

**Improving Neonatal Care
in the Resource-Limited Setting of Rwanda**
By: Sean Batenhorst

IMPROVING NEONATAL CARE IN THE RESOURCE-LIMITED SETTING OF RWANDA

INTRODUCTION

In the resource-limited setting, such as sub-Saharan Africa, there is a difficulty for hospitals to provide adequate care to babies who are born prematurely. The cause of this disparity is primarily due to a lack of practitioners within hospitals with the required knowledge to effectively treat these high-risk newborns. This results in large patient to doctor ratios in many neonatal intensive care units (NICU) throughout the underdeveloped world, and it is these high patient ratios that contribute to the high neonatal mortality death seen in these areas. Most neonatal deaths occur in two regions of the world: 39% of all deaths occur in sub-Saharan Africa and 38% occur in Southern Asia. Overall, 99% of neonate deaths occur in the resource-limited setting (Lawn, Cousens, Zupan, 2005; UNICEF 2014; Lawn et al., 2014). In Rwanda, a country with roughly 400,000 birth per year there are only 70 registered pediatricians, one registered neonatologist, and no specialized neonatal nurses creating a doctor to patient ratio of only .45 providers per 1000 residents (Tumwebaze, 2017). It should be known that the World Health Organization (WHO) recommends doctor to patient ratios of 2.3 per 1000 residents (ReliefWeb, 2015).

The ultimate solution to this problem would be to increase the number of healthcare providers but given the lack of educational resources this is not feasible. Thus, many hospitals are looking at other options for increasing the number of watchful eyes on high risk infants, both within the hospital and within the community. In Rwanda, this focus presented itself by trying to better inform parents of warning signs for ill infants, as well as better education for how to care for infants in the home environment. Parental care of basic needs would allow more time for trained healthcare professionals to focus on the most at risk patients. This paper will focus on two studies that occurred at the Central University Hospital of Kigali (CHUK) and Muhima District Hospital (MDH) in Kigali, Rwanda. The first of these studies hoped to identify a curriculum that could be taught to parents of the admitted neonates in these hospitals, while the second looked at whether videos would be an effective method of teaching this curriculum.

FAMILY INTEGRATED CARE

The admission of a child into the neonatal care unit can be a stressful time for parents, and can result in long term consequences of impaired bonding and PTSD like symptoms (Amolo, Irimu, Njai, 2017) . Family Integrate Care (FICare) is a process through which the parents of an admitted patient are given responsibilities like that of a primary caregiver, helping both to relieve the stress of low doctor patient ratios and help parents bond with their sick children (Gale, 2018; National Institute of Statistics, 2015). In the context of a resource-limited setting, such as Rwandan NICUs, FICare has become a necessity as the low doctor to patient ratios do not allow for the proper attention allocation that these patients need to thrive. The constant attention that parents can provide to their sick newborns is very valuable, and with proper training can help be a strong first line of defense for the fight against neonatal mortality. In the high stress setting of the NICU, the success of using FICare is based on the education provided to the parents, without which parents will lack the training, practice, and confidence to provide care to their infants, further increasing the risk of neonatal mortality (Weiner, Billamy, Partridge, Martinez, 2011). Currently there is no formalized training program in the NICU of CHUK and MDH (define and then explain what they are, with relevant citations) for parents of admitted neonates, making the usage of FICare difficult. This may be due to the lack of research on what topics should be taught to parents of admitted neonates. Successful FICare programs have been seen in other resource-limited settings; such as Malawi (Gale, 2018). In Pakistan, it has been shown that it is possible to involve mothers in the active care of their very low birthweight infants before discharge and that this may translate into earlier release from the hospital without an increase in short term complications and readmission (Bhutta et al., 2004)

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IMPROVING NEONATAL CARE IN THE RESOURCE-LIMITED SETTING OF RWANDA

WHAT TOPICS SHOULD BE TAUGHT TO THE PARENTS OF NEWLY ADMITTED NEONATES IN THE RESOURCE-LIMITED SETTING?

Jean Aime, with the help of Dr. Peter Cartledge, Alice Willson and myself, hoped to shed light on the above, by studying what topics should be taught in the CHUK and MDH NICUs to parents of newly admitted infants. The goal of the study was to use key stakeholders, primarily health care professionals, to help identify key topics that they felt were important in the NICU setting. Though tailored toward Rwanda, there was also talk as to whether this selected curriculum could be used to help FICare systems in other resource-limited settings.

Methodology

The aim of the study was to identify consensus from key stakeholders regarding the priority topics for a "parental neonatal curriculum". This curriculum would help define the core characteristics that should be taught to parents of admitted neonates at the CHUK and MDH NICUs and possibly other resource-limited settings. The study was designed as a three-round Delphi study. Delphi methods use sequential "rounds," with controlled feedback between rounds to build consensus from a group of experts. The Delphi-approach is useful in situations where individual opinions and judgments need to be considered and combined to answer an incomplete state of knowledge (GRADE, 2013). The process was "fully anonymized," that is participants did not know the identities of the other individuals in the group, nor did they know the specific answers that any other individual had given. Participants in the study were separated into two groups.

Group 1 - Parents: Parents were recruited at two newborn care units of the University Teaching Hospital Kigali, and Muhima District Hospital. Both units are found in Kigali, the capital city of Rwanda. The sites are responsible for approximately 2,000 and 15,000 deliveries per year respectively per hospital records. Due to the transient nature of parents at the two sites, the parent participants were different in each Round of the Delphi-study. Convenience sampling was

IMPROVING NEONATAL CARE IN THE RESOURCE-LIMITED SETTING OF RWANDA

employed at the clinical sites, in which parents of newly admitted neonates were used as the primary source due to their proximity of the study site. Parents of neonates with a poor prognosis, where participation could be distressing, were excluded along with parents who were themselves under 18 years-of-age.

Group 2 - Expert stakeholders: We defined an “expert” as professionals who had experience in clinical care for neonates and their families in the resource-limited setting, such as Rwanda. These experts were drawn from the following: (i) Nurses and midwives at the two clinical sites; (ii) Rwandan clinicians and residents working in Rwanda in pediatric and neonatal care who were identified via the pediatric academic faculty at the University of Rwanda; (iii) Members of the Rwandan Ministry of Health (MoH) Neonatal Working Group (NWG) including pediatricians, nurses, and midwives, identified through the chair of the NWG; (iv) General Practitioners (clinicians working in district hospitals) identified through the class-representatives at the University of Rwanda; (v) Non-Rwandan, international pediatricians and neonatologists with experience of working in Rwanda through the Human Resources for Health (HRH) program (Nuthulaganti, 2013) identified from the Ministry of Health (MoH) database of HRH faculty. We communicated with the expert stakeholders by e-mail or via visiting the two clinical sites.

Delphi Study Organization

Participants took part in three rounds of surveys. The questionnaires were designed specifically for this study. The questionnaires and feedback were translated for parents into Kinyarwanda, the single unifying language of Rwanda, by the Principal Investigator (JAM). Expert stakeholders (Group-2) completed the questionnaire in English. All questionnaires were piloted for understanding before use. Paper questionnaires (face-to-face) were administered at the clinical sites (CHUK and MDH), and electronic questionnaires (Google Forms) were sent by email to expert stakeholders (Group-2).

IMPROVING NEONATAL CARE IN THE RESOURCE-LIMITED SETTING OF RWANDA

Round 1 (oral open-questions): Face-to-face interviews were employed to build an initial draft list of the “parental neonatal curriculum” topics. Two open questions were posed (see supplementary file) for participants to describe the topics. There was no word limit on responses. The questions were asked verbally with responses collected by the PI. No voice recordings of the interviews were undertaken. The responses were transcribed, coded, and summarized in Microsoft Excel by the PI (JAM) and supervising consultant (PC). Consensus for inclusion in Round-2, was pre-defined as any single topic that was suggested by any one participant.

Round 2 (free-text open-questions): Feedback from Round-1 was given to participants, with the topics being presented from Round 1. Participants were asked to add any additional topics that they felt were missing from the Round 1 topics. Responses were transcribed, coded and analyzed in Microsoft Excel. Duplicate items from Round 1 were removed. Consensus for new items to be included in Round 3 was pre-defined as any single item that was given by any one participant.

Round-3 (closed-questions): Feedback was given to participants with the items from Round 1 and 2 being combined in a single list, and by presenting each topic with feedback in the form of a percentage of participants who had suggested it. These items were presented to parents and expert stakeholders who were asked to grade the importance of the topics using a 1-9 point Likert scale as described by the GRADE development group (GRADE, 2013; Williamson 2017). The data-collector (JAM) presented the list to parents and was available to clarify any items that parents did not understand. Consensus for inclusion in the final “parental neonatal curriculum” was pre-defined as items with greater than 70% of participants scoring 7–9 (important) AND less than 15% of participants scoring 1-3 (not important) GRADE, 2013).

To assess for overall correlation in opinion between the three stakeholder groups comparison of the mean scores of each topic was undertaken using linear regression and Pearson’s correlation (R). The

IMPROVING NEONATAL CARE IN THE RESOURCE-LIMITED SETTING OF RWANDA

importance of each individual topic was categorized into three levels of importance, namely 7–9 (important), 4–6 (intermediate) and 1–3 (not important) and then each individual item was compared between subject groups (clinicians, nurses, caregivers) using Chi-squared tests. Each item was color coded for importance with green representing high importance and red reflecting low importance. This allows for a visual comparison between the stakeholder groups.

Results

10, 36, and 40 participants took part in Round 1, 2, and 3 respectively (Table 1). The overall response rate was 91%, 38%, and 43% respectively which far exceeded our predicted response rate. The overall response rate was 100% amongst parents and 35% (59/171) in the experts. Expert stakeholders were from four countries; Rwanda, USA, United Kingdom, and Tanzania.

IMPROVING NEONATAL CARE IN THE RESOURCE-LIMITED SETTING OF RWANDA

Table 1: Baseline characteristics of participants of Rounds 1-3

			Round 1 (n=10)	Round 2 (n=36)	Round 3 (n=40)	
All	Response rate	All HCPs	10/11 (90.9%)	36/94 (38.2%)	40/93 (43.0%)	
		Parents	5/6 (83.3%)	24/82 (29.3%)	30/83 (36.1%)	
			5/5 (100%)	12/12 (100%)	10/10 (100%)	
	Questionnaire administration	Electronic	NA	22 (61.1%)	26 (65.0%)	
		Paper		14 (38.9%)	14 (35.0%)	
	Role	Parent		5 (50.0%)	12 (33.0%)	10 (25%)
		Pediatricians		3 (30%)	13 (36.1%)	20 (50%)
		General Practitioner		0 (0.0%)	6 (17.0%)	4 (10.0%)
		Nurses and midwives		2 (10.0%)	5 (13.9%)	6 (53.0%)
	Age	20-29		5 (50.0%)	11 (30.6%)	12 (30.0%)
30-39			4 (40.0%)	21 (58.3%)	23 (57.5%)	
>40			1 (10.0%)	4 (11.1%)	1 (2.5%)	
Gender	Male		1 (10.0%)	17 (47.2%)	16 (40.0%)	
	Female		9 (90.0%)	19 (52.8%)	24 (60.0%)	
HCPs	HCPs Main place of work	Rwanda	5 (100%)	21 (88.0%)	26 (87.0%)	
		USA	0 (0%)	2 (8.0%)	2 (7.0%)	
		United Kingdom	0 (0%)	0 (0%)	2 (7.0%)	
		Tanzania	0 (0%)	1 (4.0%)	0 (0%)	
	HCPs Years of experience	Mean	9.3 (±8.4)	5.2 (±4.9)	6.2 (±5.3)	
	HCPs - How often treating neonate	Never or rarely	0 (0%)	4 (15.3%)	0 (0%)	
		Sometimes	1 (20.0%)	2 (7.7%)	4 (13.3%)	
Frequently or very frequently		4 (80.0%)	20 (76.9%)	26 (86.7%)		
Parents	Parent Hospital	MDH	3 (60.0%)	9 (75.0%)	4 (40.0%)	
		CHUK	2 (40.0%)	3 (25.0%)	6 (60.0%)	
	Parent Social economic status	1-2 (Low)	1 (20.0%)	6 (50.0%)	3 (30.0%)	
		2-4 (High)	4 (80.0%)	6 (50.0%)	7 (70.0%)	
	Parental Residence	Urban	4 (80.0%)	12 (100%)	8 (80.0%)	
		Rural	1 (20.0%)	0 (0%)	2 (20.0%)	
	Parent Education	No education or primary	3 (60.0%)	6 (50.0%)	4 (44.4%)	
Secondary or Higher		2 (40.0%)	6 (50.0%)	5 (55.6%)		

IMPROVING NEONATAL CARE IN THE RESOURCE-LIMITED SETTING OF RWANDA

In Round 1, during face-to-face interviews, the participants generated 20 education topics (Table 2). After coding, the topics were categorized into five themes; (i) Topics at admission; (ii) General neonatal care; (iii) Feeding; (iv) Cleanliness and Hygiene, and (v) Topics to be taught during the discharge period (Table 2). During Round 1 each topic was described by a mean of 4.0 participants (SD±2.0). Only three of the 20 (15.0%) topics were suggested by only one of the participants.

Table 2: Sections of the tasks and education

	Round 1	Round 2	Round 3	Round 3
Sections	Total number of items	New items from participants	Total number of items presented in Round-3	Consensus criteria met
Topics at admission	6	8	14	8 (61.5%)
General care	4	8	12	10 (83.3%)
Feeding	6	7	13	11 (84.6%)
Cleanliness and hygiene	2	2	4	4 (100%)
Topics at discharge	2	12	14	14 (100%)
Total education topics	20	37	57	47 (83.9%)

In Round 2 the participants generated 37 additional topics (Table 2) and these were again classified into the themes identified in Round 1. The 37 new topics were each described by a mean of 2.8 (±2.6) participants, and 16 of the topics were suggested by only one of the participants. In Round 3 the 20 and 37 topics from Rounds 1 and 2 respectively were combined, and the 57 items were ranked for importance by the participants. Forty-seven topics (84%) met the pre-defined consensus criteria to be included in the “parental neonatal curriculum” (Table 2). There was a moderate correlation in the importance of items between the three groups of stakeholders with Pearson’s R ranging between 0.52-0.57, $p < 0.001$ (Figure 2). In Table 3 items have been presented with color coding to aid recognition of items with discordance in the opinion of stakeholders.

Discussion

This research project has identified the priority topics to be included in a “parental neonatal curriculum” for parents of admitted neonates in a resource-limited setting. The curriculum includes topics

IMPROVING NEONATAL CARE IN THE RESOURCE-LIMITED SETTING OF RWANDA

relating to admission, general care, feeding, cleanliness and hygiene, and discharge. This curriculum has been developed using robust Delphi-consensus techniques. All the topics (except discharge topics) within our curriculum would be essential for any parent who is providing FICare. Nineteen of the topics were also specific to caregiving (e.g., feeding through a nasogastric tube).

The strengths of this study include a high response rate from parents and clinicians and the broad experience of the HCPs who participated in this study. We followed a robust consensus methodology and have reported this work fully. The generalization of the study findings is limited because data collection occurred at just two hospital sites and in one geographical location. Another possible source of bias was acquiescence bias, the tendency of the participant to agree with statements or influential panel members, which we avoided in the initial rounds by explicitly avoiding the questions of agree/disagree and in later rounds by conducting a fully anonymized survey with no direct interaction between participants.

How can this “parental neonatal curriculum” be implemented? any newborn care unit wanting to use the neonatal curriculum described here would be encouraged to tailor it their own patient population and their care needs. Units would also be required to implement systems to assess parental knowledge and skills before specific tasks be undertaken. We have described a "parental neonatal curriculum," formed using robust consensus methods. Greater improvement in neonatal care practices is essential if neonatal mortality reduction is to be achieved in resource-limited settings where the burden of disease is found. One step in achieving this could include the use of proven low-cost interventions such as FICare, based on a foundation of effective parental education.

EDUCATION OF PARENTS

The paper, presented by Jean Aime, helps begin the discussion of how neonatal care can be improved in resource-limited settings. It however did little to address how a curriculum of this kind could be implemented into a care setting. With the already understaffed neonatal care units at CHUK and MDH it seems unfeasible that the doctors and nurses would have time to provide adequate education to those parents of admitted infants. Yet the expansion of technology and the globalization of medical care has

IMPROVING NEONATAL CARE IN THE RESOURCE-LIMITED SETTING OF RWANDA

opened a unique opportunity for the proposed problem, educational videos. In medical settings, the use of handheld videos has been shown to help disseminate information effectively and economically to patients (Mutanda et al, 2016). It has also been shown to be effective in the resource-limited settings yet little research has been done in the region of Rwanda, a community in which many residents are unfamiliar with more advanced technology.

GLOBAL HEALTH MEDIA

Global Health Media is an international company based out of Vermont that helps to create medical education videos. Started by Deborah Van Dyke, after her work in South Sudan, this non-profit serves resource-limited communities by providing free educational material, in the form of 5-10 minute videos, that can educate on a variety of maternal related topics. The videos are shot on site for each local language and they have made over 100 videos to date, all of which follow the international standard of care for the respective topic. These videos are used worldwide and thanks to the generous work done by those at Global Health Media allowed for us to attempt to use them to better neonatal care in Rwanda.

ARE VIDEOS AN EFFECTIVE MEANS OF EDUCATING PARENTS IN THE RESOURCE-LIMITED SETTING?

The aim of the study, with the help of Peter Cartledge, Alice Willson and myself, was to see if using short videos would be an effective means of disseminating knowledge to the parents of admitted neonates in the CHUK and MDH NICUs. The hope was that the usage of the videos would help to increase both the knowledge of parents as well as the confidence of parents to apply that knowledge.

Methods

The study was performed at the pediatric and neonatal units at the University Teaching Hospital of Kigali (CHUK) and Muhima District Hospital (MDH). This was a prospective interventional study to

IMPROVING NEONATAL CARE IN THE RESOURCE-LIMITED SETTING OF RWANDA

evaluate the educational benefit of a short parental educational video. Reporting of this study has been verified in accordance with the CONSORT checklist CHUK is a tertiary referral hospital located in Kigali city and serves much of the Rwandan population of 12 million. CHUK has pediatric, maternity and neonatal units. MDH is a district hospital, located in Kigali city, and serves approximately one million people. The hospital has only two major departments: obstetrics & gynecology and pediatrics with neonatology. The sites are responsible for approximately 2000 and 15000 deliveries per year respectively.

This project included mothers whose neonates were admitted at either CHUK or MDH. Eligible participants were mothers of neonates, parental language of Kinyarwanda, exclusively breastfeeding, and willingly consented. Subjects were excluded if the mother or neonate was significantly unwell and the prognosis was deemed to be poor and that participating in the study could be distressing to the mother. Participants were enrolled opportunistically when the Principal Investigator (PI) intermittently visited both study sites. The ward residents or nursing team identified potential participants.

The participants completed a questionnaire before and after watching the video to assess changes in knowledge and confidence in providing care (Global Health Media Team, 2018). The questionnaire was designed specifically for this study based on previously described breastfeeding knowledge questionnaires and the content of the GHMP video (Lakshman et al., 2011; Ferenandez-Vegue, Orega 2015). Each questionnaire had four sections: pre-video questionnaire which included i. demographics; ii. prior experience; iii. knowledge; and iv. confidence. This was followed by a post-video questionnaire which included i. demographics; ii. knowledge; iii. confidence; and iv. satisfaction about the video. The knowledge and confidence sections of the questionnaires used Likert questions. Research has shown that participants with low educational level may not understand Likert questions and therefore opt for extremes and demonstrate more acquiescence bias (Cola, 2016). Therefore, to aid participants, a modified form of the Wong-Baker faces pain scale (WBS) was used to demonstrate the 5-point Likert scoring system (Chachamovich, Fleck, 2015) visually. Responses to Likert items were combined to form Total Composite Knowledge and Total Confidence Scores for before and after the video. The content of the questionnaire was reviewed by three pediatricians and three nurses, experienced in neonatal care in this

IMPROVING NEONATAL CARE IN THE RESOURCE-LIMITED SETTING OF RWANDA

setting, to ensure content validity. The questionnaire was originally written in English and then translated to Kinyarwanda; it was piloted with two mothers to ensure understanding. Adaptations to the questions and translations were made based on the maternal feedback. We aimed to assess for a 15% increase in knowledge, with 95% confidence and 80% power requiring a total of 59 paired (pre- and post-video) scores.

Data was collected using a paper version of the questionnaire. Mothers with low literacy were given the option to complete the questionnaire with the PI verbally. Data was collected between 12-5pm to ensure it did not impede morning ward rounds. Questionnaire responses were input into a password protected Excel spreadsheet. Data was coded using a pre-defined coding sheet and was analyzed using Statistical Package for the Social Sciences (SPSS) version 21.0. Total confidence and knowledge Scores were formed by combining the Likert questions. The primary outcome was the increase in confidence from having watched the video. The pre- and post-video means were compared using paired-samples t-tests. For binary categorical data, Fischer exact tests were used as all comparisons had a group size of less than five.

Results

Sixty-five subjects were assessed for eligibility in the study and six were excluded, leaving 59 subjects that voluntarily participated in this study. Thirty mothers were recruited from the tertiary and 29 mothers from the district hospital sites. A mix of both low (52%) and high (48%) socio-economic mothers were recruited (Table 3).

Table 3: Demographic details of participants

	n=59	%
Participant Age		
15 - 19	5	8%
20 - 29	27	46%
30 - 39	24	41%
40 and above	3	5%
Ubudehe (social) Category		
Low (category 1 & 2)	32	54%
High (category 3 & 4)	27	46%
Marital Status		
Never married	13	22%
Married	41	69%
Divorced or separated	5	8%
Number of Living Children		
One -two	36	61%
Three - four	17	29%
Five - and more	6	10%

Most participants had not received previous education on how to increase their breastmilk supply with only 17% of all mothers, at both sites, reported a prior experience of being taught how to increase their breastmilk supply (Table 4). Concerning technological readiness, we found that only 10% of participants owned a smartphone which would allow them to watch a YouTube video.

IMPROVING NEONATAL CARE IN THE RESOURCE-LIMITED SETTING OF RWANDA

Table 4: Subjects' readiness for learning

Questions	CHUK n (%)	MDH n (%)	Total n (%)	p-value ^F
Have you ever been taught how to increase breast milk supply?	4 (13.3%)	6 (20.7%)	10 (16.9%)	p=0.343
Do you own a smartphone?	3 (10.0%)	3 (10.3%)	6 (10.2%)	p=0.648
Do you ever watch videos on your smartphone	3 (10.0%)	3 (10.3%)	6 (10.2%)	p=0.648
Do you have mobile phone credit to help you watch videos on YouTube?	3 (10.0%)	2 (6.9%)	5 (8.5%)	p=0.516

Statistical comparison of the study sites revealed that there were no significant differences in the knowledge (p=0.158) or confidence (p=0.102) scores of the mothers from the different sites before watching the video. After watching the video, the mean maternal knowledge score significantly increased from 27.2 to 33.2 points (p<0.001) (Table 5). Mothers already had a good understanding of hunger cues but poor understanding that breastmilk substitutes lead to reduced milk flow before the video, with the most significant gain of knowledge in this domain. Confidence scores significantly increased from 9.7 to 14.2 (p<0.001) after watching the video (Table 6).

IMPROVING NEONATAL CARE IN THE RESOURCE-LIMITED SETTING OF RWANDA

Table 5: Pre- and post-video knowledge scores

Question	Pre-video mean (±SD)	Post-video mean (±SD)	Difference (CI)	p-value
Babies signal hunger by moving fingers in mouth	4.90 (±0.58)	4.98 (±0.13)	0.09 (CI: 0.24 to 0.07)	p=0.279
<i>Formula milk better than exclusive breast milk^R</i>	4.61 (±1.05)	4.98 (±0.13)	0.37 (CI: 0.10 to 0.65)	p=0.009
Breast compression can increase the flow of milk	4.02 (±1.54)	5.00 (±0.00)	0.98 (CI: 0.58 to 1.38)	p<0.001
<i>Breastfeeding must be in large amounts infrequently^R</i>	3.83 (±1.66)	4.19 (±1.57)	0.36 (CI: 0.85 to 0.14)	p=0.158
<i>Breastmilk substitutes decrease risk of infection to the baby^R</i>	3.80 (±1.70)	4.53 (±1.24)	0.73 (CI: 0.23 to 1.22)	p=0.005
A baby must attach mouthful of breast	3.15 (±1.82)	5.00 (±0.00)	1.85 (CI: 1.37 to 2.32)	p<0.001
Breastmilk substitutes lead to reduced milk flow	2.90 (±1.77)	4.56 (±1.22)	1.66 (CI: 1.11 to 2.21)	p<0.001
Total Knowledge score	27.20 (±4.06)	33.24 (±2.96)	6.03 (CI :4.80 to 7.27)	p<0.001

Table 6: Pre/post video confidence scores

Question	Pre-video mean (±SD)	Post-video mean (±SD)	Difference (CI)	p-value
I know the technique to increase my milk supply	2.51 (±1.54)	4.86 (±0.63)	2.36 (CI :1.92 to 2.79)	p<0.001
I am confident using the techniques to increase milk supply	2.29 (±1.44)	4.86 (±0.54)	2.58 (CI :2.16 to 3.00)	p<0.001
<i>I want to know how to increase breast milk supply^R</i>	1.10 (±0.58)	4.51 (±1.27)	3.41 (CI: 3.01 to 3.81)	p<0.001
Total confidence score	5.89 (±2.94)	14.24 (±2.02)	8.34 (CI: 7.34 to 9.34)	p<0.001

Discussion

The aim of our study was to investigate whether showing a short video on a specific topic could change the knowledge and confidence of mothers as the primary caregivers. We found that both improved significantly. Our participants were from two urban sites of mixed tertiary and district level care. Very few women had received previous education or instruction on how to increase their milk supply. In the resource-limited setting the ratio of HCP's to patients/carers is low and therefore face-to-face education opportunities with HCPs pose a challenge. Regarding using an online video (e.g. GHMP), only 10% of the participants owned a smartphone, but many of those who owned a phone (5/6, 83%) report having sufficient mobile phone credit (Table 2). These findings are in the urban setting where wealth is generally higher. Therefore, if similar settings are to use videos then the hardware will need to be identified to do this, such as a desktop computer, TV or DVD player. GHMP does allow for videos to be downloaded therefore continuous internet supply is not required.

We were unable to find any previous quantitative studies in a similar setting which used video education for mothers. GHMP videos have been qualitatively assessed in Malaysia where they were incorporated as training tools to enhance the delivery of current breastfeeding peer counsellor trainings further. One key finding was the description of frequent '*Aha*' moments experienced by the participants while watching the videos as a new learning point was encountered (Garra et al., 2009). We identified a significant increase in knowledge. This was after watching one video which was enjoyed by participants. Therefore, a package of high-quality videos, in combination with other strategies, could be used to educate mothers on key topics with relatively modest resources and without using additional HCP time.

Confidence in caring for a newborn is very important. Lim et al, in Korea, used videos and qualitative methods to increase the confidence of mothers of premature infants at the point of discharge from the neonatal unit (Fernandez-Vegue & Orenga, 2015). In the resource-limited setting HCP to neonate ratios demand that parents provide care for their admitted sick neonates. If parents, in this setting, are to provide Family Integrated Care (FICare) then they need to be confident in doing so, with the right

IMPROVING NEONATAL CARE IN THE RESOURCE-LIMITED SETTING OF RWANDA

knowledge. We have shown that the confidence of the parents of these admitted neonates can be increased with a short video.

This study measured the effect of one parental neonatal topic covered by a GHMP video – increasing breast milk supply - this covered a minimal amount of the knowledge/confidence required of parents when caring for a sick neonate. From our methodology we are unable to report whether this knowledge is retained in the long-term as, for practical reasons, the repeat questionnaire was administered immediately after watching the video. Finally, the participants were all recruited in the urban setting and therefore the results may not be valid in the rural setting. This was a questionnaire-based study, so the most likely potential for bias was ‘acquiescence’ bias. This is characterized by participants giving the responses that they believe the researcher wants to hear. This has been minimized by reverse coding questions so that not all questions/responses were true. These questions were then reverse coded for analysis and interpretation of the knowledge and confidence scores.

Regarding our specific video topic of increasing breast milk supply, further research is needed into: whether the knowledge is retained, what is the minimum time required to restore satisfactory breastmilk after education and whether neonatal outcomes are improved. More generally further assessment is required of videos on other topics and with different caregivers such as fathers and relatives. Our research has shown that GHMP videos are effective in communicating a specific neonatal health message. We have shown that maternal confidence and knowledge on a specific neonatal topic can be increased using such a video. If this can be shown to improve neonatal care, ultimately neonatal morbidity and mortality could be improved. However, further research will need to be undertaken to quantify this.

A DISCUSSION ON RWANDAN MEDICAL CARE

I have worked for the Rwandan Medical Journal for nearly two years now, an opportunity that has allowed me to widen my world view and better understand what medical care looks like throughout the globe. The issues raised in this paper: lack of providers, lack of funds, and isolated communities, are

IMPROVING NEONATAL CARE IN THE RESOURCE-LIMITED SETTING OF RWANDA

not unique to the care of neonates and are found throughout the papers I have revised. The battle for improving medical care in Rwanda is not one of lacking knowledge of how a health care system works, but rather one of lacking the resources for these doctors to thrive. Though difficult, it is this unique situation that has allowed for some amazing advancements in the field of public health. These medical professionals must constantly be finding new uses for their available resources and, in publishing about their experience, make advancements that are much more relevant on a global scale.

References

1. Lawn JE, Cousens S, Zupan J. Neonatal Survival 14 million neonatal deaths: When? Where? Why? *Lancet*. 2005; 365:891–900.
2. UNICEF. Committing to Child Survival: A Promise Renewed. Progress Report. [Www.Apromiserenewed.Org](http://www.apromiserenewed.org). 2014.
3. Lawn JE, Blencowe H, Oza S, You D, Lee ACC, Waiswa P, et al. Every newborn: Progress, priorities, and potential beyond survival. *Lancet*. 2014; 384:189–205.
4. Gale C. Comment Family Integrated Care for very preterm infants: evidence for a practice that seems self-evident? *Lancet Child Adolesc*. 2018; 2:1–2.
5. National Institute of statistics. Rwanda Demographic and Health Survey. Rwanda. 2015.
6. Weiner EA, Billamay S, Partridge JC, Martinez AM. Antenatal education for expectant mothers' results in sustained improvement in knowledge of newborn care. *J Perinatol*. Nature Publishing Group; 2011; 31:92–7.
7. Amolo L, Irimu G, Njai D. Knowledge of postnatal mothers on essential newborn care practices at the Kenyatta national Hospital: A cross sectional study. *Pan Afr Med J*. 2017; 28:1–7.
8. Meseka LA, Mungai LW, Musoke R. Mothers' knowledge on essential newborn care at Juba Teaching Hospital, South Sudan. *South Sudan Med J*. 2017; 10:56–9.
9. Singh K, Brodish P, Haney E. Postnatal care by provider type and neonatal death in sub-Saharan Africa: A multilevel analysis. *BMC Public Health*. 2014; 14:1–7.
10. UNICEF. The State of World's Children. 2009.
11. Nuthulaganti T, Umubyeyi B, Sc MN, Nyemazi JP, Uwayezu A, Sc MN, et al. The Human Resources for Health Program in Rwanda — A New Partnership. 2013;
12. Hsu C, Sandford B. The delphi technique: making sense of consensus. *Pract 1 Assessment, Res Eval*. 2007; 12:1–8.
13. GRADE. Handbook for grading the quality of evidence and the strength of recommendations using the GRADE approach [Internet]. 2013 [cited 2018 Jan 4]. Available from: <http://gdt.guidelinedevelopment.org/app/handbook/handbook.html#h.1i2bwkm8zpio>
14. Williamson PR, Altman DG, Bagley H, Barnes KL, Blazeby JM, Brookes ST, et al. The COMET Handbook: Version 1.0. *Trials*. 2017; 18:1–50.

15. Sinha IP, Smyth RL, Williamson PR. Using the Delphi Technique to Determine Which Outcomes to Measure in Clinical Trials: Recommendations for the Future Based on a Systematic Review of Existing Studies. *PLoS Med.* 2011;8: e1000393.
16. Williamson PR, Altman DG, Blazeby JM, Clarke M, Devane D, Gargon E, et al. Developing core outcome sets for clinical trials: Issues to consider. *Trials.* 2012; 13:1–8.
17. Kirkham JJ, Gorst S, Altman DG, Blazeby JM, Clarke M, Devane D, et al. Core Outcome Set–Standards for Reporting: The COS-STAR Statement. *PLoS Med.* 2016; 13:1–11.
18. www.EveryPreemie.org. Family-Led Care Package - Malawi. Washington DC;
19. Bhutta ZA, Khan I, Salat S, Raza F, Ara H. Reducing length of stay in hospital for very low birthweight infants by involving mothers in a stepdown unit: an experience from Karachi (Pakistan). *BMJ.* 2004; 329:1151–5.
20. Tumwebaze P., “Rwanda needs more pediatrician: www.thenewtimes.co.rw/section/read/219921.” *THE NEW TIMES, KIGALI*, p. 2, 2017.
21. College of nurses-midwives MOH, every preemie scale, USAID, PCI, gapps, “RWANDA PROFILE OF PRETERM AND LOW BIRTH WEIGHT PREVENTION AND CARE,” Rwandan Ministry of Health, every preemie scale, pp. 10–12, 2015.
22. A. L. Kellams *et al.*, “The Impact of a Prenatal Education Video on Rates of Breastfeeding Initiation and Exclusivity during the Newborn Hospital Stay in a Low-income Population,” 2016. [4] S. C. Sonne *et al.*, “Development and pilot testing of a video-assisted informed consent process ☆,” *Contemp. Clin. Trials*, vol. 36, no. 1, pp. 25–31, 2013.
23. S. Shieh *et al.*, “The effectiveness of structured discharge education on maternal confidence, caring knowledge and growth of premature newborns,” pp. 3307–3313, 2010. [6] A. K. Kamal *et al.*, “Translating knowledge for action against stroke – using 5-minute videos for stroke survivors and caregivers to improve post- stroke outcomes: study protocol for a randomized controlled trial (Movies4Stroke),” *Trials*, pp. 1–13, 2016.
24. J. N. Mutanda, P. Waiswa, and S. Namutamba, “Community-made mobile videos as a mechanism for maternal, newborn and child health education in rural Uganda; a qualitative evaluation,” *Afr. Health Sci.*, vol. 16, no. 4, pp. 923–928, 2016.

25. M. Baernholdt, "Parents' Perceptions of Continuity of Care in the Neonatal Intensive Care Unit," vol. 27, no. 2, pp. 168–175, 2013. [9] K. Schulz, D. Altman, and D. Moher, "CONSORT 2010 statement: Updated guidelines for reporting parallel group randomised trials," *BMC Med.*, vol. 8, no. 18, pp. 1–9, 2010.
26. "RMJ research series: How to write-up the methodology of your project."
27. G. health media Team, "http://: www.globalhealthmedia.org/what-we-do/how-we-work/." Global health media, 2018.
28. R. R. Lakshman, J. R. Landsbaugh, A. Schiff, W. Hardeman, K. K. Ong, and S. J. Griffin, "Development of a questionnaire to assess maternal attitudes towards infant growth and milk feeding practices," *Int. J. Behav. Nutr. Phys. Act.*, vol. 8, no. 1, p. 35, 2011.
29. M. G. Fernández-vegue, "Development and validation of a Breastfeeding Knowledge and Skills Questionnaire en lactancia materna," pp. 1–13, 2018.
30. E. Cola, "BREASTFEEDING KNOWLEDGE AND SKILLS QUESTIONNAIRE," *Bmj*, vol. 1, pp. 2–4, 2016.
31. P. M. Chachamovich E1, Fleck MP, "Literacy affected ability to adequately discriminate among categories in multipoint Likert Scales.," *J. Clin. Epidemiol.*, vol. 62, no. 1, pp. 37–46, 2009.
32. G. Garra *et al.*, "Validation of the Wong-Baker FACES Pain Department Patients," pp. 50–54, 2009. [17] M. G. Fernández-vegue and M. M. Orensa, "Development and validation of a Breastfeeding Knowledge and Skills Questionnaire □," vol. 83, no. 6, 2015.
33. L. Scales and G. M. Sullivan, "Analyzing and Interpreting Data From Likert-Type Scales," no. December, pp. 541–542, 2013. [19] S. R. Jones, "An introduction to power and sample size estimation," *Emerg. Med. J.*, vol. 20, no. 5, pp. 453–458, 2003.
34. J. S. Lim, "Development and Evaluation of a Video Discharge Education Program focusing on Mother - infant Interaction for Mothers of Premature Infants," vol. 42, no. 7, pp. 936–946, 2012.
35. D. R. Hess and R. R. T. Faarc, "How to write an effective agenda," *Working@Office*, vol. 12, no. 7, pp. XIV–XVI, 2011.