

## Research Paper

# Hygiene practices of mothers of hospitalized neonates at a tertiary care neonatal intensive care unit in Zambia

Jason H. Park, Lawrence Mwananyanda, Maria Servidone, Jean Sichone, Susan E. Coffin and Davidson H. Hamer

### ABSTRACT

Risk of neonatal mortality secondary to infections such as pneumonia and diarrhoeal diseases can be influenced by maternal hygiene, but little information is known about current maternal hygiene practices in low- and middle-income countries. This study aimed to assess the hygiene practices of mothers of neonatal intensive care unit (NICU) patients in Lusaka, Zambia and associated epidemiological factors. A cross-sectional survey of the mothers of hospitalized neonates at the University Teaching Hospital (UTH) in Lusaka was conducted. Study nurses orally administered questionnaires to mothers in their local languages about their hygiene practices related to newborn care. Of the 201 mothers surveyed, self-reported hygiene practice was associated with literacy ( $p = 0.013$ ) and income ( $p < 0.0001$ ). In contrast, adherence to recommended hygienic newborn care was less common, with only 36% of mothers practising recommended cord care practices. Forgetfulness (32%) and lack of hygiene resources (13%) were the major barriers to hygienic behaviours. Surveyed Zambian women who delivered babies requiring NICU care self-reported adequate hygienic practices and apparently faced difficulty practising them due to forgetfulness and a lack of hygiene resources. Future efforts should focus on improving cord care education, reinforcement of the importance of hygienic behaviours, and the supply of affordable antiseptic tools.

**Key words** | global health, hygiene, maternal, neonatal, umbilical cord care

**Jason H. Park** (corresponding author)  
Boston University School of Medicine,  
112 Longwood Ave, Apt 3, Brookline, MA 02446,  
USA  
E-mail: [jhspark@bu.edu](mailto:jhspark@bu.edu)

**Lawrence Mwananyanda**  
Rights to Care-Zambia,  
Department of Global Health,  
Boston University School of Public Health,  
1109 Mikwala House, Brendwood Road, Lusaka,  
Zambia

**Maria Servidone**  
Boston Medical Centre,  
Boston University School of Public Health,  
801 Massachusetts Ave, Crosstown Building, Rm  
2003, Boston, MA 02118,  
USA

**Jean Sichone**  
Neonatal Intensive Care Unit,  
University Teaching Hospital,  
Nationalist Rd, Lusaka,  
Zambia

**Susan E. Coffin**<sup>†</sup>  
Department of Paediatrics,  
Children's Hospital of Philadelphia,  
University of Pennsylvania School of Medicine,  
2706 South St, Roberts Research Bldg,  
Philadelphia, PA 19146,  
USA

**Davidson H. Hamer**<sup>†</sup>  
Department of Global Health, Department of  
Medicine,  
Boston University School of Public Health, Section  
of Infectious Diseases,  
Boston Medical Centre,  
Right to Care-Zambia,  
Crosstown 3rd floor, 801 Massachusetts Avenue,  
Boston, MA 02118,  
USA

<sup>†</sup>Contributed equally.

### INTRODUCTION

Under-5 child mortality rates in Zambia, despite decreasing by 41% since 2000, have remained unacceptably high at 75 deaths per 1,000 live births according to the 2014 Demographic Health Survey (Central Statistical Office (CSO) [Zambia] Ministry of Health (MOH) [Zambia] and

ICF International 2014). In addition, reductions in newborn mortality in Zambia have been slower than that of infant or child under-5 mortality, with 24 deaths per 1,000 live births (Central Statistical Office (CSO) [Zambia] Ministry of Health (MOH) [Zambia] and ICF International 2014).

doi: 10.2166/washdev.2019.140

Infectious diseases led by pneumonia, diarrhoea, and malaria, accounted for 61.5% of 3.113 million under-5 child deaths in the region (Liu *et al.* 2015).

Interventions such as water, sanitation, and hygiene (WASH) educational projects have demonstrated how improved hand hygiene by a child's primary caretaker can reduce rates of paediatric diarrhoeal diseases (Hashi *et al.* 2017). A systemic review by Darvesh *et al.* (2017) also showed a pooled 27% reduction in risks of diarrhoeal disease among children under-5 with interventions targeting improvements in hand hygiene (Darvesh *et al.* 2017). In addition, hygienic newborn care, including cord care, bathing, and skin care after changing diapers, can have an impact on the health of the newborns; recommended cord care practices have been shown to reduce neonatal morbidity and mortality from infections, including newborn sepsis and omphalitis, while bathing and skin care after diaper change can reduce the risk of infection conferred by the immaturity of neonatal epidermal barrier (Blume-Peytavi *et al.* 2012; St. Clair *et al.* 2014).

Despite the impact of hygiene practices on neonatal infection, little information is known about current maternal hygiene practices, hygienic newborn care, and health literacy in many parts of sub-Saharan Africa. While the constituent parts of health literacy are not clearly defined, a case study in Zambia by Schrauben & Wiebe (2017) found that only 46.5% of males and 24.5% of females had high health literacy, as defined by the Institute of Medicine as 'the degree to which individuals have the capacity to obtain, interpret and understand basic health information and services needed to make appropriate health decisions' (Schrauben & Wiebe 2017). In addition, Nnebue *et al.* (2016) showed that there may be inadequate knowledge on hygienic newborn care among mothers in Nigeria, an African country with high neonatal mortality. Thus, improving the maternal understanding of optimal hygiene principles and practices is a potential strategy to reduce the rates of neonatal infection and mortality.

Due to the high rates of hospital- and community-acquired infections in Zambia (Gill *et al.* 2011; Kabwe *et al.* 2016) and other sub-Saharan African countries, there is a need to further investigate factors associated with high levels of maternal hygiene practices in these settings (Castro-Sanchez *et al.* 2016). While there is some evidence that access to adequate

sanitation and hygiene are influenced by disparities in wealth in African countries, there is a relative lack of information on the impact of other demographic factors such as education and literacy on maternal hygiene practices (Roche *et al.* 2017). In addition, identifying variables that could contribute to a standardized tool for assessing hygiene practices may be useful for identifying populations at risk and intervening appropriately.

Thus, additional data on maternal hygiene practices in low- and middle-income countries can be used to inform future educational and interventional efforts at reducing the rates of neonatal infections. The objective of this study was to determine the hygiene practice of mothers of neonatal intensive care unit (NICU) patients at a tertiary referral centre in Lusaka, Zambia and the factors associated with good hygiene practice.

## METHODS

### Setting and design

The study was performed in the NICU at the University Teaching Hospital (UTH) in Lusaka, Zambia. The UTH is the country's tertiary referral centre and its NICU admits approximately 3,600 neonates a year. Seventy-one per cent of the newborns admitted to the NICU were born at the UTH, with the rest admitted from home or referred from an outside health facility (Mwananyanda *et al.* 2018). Admitted newborns are preterm under 1.0 kg or term with respiratory distress, fever, failure to feed, convulsions, or asphyxia (Mwananyanda *et al.* 2018).

This survey was nested as a sub-study within an existing study, 'Prevention of nosocomial bacteraemia and mortality among neonates at a tertiary referral centre in Zambia', which investigated the impact of a bundle of infection prevention interventions in the NICU on reducing the rates of hospital-associated neonatal bloodstream infections and mortality (Mwananyanda *et al.* 2018). Therefore, all participants were mothers of newborns admitted to the UTH NICU.

This study was approved by the Boston University Medical Campus and ERES Converge Institutional Review Boards (IRBs) in Boston and Zambia, respectively.

## Survey instrument

The sociodemographic aspects of the survey were modelled from surveys used for Boston University's [AMANHI study \(2016\)](#). The questions on hygiene practices were newly designed by the study investigators. A 5-point Likert scale was used to assess the frequency of behaviour of common hygiene practices in daily life and hygienic newborn care. For the former, questions on topics such as hand hygiene before cooking, before eating, or after using toilets were used. A question on the frequency of brushing teeth was asked, as a study in rural Zambia showed limited oral hygiene knowledge in the population ([Kabali & Mumghamba 2018](#)). We also asked whether they cover their mouth when coughing or sneezing, as a study in Bangladesh showed 81% of parents did not do so ([Rahman et al. 2016](#)). For hygienic newborn care, questions regarding newborn bathing and diaper care were used. In addition, there were multiple choice questions with an option for a free form answer regarding maternal cord care practices per WHO's guidelines ([World Health Organization 2013](#)) and barriers to hygiene practice. A novel scenario, designed to reflect instances where hygienic actions would need to be taken in daily life, was presented; participants were asked to describe when and what type of hygienic behaviours would be taken, such as washing hands before cooking or after changing a baby's diapers (see Supplementary Materials for full survey). Pilot testing of the survey was conducted with 10 mothers, and the questionnaire was adapted to improve clarity. The surveys were translated to Nyanja and Bemba, two of the most common languages spoken in Lusaka, by a professional translator.

Although an analysis of relationship between newborn diagnoses and outcomes with maternal hygiene practices may have yielded interesting results, newborn hospital records were not reviewed due to pragmatic constraints of funding and timeline requirements, as well as concerns over gathering personally identifiable information that would have necessitated further ethical clearance while being outside of the main research question, which was to determine the hygiene practice of mothers of NICU patients at UTH and the factors associated with good hygienic practice.

## Survey administration

The surveys were administered at the UTH NICU from May 2016 to July 2016. Three study nurses recruited mothers who were waiting to see their newborns in the NICU. All mothers or primary caretakers of newborns admitted to the NICU were eligible, after obtaining verbal consent. The surveys were administered orally by the nurses in either Bemba or Nyanja, and responses were recorded on paper forms for subsequent entry into electronic format.

## Analysis

The numerical values of the responses on the Likert scale to these questions were summed to create a new metric called the *Hygiene Literacy Score*, with possible scores ranging from 0 to 35, where a score of 35 corresponded to every behaviour being always performed. Continuous demographic factors of age and income were categorized in 5-year brackets and quintiles, respectively. Chi-square analysis was performed to determine the relationships between demographic questions with categorical responses and hygiene score, barriers to practice, and cord care behaviour. The relationships between hygiene score and demographic factors were also explored with a paired *t*-test or ANOVA. Potential confounding of cord care practices was tested with the Cochran–Mantel–Haenszel test.

## RESULTS

### Participant characteristics

There were 201 mothers recruited and had a mean age of 26.1 years (standard deviation [SD] 6.5) and a median monthly income of 1,200 Zambian Kwacha (IQR of 700 and 3,000 ZMK) equivalent to \$114 USD at the time of the study, compared to monthly gross domestic product (GDP) per capita of \$138. About half of the mothers were primigravida, spoke Bemba, reported high literacy, and had completed up to secondary school level of education ([Table 1](#)).

**Table 1** | Demographic characteristics

Variable	Responses	Frequency	Percentage
Age	16–18	30	15
	19–25	89	45
	26–35	60	30
	36–42	20	10
	Doesn't know	1	0
Average age (years)		26.1 ( $\pm 6.54$ )	
Language	Bemba	100	50
	Nyanja	101	50
Marital status	Single	43	21
	Married	149	75
	Cohabiting	5	3
	Divorced	2	1
	Widowed	1	0
Previous children	Primigravida	97	48
	1 previous	25	13
	2	33	17
	3	19	9
	4	13	6
	5 or more	8	7
Able to read English or local languages	Very well	92	47
	A bit	50	25
	Not at all	54	28
Level of education	No education	10	5
	Lower primary (grade 1–4)	10	5
	Upper primary (grade 5–7)	40	20
	Junior secondary (grade 8–9)	51	26
	Upper secondary (grade 10–12)	65	33
	More than upper secondary	24	12
Average monthly income (ZMW)		2,927 ( $\pm 4,136$ )	

Analysis of differences in the demographic factors between Nyanja and Bemba speakers yielded no significant differences between the two groups in age, literacy, income, and education, except that Bemba-speaking mothers were more likely to be single than Nyanja-speaking mothers (16.2% vs. 4.7% of mothers,  $p = 0.021$ ).

### Hygiene literacy

The mean Hygiene Literacy Score was 33 and the median score was 34. A higher score was significantly associated with increasing income bracket. The hygiene score was also significantly associated with literacy, with moderate literacy having the highest score and high literacy having the

lowest score. Age, language, marital status, previous children, or education were not significantly associated with the hygiene score (Table 2).

### Barriers to hygienic practices

The most common barriers to hygienic practices were forgetfulness (32%) and lack of hygiene resources (13%). A significantly greater proportion of mothers speaking Nyanja rather than Bemba indicated that lack of knowledge (30% vs. 12%,  $p = 0.01$ ), lack of hygiene resources (27% vs. 1%,  $p < 0.01$ ), and forgetfulness (41% vs. 24%,  $p = 0.04$ ) were the barriers to hygiene practice. There was a significant inverse association

**Table 2** | Unadjusted relationship between demographic characteristics and hygiene score

Variable	Responses	Frequency of response	Mean score	p-value
Is this your 1st child?	Yes	97	32.7667	0.4897
	No	104	33.2564	
What language do you speak?	Bemba	100	33.3378	0.64
	Nyanja	101	32.7031	
Are you able to read English or other local languages?	Very well	92	32.7463	0.013
	A bit	50	33.4865	
	Not at all	54	33.0333	
What is your marital status?	Single	43	33.0163	0.34
	Married	149	33.069	
	Divorced	2	33.5	
	Widowed	1	35	
	Cohabiting	5	30.75	
How far have you gone in your education?	No education	10	31.75	0.30
	Lower primary (grade 1–4)	10	34.2	
	Upper primary (grade 5–7)	40	33.7308	
	Junior secondary (grade 8–9)	51	32.641	
	Upper secondary (grade 10–12)	65	33.0682	
	More than upper secondary	24	33.2632	
What is your age?	15–19	19	32.4210	0.78
	20–24	50	33.1800	
	25–29	27	33.2592	
	30–34	24	32.9167	
	35 and older	18	33.1667	
What is your income?	Poorest	35	32.8000	<0.0001
	Poorer	44	33.0909	
	Middle	20	33.3000	
	Richer	30	32.8000	
	Richest	9	34.0000	

between income and the lack of hygiene resources and inconvenience. There was also a significant inverse association between the maternal Hygiene Literacy Score and the lack of hygiene resources and forgetfulness.

### Cord care practices

We found that 64% of mothers did not follow the current WHO guidelines for proper cord care (Table 3). Women who spoke Bemba were more likely to perform proper cord care than those who spoke Nyanja (46% vs. 24%,  $p = 0.008$ ). When stratified by language spoken, adherence to recommended cord care and literacy were associated ( $p = 0.03$ ). Other reported methods of cord care included ‘pouring bread milk on stump’ and ‘applying herbal medicine’.

### Scenario responses

Of the three actionable hygiene comments in the scenario, only ‘washing hands before touching food’ was commonly done, with 98% of participants saying they do this. The other two comments – ‘washing hands after handling food and before interacting with child’ and ‘washing baby’s genitals’ – were reported by 25% and 55% of participants.

## DISCUSSION

According to our survey, there was a statistically significant association between self-reported hygiene practice and income and literacy. The lack of association with education was inconsistent with other studies that have examined maternal hygiene practices. Studies in Nigeria and India

**Table 3** | Unadjusted relationship between demographic characteristics and cord care practice

Variable	Responses	Proportion following recommended cord care practices	p-value
What language do you speak?	Bemba	46.5%	0.0076
	Nyanja	24.2%	
Are you able to read English or other local languages?	Very well	36.9%	0.078
	A bit	42.9%	
	Not at all	17.2%	
What is your marital status?	Single	46.7%	0.39
	Married	36.6%	
	Divorced	0%	
	Widowed	0%	
	Cohabiting	0%	
How far have you gone in your education?	No education	25%	0.39
	Lower primary (grade 1–4)	20%	
	Upper primary (grade 5–7)	36%	
	Junior secondary (grade 8–9)	43.2%	
	Upper secondary (grade 10–12)	25.6%	
	More than upper secondary	50%	
What is your age?	15–19	33.3%	0.54
	20–24	29.8%	
	25–29	50%	
	30–34	37.5%	
	35 and older	33.3%	
What is your income?	Poorest	34.29%	0.91
	Poorer	40.48%	
	Middle	27.78%	
	Richer	37.93%	
	Richest	33.33%	

demonstrated a significant association between maternal hand washing at critical times and education and between beneficial cord care practice and education (Datta *et al.* 2011; Abhulimhen-Iyoha & Ibadin 2012; Opara *et al.* 2017). In contrast, these studies also found little association between hygiene practices and maternal parity and had conflicting information regarding association with income (Abhulimhen-Iyoha & Ibadin 2012). Even though the existing literature generally seems to support a positive association between hygiene practice and sociodemographic factors such as education and income, the strength of the relationship seems as-yet inconclusive.

There are a few explanations for this. First, self-reported behaviour is not uncommonly higher than actual behaviour. A study in India showed that self-reported recall-based hand-washing behaviour was 13% higher than directly observed estimates (Schmidt *et al.* 2019). While some studies were able to validate self-reported practices with direct

observation, others only had survey results to draw conclusions from Datta *et al.* (2011) and Opara *et al.* (2017). Surveys may suffer from social acceptability bias, as participants might have self-reported positive behaviours to questionnaire administrators. This point is reinforced in our study by the observation that rates of positive responses to the scenario about food handling and general hygiene were markedly lower than self-reported practices. Thus, in our study, self-reported practices may not accurately portray the relationship to sociodemographic factors that was represented in other literature. It is also possible that if the Hygiene Literacy Score is representative of each participant's actual understanding of hygiene and infection transmission, then many mothers of UTH NICU patients may be unable to practice good hygiene despite knowing what they are supposed to do.

This latter possibility points to the necessity of identifying the barriers to good hygiene practices in this

population. Forgetfulness and lack of hygiene resources were the most commonly listed barriers. It is also worth noting that income and Hygiene Literacy Score were associated with some of these barriers, possibly pointing towards socioeconomic and educational effects on the ability of these mothers to practice good hygiene. There is currently a lack of research on barriers to hygiene in sub-Saharan Africa, which may be a further avenue for investigation.

Proper cord care knowledge was also lacking in this population, as 63.9% of mothers did not follow WHO recommended behaviours. The varieties of responses that may have been introducing germs to the newborn were representative of the absence of hygiene understanding, indicating that cord care may be another possible route of infection prevention by proper education. This is also reinforced by our stratified analysis showing that literacy was associated with better cord care, which is consistent from findings from Nigeria that showed a positive significant relationship between education and cord care practice.

A variable that showed significant associations with cord care and different barriers to hygiene practice was local language spoken. There are currently no known epidemiological relationships between speakers of Nyanja and Bemba in terms of socioeconomic factors or their impact on health. While both languages are spoken by the Zambian population, Nyanja is the main language in Lusaka, while Bemba is more commonly spoken in the Copperbelt region (Eberhard *et al.* 2019). We were unable to detect any differences in sociodemographic factors that could explain the difference in hygiene practices between the two language groups. There may be cultural differences among the families who relocated from the Copperbelt to Lusaka Province that contributed confounders that our survey on demographic factors was unable to characterize. The significant differences in identified hygiene practice warrant a further investigation into their epidemiological basis.

The scenario could be used as a validation tool in settings where direct observation may not be feasible. Studies in Slovakia and Iran of hand hygiene in healthcare settings showed discrepancies between hand hygiene knowledge and self-reported practices versus observed behaviours (Nematian *et al.* 2017; Kelchkova *et al.* 2018). This points to the importance of being able to validate the self-reported practices. As validating mothers' self-reported behaviours

at home via observation can be impractical or unfeasible in some circumstances and it presents a risk of observer bias, using a scenario is a potentially practical strategy that has not been described in prior literature. The absence of certain behaviours during a scenario response in our survey indicates that the scenario may measure a different construct than the self-reported practice. The development of a standardized hygiene literacy tool with scenarios that have been validated by observations could contribute to a collection of accurate hygiene practice data even in situations where direct observation may be impossible.

Some limitations to this study included the subjectivity of categorizing free form answers for statistical analysis, lack of generalizability since all participants were mothers whose newborns were already in the NICU, and social acceptability bias present in self-reported behaviour on an orally administered questionnaire. The study would also have benefitted from linking each participant with the clinical diagnosis and outcomes of her newborn, and future investigation into links between maternal hygiene practices and newborn admission diagnoses could be elucidating. Comparisons with Demographic Health Survey data showed differences in the proportions of primigravida women, which may limit generalizability of our findings as a whole. However, we believe that our findings on barriers and cord care practices with respect to sociodemographic factors still raise valid questions about maternal hygiene practices.

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## CONCLUSIONS

Maternal hygiene is an important route for neonatal infection prevention, and a better understanding of current maternal hygiene literacy and behaviour is necessary to improve neonatal outcomes from infectious processes in the developing countries. Many mothers of UTH NICU patients had adequate self-reported hygiene practices according to their Hygiene Literacy Score, but showed limited consistency in behaviour when going through scenarios. The main identified barriers to self-reported hygiene practices were forgetfulness and lack of hygiene resources, which may be potential future routes for interventions to reduce the rates of neonatal infection and mortality. The prevalence of improper cord care practice points to the importance of improving cord

care education as a strategy for newborn infection prevention. Future efforts should focus on improving cord care education, reinforcement of the importance of hygienic behaviours, and supply of affordable antiseptic tools. Further investigation may be warranted into the contributions that language and culture have on hygiene practice and newborn care. In circumstances where direct observation of hygiene practice may be impractical, using a scenario may be an avenue for validation of self-reported practice.

## ACKNOWLEDGEMENTS

This research was supported by the Boston University School of Medicine Global Health Summer Scholarship and the Fogarty International Center and the National Institute of Mental Health, of the National Institutes of Health under Award Number D43 TW010543. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health. We thank our colleagues from the Boston University School of Medicine and the University Teaching Hospital in Lusaka, Zambia who provided insight and expertise that greatly assisted the research, although they may not agree with all of the interpretations/conclusions of this paper. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

## DISCLOSURES

No potential conflict of interest was reported by the authors.

## SUPPLEMENTARY MATERIAL

The Supplementary Material for this paper is available online at <http://dx.doi.org/10.2166/washdev.2019.140>.

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First received 16 August 2018; accepted in revised form 22 August 2019. Available online 3 October 2019