Trends and determinants of neonatal mortality in Uganda: Analysis of the Uganda demographic and health surveys

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Abstract

Background: Uganda's neonatal mortality has stagnated at 27 deaths per 1,000 live births over the past decade. Studying consistent factors could inform policy to reduce it.

Data Source and Methods: We used Uganda Demographic and Health Surveys (2001 to 2016) in analyses.

Results: 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 (3.1 and 2.0 respectively) of neonatal deaths in 2016. The maternal risk factors include: young mothers, too old, short birth intervals or many children. Neonatal deaths was also higher among male compared to female newborns.

Conclusion: There is a need to raise awareness about the importance of breastfeeding newborns immediately after birth. Interventions to reduce maternal risk factors are critical to reducing neonatal mortality in Uganda. Programmes need measures that can reduce more neonatal deaths among male than female.

Keywords: Neonatal, mortality, Uganda, children, trends

Introduction

Globally, 5.4 million children under age 5 die each year, and about 46% of these are neonatal deaths, occurring before 28 days of life (UNICEF, 2018). In sub-Saharan Africa alone, 1.2 million newborns die every year (Kananura et al., 2016), and it 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 & ICF, 2018). The Millennium Development Goal on improving under-five survival to reduce by two-thirds by 2015, 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.

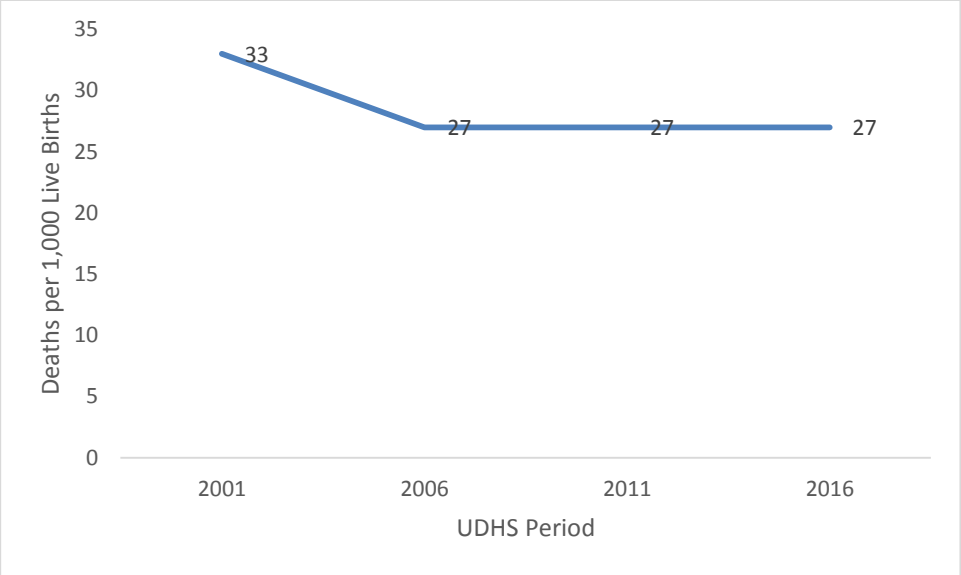
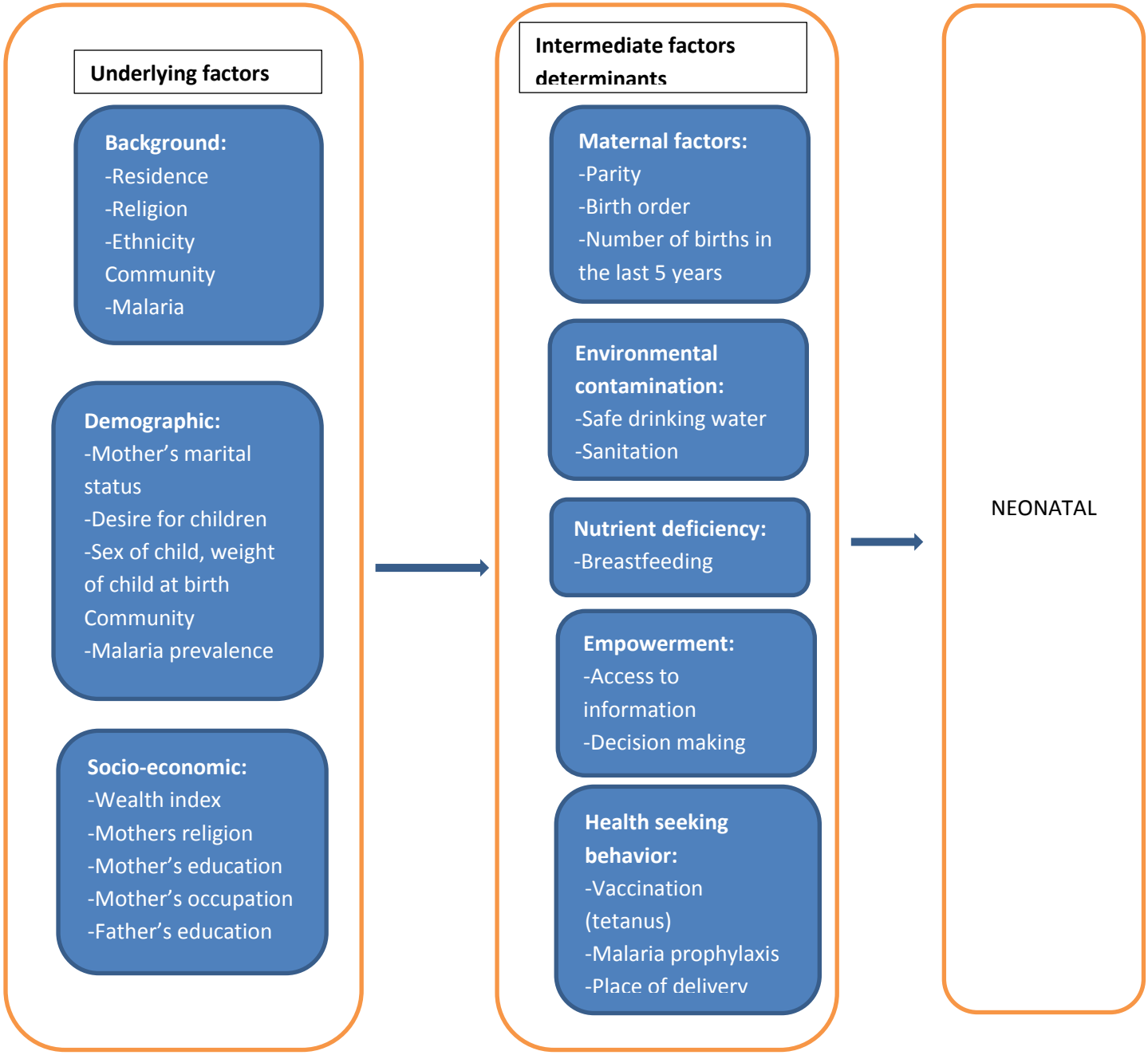


Figure 1: Trend in Uganda's Neonatal Mortality, 2001 to 2016
Source: Uganda Demographic and Health Surveys (https://www.statcompiler.com/en/)

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, 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 biological factors, exerting an impact on mortality. Three levels were proposed: the socio-economic determinants of disease and survival, the intermediate 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 et al., 2009). We have conceptualized these factors and summarized them as in Figure 2.



Adopted from Mosley and Chen (1984); Sastry (1997)

Figure 2: Pathways through which underlying and intermediate 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.

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; delivery by caesarian section 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 & Osmetti, 2013]). We ran two models separately for underlying and then for intermediate factors consistent with the conceptual framework although there was minimal difference when all variables were in the one model. Results were presented with their 95% confidence interval. We tested for multicollinearity among the independent variables and excluded from the model the variables birth order and parity, which exhibited high correlation.

Results

Table 1 shows a comparison between child survival status by selected child and maternal background characteristics, using 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 ($p=0.012$), children born to younger mothers age between 15-19 ($p=0.001$), children of mothers who had less than four visits for antenatal care ($p=0.000$), and children not put on breast milk immediately ($p=0.000$).

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 ($p=0.000$) to 2016 ($p=0.000$) 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 ($p=0.012$) associated with higher neonatal mortality compared with females. Children whose mothers had less than four ANC visits were significantly ($p=0.000$) 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 (p=0.001) associated with higher neonatal mortality compared to those with no risk factor. Association between place of delivery by caesarian section was only significant factor between the period 2006 (p=0.000) and 2011 (p=0.027) with more children born to mothers who had undergone caesarian dying before 28 days.

Table 1: Shows a comparison between child survival status by selected child and maternal background characteristics, using UDHS surveys, from 2001 to 2016

Variable	2016			2011			2006			2001		
	%	p-value	n	%	p-value	n	%	p-value	n	%	p-value	n
Place of residence												
Urban	2.7		3,233	2.4		1,147	2.2		953	2.1		821
Rural	2.6	**0.936**	12,038	2.7	**0.537**	6,928	2.7	**0.471**	7,470	3.4	**0.038**	6,850
Region												
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
Western	2.3	**0.056**	3,829	2.6	**0.822**	2,155	2.7	**0.315**	2,323	3.7	**0.036**	1,878
Religion	2.7			3.0			2.7			3.4		
Catholic	2.8		5,904	2.1		3,350	2.3		3,716	3.1		3,159
Anglican	3.0	**0.172**	4,712	2.3		2,373	2.3		2,889	3.2		3,008

Variable	2016			2011			2006			2001		
	%	p-value	n	%	p-value	n	%	p-value	n	%	p-value	n
Moslem	1.9		2,199	3.1		1,055	3.7		936	3.3		1,009
Others			2,456		**0.254**	1,298		**0.293**	881		**0.945**	496
Sex of child												
Male	3.0		7,695	3.1		4,050	3.3		4,180	3.6		3,814
Female	2.3	**0.012**	7,576	2.2	**0.029**	4,026	1.9	**0.000**	4,243	2.9	**0.116**	3,858
Mother's age												
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	**0.001**	238	2.6	**0.049**	141	5.1	**0.100**	159	3.5	**0.215**	123
Marital status	3.0			1.5			3.0			1.2		
Never married	2.6		657	2.7		219	2.6		266	3.2		211
Married/living together	2.5	**0.951**	12,863	3.9		7,004	2,0	**0.916**	7,233	3.1		6,746

Variable	2016			2011			2006			2001		
	%	p-value	n	%	p-value	n	%	p-value	n	%	p-value	n
Widow/divorced	2.8		286	2.2		225	2.7		282	4.3		190
Not living together			1,464			620			642			525
					0.529						**0.341**	
Mother's highest educational level												
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
Higher	1.9	**0.488**	958	3.2	**0.533**	279	2.9	**0.464**	198	0.5	**0.091**	123
Wealth quintile												
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	**0.140**	2,940	2.7	**0.316**	1,496	2.5	**0.646**	1,351	3.5	**0.937**	2,344

Table 1: Shows a comparison between child survival status by selected child and maternal background characteristics, using UDHS surveys, from 2001 to 2016 (Continued)

Variable	2016			2011			2006			2001		
	%	p-value	n	%	p-value	n	%	p-value	n	%	p-value	n
Women's empowerment												
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	**0.606**	7,324	2.3	**0.132**	3,174	2.8	**0.808**	3,259	3.4	**0.614**	2,289
Number of antenatal visits												
Less than four	2.6		4,072	1.8		2,602	1.5		2,658	2.2		2,603
Four or more	1.5	**0.000**	6.080	1.8	**0.955**	2,366	1.7	**0.644**	2,377	1.6	**0.203**	1,881
Place of delivery												
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	**0.469**	4,068	2.5	**0.237**	3,433	2.5	**0.525**	4,886	3.3	**0.515**	4,816
Delivery by caesarian section	3.7		877	4.3		467	6.6		256	4.3		208
Yes	2.6	**0.053**	14,583	2.6		7,411	2.5		8113	3.1	**0.313**	6889

No					**0.027**			**0.000**				
Women's occupation												
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	**0.502**	5,685	3.1	**0.292**	2,180	2.5	**0.370**	1,742	3.6	**0.749**	1,098
Access to information												
No access to information												
With access to information	2.8		3,596	2.9		1,292	3.0		1,609	3.7		3,390
	2.6	**0.576**	11,674	2.6	**0.585**	6,783	2.5	**0.441**	6,814	2.9	**0.118**	4,282
When child put to breast												
Not immediately												
Immediately after birth	3.7		6,470	3.4		3,955	2.9		5,215	3.5		6,937
	1.8	**0.000**	8,801	1.9	**0.002**	4,121	2.2	**0.108**	3,208	1.1	**0.002**	734

Tetanus injections before birth												
No tetanus injection												
Under dose 1-2	3.7		6,550	3.5		4,028	3.7		4,561	4.4		4,550
Recommended dose 3+	1.9		6,322	1.9		2,885	1.3		2,826	1.2		2,376
	1.6	**0.000**	2,398	1.7	**0.000**	1,162	1.6	**0.000**	1,036	2.4	**0.000**	746
Distance to health facility												
Big problem												
No problem/small problem	2.5		6,254	2.5		3,697	2.9		5,026	3.8		3,593
	2.7	**0.346**	9,016	2.8	**0.462**	4,369	2.2	**0.071**	3,394	2.7	**0.041**	4,067
Maternal risk (too young/too old/too many/too soon)												
Not multiple risk												
Had multiple risk	2.4		12,078	2.4		6,156	2.5		6,371	3.0		5,922
	3.5	**0.002**	3,192	3.3	**0.074**	1,919	3.0	**0.354**	2,052	4.1	**0.060**	1,750

Tables 2 and 3 presents results (odds and their 95% CI) from a complementary log-log model to establish underlying and intermediate factors respectively 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 not immediately put on breast milk were significantly associated with increased odds (2006: 2.1 95%CI: 1.1-3.8; 2016: 3.1 95%CI:2.2-4.4) 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 (2011: 1.7 95%CI: 1.1-2.8; 2016: 2.0 95%CI:1.5-2.8) of neonatal deaths. From 2006 to

2016, results show that male children were significantly associated with increased odds (2006: 1.8 95%CI: 1.3-2.4; 2016: 1.3 95%CI:1.1-1.6) of neonatal deaths compared to female ones.

Children who were not put on breast milk immediately after birth were significantly associated with higher odds of neonatal mortality, ranging from 2.1 (95%CI: 1.1-3.8) in 2006 to 3.1 (95%CI:2.2-4.4) 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. Male children were significantly associated with increased odds (2006: 1.8 95%CI: 1.3-2.4; 2016: 1.3 95%CI:1.1-1.6) of neonatal deaths compared to female ones. Children whose mothers attended four or more ANC visits were significantly associated with lower odds (0.6: 95%CI:0.4-0.9) of neonatal deaths, but only in the most recent survey, as shown in Table 2.

Table 2: Odds with their 95% CI from complementary log-log regression of underlying factors associated with neonatal mortality, UDHS 2001 to 20016

Variable	Year			
	2016	2011	2006	2001
	n=15,522	n=7,871	n=8,369	n=7,113
Type of place of residence (Ref: Urban)	1.0	1.3	1.2	1.6
Rural	(0.7 - 1.4)	(0.7 - 2.3)	(0.6 – 2.6)	(1.0 - 2.6)
Religion (Ref: Catholic)				
Anglican	1.0	0.7	0.9	0.9
	(0.8 - 1.4)	(0.4 - 1.0)	(0.6 – 1.3)	(0.6 - 1.3)
Moslem	1.1	0.7	0.9	1.0
	(0.8 - 1.6)	(0.5 - 1.2)	(0.5 – 1.6)	(0.6 - 1.5)
Others	0.7	1.0	1.5	0.9
	(0.5 – 1.0)	(0.6 - 1.5)	(0.9 – 2.4)	(0.5 – 1.6)
Sex of child (Ref: Female)	1.3*	1.4*	1.8***	1.3

Variable	Year			
	2016	2011	2006	2001
	n=15,522	n=7,871	n=8,369	n=7,113
Male				
	(1.1 - 1.6)	(1.0 – 2.0)	(1.3 – 2.4)	(1.0 – 1.8)
Marital status (Ref: Single)				
Married/living Together	0.9	1.9	0.8	2.6
	(0.5 - 1.6)	(0.7- 5.3)	(0.4 – 1.7)	(0.7 – 9.2)
Widow/divorced	0.8	3.1	0.6	2.6
	(0.3 - 2.2)	(0.8–12.4)	(0.2 – 1.8)	(0.5 – 14.3)
Not living together	0.9	1.7	0.8	3.5
	(0.4 - 1.9)	(0.5 – 5.4)	(0.3 – 2.0)	(0.9 – 13.3)
Highest educational level (Ref: None),				
Primary	0.8	1.3	0.8	1.2
	(0.5 - 1.1)	(0.8 – 2.1)	(0.5 – 1.2)	(0.8 – 1.8)
Secondary	0.7	1.5	0.6	0.8
	(0.5 - 1.1)	(0.8 - 2.6)	(0.3 – 1.2)	(0.4 – 1.6)
Higher	0.5	1.6	0.9	0.2*
	(0.2 - 1.1)	(0.5 – 4.9)	(0.3 – 2.7)	(0.1 - 0.7)

Variable	Year			
	2016	2011	2006	2001
	n=15,522	n=7,871	n=8,369	n=7,113
Wealth quintile (Ref: Poorest),				
Poorer	1.0	1.7	1.0	1.3
	(0.7 - 1.4)	(0.9 – 3.0)	(0.6 – 1.5)	(0.8 – 2.3)
Middle	1.0	1.3	0.7	1.0
	(0.7 - 1.5)	(0.6 – 2.5)	(0.4 – 1.2)	(0.6 - 1.8)
Richer	1.5*	1.8	1.1	0.9
	(1.1 - 2.2)	(1.0. - 3.3)	(0.7 – 1.7)	(0.5 - 1.6)
Richest	1.1	1.5	1.1	1.1
	(0.7 - 1.9)	(0.7 – 3.2)	(0.5 – 2.1)	(0.7 - 1.7)

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

Table 3: Odds with their 95% CI from complementary log-log regression of intermediate factors associated with neonatal mortality, UDHS 2001 to 20016

Variable	Year			
	2016	2011	2006	2001
	n=10,263	n=4,903	n=4,961	n=4,230
Empowerment (Ref: Not empowered)	0.9	1.5	0.7	1.0

Variable	Year			
	2016	2011	2006	2001
	n=10,263	n=4,903	n=4,961	n=4,230
Limited empowerment				
	(0.6 - 1.3)	(0.8 – 2.7)	(0.4 - 1.2)	(0.5 - 1.9)
Empowered	1.0	1.5	0.8	1.0
	(0.7 - 1.3)	(0.8 – 2.6)	(0.5 - 1.5)	(0.5 - 1.8)
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 - 1.7)	(0.7 - 2.0)	(0.5 - 1.3)
Place of delivery (Ref: Home/not health facility)				
Public	1.1	0.9	1.3	1.4
	(0.7 - 1.6)	(0.6 - 1.4)	(0.8 - 2.3)	(0.7 - 2.6)
Private	1.5	0.6	0.9	0.9
	(0.9 - 2.5)	(0.3 - 1.4)	(0.4 – 2.0)	(0.4 - 1.8)
Access to information (Ref: No access)	0.7*	0.8	0.8	0.8
Access	(0.5 - 1.0)	(0.4 - 1.5)	(0.4 - 1.4)	(0.5 - 1.3)
When child first breastfed (Ref: Immediately)				
Not immediate	3.1***	3.3***	2.1*	1.9

Variable	Year			
	2016	2011	2006	2001
	n=10,263	n=4,903	n=4,961	n=4,230
	(2.2 - 4.4)	(2.0 - 5.4)	(1.1 - 3.8)	(0.9 - 4.2)
Mother received TT Injections before birth? (Ref: No tetanus injection)				
Received under dose	1.5	1.0	1.5	1.2
	(0.9 - 2.4)	(0.5 - 2.0)	(0.7 - 3.3)	(0.7 - 2.1)
Received recommended dose	1.1	1.1	0.9	0.5*
	(0.7 - 1.6)	(0.6 – 1.0)	(0.4 – 1.9)	(0.2 - 1.0)
Distance to medical facility a problem? (Ref: Big problem)				
Not a problem	0.8	0.7	1.4	1.2
	(0.6 - 1.1)	(0.5 - 1.2)	(0.8 - 2.3)	(0.8 – 1.9)
Multiple risk (Ref: No risk)	2.0***	1.7*	1.0	1.4
Risk	(1.5 - 2.8)	(1.1 – 2.8)	(0.6 - 1.8)	(0.9 - 2.2)

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

Discussions

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 four survey periods. However, there were three key factors that were shown to be associated with increased neonatal mortality in the more recent surveys, namely children not breastfed immediately, sex of the child 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. Our analysis did not include medical factors and children born sick as they were not available in the dataset and were not the focus of the study.

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. There is increasing availability and use of fortified foods among neonates compared with earlier years could explain the reduction in mothers who breastfeed immediately after birth.

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, 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 (Chen et al., 2008; Neal et al., 2018), 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.

Results show that males have higher odds to neonatal deaths compared to females. Available literature show that male infants have an excessive risk of neonatal death compared to females (Naeye et al., 1971) and some explanations relate to biological factors like the woman not fully recuperating from one pregnancy before supporting the next one. For instance studies have shown that male fetus is more fragile than a female one (Kraemer, 2000). In Uganda, neonatal deaths have also been higher among male compared to female for instance statistics show that there are 31 male neonatal deaths per 1,000 live birth compared to 23 for females (UBOS & ICF, 2018). The findings of this study rhymes with available literature that show high neonatal deaths among male compared to female and the plausible factors include biological effects.

Conclusion and recommendations

Neonatal mortality in Uganda has stagnated over the last three UDHS surveys. The factors that were identified to be associated with high neonatal deaths over time were children not put on breast milk immediately after birth, and children of mothers with multiple risk factors and male infants. 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 raise awareness of young and older women to ensure make atleast four ANC visits. There is need to ensure more care for the male infants immediately after birth. There is also a need to encourage expectant in women general to go for at least four ANC visits.

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