Assessing Quality of Newborn Care at District Facilities in Malawi

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Abstract

Background: Malawi is celebrated as one of the few countries in sub-Saharan Africa to meet the Millennium Development Goal of reducing under-5 mortality by two-thirds between 1990 and 2015. However, within this age range neonatal mortality rates are the slowest to decline, even though rates of facility births are increasing. Examining the quality of neonatal care at district level facilities where most deliveries occur is warranted.

Objective: The objective of this paper is to evaluate the quality of neonatal care in three district hospitals and one primary health centre in southern Malawi as well as to report the limitations and lessons learned on using the WHO integrated quality of care assessment tool. Methodology: These facility assessments were part of the “Integrating a neonatal healthcare package for Malawi” project, a part of the Innovating for Maternal and Child Health in Africa (IMCHA) initiative. The WHO integrated quality of care assessment tool was used to comprehensively assess quality of care in addition to availability and quantity of supplies and resources. Because this study focused on neonatal care, the modules on infrastructure, neonatal care and labour and delivery were included. Facility assessments were administered in November 2017.

Results: The continuum of labour, delivery and neonatal care were all assessed and areas that required improvements to meet standards of care were identified. Critical areas for improvements included the facilities for delivery, including operations and newborn care; for equipment and supplies; for neonatal case management, including sick newborns and routine monitoring and follow-up. Only one of the 12 domains, laboratory, met the standards of care with only minor improvements needed.

Conclusion: The WHO integrated quality of care assessment tool is a validated tool that can shed light on the complex quality of care challenges faced by district level health facilities. The results reveal that the quality of care needs improvement, particularly for sick and vulnerable newborns.

Background

Maternal and child health trends in Malawi

Malawi is celebrated as one of the few countries in sub-Saharan Africa to meet the Millennium Development Goal of reducing under-5 mortality by two-thirds between 1990 and 2015 (1). Under-5 mortality declined from 234 deaths per 1,000 live births in 1992 to 63 deaths per 1,000 live births in 2015-16, representing a 73% decrease over a 24 year period (2). This reduction in mortality was attributed to early adoption of high impact interventions in communities and basic obstetric and neonatal care to address major causes of child death, such as treating pneumonia, diarrhoea and malaria, promotion of vaccines

and insecticide-treated bed-nets, supplementary nutrition programme, facility birth care and prevention and treatment of HIV (1). However, while child mortality has decreased for all age groups, neonatal mortality rates are declining the slowest, even though rates of facility births are increasing (2). Neonatal mortality declined from 41 deaths per 1,000 live births in 1992 to 27 deaths per 1,000 births in 2004 (2). Over a decade later, the 2016 neonatal mortality rate in Malawi remains at 27 deaths per 1,000 live births (2). Preterm birth is a risk factor in over 50% of all neonatal deaths (3), and at 18%, Malawi has the highest recorded rate of babies born prematurely in the world (4). Preterm infants are especially vulnerable to feeding difficulties because of immature sucking and swallowing reflexes, have a higher likelihood of developing breathing problems and have body temperature instability (5,6). In Malawi, children reported to be small or very small are twice as likely to die in the first month of life as children reported to be average or larger (44 deaths per 1,000 live births versus 22 deaths per 1,000 live births) (2).

Importance of quality of care at facilities

Public health initiatives and improved basic obstetric and neonatal care, including feeding, warmth, hygiene, antibiotics, and resuscitation, can lead to major reductions in neonatal deaths (6). However, early preterm births require targeted and intensive care. While there are some community-level public health approaches for the care of premature babies, the highest impact interventions require facility-based services (7). Neonatal intensive care includes incubators, ventilation, and overall increasing complexity of care (6,7). The rapid increases in health facility births in many countries in sub-Saharan Africa and South Asia, including Malawi where 55% of births were delivered in health facilities in 2000 compared to 91% in 2016 (2,8), has not been accompanied by similar increases in quality of care (9). In Malawi, complications of preterm birth, severe infection and birth asphyxia account for 89% of all neonatal mortality, which may be reduced by quality facility-based care. However, the quality of newborn health care services in Malawi was found to be lower than for other health services at health facilities (10). The high rates of survival of premature babies in high-income countries demonstrates that it is possible to effectively reduce morbidity and mortality among this vulnerable population, but there remains a gap in

implementing effective interventions in low- and middle-income countries (LMICs), particularly at the district level health facility where the burden, but also the potential for impact, is highest (7). In general, improving newborn survival is possible with simple, immediate, facility-based interventions, including the provision of warmth with immediate drying, stimulation and skin-to-skin contact for the newborn; additional neonatal resuscitation measures as necessary, early initiation of exclusive breastfeeding, hygienic cord care and management of respiratory complications (11). Consequently, it is important to understand quality of care for newborn health at facilities in Malawi, particularly at the rural district level.

District level hospitals

A World Health Organization (WHO) report notes that improving quality of care for neonatal health at district hospitals is a key priority as more births are occurring at facilities (12). It is especially important to look at quality of care for neonatal health at district level hospitals in Malawi because most deliveries are happening at the district hospitals, not tertiary facilities. The objective of this paper is to evaluate the quality of neonatal care in three district hospitals and one primary health centre in southern Malawi as well as to report the limitations and lessons learned on using the WHO integrated quality of care assessment tool.

Methodology

Integrating a Neonatal Healthcare Package for Malawi

These facility assessments were carried out within the “Integrating a neonatal healthcare package for Malawi” project, which is part of the Innovating for Maternal and Child Health in Africa (IMCHA) initiative, funded by the Canadian International Development Research Centre (IDRC), Global Affairs Canada (GAC) and the Canadian Institutes for Health Research (CIHR). With a focus on implementation science and quality improvement, the project seeks to strengthen neonatal care at health facilities in low-resource settings, such as Malawian central and district hospitals, through understanding how the roll out of low cost technologies and locally appropriate innovations can be effectively implemented. The

facility assessments are a baseline for the overall project to understand the current routine care environment and capacities for neonatal care at district level facilities in Malawi.

Adaptation of the WHO integrated quality of care assessment tool

The WHO integrated two existing survey instruments, the Health Facility Survey to evaluate the quality of care for sick children and the quality assessment and improvement tool for hospital care for mothers and newborn babies in 2014 (13). The comprehensive facility assessment was designed to be both a management and evaluation tool and in contrast to other facility assessments, it examined quality of care as well as quantity and availability (13). It was used for the first time in Malawi in 2015 in 35 health facilities in five districts across the country (13). To the best of our knowledge, our study is the second time it has been used in Malawi.

The full tool has four modules related to A) infrastructure, B) maternal, C) newborn and D) paediatric care. While Smith and colleagues (13) evaluated using the full tool, this study focuses only on neonatal care. Consequently, only the modules on infrastructure, neonatal care and maternal care, as related to labour and delivery, were included. This reduced the length and time of the assessments by about two thirds.

Study sites

Our study was conducted in the Southern region of Malawi. Three districts were chosen in consultation with the Malawi Ministry of Health because they represent a variety of health management structures available in Malawi. District 1 and 3 each have a government district hospital while District 2 features a Mission Hospital that operates as the region’s district hospital. Mission hospitals are under the umbrella of Christian Health Association of Malawi (CHAM) and they provide between 30-40% of the health care in the country (14). Essential health care, which includes maternal and child health services, are free to patients at Mission Hospitals under a service agreement with the government. Because the government does not have a district hospital in District 2 and rely on the Mission Hospital as the secondary level facility in the region, our study also conducted an assessment at the primary health centre in the district’s main town, where the government district

management is located. The data for the health centre and Mission Hospital are combined to show the comprehensive availability of secondary level services in the district.

Districts were also selected because they represent different geographic zones in Southern Malawi. District 1 and 3 are in the southwest and District 2 is in the southeast zone. District 2 is also more remote. The three hospitals represent a spectrum of district level facilities for implementation.

Administering the facility assessment

The research team initially introduced the project and its objectives to the district health management and obtained permission. Five IMCHA employed research nurses were trained on the data collection tool and then deployed to the three districts in November 2017 to conduct the facility assessment. This involved observations of practices and availability of infrastructure, equipment and supplies as well as surveying relevant health professionals, such as the nurse-in-charge of the ward and laboratory technicians, following the structured checklists in the tool.

Aspects of care observed by data collectors were scored on a Likert scale from one to five. A score of five indicated good practice complying with standards of care recommended by the WHO, a score of four indicated minor need for improvement to reach standard of care, a score of three indicated some need for improvement, a score of two indicated considerable need and a score of one indicated totally inadequate care or a potentially life-threatening practice (13). There were twelve key areas of care assessed covering infrastructure, laboratory, labour and delivery facilities, caesarean section facilities, prevention and management of preterm labour, nursery facilities, infection control, supportive care of sick neonates, neonatal care equipment and supplies, routine neonatal care, case management of the sick newborn and monitoring and follow-up of sick newborns (see Appendix). Open-ended comments were elicited from data collectors following each section to reflect on the strengths and weaknesses as observed. The assessments took between three days to two weeks to complete, depending on the availability of hospital

staff. Approval was obtained from the research ethics boards of the Malawi College of Medicine (P.08/15/1783) and the University of British Columbia (H15-01463-A003).

Data analysis

Results were recorded on paper, scanned and transferred to a RedCap database. Each facility assessment was manually entered by two independent people and results compared to reduce inaccuracies in data entry and interpretation. Embedded in the tool, summary scores for each area of care were calculated as an average of responses in the section. Basic descriptive statistics completed on Excel were used to analyze summary scores for each area of care. Following Smith and colleagues (13), standards were considered to have been met if scored four or five.

Results

Facility statistics

In 2016, 3,019 deliveries were recorded in District 1, 2,728 in District 2 and 6,275 in District 3. Neonatal mortality rates per 1,000 live births was 12 at District 1, 16 at District 2, and 7 at District 3 (see Table 1).

Table 1: Facility Statistics (2016)

	District 1	District 2	District 3	Total
Number of deliveries	3019	2728	6275	12022
Number of live births	2919	2463	6112	11494
Rate of low birth weight newborn babies (< 2500 g)	5.8%	4.9%	10.7%	8.2%
Rate of very low birth weight newborn babies (< 1500 g)	1.1%	0.7%	0.6%	0.8%
Rate of extremely low birth weight babies (< 1000g)	0.6%	0.3%	0.3%	0.4%
Rate of deliveries: < 37 completed weeks	45.8%	17.5%	19.6%	25.8%
Rate of deliveries: < 32 weeks	1.7%	1.9%	1.9%	1.9%
Rate of deliveries: < 28 weeks	1.1%	0.5%	0.5%	0.6%
Rate of babies diagnosed with birth asphyxia	7.1%	8.0%	4.6%	6.0%
Rate of babies with Apgar score < 3 at 5 minutes	3.0%	4.1%	1.5%	2.4%
Facility neonatal mortality rate –deaths <28 days per 1000 live births (NMR)	12 (1.2%)	16 (1.6%)	7 (0.7%)	10 (1.0%)

Facility characteristics

Two of the three hospitals, District 2 and 3, had a separate ward for admitting newborns with 10-12 beds each. The hospital in District 1 admitted neonates to the labour and postnatal wards. However, nurseries at District 1 and 3 hospitals were under renovation at the time of assessment. The primary health centre did not admit newborns and specialized neonatal care (supportive care, case management, monitoring and follow-up of sick newborns, and neonates requiring specialized care) were referred to the Mission Hospital. The primary health facility did not have a separate nursery and facility data were collected in the general postnatal ward where babies were observed with their mothers for a few hours before discharge. Caesarean deliveries were separate from the labour ward in all three district hospitals; the primary health centre did not conduct caesarean deliveries.

None of the facilities had a full time obstetrician-gynaecologist. One hospital (District 1) had a clinical officer trained in obstetrics and gynaecology while the other three sites (District 2 Mission Hospital and primary health centre, District 3 hospital) had visits by an

obstetrician approximately once a month. However, staff reported that the obstetrician had not been visiting of late at the hospital in District 3. Caesarean deliveries were done by clinical officers and general medical officers, in some cases, who had been trained ‘on the job.’ None of the facilities had a full time paediatrician. The primary health centre had a visiting paediatrician once a month while the three district hospitals did not have a visiting paediatrician. District level facilities were staffed by clinical officers, nurses/midwives and lay health workers.

Table 2: Quality of care scores

	District 1	District 2	District 3	Overall average
Infrastructure	3.0	3.7	3.9	3.6
Laboratory	4.0	4.0	4.0	4.0
Labour and delivery facilities	3.0	2.0	2.0	2.3
Caesarean section facilities	3.0	3.0	4.0	3.3
Prevention and management of preterm labour	4.2	3.9	3.6	3.9
Nursery facilities	2.5	3.5	3.9	3.4
Infection control	3.3	2.9	2.5	2.9
Supportive care of sick neonates	3.4	4.4	3.8	3.9
Neonatal care equipment and supplies	3.0	3.0	3.0	3.0
Routine neonatal care	4.1	3.5	3.8	3.7
Case management of the sick newborn	3.1	3.4	3.0	3.2
Monitoring and follow-up of sick newborns	4.2	3.8	2.8	3.6

Infrastructure

The overall average score for the four facilities was 3.6, indicating that all facilities required some need for improvement to meet standards of care. The sites ranged from

scores of 3.0 to 3.9. Electricity was not continuously available in all four sites and back-up power systems were insufficient. For example, a solar power system in one site was not sufficient to operate heavy machines and an additional diesel generator was needed for the operating theatre and nursery. Another site noted that water was usually not available when there was a power cut. A third site noted that while a back-up power system was available, it was not in use most of the time. While there was often a functioning fridge available for drugs or vaccines, it may be located in a different department. There was a lack of soap and disinfectants in three out of the four facilities.

Laboratory

All of the laboratory facilities scored 4.0, placing them in the category of little improvement needed to meet standards of care. Most tests were available in the laboratory, including blood glucose, haemoglobin, HIV, syphilis, urine dipstick, urine microscopy and full blood count testing. There were some gaps for hematocrit (PCV) and bilirubin testing across sites and testing for blood grouping and Rhesus antibody was only available at the hospital facilities. However some key tests for management of sick newborns were missing - none of the four sites had blood gas analysis and blood cultures available. All available tests were reported to take under an hour. Space was frequently limited in the laboratory and one site noted that there was no back-up power for the laboratory in case of power cuts.

Labour and delivery, caesareans and nursery facilities

For labour and delivery facilities, the average score was 2.3, indicating considerable need for improvement to meet standards of care. The hospital in District 1 had a score of three while the other three sites scored two. Inadequate lighting, limited space and lack of sterile gloves, a heating source for neonates and equipment for neonatal resuscitation were areas of concern in the labour and delivery ward. In two of the three hospitals, the oxygen concentrator was shared by the whole maternity department or borrowed from the nursery. The average score for caesarean section facilities for the three hospitals was slightly better at 3.3, indicating some need for improvement to meet standards of care. District 3, where the most deliveries recorded, had a score of 4.0. Most equipment and

supplies were available and at one site the theatre was well arranged. Heating lamps for newborns and an infusion pump were not available in all sites.

For nursery facilities, the average score was 3.4, indicating some need for improvement. There were considerable differences between the sites ranging from 2.5 to 4.1, with the Mission Hospital scoring the highest. Lack of running water was a problem in two of the three hospitals, leading to unclean toilets. Understaffing was explicitly highlighted in the comments in one hospital. Two of the three hospitals did not have mosquito nets in the nursery despite being a malaria endemic area. The Mission Hospital was clean but only the staff had access to handwashing stations.

Prevention and management of preterm labour

The overall average score for prevention and management of preterm labour was 3.9. District 1 scored over four, indicating little improvement needed, while District 2 and 3 facilities score 3.4-3.9, indicating the need for some improvement. When interviewed, staff were knowledgeable around managing preterm labour and the use of tocolytic drugs. Corticosteroids were given to the mother to improve foetal lung maturity and chances of neonatal survival, if less than 34 weeks gestation and medical staff were prepared to care for and resuscitate a preterm or low birth weight baby if necessary. However, protocols and guidelines on the management of preterm labour were largely not available, vacuum extraction was not avoided and most of the preterm labour was not being prevented. Additionally, records on preventing labour or antenatal administration of corticosteroid were not kept.

Infection control

None of the district-level facilities met standards of care for infection control and the average score was 2.9, indicating considerable need for improvement. The scores ranged between 2.5-3.3. At the three public health facilities, hand hygiene was not followed usually and soap/disinfectants were not available. Though the private mission hospital had a well organized handwashing station and guidelines posted, hand hygiene was still not practiced regularly. Gloves were sometimes used instead of hand hygiene. Sterile gloves were not

available at the primary health centre. While infection control policies were sometimes available, they were rarely put into practice. Routine disinfection of the premise were scheduled but irregularly preformed due to staff shortages. Additionally, one site noted that disinfection was compromised by facilities remaining open. In the three hospitals, a routine policy of changing dress and footwear by staff in the operating room was not observed.

Essential drugs, equipment and supplies for neonatal care

The three hospitals each scored 3.0, indicating some need for improvement. Incubators, heated mattress cots, multi-function monitors and appropriately sized nasogastric tubes for preterm babies were not available. A radiant warmer and digital scale were available at the hospital in District 3 but located in the labour ward. One phototherapy lamp was available, one to two functioning oxygen concentrators, appropriate sized face masks, and one to two functioning CPAP machines, pulse oximeter and suction apparatus were available at each hospital. Glucometers were available but at one site there were no reagents to perform the test. Some oxygen concentrators and CPAP machines were not functioning and not all staff were trained to use the CPAP machine. Appropriate-sized self-inflating bags were available though of insufficient number and not always functional. Thermometers were reported to be available but mostly staff kept their own personal thermometers.

Of the drugs penicillin, ceftriaxone and gentamicin were the most available antimicrobials, and phenobrbitone the available anticonvulsant. IV glucose and ferrous sulphate were most readily available. Drugs that were available were not close to expiry but there was often minimal stock. Vancomycin, surfactant, sodium bicarbonate, chlorohexidine for cord care, vitamin D and IV calcium were not stocked at the district hospitals. Most of the drugs are kept at the pharmacy rather than in the nursery.

Routine neonatal care

The overall average score for routine neonatal care was 3.7, indicating some need for improvement to meet standards of care. The hospital in District 1 scored 4.1 while the other districts scored between 3.5 - 3.8. Early and exclusive breastfeeding (4.6), neonatal resuscitation (4.0), screening, prevention and management of vertically transmitted

infectious diseases (4.0), and counselling for mothers (4.0) met standards of care with minor improvements needed. However, newborn assessments were not complete and newborns' breathing and body temperatures were irregularly monitored. Additionally, there were failures to document breastfeeding, jaundice and mothers' health profiles.

Supportive care, case management, monitoring and follow-up of sick neonates

The three hospitals had an average score of 3.9 in supportive care for sick neonates, indicating the need for some improvements. Only the private mission hospital met the standards of care with little improvements needed (4.4). The provision of IV fluids and blood transfusions were rare and none were observed during the assessments. However, staff reported that IV fluid use and blood transfusions were used when indicated. Drugs were also given with a clear indication and routine use of sedatives was not the norm. Blood glucose was poorly monitored.

The three hospitals had an average score of 3.1, ranging between 3.0-3.4, for case management of sick neonates, indicating the need for some improvements. In particular, there was poor recognition and treatment of jaundice and management of convulsions. There were also problems in diagnosing neonatal sepsis because of the lack of blood and urine cultures. Guidelines for management of convulsions and jaundice were not available and feeding sick neonates were not recorded or monitored routinely. The wards practiced kangaroo mother care and there was good maintenance of room temperature at 25-28C.

The three hospitals had an average score of 3.6 in monitoring and follow-up of sick newborns, indicating that some improvements are needed. However, there was variation across the three sites. The hospitals in District 3 scored 2.8, District 2 scored 3.8 and District 1 scored 4.2 indicating substantial, some and little need for improvement, respectively. Monitoring by nurses met the standards with little improvement required (4.0) but reassessment by physicians required substantial improvements to meet standards of care (average score = 2.9). Daily reassessments by a doctor were not completed, and with the exception of the Mission Hospital in District 2, though a doctor did not review sick neonates or new admissions on weekends and holidays.

Discussion

In the evaluation of neonatal quality of care at four district level health facilities in southern Malawi using the WHO integrated quality of care assessment tool, only one of the 12 domains, laboratory, met the standards of care with minor improvements needed. There were critical gaps in labour and delivery facilities as well as infection control, which both required substantial improvements to meet standards of care. Caesarean section facilities, nursery facilities, neonatal care equipment and supplies and case management of the sick newborn were also critical areas for improvement. Infrastructure, prevention and management of preterm labour, supportive care of sick neonates, routine neonatal care and monitoring and follow-up of sick newborns required some improvement to meet standards of care but were getting closer to the score of four out of five. A cross-cutting theme throughout the entire facility assessment was that documentation was poorly kept.

Smith and colleagues (13) implemented the full tool in five districts in Malawi, including two districts from southern Malawi, and found similar key areas for improvement. This included in the domains of neonatal care equipment and supplies (3.0 our study vs 2.9 Smith et al), infection control (2.9 our study vs 3.3 Smith et al), case management of the sick newborn (3.2 our study vs 3.2 Smith et al) and nursery facilities (3.4 our study vs 3.2 Smith et al). Prevention and management of preterm labour was higher in the facilities surveyed than those reported by Smith et al (3.9 vs 3.0) though this may be because Smith et al (13) surveyed a wider range of facilities in the districts while this survey emphasized district hospitals. Monitoring and follow-up of sick neonates, especially with physician reassessment, and infrastructure, particularly of electricity and running water supplies, were also highlighted as key challenges that were previously not discussed by Smith et al (13). At the time of the assessments, there were daily power outages of six to eight hours per day, which compromised ability to use various machines, have running water and carry out lab tests. Though back-up power supplies were available, these were not sufficient to

operate the entire hospital and often prioritised for the operation theatre. Often there were delays in obtaining permission to start the generator.

Complexities in key areas of newborn care

Neonatal jaundice is a key concern for premature babies as the immature liver cannot metabolise bilirubin efficiently, and high levels carry the risk of irreversible brain damage (15). A closer look at the questions around neonatal jaundice and management with phototherapy demonstrates some complexities of care. Bilirubin testing was available in each of the districts and the average time to get bilirubin results were remarkably fast, about 45 minutes to one hour. However, low scores on the questions pertaining to jaundice and phototherapy contradict the high scores in availability of lab testing. There were gaps in procedures to check bilirubin levels, examining babies for jaundice and problems with the guidelines and supply of phototherapy. Only one phototherapy lamp was available at each of the three district level hospitals and the phototherapy lamps were irregularly checked for correct functioning. Consequently, the fast bilirubin testing may also be associated with low ordering of the tests from the wards. Additionally, the private district hospital could not test bilirubin levels but could provide phototherapy while the primary health centre had bilirubin testing available but did not manage neonatal jaundice.

A closer look at management of respiratory complications also sheds light on complexities of care. Currently CPAP is available in all district hospitals in Malawi, which itself is an accomplishment for scaling up important neonatal care technologies. The widespread availability of CPAP is unusual for secondary level facilities in sub-Saharan Africa. However, findings of the management of respiratory complications and the case management of sick newborns revealed a number of concerns. While CPAP systems were available and all facilities had high scores for managing respiratory distress, there was a lack of guidelines for the use of oxygen in preterm babies, oxygen needs were not routinely assessed using a pulse oximeter and at one site, two of their three oxygen concentrators were not functional. In a study of the role out of CPAP in Malawi it was noted that though an innovative low-cost bubble CPAP system developed for low-resource settings withstood voltage surges, 40% of the study's (WHO recommended) oxygen concentrators did not (16).

With any of the care provided, there are interactions between the different components of the care package that when only one component is assessed, the results may not reflect the complete picture. Where there are these interactions, failures in one component may lead to failure of the whole package.

While kangaroo mother care (KMC) met standards of practice in each of the district hospitals; however, there were critical gaps in infant warming devices such as incubators, radiant warmers and heated mattresses cot/hot cots. Infant warming devices are recommended for unstable newborns weighing 2000g or less at birth or stable newborns who cannot be given KMC (17).

A key issue highlighted by our study, and also noted by others, is the lack of effective infection prevention and control practices and resources for neonatal care at the facility level. In many low resource settings this has been associated with very high rates of nosocomial (hospital onset) infections, generally 3 to 20 times higher than those seen in babies born in hospitals in industrialized countries (18). The rise of antimicrobial resistant organisms often resistant to first and second line antibiotics (19) coupled with the lack of the availability of basic microbiology testing at district facilities will unfortunately likely further amplify the impact of gaps in infection prevention and control.

Quality of care and impact on neonatal mortality

The Endline Survey for the Millennium Development Goals (MDGs) found that there was a lot of variability in neonatal mortality rates (NMR) across Malawi (20), which our study also found. However, the NMR found in our survey were largely lower than expected. The Endline Survey described NMRs of 25 per 1,000 livebirths in District 1, 40 in District 2 and 39 in District 3 (20). Only the Mission Hospital registries reported an NMR that matched its district rates. The primary health centre in District 2 reported an NMR of 3 per 1,000 live births from its facility registries, while District 1 and 3 hospitals were 12 and 7, respectively. With 91% of deliveries in health facilities and 95% of women receiving at least one antenatal care visit (2), the low facility NMR may reflect how high risk cases may have been recognised early and delivered at the tertiary facility, Queen Elizabeth Central

Hospital (QECH). The hospitals in District 1 and 3 may be referring sick neonates to QECH, while the main primary health centre in District 2 referred to the Mission Hospital. The high rates of neonatal mortality in districts and the stagnation of national NMR of 27 for over a decade and a half suggests that newborns are dying, but our assessment reveals that these deaths may not be occurring at the public district level facilities. These deaths may be occurring in communities before reaching facilities or at the tertiary level facility. QECH had a neonatal mortality rate of 15-20% (21). Further research is needed on where neonates are dying and on referral linkages, including how many newborns are referred, what type of conditions are being referred and if these newborns tend to die at the tertiary facility. It would be helpful to include questions relating to referral practices and policies in the assessment tool.

Facility statistics may reflect referral rates rather than the real neonatal mortality rates, but the quality of care may reveal insights into the NMR in Malawi. Historical modelling of reductions in neonatal mortality rates in the United Kingdom and United States during the 20th century mapped the decline from NMR from 40 to 5 deaths per 1,000 births according to capacities for care (6,12). Historical modelling described the first phase of reducing NMR from 40 to 30 as associated with public health approaches in the early 20th century, such as significant improvements and awareness in sanitation and hygiene around birth (6,12). Additionally, hospital births began to outnumber homebirths in the early 20th century in UK and USA (12). The second phase of reducing NMR was associated with improved obstetric and neonatal case management. In particular, improvements in newborn thermal care with the introduction of incubators and a focus on breastfeeding were associated with a decline from 30 to 20 NMR. Antibiotics and infection management furthered the decline from 20 to 15 NMR (12). Historical modelling associated improved respiratory complications management and neonatal intensive care scale up to the third phase of NMR decline from 15 to 5 per 1,000 live births (6,12).

In Malawi, the rapid increase in facility births may reflect the declining NMR from 41 in 1992 to 27 in 2004, as hospital births began to outnumber home births in the early 2000s (2). However, in the last 16 years, the rate of decline has stagnated around 27 deaths to

1,000 live births. Critical gaps around case management of sick newborns and infection control found in this study may help explain the situation. The facility survey found that incubators, warming mattresses/cots and radiant warmers were not yet widely available at district level health facilities and there were some unanswered questions around lactation support. To improve from an NMR of 27, infection control practices must be addressed. Improving the implementation of locally appropriate technologies for targeted neonatal care, scaling up intensive care, improving respiratory complication management, newborn thermal care, breastfeeding and kangaroo mother care counselling and the diagnosis and management of neonatal jaundice and sepsis have great potential to further reduce NMR. In addition to the similarities with historical modelling, our study highlighted facility capacity challenges in the low-resource health settings. These include staff and essential equipment and supply shortages, gaps in collaboration from lab technicians to nurses to clinical supervisors, lack of reliable running water and electricity and inability to diagnose infections. These must be overcome for Malawi to achieve further declines in NMR.

Using the assessment tool: limitations and lessons learned

There were a number of data collection challenges to implementing the facility assessments. It was challenging to find staff for interviews, particularly the district supervisors. One of the recommendations to improve the WHO integrated quality of care assessment tool was to shorten the assessment (13). However, even reduced to only the neonatal care components, the facility survey was still lengthy and took up to two weeks to complete. There was some pushback from hospital staff who did not see any direct benefits of the survey. They felt that it was only time consuming, which is understandable in understaffed units. Extracting data from the registries for background statistics information on the health facility was also challenging because data were poorly entered in the register, with missing and torn pages. Documentation was found to be a critical gap in understanding quality of care at the health facilities.

Additionally, there were concerns with the checklist methodology of the assessment tool; values were weighted equally and some scores were artificially inflated by questions of less value. For example, while the case management of sick newborns required some

improvement to meet standards of care, the overall score hid critical low scores in individual questions around management of convulsions, diagnostics of infection and monitoring glucose levels. Additionally, while the calculated monitoring and follow-up of sick neonates score was in the high threes across the three district hospitals, a closer examination finds that this is largely driven by follow-up by nurses but hiding a critical gap in reassessment by physicians.

Furthermore, there was ambiguity in some of the topic areas due to lack of specificity of the questions. For example, it was unclear which specific components of kangaroo mother care were practiced beyond a focus on skin-to-skin contact immediately after birth. While there was one question about restrictions on the frequency or length of breastfeeding, no questions explored whether there was continued support for the mother to continue breastfeeding or her level of comfort around breastfeeding practices during the rest of her stay and post-discharge. Additionally, there is ambiguity around the use of the word “disinfection” and it is unclear whether it is deep or surface cleaning.

Lastly, the different perspectives from different respondents, from nurses to lab technicians to district health officers to the observations of the data collectors themselves, were consolidated into a calculated quantitative score. This masks some of the complexities and contradictions that are found as components are teased apart. Lab test times may reflect the response of the laboratory technician to run the test but not the whole diagnostic cycle from the ward to the lab. In the Malawian district hospitals covered in this study, it is of note that that the assessment tool does not integrate substantial delays due to power outages into the reported timing. Knowing tests availability at laboratory may fail to reveal crucial overall health system barriers such as reliable electricity, the whole diagnostic cycle from ward to lab, rate of ordering tests, etc. This is especially important as the WHO recently added an essential diagnostics list to accompany the essential medicines list. Consequently, qualitative research is recommended to accompany the tool in order to better understand the contexts of care and how the areas of care interact.

Conclusions

The WHO integrated quality of care assessment tool is a validated tool, approved by WHO and is a good way of standardising facility assessments. Therefore, with the results found, we can understand some of the quality of care challenges that district level health facilities face. The results reveal that women and newborns are receiving care. However, the quality of care received needs improvement, particularly for sick and vulnerable newborns. There are stakeholders who are interested in this information and can translate these findings into improvements in care.

References

1. Kanyuka M, Ndawala J, Mleme T, Chisesa L, Makwemba M, Amouzou A, et al. Malawi and Millennium Development Goal 4: A Countdown to 2015 country case study. Lancet Glob Heal. 2016 Mar;4(3):e201–14.

2. National Statistical Office (NSO)[Malawi] and ICF. Malawi Demographic and Health Survey 2015-2016. Zomba, Malawi and Rockville, Maryland, USD; 2017.

3. Lawn JE, Kerber K, Enweronu-Laryea C, Cousens S. 3.6 Million Neonatal Deaths—What Is Progressing and What Is Not? Semin Perinatol. 2010 Dec;34(6):371–86.

4. Blencowe H, Cousens S, Oestergaard MZ, Chou D, Moller AB, Narwal R, et al. National, regional, and worldwide estimates of preterm birth rates in the year 2010 with time trends since 1990 for selected countries: A systematic analysis and implications. Lancet. 2012 Jun 9;379(9832):2162–72.

5. Behrman RE, Butler AS. Preterm Birth: Causes, Consequences and Prevention. Washington, D.C.: National Academies Press (US); 2007.

6. Lawn JE, Davidge R, Paul VK, von Xylander S, de Graft Johnson J, Costello A, et al. Born too soon: care for the preterm baby. Reprod Health. 2013;10 Suppl 1(Suppl 1):S5.

7. Lawn JE, Kinney M V, Belizan JM, Mason EM, McDougall L, Larson J, et al. Born too soon: accelerating actions for prevention and care of 15 million newborns born too soon. Reprod Health. 2013;10 Suppl 1(Suppl 1):S6.

8. National Statistical Office (NSO) and ICF Macro. Malawi Demographic and Health Survey 2010. Zomba, Malawi and Calverton, Maryland, USA; 2011.

9. Requejo J, Merialdi M, Althabe F, Keller M, Katz J, Menon R. Born too soon: care during pregnancy and childbirth to reduce preterm deliveries and improve health outcomes of the preterm baby. Reprod Health. 2013;10 Suppl 1(Suppl 1):S4.

10. Zimba E, Kinney M V, Kachale F, Waltensperger KZ, Blencowe H, Colbourn T, et al. Newborn survival in Malawi: a decade of change and future implications. Health Policy Plan. 2012 Jul;27(suppl_3):iii88–103.

11. Graft-Johnson J de, Vesel L, Rosen HE, Rawlins B, Abwao S, Mazia G, et al. Cross-sectional observational assessment of quality of newborn care immediately after birth in health facilities across six sub-Saharan African countries. BMJ Open. 2017 Mar 1;7(3):e014680.

12. March of Dimes, PMNCH, Save the CHildren W. The Global Action Report on Preterm Birth Born Too Soon. Howson C, Kinney M, Lawn J, editors. Geneva; 2012.

13. Smith H, Asfaw AG, Aung KM, Chikoti L, Mgawadere F, d'Aquino L, et al. Implementing the WHO integrated tool to assess quality of care for mothers, newborns and children: results and lessons learnt from five districts in Malawi. BMC Pregnancy Childbirth. 2017 Aug 25;17(1):271.

14. Department of Essential Health Technologies World Health Organization. Joint WHO Meetings with Ministry of Health towards a Standardized Emergency and Essential Surgical Training in Malawi [Internet]. Geneva; 2006 [cited 2019 May 18]. Available from: http://apps.who.int/medicinedocs/documents/s15345e/s15345e.pdf

15. Olusanya BO, Osibanjo FB, Slusher TM. Risk Factors for Severe Neonatal Hyperbilirubinemia in Low and Middle-Income Countries: A Systematic Review and Meta-Analysis. Carlo WA, editor. PLoS One. 2015 Feb 12;10(2):e0117229.

16. Kawaza K, Machen HE, Brown J, Mwanza Z, Iniguez S, Gest A, et al. Efficacy of a low-cost bubble CPAP system in treatment of respiratory distress in a neonatal ward in Malawi. PLoS One Jan Malawi Med J. 2014;299(283):e86327.

17. The WHO Reproductive Health Library. WHO recommendation on provision of care in a thermo-neutral environment for newborns cannot be given Kangaroo mother care. Geneva: World Health Organization; 2015.

18. Zaidi AK, Huskins WC, Thaver D, Bhutta ZA, Abbas Z, Goldmann DA. Hospital-acquired neonatal infections in developing countries. Lancet. 2005 Mar;365(9465):1175–88.

19. Iroh Tam P-Y, Musicha P, Kawaza K, Cornick J, Denis B, Freyne B, et al. Emerging Resistance to Empiric Antimicrobial Regimens for Pediatric Bloodstream Infections in Malawi (1998–2017). Clin Infect Dis. 2019 Jun 18;69(1):61–8.

20. National Statistical Office. Malawi MDG Endline Survey 2014. Zomba, Malawi; 2014.

21. Mbvundula T, Mussa T, Chirwa E. Trends in neonatal mortality at Queen Elizabeth Central Hospital. Blantyre, Malawi; 2013.

Declarations

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Availability of data and materials

See Additional file 1 for areas of care assessed by the adapted WHO integrated quality of care assessment tool.

Any additional data will be available upon request to the corresponding author.

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Contributions

KK, QD, DMG, ALNM and LN contributed to the conceptualization of the research project and its funding. KK, TH, JN, LN and EM contributed to the study design and methodology of the facility assessment. KK supervised project activities and MB administrated the project. KK, MWK and TH contributed to the investigation, analysis and interpretation. KK and MWK wrote the initial draft. MV, ALNM and EM gave advice on the structure of the paper and critically reviewed all versions. All authors have read and approved the manuscript.

Ethics declarations

Ethics approval and consent to participate

Approval was obtained from the research ethics boards of the Malawi College of Medicine (P.08/15/1783) and the University of British Columbia (H15-01463-A003).

Consent for publication

Not applicable

Competing interests

The authors declare that they have no competing interests.

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