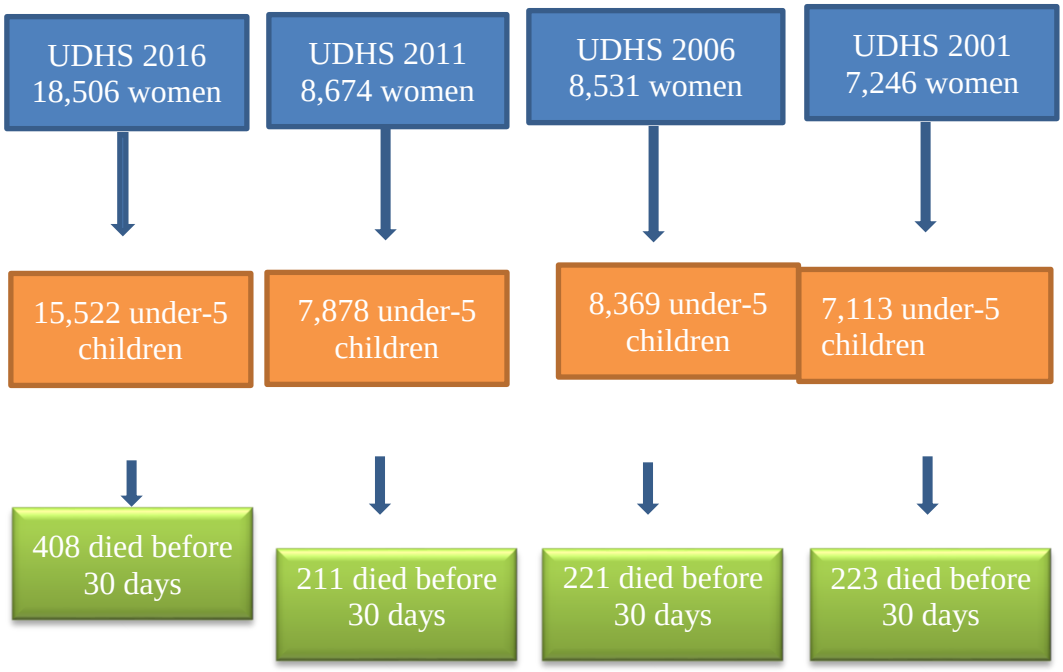

Figure 2: Selection of the Number of Children Who Died Before Age One Month

Measurement of variables and statistical methods

The statistical analyses focused only on children under age one month born to mothers age 15-49 in the five years prior to the different surveys considered in the study. The analysis took into consideration the complex survey design, and weights were applied to ensure representativeness and to correct for non-response.

The outcome variable of interest was survival status of the child before age one month, which is a binary variable (dead or alive). The independent variables in the study included: place of residence; ethnicity; marital status of the mother; sex of the child; household wealth index; mother's religion; mother's education; mother's occupation; father's education; father's occupation; access to safe water for drinking; breastfeeding; access to information; women's empowerment; vaccination (tetanus); ever had fever; place of delivery; and risk factors for childbearing. A women's empowerment index was derived from survey responses on participation in decision-making on household purchases, visits to family relatives, and own health care. The index was categorized into three parts: 0 for low empowerment (no participation in decision-making); 1 for weak empowerment (participation in one or two types of decisions); and 2 for high empowerment (participation in all three types of decisions). We used four regions (Central, East, North, and West) to harmonize among the four surveys, since there have been variations in the number of regions across the survey period. Mother's age at the time of survey, birth order, and preceding birth interval were used to compute maternal risk factors associated with newborn mortality. The risk factors were considered as mother's age too young (under age 18), or too old (over age 34), birth interval too soon (birth intervals less than two years), or with too many births (more than four children). A composite variable showing children born to mothers with multiple risks for childbearing was computed from these risk factors and was used at the bivariate level and in the regression model.

Cross-tabulation of the outcome variable with the independent variables was carried out. At the multivariable level, an association between selected variables of interest and the outcome variable (survival status of children under age one month) was estimated using a complementary log-log model. This model was used because the outcome—neonatal death—is rare (Calabrese and Osmetti, 2013). Results were accepted at the 95% confidence level. We tested for multicollinearity among the independent variables and excluded from the model the variables birth order and parity, which exhibited high correlation. One major limitation of the analysis is that medical factors associated with neonatal death were not considered, as they were not available in the dataset and were not a focus of the study.

Results

Table 1 shows the association between the percentage of children who died before age one month and selected child and maternal background characteristics, among children born in the five years prior to the UDHS surveys, from 2001 to 2016. At the bivariate level, the only factor found to be significantly and consistently associated with higher neonatal mortality in each of the four surveys was mother not receiving a tetanus injection. Other factors that were significantly associated with higher levels of neonatal deaths in some of the surveys, particularly the 2016 UDHS, included: male children, children born to younger mothers (age 15-19) or older mothers (age 45-49), children of mothers who had less than four visits for antenatal care (ANC), and children not put on breast milk immediately.

Children born to mothers who received recommended doses of tetanus injection were significantly associated with a lower percentage of neonatal deaths, ranging from 1.6% to 2.4% over the survey period 2001 to 2016 compared with 3.5% to 4.4% among those whose mothers who did not receive any doses of the tetanus vaccine. Male children were significantly associated with higher neonatal mortality compared with females. Children whose mothers had less than four ANC visits were significantly associated with higher neonatal mortality compared with those who had the recommended four or more visits (WHO, 2016). Children who were breastfed immediately after birth registered lower neonatal mortality, ranging from 1.1% to 2.2% over the survey period 2001 to 2016 compared with 2.9% to 3.7% among those who were not immediately breastfed. Children born to mothers with

multiple risk factors were significantly associated with higher neonatal mortality compared to those with no risk factor.

Table 1: Percentage of children who died before age one month by selected child and maternal background characteristics, UDHS 2001 to 2016

Variable	2016		2011		2006		2001	
	p-value/ percentage	N	p-value/ percentage	n	p-value/ percentage	N	p-value/ percentage	n
Type of place of residence	**0.936**		**0.537**		**0.471**		**0.038**	
Urban	2.7	3,233	2.4	1,147	2.2	953	2.1	821
Rural	2.6	12,038	2.7	6,928	2.7	7,470	3.4	6,850
Region	**0.056**		**0.822**		**0.315**		**0.036**	
Central	3.2	4,106	2.9	2,129	2.8	1,942	3.0	2,173
Eastern	2.2	4,297	2.4	2,281	2.0	2,222	2.4	2,305
Northern	2.8	3,038	2.8	1,510	3.1	1,937	4.6	1,316

Variable	2016		2011		2006		2001	
	p-value/ percentage	N	p-value/ percentage	n	p-value/ percentage	N	p-value/ percentage	n
Western	2.3	3,829	2.6	2,155	2.7	2,323	3.7	1,878
Religion	**0.172**		**0.254**		**0.293**		**0.945**	
Catholic	2.7	5,904	3.0	3,350	2.7	3,716	3.4	3,159
Anglican	2.8	4,712	2.1	2,373	2.3	2,889	3.1	3,008
Moslem	3.0	2,199	2.3	1,055	2.3	936	3.2	1,009
Others	1.9	2,456	3.1	1,298	3.7	881	3.3	496
Sex of child	**0.012**		**0.029**		**0.000**		**0.116**	
Male	3.0	7,695	3.1	4,050	3.3	4,180	3.6	3,814
Female	2.3	7,576	2.2	4,026	1.9	4,243	2.9	3,858

Variable	2016		2011		2006		2001	
	p-value/ percentage	N	p-value/ percentage	n	p-value/ percentage	N	p-value/ percentage	n
Mother's age	**0.001**		**0.049**		**0.100**		**0.215**	
15-19	4.5	971	2.9	469	3.8	439	3.6	518
20-24	2.5	4,216	3.6	2,023	2.8	2,208	3.5	2,237
25-29	2.1	3,968	2.0	2,365	3,0	2,241	2.2	2,116
30-34	2.4	3,025	1.6	1,455	2.1	1,758	3.5	1,389
35-39	2.6	1,932	3.2	1,128	1.8	1,087	4.4	901
40-44	3.2	920	3.2	495	1.9	531	3.4	388
45-49	6.5	238	2.6	141	5.1	159	3.5	123
Marital status	**0.951**		**0.529**		**0.916**		**0.341**	

Variable	2016		2011		2006		2001	
	p-value/ percentage	N	p-value/ percentage	n	p-value/ percentage	N	p-value/ percentage	n
Never married	3.0	657	1.5	219	3.0	266	1.2	211
Married/living together	2.6	12,863	2.7	7,004	2.6	7,233	3.2	6,746
Widow/divorced	2.5	286	3.9	225	2,0	282	3.1	190
Not living together	2.8	1,464	2.2	620	2.7	642	4.3	525
Mothers highest educational level	**0.488**		**0.533**		**0.464**		**0.091**	
No education	3.2	1,680	1.9	1,161	3.1	1,910	3	1,891
Primary	2.6	9,391	2.7	5,161	2.5	5,358	3.6	4,922
Secondary	2.7	3,243	3.0	1,475	2.1	957	2.2	735

Variable	2016		2011		2006		2001	
	p-value/ percentage	N	p-value/ percentage	n	p-value/ percentage	N	p-value/ percentage	n
Higher	1.9	958	3.2	279	2.9	198	0.5	123
Wealth quintile	**0.140**		**0.316**		**0.646**		**0.937**	
Poorest	2.5	3,442	1.9	1,812	2.9	1,893	3.2	1,604
Poorer	2.3	3,203	3.1	1,727	2.7	1,900	3.5	990
Middle	2.5	2,950	2.4	1,616	2.1	1,676	3.2	1,237
Richer	3.5	2,735	3.3	1,425	2.8	1,604	2.8	1,497
Richest	2.4	2,940	2.7	1,496	2.5	1,351	3.5	2,344
Women's empowerment	**0.606**		**0.132**		**0.808**		**0.614**	

Variable	2016		2011		2006		2001	
	p-value/ percentage	N	p-value/ percentage	n	p-value/ percentage	N	p-value/ percentage	n
Low	2.8	3,874	2.4	2,322	2.5	2,681	2.8	1,939
Middle	2.4	4,073	3.3	2,580	2.5	2,483	3.4	3,443
Empowered	2.6	7,324	2.3	3,174	2.8	3,259	3.4	2,289
Number of antenatal visits	0.000		0.955		0.644		0.203	
Less than four	2.6	4,072	1.8	2,602	1.5	2,658	2.2	2,603
Four or more	1.5	6.080	1.8	2,366	1.7	2,377	1.6	1,881
Place of delivery	**0.469**		**0.237**		**0.525**		**0.515**	

Variable	2016		2011		2006		2001	
	p-value/ percentage	N	p-value/ percentage	n	p-value/ percentage	N	p-value/ percentage	n
Public	2.5	8,748	3,0	3,554	2.9	2,455	2.7	1,704
Private	2.8	2,455	1.9	1,078	2.2	1,008	3.3	1,103
No facility	2.9	4,068	2.5	3,433	2.5	4,886	3.3	4,816
Women's occupation	**0.502**		**0.292**		**0.370**		**0.749**	
Not working	2.4	2,642	3.0	1,668	1.8	624	3.4	1,243
Agriculture/self employed	2.5	6,944	2.3	4,227	2.8	6,057	3.1	5,331
Other occupations	2.8	5,685	3.1	2,180	2.5	1,742	3.6	1,098
Access to information	**0.576**		**0.585**		**0.441**		**0.118**	

Variable	2016		2011		2006		2001	
	p-value/ percentage	N	p-value/ percentage	n	p-value/ percentage	N	p-value/ percentage	n
No access to information	2.8	3,596	2.9	1,292	3.0	1,609	3.7	390
With access to information	2.6	11,674	2.6	6,783	2.5	6,814	2.9	4,282
When child put to breast	**0.000**		**0.002**		**0.108**		**0.002**	
Not immediately	3.7	6,470	3.4	3,955	2.9	5,215	3.5	6,937
Immediately after birth	1.8	8,801	1.9	4,121	2.2	3,208	1.1	734
Tetanus injections before birth	**0.000**		**0.000**		**0.000**		**0.000**	
No tetanus injection	3.7	6,550	3.5	4,028	3.7	4,561	4.4	4,550

Variable	2016		2011		2006		2001	
	p-value/ percentage	N	p-value/ percentage	n	p-value/ percentage	N	p-value/ percentage	n
Under dose 1-2	1.9	6,322	1.9	2,885	1.3	2,826	1.2	2,376
Recommended dose 3+	1.6	2,398	1.7	1,162	1.6	1,036	2.4	746
Distance to health facility	**0.346**		**0.462**		**0.071**		**0.041**	
Big problem	2.5	6,254	2.5	3,697	2.9	5,026	3.8	3,593
No problem/small problem	2.7	9,016	2.8	4,369	2.2	3,394	2.7	4,067
Maternal risk (too young/too old/too many/too soon)	**0.002**		**0.074**		**0.354**		**0.060**	

Variable	2016		2011		2006		2001	
	p-value/ percentage	N	p-value/ percentage	n	p-value/ percentage	N	p-value/ percentage	n
Not multiple risk	2.4	12,078	2.4	6,156	2.5	6,371	3.0	5,922
Had multiple risk	3.5	3,192	3.3	1,919	3.0	2,052	4.1	1,750

Table 2 presents results from a complementary log-log model to establish factors associated with neonatal mortality. Our results did not show consistent factors associated with neonatal deaths over all four of the surveys. However, in the three most recent surveys, from 2006 to 2016, children who were put on breast milk were significantly associated with reduced odds of neonatal deaths. Results also show that in the two most recent surveys, 2011 and 2016, children whose mothers had multiple risk factors were associated with increased odds of neonatal deaths.

Children who were not put on breast milk immediately after birth were significantly associated with higher odds of neonatal mortality, ranging from 2.1 times higher in 2006 to 3.3 times higher in 2016 compared with children who were breastfed immediately. In the 2011 and 2016 surveys, children whose mothers had multiple risk factors had about twice the odds of dying in the first month compared with those whose mothers had no risk factors. Children whose mothers attended less than the four recommended ANC visits were significantly associated with lower odds (0.6) of neonatal deaths, but only in the most recent survey, as shown in Table 2.

Table 2: Results from complementary log-log regression of socioeconomic factors associated with neonatal mortality, UDHS 2001 to 20016

Variable	Year 2016	2011	2006	2001
Type of place of residence (Ref: Urban)	0.9	1.3	1.7	1.1
Rural	(0.6 - 1.5)	(0.6 - 2.9)	(0.8 - 3.5)	(0.5 - 2.4)
Region (Ref: Central)				
Eastern	0.6	0.8	1.0	0.7
	(0.4 - 1.1)	(0.4 - 1.5)	(0.4 - 2.6)	(0.3 - 1.6)
Northern	0.9	0.5	1.7	1.0
	(0.5 - 1.5)	(0.2 - 1.1)	(0.8 - 3.8)	(0.4 - 2.5)
Western	0.9	0.7	0.8	0.9
	(0.5 - 1.5)	(0.3 - 1.6)	(0.4 - 1.8)	(0.4 - 2.3)
Religion (Ref: Catholic)				
Anglican	1.1	0.7	1.1	0.8
	(0.8 - 1.6)	(0.4 - 1.2)	(0.6 - 2.0)	(0.5 - 1.4)
Moslem	1.2	0.7	0.8	0.8

Variable	Year 2016	2011	2006	2001
	(0.7 - 1.9)	(0.3 - 1.4)	(0.3 - 2.1)	(0.4 - 1.8)
Others	0.5*	0.9	1.4	1.0
	(0.3 - 0.9)	(0.5 - 1.6)	(0.6 - 3.2)	(0.4 - 2.6)
Sex of child (Ref: Female)				
Male	1.3	1.0	2.1**	1.5
	(1.0 - 1.8)	(0.7 - 1.6)	(1.2 - 3.5)	(0.9 - 2.5)
Marital status (Ref: Single)				
Married/living Together	0.9	0.8	1.1	1.3
	(0.4 - 1.9)	(0.2 - 2.9)	(0.3 - 4.6)	(0.3 - 4.7)
Widow/divorced	0.9	1.2	0.2	1.7
	(0.3 - 2.8)	(0.2 - 6.1)	(0.0 - 2.4)	(0.3 - 9.5)
Not living together	0.7	0.7	1.4	1.6
	(0.3 - 1.6)	(0.2 - 3.1)	(0.4 - 4.6)	(0.4 - 7.2)
Highest educational level (Ref: None),	0.9	0.9	1.4	1.2

Variable	Year			
	2016	2011	2006	2001
Primary				
	(0.6 - 1.5)	(0.5 - 1.9)	(0.7 - 2.8)	(0.6 - 2.3)
Secondary	0.9	0.9	0.5	0.9
	(0.5 - 1.8)	(0.4 - 2.1)	(0.1 - 2.1)	(0.3 - 2.3)
Higher	0.7	1.6	0.9	0.1*
	(0.3 - 1.9)	(0.4 - 7.2)	(0.1 - 6.3)	(0.0 - 0.6)
Wealth quintile (Ref: Poorest),				
Poorer	1.0	2.3*	0.9	0.6
	(0.6 - 1.5)	(1.0 - 5.2)	(0.4 - 2.1)	(0.2 - 1.6)
Middle	1.1	2.0	1.0	0.6
	(0.6 - 1.9)	(0.8 - 4.9)	(0.4 - 2.3)	(0.3 - 1.3)
Richer	1.3	2.2	1.5	0.8
	(0.8 - 2.4)	(0.9 - 5.3)	(0.7 - 3.3)	(0.3 - 1.8)
Richest	0.8	2.5	1.5	0.7

Variable	Year 2016	2011	2006	2001
	(0.3 - 1.7)	(0.9 - 7.1)	(0.5 - 4.9)	(0.3 - 1.5)
Empowerment (Ref: Not empowered)				
Limited empowerment	0.8	1.7	0.6	0.9
	(0.5 - 1.6)	(0.8 - 3.8)	(0.3 - 1.3)	(0.5 - 1.8)
Empowered	1.0	1.8	0.8	0.9
	(0.5 - 1.7)	(0.8 - 4.0)	(0.4 - 1.7)	(0.4 - 1.7)
Attend recommended ANC visits (Ref: <=3 visits)				
4 or more ANC visits	0.6**	1.1	1.2	0.8
	(0.4 - 0.9)	(0.7 - 1.8)	(0.7 - 2.0)	(0.5 - 1.3)
Place of delivery (Ref: Home/not health facility)				
Public	1.1	0.8	1.2	1.4
	(0.8 - 1.7)	(0.5 - 1.3)	(0.7 - 2.2)	(0.7 - 2.6)
Private	1.6	0.4*	0.9	0.8

Variable	Year 2016	2011	2006	2001
	(0.9 - 2.6)	(0.2 - 1.0)	(0.4 - 1.9)	(0.4 - 1.9)
Woman's occupation (Ref: Not employed) Agriculture/self-employed	1.2	0.6	0.6	0.7
	(0.7 - 1.9)	(0.3 - 1.1)	(0.2 - 1.9)	(0.3 - 1.2)
Other occupations	1.2	0.8	1.0	1.2
	(0.7 - 2.0)	(0.5 - 1.3)	(0.3 - 3.1)	(0.6 - 2.7)
Access to information (Ref: No access)	0.7	0.6	0.7	0.7
Access	(0.5 - 1.0)	(0.3 - 1.3)	(0.4 - 1.4)	(0.4 - 1.2)
When child first breastfed (Ref: Immediately)				
Not immediate	3.3***	3.5***	2.1*	2.0
	(2.3 - 4.6)	(2.2 - 5.7)	(1.1 - 3.7)	(0.9 - 4.4)
Mother received TT Injections before birth? (Ref: No tetanus injection)				
Received under dose	1.5	0.9	1.6	1.2

Variable	Year 2016	2011	2006	2001
	(0.9 - 2.4)	(0.4 - 2.0)	(0.7 - 3.3)	(0.6 - 2.1)
Received recommended dose	1.1	1.1	0.9	0.5
	(0.7 - 1.7)	(0.6 - 2.0)	(0.4 - 2.0)	(0.3 - 1.0)
Distance to medical facility a problem? (Ref: Big problem)				
Not a problem	0.8	0.8	1.5	1.2
	(0.6 - 1.2)	(0.5 - 1.4)	(0.9 - 2.4)	(0.8 - 2.0)
Multiple risk (Ref: No risk)	2.0***	1.9*	1.1	1.5
Risk	(1.5 - 2.7)	(1.1 - 3.2)	(0.6 - 1.9)	(0.9 - 2.4)

***** p<0.001, ** p<0.01, * p<0.05**

Discussion

We conducted an analysis of the trends and socioeconomic determinants of neonatal mortality in Uganda, using data from the Uganda Demographic and Health Surveys conducted in 2001, 2006, 2011, and 2016. The results did not show factors that could consistently explain neonatal mortality over the entire survey period. However, there were two key socioeconomic factors that were shown to be associated with increased neonatal mortality in the more recent surveys, namely children not breastfed immediately and children born to mothers with multiple risk factors for childbearing. Also, children whose mothers did not attend the recommended number of ANC visits were significantly associated with increased neonatal deaths only in the most recent DHS survey of 2016.

Children not put on breast milk immediately after birth have been found to be associated with high odds of neonatal deaths elsewhere. Studies by Smith et al. (2017) and Phukan, Ranjan, and Dwivedi (2018) show a positive association between breastfeeding within one hour after birth and reduced prevalence of neonatal deaths that closely relates with our findings. Breastfeeding mothers are also more likely to contribute to the Kangaroo method by creating a close bond between the child and mother (WHO, 2015). The Kangaroo method also has other benefits in reducing neonatal mortality; a mother is more likely to detect an illness in the child and therefore more likely to act faster to seek treatment compared with a non-breastfeeding mother. Breast milk immediately after birth is also rich in antibodies and essential nutrients. The trends in the results on children

breastfeeding immediately after birth are likely to be further explained by the increasing availability and use of fortified foods compared with earlier years.

Children whose mothers had multiple risk factors were associated with increased odds of neonatal deaths. Multiple risk factors were considered to be two or more of the following; too young, too old, too many children, and birth intervals too short. Bivariate results equally showed that mothers age 15-19 (too young) and those age 45-49 (too old) were associated with higher levels of neonatal deaths compared with those age 20-44. Other studies have found that children born to mothers with risk factors are associated with increased neonatal deaths (GSS et al., 2004). Children born to mothers who are too young (under age 18) do not have a fully developed body for reproduction. Young mothers are more likely to have children born prematurely or with low birth weight (Neal et al., 2018; Chen et al., 2008), and these children are prone to neonatal death. Such young mothers might also have problems of not being well versed on how to care for children, since they are still children themselves. Other studies have shown that young mothers have such problems as lack of a stable partner and paid job (Ribeiro et al., 2014). Uganda's teenage pregnancy prevalence stalled at 25% over the last decade, which could partly explain why risk factors have been significant over the last two recent surveys.

Older mothers (age 35+) have higher risks of hypertension during pregnancy (Ribeiro et al., 2014), which is more likely to cause neonatal and maternal deaths.

It is possible that older women tend to think that they are well versed with pregnancy, as indicated by their low rates of ANC attendance (Rurangirwa et al., 2017), and could be complacent and thus ignore some of the key aspects of proper care for their infants.

In the 2016 survey children whose mothers had fewer than the recommended number of ANC visits were associated with higher odds of neonatal deaths compared with those who had at least four attendances. Other studies have associated low ANC attendance with high neonatal mortality (Arunda et al., 2017; Ibrahim et al., 2012). ANC attendance of the recommended number and intervals increases chances of detecting pregnancy-related complications early enough, and appropriate advice can be given to the expectant mother.

Conclusion and Recommendations

Neonatal mortality in Uganda has stagnated over the last three UDHS surveys. The factors that were identified to be associated with neonatal deaths over time were children not put on breast milk immediately after birth, and children of mothers with multiple risk factors. Attendance at the recommended number of ANC visits was also found to be important. Actions targeted toward promotion of breastfeeding within one hour after birth, and sensitization of young and older women to take precautionary measures during birth are critical. There is also a need to encourage expectant women to go for at least four ANC visits.

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