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Quality of Neonatal Health Care: Learning From Health Workers' Experiences in Critical Care in Kilimanjaro Region, Northeast Tanzania

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Abstract

Background: Neonatal deaths are generally attributed to suboptimal standards of health care. Health care worker motivation and adherence to existing guidelines are rarely studied.

The objective: To assess the performance of health workers for neonatal health care in the hospitals of Kilimanjaro region.

Methods: A descriptive study using a semi-structured interview for health care workers at a tertiary referral hospital and peripheral health facilities (regional referral, district hospitals and health centres).was used. Health Care Workers (HCW) were asked to recall a scenario of a critically ill neonate admitted in the wards and the treatment that was provided. The WHO Emergency Triage Assessment and Treatment (**ETAT**) guidelines were used as a standard reference for knowledge of critical care.

Results: Birth asphyxia was the most recalled health problem requiring critical care, reported by 27.5% of 120 HCW at both peripheral hospitals and by 46.4% of 28 health workers in tertiary referral centres. Half of the HCW commented on their own performance (47.5%, n=140). HCW presented with low to moderate levels of knowledge for critical care were at 92%. Supplementary training was associated with a higher levels of knowledge of neonatal critical care (p value = 0.05). HCW in peripheral hospital had lower levels of knowledge (only 44.7% at peripheral hospitals had sufficient ratings compared to 82.1% at the referral centre). [Pearson $\chi^2(2) = 12.10$, p value = 0.002].

Conclusion: Guided Practical-Competence Diagnostic Specific neonatal health care training is highly needed in the peripheral facilities of rural Kilimanjaro region.

Keywords: Neonatal; Health care workers; Quality of care; Peripheral hospitals; Kilimanjaro; Northen Tanzania

Abbreviations: AMO: Assistant Medical Officer; CO: Clinical Officer; DMO: District Medical Officers; ENmdwf: Enrolled midwife nurse; ETAT: Emergency Triage Assessment and Treatment; HCW: Health Care Worker; HMIS: Health Management Information System (in Swahili version MTUHA: Mfumowa Taarifaza Uendeshaji Hudumaza Afya); MO: Medical Officer; NO: Nurse Officer; Resident MMED: Resident Master of Medicine in Paediatrics; RMO: Regional Medical Officer; STATA: The Complete Package of Statistical Software used for Data Analysis; TOT: Training of Trainers; WHO: World Health Organization; WISN: WHO devised Workload Indicator for Staffing Need

Introduction

Worldwide, neonatal deaths account for 40% of under five deaths and play a barrier for the achievement of the Millennium Development Goal number 4 (MDG 4) [1,2]. A large proportion of these barriers are from sub-Saharan Africa [3-5]. Most of the causes of these deaths are preventable through appropriate Health Care Workers' (HCWs) interventions [6,7]. Distance, cost of health care and performance of HCWs are the contributing barriers [8,9]. However, facility-based births are increasing in many resources limited countries, and therefore a call for improving the performance of HCW at these hospital settings is vital [10-14].

Tanzania is a sub-Saharan African country with an infant mortality rate of 65.74 deaths per 1,000 live births and a neonatal mortality rate of 26 deaths per 1000 live births in 2012 [15]. From 2000 to 2010 perinatal mortality at a tertiary referral hospital in the Kilimanjaro region was 57.7/1000 (1958 out of 33,929), of which 1,219 (35.9/1000) were stillbirths and 739 (21.8/1000) were early neonatal deaths [16]. Neonatal deaths remain higher in rural settings compared to urban settings [17-19]. Several studies have demonstrated poor adherence to existing guidelines [20-22] as a cause for a large proportion of neonatal deaths, and training focused on maternal-child health has been shown to result in improvement [23]. However, monitoring and maintenance of training remain suboptimal [22,24,25] in terms of adherence to guidelines [26] and other service-related factors [22,27,28].

There are growing concerns regarding the performance of rural health care workers in Tanzania [20]. Further evidence shows that there are challenges related to lack of motivation and evidence based guidelines [18,20]. Qualitative approaches have rarely been made to synthesize and describe the causes of neonatal deaths in the hospitals during first referral care of the sick neonates. Little information can be obtained regarding the role of Health Care Workers, HCW in assuring the quality of neonatal health care in Tanzania [29]. The aim of this

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study was to assess the performance of HCW in providing neonatal health care in the hospital set up in northern Tanzania.

Methods

Study purpose and setting

The overall research design was a cross sectional study using mixed method approaches in 14 hospital facilities within all 7 districts of the Kilimanjaro region.

Hospital and health workers selection

Hospitals were selected by a non-random purposive sampling method with a goal to include all district and District Designated Hospitals (missionary hospitals) which are commonly referring sick neonates to the one tertiary referral hospital in the region.

Within each selected hospital, HCWs who had neonatal care responsibilities in the past 6 months (main criterion) were selected by convenience sampling. They were then asked to recall a sick neonate needed critical care in past 6 months (second criterion) before approached for a possible interview (Figure 1) recalling neonatal deaths in the last 12 month was additional. Visits to hospitals were unannounced.

Data collection

Data were collected from 26th November, 2010 to 25th April, 2011 in all districts of the Kilimanjaro region. All interviewers were trained in a structured system so as to standardize their interpretation of management and minimizing information bias such as interview bias and reporting bias. Hospitals were visited without prior notification and all HCW with the criteria to be interviewed were contacted. District Medical Officers were contacted to introduce the study and written consent was obtained from the Medical Officer In-Charge from each visited hospital facility.

After consenting in written permission, HCWs in the morning shift were interviewed individually in English and inquired about the specific training they had received related to neonatal health care. Semi-structured interviews were used to probe the management of the problem, including their recall of what was done and what they thought ideally should have been done. This included inquiries into appropriate diagnostics, therapies, and challenges faced.

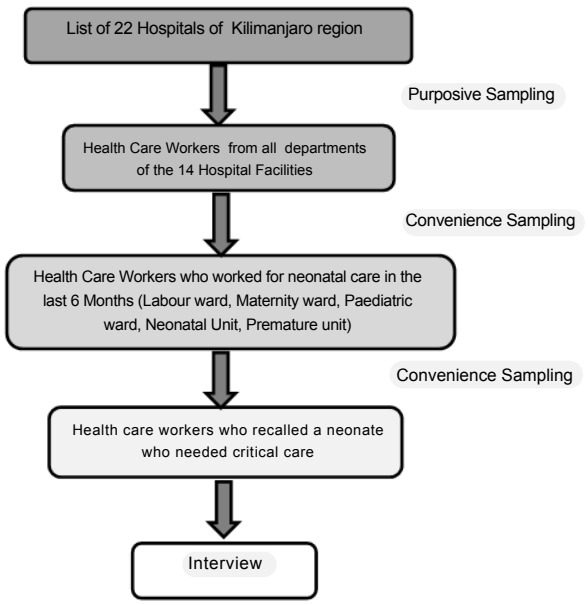


Figure 1: Sampling Techniques in general.

First, HCWs were asked to rate their own level of knowledge. Second, through indirect assessment, HCWs were asked to describe the critical clinical condition of the neonate recalled, and then questioned on what was done and what she/he would like to do for appropriate management. The number of wrong answers/mistakes (not concise with WHO ETAT Manual) made during the interview for the management was then documented. The numbers of mistakes were used to estimate the level of knowledge. One wrong answer on a clinical problem or no wrong answer was taken as satisfactory; two wrong answers of any type were moderate, and three or more wrong answers were considered as a low level of knowledge.

The qualitative information was gathered from the question that asked what went well and what went wrong. When the explanations were ambiguous, the embedded guide of in-depth interview was used to catch the responses in details. Detailed discussions were written in the notebooks while the digital recorders were left on recording the discussions. The narratives were then entered in a Microsoft Access 2007 database.

Data analysis

We analysed our quantitative data by using STATA v10 (StataCorp, TX, USA) for statistical comparison using Chi-square test to test the difference between the categories and association between independent and dependant variables. Microsoft Excel 2007 software was used for graphical presentations from the STATA results.

The taped interviews were transcribed verbatim. Qualitative variables from the narratives were coded into different themes using colors, and the themes were counted so as to generate the final picture of the discussions. Narrative given by health workers are labeled by academic qualifications, age and the facility they are from.

A pre-prepared list of anticipated conditions, including birth asphyxia, extreme prematurity, meconium aspiration, general respiratory distress, congenital cardiac disease, complex congenital malformations. This was compiled with the additional guide for triaging sick neonates who needs critical care based on the WHO-ETAT manual for justifying mistakes.

Staffing numbers were recorded from the Health Management Information System (HMIS) or Mfumowa Taarifaza Uendeshaji Hudumaza Afya (MTUHA) booklets and duty roasters for work shifts. We calculated the WHO devised Workload Indicator for Staffing Need (WISN) [30,31] by using the WHO Manual for Implementation [32] for duties of each cadre of health workers in the district hospitals. The World Health Organization's Workforce/workload Indicators of Staffing Need (WISN) method is used to calculate and estimate the number of health workers required to achieve the maternal and child health 'service guarantees.' We measured the ratio between current staffing levels and the ideal expected number. We calculated the expected numbers of health workers by using the amount of hours available for work in a year per one health worker compared to the total duration of time in hours in one year required to serve hospital based on neonates available. The WISN ratio was given by the number of health workers available divided by the number of health workers expected.

Ethics

The study was approved by the Kilimanjaro Christian Medical University Ethical Committee and written approval for data collection was also received from the Kilimanjaro Regional Medical Officer. Written consent for permission was obtained from the DMOs and Medical Officer In-Charges of the hospital facilities that medical records and case notes will be assessed, pictures might be taken and results published. Before conducting interviews for health workers, written consents were obtained from all HCWs approached for discussions.

Quantitative results

A total of 148 HCWs responsible for providing neonatal care were interviewed; 120 (81.1%) were from peripheral hospitals (2 health centres, 10 District Hospital and 1 Regional Hospital), and 28 were from the northern zone referral hospital in the Kilimanjaro region. Generally 6 HCWs (4.1%) were unable to recall a sick neonate and as such their data were not assessed, leaving 142 interviews for analysis on this particular variable. The demographic information for the mix of doctors and nurses interviewed are shown in Table 1.

	Frequency in Peripheral facilities (n=120)	Frequency at a Tertiary Health Center (n=28)
Age in years		
20-30	32 (26.7%)	10 (35.6%)
31-40	36 (30.0%)	12 (42.9%)
41-50	28 (23.3%)	1(3.6%)
51-60	19 (15.8%)	4 (14.3%)
60-80	5 (4.2%)	1 (3.6%)
Sex		
Male	31 (25.8%)	8 (28.6%)
Female	89 (74.2%)	20 (71.4%)
Profession		
Trained Nurse	10 (8.3%)	0 (0.0%)
Enrolled Midwife Nurse	26 (21.7%)	0 (0.0%)
Reg Nurse Officer	41 (34.2%)	9 (32.14)
BSc Nurse Officer	3 (2.5%)	1 (3.6%)
Clinical Officer	8 (6.7%)	0 (0.0%)
AMO	19 (15.8%)	0 (0.0%)
Medical Officer	12 (10.0%)	5 (17.8%)
Resident Doctor	0 (0.0%)	9 (32.1%)
Paediatrician	1 (0.8%)	4 (14.3)

*Note: The number of HCW are based on the number of HCW found in a day of un announced visit

Table 1: Demographical information of health workers interviewed by 2011.

The staffing levels by shifts are shown in Table 2 and the respective WISN levels are shown in Table 3 for the implication of work load indication. Common diagnoses of neonates as recalled by HCW are shown in Table 4.

With exception to Designated District Hospitals (DDH) which do not refer severe illnesses frequently, the rest of peripheral hospital facilities generally refer neonates who needed close follow up for critical management (Figure 1). At the referral hospital, half of the referred cases presented with a complicated picture of the illness.

Birth asphyxia was the leading health problem requiring critical care among all critically ill neonates recalled by health workers at both the first referral care centres (27.5%) and tertiary centres (46.4%) (Figure 2).

On job based training is not normally practiced in the facilities. For example, among 70 health workers who reported the presence of incubators in their facilities, only 15 (21%) had training on proper uses of incubators, while the remaining 55 (79%) did not (Figure 3 showing two neonates in one incubators by our observation). Half of the HCWs who received training in neonatal care were trained in one week or less. The highest level of knowledge (0-1 mistakes) was found in 1 health worker (3.5%) at the health centre, 7 (25.0%) in a group of district hospitals, in a regional hospital and 19(67.8%) at a tertiary referral centre [Pearson χ^2 (6) = 71.33, p value <0.000]. Among the peripheral facilities (n=120), the lowest level of knowledge on neonatal critical care (more than 3 mistakes) was 49.1%. HCWs with moderate levels of knowledge (2 to 3 mistakes) were higher in the facilities among the district hospitals (42.9%). On the other hand, health workers with higher levels of knowledge (0-1 mistake noted) were at the proportion of (8.0%).

The proportions of health workers with the highest level of knowledge by indirect assessment were slightly higher: 15 (53.6%) among the trained workers compared to 13 (46.4%) who did not receive training [Pearson χ^2 (2) = 5.89, p value = 0.053]. When asked to self-grade on the level of skills required for neonatal critical care, HCWs

Facility Code	Number of clinicians Total	Number of clinicians AM shift	Number of nurses Total	Number of nurses AM shift	Number of attendants nurses Total	Number of attendants nurses AM shift
F01	4	2	19	3	8	2
F02	2	2	10	2	2	1
F03	5	1	12	3	13	2
F04	2	1	7	2	2	1
F05	5	2	10	2	5	1
F06	1	1	8	2	7	1
F07	2*	1	27	1	18	1
F08	5	1	25	2	33	2
F09	2	1	15	2	6	1
F10	2	1	4	1	5	1
F11	4	2	6	2	2	1
F12	2*	1	13	1	3	2
F13	1	1	1	1	1	1
F14	9	4	21	2	2	3

† Note: At F07, there are 11 doctors who make rotations in the neonatal related ward during a week. Similarly, at the F012, there are 9 doctors allocated who make rotations within a week.

Table 2: Allocation of health workers in the rooms of neonatal care in the 14 hospitals of Kilimanjaro region.

Facility Code	Clinicians			Nurses			Nurse attendants		
	Available	Expected	WISN	Available	Expected	WISN	Available	Expected	WISN
F01	4	20.69	0.19	19	3.76	3.98	8	5.64	0.35
F02	2	3.66	0.55	10	0.65	6.01	2	0.99	2.01
F03	5	3.61	1.37	12	0.63	18.09	13	0.96	13.07
F04	2	0.85	2.46	7	0.19	47.33	2	0.22	22.56
F05	5	1.37	1.44	10	0.23	39.5	5	0.36	13.18
F06	1	7.76	0.26	8	1.48	5.7	7	2.19	1.9
F07	2*	4.58	0.87	27	0.81	14.4	18	1.29	0.8
F08	5	5.75	0.53	25	1.03	6.74	33	1.55	2.57
F09	2	18.03	0.11	15	3.35	0.6	6	5.04	0.4
F10	2	5.92	0.51	4	1.07	3.71	5	1.61	3.1
F11	4	2.43	1.66	6	0.43	4.56	2	0.65	3.04
F12	2*	1.92	1.57	13	0.35	8.56	3	0.52	1.9
F 13	1	2.66	0.37	1	0.48	6.13	1	0.73	4.09
F14 (referral centre)	9	26.1068	0.27	21	4.76	1.47	2	7.12	0.56

‡Note: Also shown in the publication Mbwele et al. BMC Pediatrics 2012, 12:182 http://www.biomedcentral.com/1471-2431/12/182

Table 3: Staff need by WHO devised indicator of WISN, Work load indicator for staff need.

Facility Code	No of HW Interviewed	No of sick neonates recalled	Sick neonates recalled by health workers
F01	19	19	(Birth injury, Convulsions),Breathing problems, Pneumonia,Breathing problem, Febrile illness (3), (Febrile illness, Breathing problems), (Febrile illness, Cord sepsis), (Febrile illness, Diarrhoea) ,(Febrile illness, Neonatal septicaemia) (Febrile illness, Sucking problem), (Febrile illness, Sucking problem, Convulsions) (Febrile illness, Sucking problem, vomit), (Febrile illness, Sucking problems) (Febrile illness, Vomiting), (Febrile illness, Vomiting, Convulsions) (Low APGAR, Febrile illness),Second twin with breeched delivery(2)
F02	7	6	Birth Asphyxia (2), (Breathing problem, Convulsions, Febrile illness), (Febrile illness, Poor feeding), (Hypoglycaemia, Low APGAR score, Breathing problem), (Prolonged labour, Low APGAR)
F03	8	7	Febrile illness, Breathing problems(4), Febrile illness, Breathing problems, Sucking problem, Febrile illness, Sucking problem, Prolonged labour, Birth Asphyxia
F04	10	10	Birth Asphyxia (5), (Birth Asphyxia, Low APGAR), Congenital Heart Disease, (Congenital Heart Disease), (Premature baby, Neonatal septicaemia), (Premature baby, hartstopping)
F05	8	7	Birth Asphyxia, (Congenital Heart Disease, Breathing problem), (Febrile illness, Birth Asphyxia), Low APGAR, (Septic cord, Breathing problems), Severe Malaria, spinal bifida.
F06	6	5	Birth Asphyxia ,(Breathing problems, Birth trauma), (Febrile illness, Sucking problem, Jaundice), (Low APGAR, Febrile illness, Convulsions), (Pneumonia)
F07	9	9	Birth Asphyxia (3), Breathing problems (3), (Breathing problems, Jaundice), Premature baby, (Premature baby, Breathing problems)
F08	11	11	Birth Asphyxia (2), Birth Asphyxia, Premature baby (2), Breathing problems (4), Pneumonia, Premature baby, Swelling in the neck
F09	9	9	Birth Asphyxia (4), (Birth Asphyxia, Cyanosis), Breathing problems, (Breathing problems, Cyanosis), (Low APGAR, Sucking problem), Pneumonia
F10	10	9	Birth Asphyxia (4), Neonatal Septicaemia (2), Premature baby with breathing problem, Sucking problem (2), (Birth Asphyxia, Meconium aspiration)
F11	10	9	Premature baby (2), Pneumonia, (Bilateral cleft lip and cleft palate), Birth Asphyxia, Breathing problems, Exophaloncene, Febrile illness, Breathing problems, Meconium aspiration, Breathing problems
F12	6	6	Birth Asphyxia, Febrile illness (2), Febrile illness, Neonatal Septicaemia, Febrile illness, convulsion, Neonatal septicaemia
F13	7	7	Birth Asphyxia (3), Breathing problems, Febrile illness, (Febrile illness, Neonatal Septicaemia), (Premature baby, Neonatal septicaemia, Febrile illness)
F14	28	28	Severe birth asphyxia 8, Birth asphyxia 4, Bleeding per umbilicus, Difficulty in breathing, Extreme Prematurity 3,Failure to breathe, HIV exposed neonate with intestinal obstruction, Imperforate anus, Neonatal Sepsis, Meconium Aspiration, Meningitis, Septicaemia, Premature baby with severe birth asphyxia, Respiratory failure, Severe anaemia, Severe meconium aspiration, Suspected bacterial meningitis, HSV infection

§ Note: Some neonates presented with more than one diagnosis

Table 4: Recalling critically ill neonates by health workers from the facilities.

in peripheral hospitals (Health centre, District Hospital and Regional Hospital) reported a 44.7% score compared to a score of 82.1% by HCWs at the tertiary referral centre. Self-grading had a statistical difference in measuring the results compared to indirect assessment of knowledge through interviews [Pearson $\chi^2(2) = 12.10$, p value = 0.002].

Quality of records

The invariable reasons for the absence of records are shown in Table 5 for the peripheral facilities. Outcome of care in both settings is shown in Figure 4.

Qualitative Results

Knowledge in critical care

Enrolled Nursing midwifery (ENmdwf) 44 years old who worked for 23 years at facility F07 recalled a baby with shortness of breath and

jaundiced and stated "*there was no investigation that was missing apart from blood sample for malaria parasites*". When asked what could be done to improve neonatal care she said" *I don't remember I think the baby needed anti-malaria*".

What could have been done better? (Qualitative findings)

There were 173 opinions of health workers gathered, 140 of which were from the peripheral hospitals. The leading opinion from the periphery was on performance of health workers themselves (28.6%, n=140). Where three themes were found on performance, first on appropriate management, monitoring, and follow-up of neonatal cases (47.5%, n=40). For example, AMO F3, 46 years old HCW, has seen a need to "*monitor the baby, do faster reporting, and make special follow up care for neonates, especially those who have been resuscitated, will really improve the outcome of these babies*." Second theme was on a need of skills (45%, n=40). NO F4, 55 years old explained that, "*I think training of health workers on follow up of neonatal care is necessary because resuscitation has remained to be challenging and difficult*."

Third theme was on theme was on lack of timely referrals to the regional or referral hospitals (7.5%, n=40). ENmdwf F7, 38 years old observed while considering a specific case, "*We should have referred the baby; the condition was very bad, and we did not have anything to do here that could help the baby*."

Figure 2. Prominent cases recalled in need of critical care by proportions.

Note: Without detailed laboratory investigation of their infection these two neonates were kept in one incubator in one of the facilities we visited.

Figure 3. Observation: Allocation of the two sick neonates in one incubator.

At the zonal referral hospital the performance of health workers was reported at 39.4% (n=33). NO F14, 25 years old recalled a baby with Birth asphyxia, and she explained that "*Birth asphyxia is the main problem here. If labour and delivery were appropriately monitored, there would be less cases of birth asphyxia*."

Generally there was a 26.4% shortage of proper equipments at the periphery centres (n=140). AMO F11, 36 years old who recalled a baby with febrile illness and breathing problems explained, "*If we could have a ventilation machine and pulse oximeter we could serve many babies here*." Drug supplies were complained at 7.9% (11 from the periphery hospitals and 1 comment from the referral hospital) reported fluctuations of drug supply in the facility.

Shortage of staff was reported at 12% (n=140). For example, NO F9, 28 years old, complained "*we needed more skilled staff to treat the critically ill baby, again not only skills nut number of doctors here is not satisfying, one doctor and one nurse is not enough. We miss some techniques and team work here*."

Lack of organization of care in the peripheral facilities were reported by 11.0% (n=140) (all from the periphery, none from the zonal referral hospital). MO F12, 47 years old HCW, told the interviewers that "*if we had a neonatal unit, we could do more monitoring and more supportive neonatal care. I think we have some tools to start with, but we only miss the arrangement.*"

The concern of proper hygiene was reported at 2.9% (all from the periphery, none from the tertiary referral hospital).

Neonatal deaths recalled

There were 78 HCW (68.42%) from peripheral hospitals and 26 HCW (92.9%) at the tertiary referral hospital who recalled deaths in their facility (Table 6). Among HCWs who recalled cases of neonatal deaths, 63 HCW (52.2%) at the District hospitals and Health Centers, 9 HCW (47.4%) at the Regional hospital and 17 HCWs at the tertiary referral hospital (60.7%) reported that these deaths could have been avoided.

What could be done to avert neonatal deaths? (Qualitative findings)

We had 81 opinions on avoiding deaths from the 78HCWs in the periphery. From these, 43.2% (n=81), reflected a concern regarding the quality of skills required during birth. NO F1, 28 years old HCW recalled a case fatality involving a breeched delivery in the night shift with the umbilical cord around the neck. The worker commented, *"the diagnosis of the breech was known before delivery, but caesarean-section was not performed. We had a difficult time resuscitating the baby."* *From the periphery* 23.5% (n=81), of HCWs complained on the lack of mother's education and delay of care. NO F4, 47 years old HCW explained the need to *"educate the mothers not to take herbs and to come to the hospital with any signs of a problem."*

	Record Not available (n=120)	Reason for the record not being available					
		No space	Notes not available	No enough time to do so	I do not record	Neonates got better why bothering	Shortage of staffs
Record of cyanosis	84	0 (0.0%)	18 (21.4%)	39 (46.4%)	14 (16.8%)	4 (4.8%)	7(8.4%)
Record of Oxygen saturation	107	0 (0.0%)	7 (6.54%)	18 (16.82%)	10 (9.35%)	4 (3.74%)	2 (1.87%)
Record of Gestation	50	0 (0.0%)	1 (2.0%)	14 (28.0%)	26 (52.0%)	0 (0.0%)	1 (2.0%)
Record of tone	71	0 (0.0%)	0 (0.0%)	12 (16.9%)	39 (54.9%)	13 (18.3%)	2 (2.82%)
Record of level of consciousness	112	0 (0.0%)	1 (0.9%)	13 (11.6%)	57 (50.9%)	31 (27.7 %)	5 (4.5%)

**Note: Summation of the reasons goes in a row wise. More than one reasons could be mention and taken into consideration.

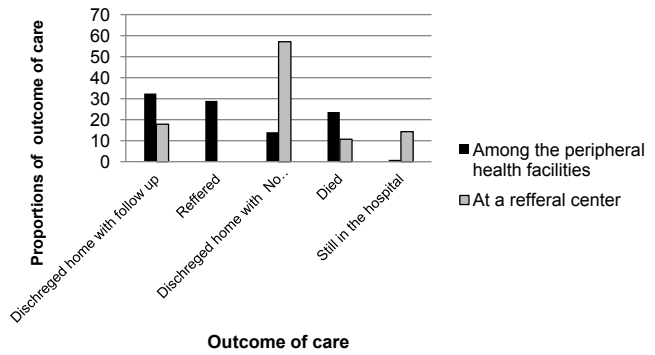
Table 5: Reasons for the absence of records of care and their reasons, as recalled by HCW in the peripheral hospitals.

A lack of equipment was mentioned by 13.6% of HCW's (n=81) among peripheral hospitals. From the tertiary referral hospital, 36.8% (n=19) reported a lack of sufficient equipment. Resident MMED F14 37 years old HCW recalled a fatality involving Kernicterus and Bilirubin cephalopathy. She emphasized, *"we needed systematic blood transfusions, logistics, more tools, and phototherapy, as in many occasions babies need to share tools here. Lastly I would like to comment on exchange blood transfusion as an important way to save this baby."*

Discussions

The Kilimanjaro region is generally characterized by poor performance of health workers in critical care for both peripheral and tertiary referral centres. While the tendency to refer neonates to tertiary centres is high, a majority of neonates die in the process of referral or immediately after a referral to a tertiary centre [29].

Neonatal mortality has remained high due to poor performance as shown in our qualitative findings [1,33]. Previous quantitative report from Tanzania [34] showed the similar concerns on quality improvements through health workers' performance attributes [16]. Supplies of equipment and drugs are crucial barriers of the performance but not the core of the problem [23]. Organization of care and low levels of hygiene are likely to be found in the periphery than at the zonal referral hospital.



†† Note Majority of the critically ill neonates in the peripheral facilities are referred to the tertiary referral hospital in the region

Figure 4. Outcome of care as recalled by health workers for the sick admitted neonates.

Generally, there is no standardized best practice for neonatal care in the periphery, and high workload among clinicians remains as a challenge in provision of acceptable quality care in these areas [31]. WISN calculations was useful in estimating staffing need in neonatal care [30-32]. The higher staffing need for the night shift in the peripheral facilities disrupts the documentation health care despite their little knowledge.

The lack of guidelines on care and staffs supports may be a constraint in quality of care in developing countries [35]. There is a need for further development of the standards for defining staff duties by cadres, level of education and motivation of HCW [29].

Our quantitative findings also reflect that qualifications of majority of HCWs are at certificates and diploma level. The categories of their facilities and levels of knowledge tend to explain the setbacks of improving quality of care in the peripheral facilities through involving health care workers. These findings are similar in both rural Asia and America [6,36]. However, the responsible Ministries in sub-Saharan Africa including Tanzania delay in setting strategies to educate the health workers [20,37]. There are lower cadres of health care like CO with Diploma, AMO with advanced Diploma and Enrolled nurses with certificates attempting to perform highly technical demanding services to the critically ill neonates.

However, the borderline significance level of association (p value= 0.05) between the previous trainings on neonatal resuscitation, integrated management of childhood illnesses, IMCI, and the use of kangaroo methods and the levels of knowledge, reflect a need of training [25,38]. The guided management of serious neonatal illness/

Facility Name	No of HW	No of deaths recalled	Main causes of Deaths as recalled by health workers
F01	19	11	Birth asphyxia (3),Breathing problems (2)Breech delivery and Cord around the neck,Cord sepsis,Died on arrival reason not known, (Died on arrival, Febrile illness, Neonatal septicaemia), Neonatal septicaemia, Prolonged labour
F02	6	6	Birth asphyxia (4),Congenital malformation, Febrile illness
F03	7	6	Birth asphyxia, Breathing problems, Febrile illness, Sucking problems, Neonatal septicaemia, (Premature delivery, Febrile illness, Cord sepsis), (Shortness of breath, Physiological Jaundice)
F04	10	6	Cord around the neck (2), Premature delivery (2), Neonatal septicaemia, Sucking problems
505	7	6	Birth asphyxia (3), Jaundice, Local herbs intoxication, Neonatal Septicaemia
F06	5	4	(Birth asphyxia, Cord around the neck), (Birth injury, Febrile illness), (Febrile illness, Convulsions), Local herbs intoxication
F07	9	8	Shortness of breath (2), Congenital heart disease, (Congenital heart disease, Shortness of breaths), Diarrhoea, Neonatal septicaemia, Premature delivery, Premature twin delivery
F08	11	6	Shortness of breath (4), Premature delivery, Birth asphyxia
F09	9	8	Neonatal septicaemia (3), Birth asphyxia (2), Mother with big breasts lied on a baby, Premature delivery, (Ruptured placenta, Birth asphyxia)
F10	10	7	(Cord prolapsed, Breech delivery, Shortness of breath), (Fetal distress, Birth asphyxia),(I don't remember, I heard in a morning report), (Meningitis, Neonatal septicaemia), Premature delivery, (Prolonged labour, Premature rapture of membrane), Shortness of breath
F11	9	4	Birth asphyxia (2),(Premature delivery, Shortness of breath,),Premature delivery
F12	6	3	Febrile illness, (Febrile illness, Convulsions), Neonatal Septicaemia
F13	7	3	Birth asphyxia, (Birth asphyxia, Cord around the neck), (Breech delivery, Cord around the neck)
F14	28	26	Severe birth asphyxia (3), Birth asphyxia, Premature delivery (4), Extreme prematurity (2), Arrived too late for delivery (very low birth weight), End Stage Renal Disease,,Gastroschisis, Imperforate anus, (Kernicterus Hyperbillirubinemia (2), Meningomyelocoele, Necrotizing eneteroclolitis,Neonatal Septicaemia, (Premature with extremely low birth weight), (Preterm birth, necrotising enterocolitis),Respiratory distress syndrome, Severe anaemia, Severe birth asphyxia, HIE stage 2.

‡‡ Note: Some neonates presented with more than one possible causes

Table 6 Recalling deaths from the facilities the facilities.

critical care in the 24 hours of life of the neonate needs to be promoted [35]. These promotions should go in line with a practical trainings on what made the guidelines need to be set into place [39,40].

After the trainings, monitoring, evaluation of HCW preparedness, motivation and performance needs to be set into routine practice [12,41]. Other stake holders of health care services [42] can assist the exercise especially where there is a challenge of finance [43] and supplies [37]. Guided by the evaluations, we have found that small scale diseases specific training programs with a reputable and recognized academic motivation are crucial [12] towards improving HCW performance.

Study Limitations and Strengths

Our study design used one interviewer to one HCW and could not solve all issues of systemic error like inter-observers variation. However to avoid a Hawthorn Effect (observation bias), visits were made in short period to all facilities at once without prior information. The study design was cross-sectional; hence it failed to generate temporal relationships between quality of antenatal care and neonatal outcome. Recalling the sick neonates exposed the data to recall bias.

The strength of the study comes from gathering a combination of data collection techniques at the different levels of healthcare [44].

Conclusion

Health care workers and mothers are good sources of hospital based appraisal systems for quality of care on medical supplies and staffing levels. Guided Practical-Competence Diagnostic Specific neonatal health care training in the first 24 hours of life is missing in both tertiary and peripheral facilities of Kilimanjaro region.

Recommendations

Advanced Guided Practical-Competence Diagnostic specific neonatal care training is of paramount importance. This can be organized with a well-known recognized Universities for the motivational prize for CO, AMO and Enrolled nurse assistants in rural peripheral settings is a key solution to reduce unwanted neonatal outcomes. The use "Training of Trainers" Manner (TOT) with a monitoring system will allow easy expansion.

Competing Interests

There has been no competing interest for funding of the study. There have been no reimbursements, fees, funding, or salary from any organization that might be affected in any way by this publication, neither now nor in the future.

Authors' Contribution

BM developed a concept of research work, proposal development, data collection, database development, analysis and writing of the manuscript. NLI performed data analysis in the qualitative narratives. JGM supported the early development of data collection tools and manuscript development. SAPW supported database development and initial data collection. JAM worked in data collection in the hospitals and data entry. RM was the official local supervisor.

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