

Newborn survival in south Asia: contributions of thermal and umbilical cord care

Lindsay Mallick¹, Jennifer Yourkavitch², Courtney Allen³

¹ The Demographic and Health Surveys (DHS) Program, Avenir Health

² Program Assistance, Design, Monitoring and Evaluation for Sustainable Development (PADMES), ICF

³ The DHS Program, ICF

Short Abstract:

Although child mortality has decreased over the last several decades, neonatal mortality has declined less substantially. In South Asia, neonatal deaths account for the majority of all under-five deaths, calling for further study on newborn care practices. Using data from Demographic and Health Surveys conducted in Bangladesh, India, and Nepal between 2005 and 2016, we conducted multivariable logistic regression to identify predictors of two key newborn care practices—thermal care and hygienic cord care—and their associations with neonatal mortality among home births. With limited neonatal mortality events in Bangladesh and Nepal, we pooled data from these countries. Antenatal care and skilled birth attendance increased the odds of infants' receipt of the recommended practices. Hygienic cord care significantly predicted newborn survival, as did skilled care during pregnancy and birth. Findings highlight the importance of these services for newborn survival in south Asia. However, missing responses were common for mothers whose newborn died.

Extended Abstract:

Introduction

In 2016, an estimated 2.6 million children died within the first 28 days after birth, or an average of about 7,000 every day¹. Newborn (neonatal) mortality—deaths within the first 28 days—currently accounts for 59% of all under-five mortality in South Asia¹. About three-fourths of deaths among newborns occur in the first week of life, and 25-40% occur in the first 24 hours². The main causes of newborn death are prematurity (and consequently, low birthweight), intrapartum-related birth complications, and infections, but the root cause is poverty—when people cannot access the high-quality health care they need³. Home births carry a higher risk of neonatal mortality compared with facility births in low- and middle-income countries⁴. Our analysis examines the association between newborn care practices and newborn survival among home births in 3 South Asian countries: Bangladesh, India, and Nepal. The newborn care practices we assess include immediate drying and wrapping, delayed bathing, cord cutting with a clean instrument, and the absence of any harmful substance on the cord.

Interventions related to thermal care and clean cord care are evidence-based and low cost; however, there is scant research using population-based, nationally-representative surveys to examine their coverage or how these practices may relate to neonatal mortality in South Asian countries. Seeking to fill these gaps, this paper assesses the following questions:

1. What are the key predictors of newborn care practices among home births in South Asia, specifically Bangladesh, Nepal, and India?
2. Is there an association between newborn care practices and newborn mortality among home births and how have the associations changed over time?

Data and Methods

This study used data from nationally-representative surveys in Bangladesh (2011, 2014), India (2005-06, 2015-16), and Nepal (2011, 2016), three countries where surveys included comparable questions on newborn care practices including thermal care and hygienic cord care interventions over time. Table 1 shows the indicators of thermal care and hygienic cord care used in this analysis. We also created composite variables of thermal care and hygienic cord care. Although skin-to-skin is important for thermal care, not all surveys inquired about the practice; thus, we could not include it in our analysis.

To address our question on the key predictors of newborn care practices among home births in South Asia, we used the most recent surveys in India, Bangladesh, and Nepal and conducted unadjusted and adjusted logistic regressions, one model for each survey for each outcome of thermal care and cord care. Independent variables included place of residence, wealth, education, religion, maternal age at birth, birth interval, previous child death, ANC, size at birth, sex of the child^{5,6}.

We conducted logistic regressions to assess the associations between newborn care practices and newborn mortality among home births. We excluded births born in the month preceding the survey to avoid censoring

¹ United Nations Inter-agency Group for Child Mortality Estimation (IGME). 2017. Levels and Trends in Child Mortality. UNICEF: New York.

² Liu, L., H. L. Johnson, S. Cousens, J. Perin, S. Scott, J. E. Lawn, et al. Global, regional, and national causes of child mortality: an updated systematic analysis for 2010 with time trends since 2000. 2012. *Lancet* 379: 2151-61.

³ UNICEF. 2018. Every Child Alive: The urgent need to end newborn deaths. UNICEF: New York.

⁴ Tura, G., M. Fantahun, A. Worku. 2013. The effect of health facility delivery on neonatal mortality: systematic review and meta-analysis. *BMC Pregnancy and Childbirth* 13:18.

⁵ Mullany, L. C., J. Katz, S. K. Khatri, S. C. LeClerq, G. L. Darmstadt and J. M. Tielsch. 2010. Neonatal hypothermia and associated risk factors among newborns of southern Nepal. *BMC medicine*, 8(1): 43.

⁶ Seward, N., D. Osrin, L. Leah, A. Costello, A. Pulkki-Brannstrom, T. A. J. Houweling, et al. 2012. Association between clean delivery kit use, clean delivery practices, and neonatal survival: pooled analysis of data from three sites in South Asia. *PLoS Medicine* 9(2): e1001180.

and deaths on the first day of life to ensure that the exposure to newborn care practices would have preceded the outcome. Adjusted models controlled for known predictors of newborn mortality, including place of residence, wealth, education, religion, maternal age at birth, preceding birth interval, previous child under age 5 died, receipt of antenatal care, tetanus toxoid vaccine coverage, size at birth (a proxy for premature birth), gender of child, skilled attendance at birth, and postnatal care^{2,7,8,9,10,11}. We evaluated the change in the associations by comparing the magnitude and strength of the associations over time.

We examined India separately from two pooled samples of data from Bangladesh and Nepal, one for each survey cohort. We pooled the most recent surveys (Bangladesh 2014 and Nepal 2016) and the second most recent surveys (Bangladesh 2011 and Nepal 2011). Pooled samples in the two rounds of Bangladesh and Nepal were weighted equally; the pooled, equally weighted sample for Bangladesh and Nepal 2011 surveys included 5,464 births total, with each country holding an equal share of cases (2,732) and 4,214 births in the two most recent surveys (2,107 for each). The samples for India included 23,135 births in 2005-06 and 34,325 births in 2015-16. Pooling the two countries provides a larger sample and more power to detect significant associations for rare events like mortality. Second, the surveys in Bangladesh and Nepal both included questions on bathing and substance applied to the cord, whereas India did not. Therefore, we could examine the practices separately as well as by the composite thermal care or hygienic cord care indicators.

Preliminary Results and Implications of findings

Preliminary results indicated that skilled attendance at birth positively predicted receipt of recommended thermal and hygienic cord care practices. Although less consistent across all models, we also saw an association between mother's ANC attendance and the recommended practices. (Results not shown.)

After controlling for known predictors of newborn mortality, we found significant associations between neonatal mortality and cord care but not thermal care (Tables 2 and 3). In our multivariable analysis using pooled data from recent surveys in Bangladesh and Nepal, we found that application of antiseptics (compared with dry cord care) reduced the odds of dying on days 1-28 after birth. The significance of the association between antiseptic use and mortality also increased between surveys in the Bangladesh and Nepal pooled sample, likely in relation to the increased use of antiseptics. In the pooled most recent Bangladesh and Nepal surveys, infants delivered by a skilled birth attendant and infants delivered to mothers who attended four or more ANC visits had lower odds of dying. Given the link between ANC and SBA with increased implementation of recommended practices, and that both health care services and recommended practices can prevent newborn mortality, promotion of both use of maternal health services and the recommended newborn practices may have synergistic effects on newborn survival.

In pooled samples in Bangladesh and Nepal, the regression analysis revealed alarmingly high associations between newborn death and the “don't know” or missing responses to questions on bathing (Table 3). While of course the absence of a response to the survey does not cause mortality, mortality could cause the absence of a response. Given the nature of the relationship, we did not include the bathing or combined thermal care variables in our adjusted models. A person's recall of details surrounding the traumatic event of a loss of a child may be problematic¹².

⁷ Arunda, M., A. Emmelin, B. O. Asamoah. 2017. Effectiveness of antenatal care services in reducing neonatal mortality in Kenya: analysis of national survey data. *Global Health Action* 10(1): 1328796.

⁸ Conde-Agudelo A., A. Rosas-Bermudez, A.C. Kafury-Goeta. 2006. Birth spacing and risk of adverse perinatal outcomes: a meta-analysis. *Journal of the American Medical Association* 295: 1809–1823.

⁹ Kumar, C., P. K. Singh, R. K. Rai, L. Singh. 2013. Early neonatal mortality in India, 1990–2006. *Journal of Community Health*, 38(1):120-130.

¹⁰ Lawn, J. E., S. Cousens, J. Zupan, and Lancet Neonatal Survival Steering Team. 2005. 4 million neonatal deaths: when? Where? Why? *Lancet* 365(9462): 891-900.

¹¹ Winter, R., T. Pullum, L. Florey, S. Hodgins. 2017. Impact of Scale-up of Maternal and Delivery Care on Reductions in Neonatal Mortality in USAID MCH Priority Countries, 2000–2010. *Applied Demography and Public Health in the 21st Century. Applied Demography Series*, 8:269-305.

¹² Barry, T. J., B. Lenaert, D. Hermans, F. Raes, J.W. Griffith. 2018. Meta-Analysis of the association between autobiographical memory specificity and exposure to trauma. *Journal of Traumatic Stress* 31(1): 35-46.

Table 1 Definitions of newborn care practices

Intervention	Indicator	WHO Recommendation ¹	Harmonized Response Categories	Notes
Thermal care	Immediate drying or wrapping	Dried or wrapped immediately ²	(1) Dried or wrapped within five minutes of birth or before delivery of the placenta (2) Dried or wrapped after five minutes of birth or after delivery of the placenta (3) Not dried, don't know, or missing	Only Bangladesh included options for not being dried or wrapped
	Delayed bathing	Bathed after 24 hours; however, after 6 hours may be appropriate	(1) Bathed six hours or more after birth (2) Bathed within the first six hours of birth (3) Not bathed, don't know, or missing	Only surveys in Bangladesh included an option for "Not bathed"
	Composite thermal care	Thermal care for all children	(1) Both recommended thermal care practices including immediate drying or wrapping and delayed bathing (2) No thermal care or partial thermal care (neither or only one recommended practice) (3) Don't know or missing to either recommended thermal care practice	
Hygienic cord care	Clean instrument used to cut the cord	A new or boiled instrument should be used to cut the cord	(1) A new or boiled instrument was used to cut the umbilical cord, or a clean delivery kit was used (2) A used or non-boiled instrument (3) Don't know or missing	Clean instruments could include (boiled or new) blade, scissors, or knife. Other instruments included bamboo, sickle, fodder cutter, or other
	Nothing applied to the cord	Dry cord care is recommended; however, in high mortality settings chlorhexidine is recommended	(1) Nothing was put on the umbilical cord stump (2) Only an antiseptic and no other substance (3) Any other substance applied (4) Don't know or missing	Antiseptics: chlorhexidine, antibiotic/antiseptic (non-specified), betadine, methylated spirits, gentian violet Other substances: mustard oil, ghee, turmeric, chewed rice, ginger juice, powder, oil, ash, vermilion, dung
	Composite hygienic cord care	Hygienic cord care for all children	(1) Both recommended cord care practices including a clean instrument used to cut the cord and antiseptic or dry cord care) (2) No or partial hygienic cord care (neither or only one recommended cord care practice) (3) Don't know or missing to either recommended cord care practice	

1 WHO 2017
2 WHO 1997

Table 2 Unadjusted (UOR) and adjusted odds (AOR) of dying in the first month after life among most recent home births in India, by newborn care practices

	India 2005-06				India 2015-16			
	UOR	95% CI	AOR	95% CI	UOR	95% CI	AOR	95% CI
Drying (ref = immediately)								
Delayed drying	1.1	[0.8,1.4]	1.0	[0.8,1.3]	1.2	[0.9,1.6]	1.1	[0.8,1.5]
Not dried, don't know, missing	0.4	[0.2,1.1]	0.5	[0.2,1.6]	n/a			
Instrument used to cut cord (ref = clean)								
Unclean	1.3	[0.7,2.3]	1.1	[0.6,2.0]	1.6*	[1.0,2.7]	1.4	[0.8,2.4]
Don't know, missing	0.5	[0.2,1.0]	0.6	[0.2,1.5]	n/a			

Note: Adjusted models control for place of residence, wealth, education, religion, maternal age at birth, birth interval, previous child death, receipt of antenatal care, tetanus protection, size at birth, sex of the child, skilled birth attendance, and postnatal care. P-values * <0.05 , ** <0.01 , *** <0.001 .

Table 3 Unadjusted (UOR) and adjusted odds (AOR) of dying in the first month after birth among most recent home births in Nepal and Bangladesh (pooled), by newborn care practices

	Bangladesh and Nepal, 2011						Bangladesh 2014 and Nepal 2016					
	UOR	95% CI	AOR	95% CI	AOR	95% CI	UOR	95% CI	AOR	95% CI	AOR	95% CI
Drying (ref = immediately)												
Delayed drying or wrapping	0.8	[0.4,1.5]	0.8	[0.4,1.6]	0.8	[0.4,1.6]	0.7	[0.3,2.0]	0.6	[0.2,1.7]	0.7	[0.2,1.9]
Not dried/wrapped, don't know, missing	0.7	[0.2,2.5]	0.8	[0.2,2.8]	0.8	[0.2,2.8]	1.3	[0.3,6.0]	0.9	[0.2,4.3]	0.9	[0.2,4.2]
Bathing (ref = 6 hours or more)												
<6 hours	1.8	[0.8,3.7]					1.4	[0.6,3.3]				
Not bathed, don't know, missing	90.1***	[41.0,197.8]					52.4***	[18.2,150.6]				
Thermal care (ref = both)												
One or neither	1.7	[0.7,3.9]					1.0	[0.4,2.2]				
Don't know or missing	42.5***	[16.8,107.0]					11.5***	[4.1,32.1]				
Instrument used to cut cord (ref = clean)												
Unclean	0.8	[0.3,2.0]	0.7	[0.3,1.8]			2.4*	[1.1,5.4]	1.9	[0.9,4.2]		
Don't know, missing	0.6	[0.1,4.7]	0.6	[0.1,5.2]			1.4	[0.2,10.5]	1.7	[0.2,16.8]		
Substance placed on cord (ref = nothing)												
Antiseptic	0.4	[0.1,1.2]	0.4	[0.1,1.2]			0.1**	[0.0,0.4]	0.2**	[0.0,0.6]		
Other substance	0.6	[0.3,1.2]	0.5*	[0.3,0.9]			0.6	[0.3,1.5]	0.7	[0.3,1.7]		
Don't know, missing	0.8	[0.3,2.6]	0.9	[0.3,2.9]			1.7	[0.5,5.3]	1.9	[0.5,6.7]		
Hygienic cord care (ref = both)												
One or neither	0.7	[0.4,1.3]			0.6	[0.3,1.1]	1.3	[0.6,2.8]			1.3	[0.6,2.9]
Don't know or missing	0.9	[0.3,2.7]			0.9	[0.3,2.8]	2.5	[0.8,7.5]			3.1*	[1.0,9.6]

Note: Adjusted models control for country, place of residence, wealth, education, religion, maternal age at birth, birth interval, previous child death, receipt of antenatal care, size at birth, sex of the child, skilled birth attendance, and postnatal care. P-values *<0.05, **<0.01, ***<0.001.