Original Article

Capacity for providing caesarean section services in selected health centres and district hospitals in Tanzania

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SUMMARY

Objective: Tanzania has a high maternal mortality ratio of 556 per 100,000 live births. Timely caesarean sections avert mortality due to life threatening conditions like obstructed labour. This study assessed capacity of selected health facilities to provide caesarean sections in terms of infrastructure, equipment, essential supplies and skill mix.
Methods: A cross-sectional mixed methods design was used to include systematic observations using highly structured checklists to determine the adequacy of infrastructure, functional status of equipment, availability of supplies and skill mix. An interview guide and a key-informant interview guide were used to collect data from assistant medical officers and key informants respectively. Descriptive data analysis was conducted using IBM SPSS software package.
Results: Deficit for doctors ranged between 3 (37.5%) and 5 (62.5%) per each district hospital. Two out of 3 health centres did not have doctors. Deficit for assistant medical doctors ranged between 10 (62.5%) and 11 (68.8%) per each district hospital. In terms of absolute numbers, assistant medical doctors were more than doctors. Not all facilities had all the equipment, infrastructure or supplies. Challenges cited by most assistant medical officers were; shortage of theatre-trained nurses (91%; n=21), theatres not functioning (61%; n=14), inadequate blood supply (87%; n=20) and inadequate equipment (96%; n=22).
Conclusion: Capacity of health facilities to provide caesarean sections was found to be sub-optimal due to health workforce shortages, inadequate infrastructure, equipment and supplies, thus increasing the risk of maternal deaths. These findings are useful in informing strategies to reduce maternal mortality.

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Keywords: Task sharing, skill mix, surgical equipment, assistant medical officers, infrastructure, caesarean sections, obstetric drugs and medical supplies

INTRODUCTION

Globally, an estimated 289,000 women[1] and 3 million newborns[2] die annually during pregnancy, childbirth and post-delivery. Most maternal deaths (62%) are recorded in Sub-Saharan Africa where the adult lifetime risk of maternal mortality is 1 in 38 compared to 1 in 3700 in developed regions.[1] Major direct causes of maternal deaths such as infections, obstructed labour, bleeding, high blood pressure can be averted by providing emergency obstetric maternal and newborn care (CEmONC) including caesarian sections (C-sections) where indicated.[3] The World Health Organisation (WHO) recommends a C-section rate of 10%-15% as optimal for prevention of maternal and neonatal mortality.[4]

A study of 137 United Nations Member States found that 33 (68.5%) out 54 countries with C-section rates lower than 10%, were from Africa.[5] An additional 3.2 million C-sections was needed for such countries to reach a 10% threshold of optimal care. Only a third of facility deliveries receive the life-saving care that they need with the situation being worse for women in rural areas where only one third has access to C-sections compared to urban-based women.[6] Analyses of C-section trends and maternal mortality trends in African countries with high mortality ratios, have proven an inverse relationship between C-section rates and maternal mortality.[7, 8]

Earlier studies have reported barriers to accessing C-sections as inadequate skilled human resources (medical doctors, gynaecologists, obstetricians, anaesthetists and midwives),[9,10,11] equipment,[12,13,14] commodities,[15] infrastructure,[11,16] delays in accessing services and failure to follow policies and guidelines on quality of C-section care.[13]

Tanzania, with an estimated population of 58.4 million,[17] is one of the top 10 countries that contribute to 58% of the global maternal mortality.[3] Demographic and Health Surveys and WHO trend analyses reported maternal mortality ratios for 2010, 2014 and 2016 as 556, 410 and 556 per 100,000 live births respectively.[18, 1, 19] Most women in Tanzania die as a result of obstructed labour and its sequelae of sepsis and post-partum haemorrhage, [20, 21, 22] and yet complications of obstructed labour can be averted through timely provision of caesarean sections.

The National Road Map Strategic Plan 2008-2015 cited the following systems challenges for persistently high maternal mortality for decades as weak infrastructure, inadequate human resources, lack of equipment and supplies and limited access to health services in underserved areas.[23] In attempting to mitigate those barriers, the country has been implementing various strategies to increase access to C-section services. District hospitals were increased from 219 in 2006 to 264 (21%) in 2011 through the Primary Health Services Development Programme (PHSDP 2007 – 2017).[24] Health centers increased from 481 to 682 (42%) in the same period.

In 1963 the country introduced a new cadre, the assistant medical officer (AMO) to provide advanced clinical care including C-sections at primary and secondary health facilities.[25] AMOs are qualified clinical officers with more than 3 years' experience and have undergone further training for two years to obtain an advanced diploma in clinical medicine.[25] Their training includes rotations in the areas of medicine, surgery obstetrics and gynecology, child health, and community medicine at a teaching hospital.[26]

AMOs perform a large percentage of surgeries in health centers and district hospitals with results that are comparable to physicians in term of outcomes, quality and risk indicators.[27] In this manuscript, utilizing AMOs in complementing doctors is considered as task sharing strategy.[28] Despite these efforts, the country still suffers a 56% shortage of skilled staff that could provide C-Section services.[29] In 2013, low densities of doctors, AMOs and nurses were reported as 0.260, 0.399 and 3,231 per 10,000 (ten thousand) population respectively.[30] Of the 1,135 medical doctors available, 69% work in urban centers leaving only 31% to serve 75% of the rural population.[31]

National C-section rates have remained low, ranging between 3.2% and 6% since 2004[32, 19] with underserved regions reporting average rates of 1%-4% in 2016.[19]

This study assessed availability of skilled staff, adequacy of infrastructure, availability of essential supplies and availability, adequacy and functional status of essential equipment required for the provision of emergency obstetric care. The goal, in assessing these health system components, was to determine capacity of selected health centres and district hospitals in Tanzania to provide C-section services in the context of ongoing task sharing arrangements.

Conceptualization of barriers to provision of C-sections may be based on the structural functionalism framework by Emile Durkheim, a social scientist[33] who viewed a system as composed of interrelated and interdependent parts (structure). Structural functionalism views a system as a whole in terms functions of its constituent elements.[33] Applying this to the current manuscript, the implication is that if one of the health systems elements like human resources or equipment becomes dysfunctional, it produces a ripple negative effect on the rest of system components; ultimately the workforce will fail sto deliver a service and mortality rates will not reduce. We used the structural functionalism framework for our study (Figure1) as it has been used successfully as the foundation for systems analysis to identify bottlenecks and plan for solutions.

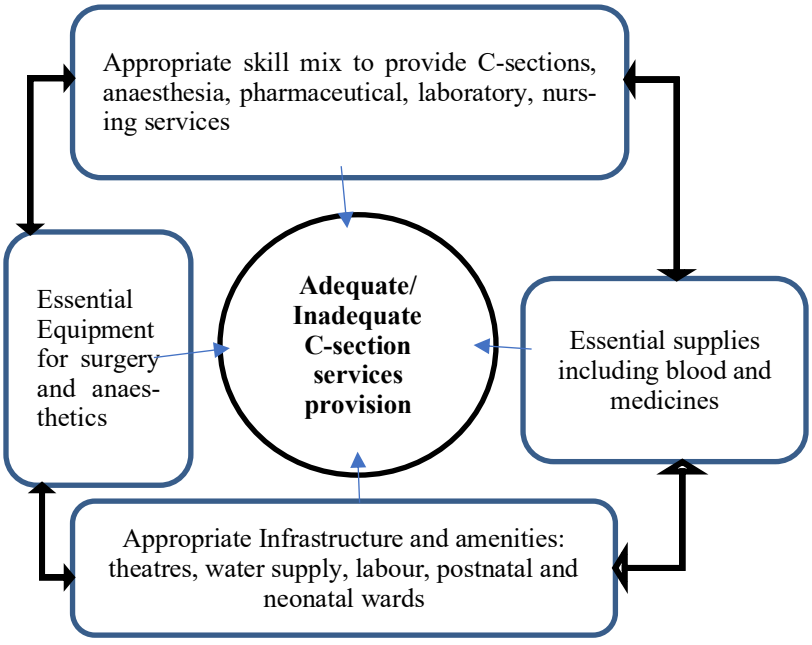

Figure 1 Structural Functionalism framework for assessing systems adequacy for provision of C-section

Here we report the current status of system factors that influence the adequacy of C-sections services at selected health centres and hospitals in Tanzania.

METHODS

A cross-sectional mixed methods design was used. The main method employed was a systematic observation of the availability, adequacy, and functional status of infrastructure, amenities, equipment and available staff to provide C-sections. This method was preferred because units of analysis were mostly equipment, infrastructure, supplies and skill mix standards.

In addition, the method improved objectivity as compared to heads of facilities self-reporting capacities and preparedness of their institutions, to provide C-section services. Infrastructure that was assessed included operation theatres, labour, maternity, neonatal and postnatal wards, water and sanitation facilities. Essential equipment assessed were C-section kits, delivery kits, anaesthetic machines, assisted delivery and resuscitation equipment.

The following supplies commonly used in obstetric emergencies; blood, surgical sutures, syringes, intravenous fluid administration sets, antibiotics, anticonvulsants for eclampsia, uterotonics for prevention of postpartum haemorrhage and anaesthetic drugs were assessed for availability and frequency of stock-outs. A human resource assessment for staff needed to perform C-sections was done using the facility staff establishment tool.

Numbers of medical doctors, AMOs, nurses and midwives, theatre trained nurses, anaesthetists and laboratory practitioners were recorded and expressed as a ratio of the ideal number required to perform C-sections. To complement the observation method, the study employed both quantitative and qualitative descriptive survey design for AMOs and key informants, respectively to obtain contextual data and perceptions on challenges facing AMOs in health facilities.

Selection of study sites

Six study sites were purposively selected using inclusion criteria that took into consideration diversity and variability of health facilities where AMOs provided C-sections. The criteria included; i)Geographical representation ensuring facilities from Northern, Southern, Eastern and Western zones were included, ii)Health facilities at primary and secondary levels of care where AMOs were the main health care providers for C-sections under task sharing arrangements, iii) Fifty percent of the facilities being rural and remote while 50% were urban centres and iv)Half of the facilities owned and run by the government and 50% being designated public health facilities but supported by non – governmental organisations .

Based on these criteria, six health facilities were selected; 3 district hospitals (DH) and 3 health centres (HC) (Table 1). Of the 3 district hospitals, 2 were in urban settings while one was rural based. Of the 3 health centres, 2 were both remote and located in a rural setting. Five of the facilities were under government administrative authority and one was being run by a church organisation with support for staffing from the government.

Three facilities, (a district hospital and 2 health centres) were supported by a non-governmental institution. Selection of the facilities allowed the determination of influence of geographical location, level of care and involvement of non-state actors in skill mix, infrastructure, equipment, supplies and medicines

Table 1: Study sites, catchment population, bed capacity and location Tanzania, 2016

Health facilities	**Catchment population	Bed capacity per policy	Actual bed capacity	Location	Administrative authority
Kasulu DH	425794	100-175	188	Remote	Government with NGO support
Mkomaindo DH	247,993	100-175	251	Urban	Government
Muheza DH	204,461	100-175	330	Urban	Faith-based with support from Government
Kibaoni HC	28869	24	104	Urban	Government
Mlimba HC	38108	24	62	Remote - *150 Km from the nearest town*	Government with NGO support
Nyenge HC	21,832	24	12	Remote 140Km from nearest town	Government with NGO support

***** population figures obtained from the 2012 Population Census available from:*** https://www.citypopulation.de/php/tanzania-coastal-admin.php?adm1id=0503

Key
HC = Health Centre
DH = District Hospital
NGO = Non-governmental organisation

Although government stipulated the bed capacities of hospitals (100-175) and health centres (24), none of the facilities conformed to that standard. All the district hospitals had bigger capacities with Muheza, a church-run hospital almost doubling to 330.

Similarly, health centres like Kibaoni had almost 3 times bigger capacity than stipulated. Furthermore, a hospital and a health centre with the largest catchment populations were not the ones with the biggest bed capacity.

Recruitment of study participants

For the descriptive survey, all 23 AMOs from participating health facilities were recruited into the study as they were the main providers of C-sections at district hospitals and health centres. A total sample improved the chances of developing a deep understating of the study variables.[35] Their inclusion was to specifically give their views on the variables of interest. In addition, 22 key informants purposively selected at national, regional and district levels, were included in the study.

Their selection was based on their experience and responsibilities in relation to the AMO programme and maternal health in the Tanzania health sector. These included seven (7) policy makers at national level as they were responsible for policies that govern training, practice and HR management. They were from the following directorates: human resource management, human resource development, policy and planning, nursing, hospital services, reproductive health and allied health training. Other key informants included regional medical officers (4) and district medical officers (5) as these had the responsibility to support and supervise health personnel at district hospitals and health centres in their clinical practice. Also included were the medical officers in charge (MOIC) of facilities from where data was collected as these had both the responsibility to provide C-sections and as also to provide supervisory and technical support to AMOs in their provision of C-sections services in their respective health facilities.

Data collection

Data was collected in September 2016. This was exactly 2 years after the review of the staffing norms. It was also the year that the task sharing policy guidelines were established although the task sharing practice had been in Tanzania for 5 decades. The policy guidelines are intended to promote a formal framework that can support task sharing as a national strategy for organizing the health workforce. Research medical doctors were recruited to assist with data collection because they were already familiar with data collection techniques and hospital environments. They had knowledge of essential supplies and functional status of surgical equipment; thus, ensuring the reliability of data. To enhance objectivity, structured checklists were prepared to collect pre-determined evidence of availability, gaps, functional status of infrastructure, amenities and equipment.[36] Pre-determined critical skill mix for C-sections, availability of essential supplies and medicines, and frequencies of stock-outs were all built into the checklists prior to data collection.

Pre-testing of data collection instruments was conducted in a rural district hospital that was not participating in the study and ambiguous questions were identified and modified.

Observations were recorded on checklists as observations were being made to reduce recall bias associated with recording at a later stage. Observation bias was minimised by engaging data collectors that were not part of the study as this reduced the "seeing what you want to see" effect. Data from AMOs was collected through face-to-face interviews using a structured interview guide. AMOs provided data on their practice environment including the availability of appropriate equipment, the skill mix, infrastructure and essential supplies to enable them to conduct C-sections.

Data from key informants was collected using a semi-structured interview guide. Interviews were conducted in privacy in participants' offices. The purpose of the study was explained to participants, clarifications given after which informed consent were obtained. Confidentiality of information obtained, and anonymity of subjects were assured by using codes and not names on the study questionnaires. Responses from key informant's facilitated triangulation of data as similar questions were also answered by AMOs.

Data Analysis

Data from checklists was critically examined. The analysis included calculation of frequencies, percentages of deficits, and noting what level and location of facilities where such deficits were found. Comparisons were also made between facilities of a similar level of care. Quantitative data from AMOs were coded, entered into IBM SPSS software package (version 23) and descriptive data analysis conducted. Thematic content analysis was applied to qualitative data. Responses were studied to develop insight into their meanings, also called content units or coding units.[37, 38] This was followed by post-coding to regroup similar responses with similar meanings into categories. Emerging themes were identified and analysed for their convergence and divergence of insights. Interpretation of such insights and concepts informed final conclusions.

Ethics and approval

The study protocols were approved by the University of KwaZulu Natal Biomedical Research Ethics Committee (number BE390/14) and the Tanzania National Institute for Medical Research (NIMR/HQ/R.8a/Vol.IX/2249). Permission to collect data was granted by the Ministry of Health.

RESULTS

Staffing situation at district hospitals

There was a considerable variability in the staffing situation for all health care providers at all facilities, even in health facilities of similar level of care (Table 2). At Secondary level, staffing norms stipulate that a district hospital should have a minimum of eight and a maximum of 23 medical doctors and a minimum of 16 AMOs, but none of the 3 hospitals had the minimum numbers. Based on the minimum requirements, the biggest deficit for medical doctors, 5(62.5%), was for Kasulu, a remote rural hospital where only 3 were available.

The other 2 district hospitals that were located in urban areas had five doctors each giving a deficit of 3 (37.5%). However, compared to doctors, the AMO deficit was worse in all 3 district hospitals. Out of the 16 required, one hospital had 6 and two had 5 each, giving deficits of 62.5% and 68.8% respectively, thus implying a general shortage of AMOs. However, in terms of absolute numbers, AMOs are more than medical doctors but when we calculate deficits based on staffing norms, shortages for AMOs yield higher percentages.

Table 2 Health facility staffing levels versus Ministry of Health staffing norms, Tanzania

DISTRICT HOSPITALS							
		Kasulu (rural)		Mkomaindo (urban)		Muheza (urban)	
Actual bed capacity		188		251		330	
	Staffing per MoH norms	Available	n(%) Deficit*	Available	n(%) Deficit*	Available	n(%) Deficit*
Medical doctors	8 – 23	3	5(62.5)	5	3(37.5)	5	3(37.5)
AMOs	16 – 39	5	11(68.8)	5	11(68.8)	6	10(62.5)
Theatre nurses	N/A	4	N/A	0	N/A	13	N/A
Anaesthetists	6	4	2(33.3)	1	5(83.3)	1	5(83.3)
Nurses/ Midwives	78 – 99	83		40	38(48.7)	52	26(33.3)
Laboratory officers	5 – 8	10		3	2(40)	2	3(60)
HEALTH CENTRES							
		Kibaoni (urban)		**Mlimba (remote)**		**Nyenge (remote)**	
Actual bed capacity		104		62		12	
	Staffing per MoH norms	Available	n(%) Deficit*	Available	n(%) Deficit*	Available	n(%) Deficit*
Medical doctors	1	2	-	0	1(100)	0	1(100)
AMOs	1	3	-	2	-	2	-
Theatre nurses	N/A	0	N/A	0	N/A	0	N/A
Anaesthetists	N/A	3	-	4	-	0	-
Nurses/Midwives	10 -15	54	0	16	-	4	6(60)
Laboratory officers	2 -3	2	0	1	1(50)	2	0

Key
N/A = Not applicable
MoH = Ministry of Health
*Deficit based on minimum number required

Although there were no established posts for nurses trained to work in theatre, some had in-service training to facilitate surgical procedures in line with the task sharing strategy. The regional authority seconded four (4) and thirteen (13) of such nurses to Kasulu and Muheza district hospitals respectively. Plans to create posts for nurses trained in theatre technique were underway at the time of data collection pending development of an appropriate scheme of service.

Of note was the severe shortage of anaesthetists at Mkomaindo and Muheza hospitals where there was only one out of six, indicating a deficit of 83.3%.

When key informants were asked how Mkomaindo hospital conducted caesarean sections without this critical cadre, they explained:
The anaesthesia in health centres is provided by either clinical officers/registered nurses/Enrolled nurses who underwent intensive training on anaesthesia. The training was conducted as on job training through task shar-

ing at a Regional Referral Hospital in collaboration with Tanzanian Training Centre for International Health TTCIH) (KII district hospital)

The training in anaesthesia was run concomitantly with CEmONC training to AMOs to enable the hospital to perform C-sections. The beneficiaries of that TTCIH CEmONC training (AMOs and the anaesthetists) are in various places in the country and Zanzibar, doing a recommendable job and supported by UNFPA (KII district hospital)

Anaesthesia & Intensive Care is severely under-resourced in Tanzania. Tanzania has only 26/10,000. Most anaesthesia and intensive care is carried out by nurses, or by partially trained Anaesthetic Officers. The knowledge and skills of these staff were largely gained during their initial vocational training. A lack of in-service training and educational material results in knowledge that is old and out-of-date. (KII at national level)

The deficit for nurses was lower than for doctors and AMOs, with Mkomaindo and Muheza reporting deficits of 48.7% and 33.3%, respectively. For Kasulu, despite its rural location, the number of nurses and laboratory technicians/assistants exceeded the recommended minimum levels. This could be the effect of partnerships as Kasulu hospital was being supported by an NGO in terms of infrastructure refurbishment, equipment supply and skills upgrading for AMOs and nurses for the provision of CEmONC.[13]

Staffing situation at health centres

Heath centres were expected to have one medical doctor and one AMO. However, Kibaoni, an urban facility, had greater numbers than stated in the establishment for medical doctors, AMOS, nurses and other service providers (Table 2). For example, there were 2 medical doctors, unlike the other two rural health centres that had none. In addition, Kibaoni had 3 AMOs compared to rural facilities with 2 each. Furthermore, Kibaoni had 54 nurses, 5 times the minimum number of nurse/midwives required (ten).

This could be attributed to the "urban pull" factor. Despite clinical staff shortage in the 2 rural health centres, one of them, which was being supported by an NGO to improve infrastructure, supplies and skill mix, had 16 nurses, exceeding the maximum recommended. However, in stark contrast to the other rural health centres, Nyenge, situated 30km from the main road and 150km to the nearest town, had four nurses only, presenting a deficit of 60%. Two of those nurses were also trained to provide anaesthesia.

This shows a serious shortage, not only because of failure to fill the vacancies but also as a result of the set establishment for this level of care (Table 2). For example, the policy did not provide for posts of anaesthetists and nurses trained to work in theatre despite such centres being mandated to conduct caesarean sections. In summary, five out of six facilities had less than the minimum required number of doctors and AMOs. Where establishments of theatre trained nurses and qualified anaesthetists did not exist, C-sections were still being provided as tasks were being undertaken by nurses through task sharing arrangements.

Infrastructure and amenities

Infrastructure and amenities essential for C-sections include operating theatres, maternity wards, labour wards, postnatal ward, neonatal ward, consultations rooms, sanitation facilities, running clean water electricity and staff accommodation near enough for the emergency care team to be assembled and summoned timely to conduct C-sections when the need arises to save lives.

It was not expected that facilities at the same level of care would have uniform infrastructure and amenities as facilities varied in terms size (bed capacity), catchment population, and geographical settings (Table 1). Hence, adequacy was measured according to perceptions of users. Results on availability, adequacy and functionality are shown in Table 3.

Table 3 Number of available infrastructure and amenities at selected health facilities, Tanzania, 2016

	District Hospital	Health facility	All Health facilities
Infrastructure & Amenities	n=3(%)	n=3(%)	n=6 (%)
Theatres	3 (100)	3 (100)	6(100)
Maternity wards	2(66.7)	1(33.3)	3(50)
Labour wards	3(100)	1(33.3)	4(66.7)
Postnatal ward	2(66.7)	1(33.3)	3(50)
Neonatal unit	3(100)	0(0.0)	3(50)
Consulting rooms	3(100)	3(100)	6(100)
Clean running water	3(100)	2(66.7)	5(83.3)
Electricity (power)	3(100)	2(66.7)	5(83.3)
Generator	3(100)	1(33.3)	4(66.7)
Staff accommodation	3(100)	1(33.3)	4(66.7)
Sanitation & waste disposal	1(33.3)	0(0.0)	1(16.7)
Internet facility	3(100)	0(0.0)	3(50)
Air-conditioning	2(66.7)	1(33.3)	3(50)

Operation theatres at all health facilities were adequate and functioning well. Of note was one health centre, a lower level facility (Kibaoni), with 2 theatres while one district hospital (Mkomaindo), referral level- had one only. Maternity wards were available in all facilities except at one rural health centre. Out of those that were available, only two had adequate space. Three facilities had labour wards that were adequate, while one facility did not have a labour ward. The remaining labour wards at 2 facilities needed refurbishment.

In one facility, an improvised room being used as a labour ward was described by one key informant as "*below standard"*. Postnatal wards were available in 5 facilities out of six. Two of the postnatal wards, did not have adequate space. Neonatal wards only existed at District Hospitals. One key informant at one facility stated that "*the neonatal unit was urgently needed".* Consulting rooms were inadequate at 2 health centres and one district hospital. With regards to clean running water and electricity, one facility (Nyenge) was using solar power and did not have running water.

Staff accommodation was adequate at 4 facilities. Internet and air conditioning systems were only available at 3 facilities. As for sanitation and disposal of hospital waste, all facilities except one, reported challenges of inadequacy and need for refurbishment. One rural health centre was using pit latrines and rubbish pits. This data shows that there was no facility with all the required infrastructure and amenities, although the situation at district hospitals was better than at health centres.

Availability of equipment

None of the health facility had all the equipment necessary for efficient functioning (Table 4). Baby delivery kits and C-section sets were both described as inadequate in all facilities. Furthermore, available baby delivery kits and C-section sets were similar in number for district hospitals despite their variations in bed capacity and a number of available staff. Even for health centres, each one had only 2 C-section sets, that were described as inadequate and yet they also had different capacities.

Table 4 Health facility equipment, deficit and functional status, Tanzania, 2016

Health facility Equipment	District hospital			Health facility		
	Number needed	**% Available**	**% Functional**	**Number needed**	**% Available**	**% Functional**
Baby delivery kit	34	24 (70.6)	24(100)	25	13 (52.0)	13(100)
C-sections trays	25	16 (64)	16(100)	16	6 (37.5)	6(100)
Sterilising equipment	12	8 (66.7)	4(50)	10	6 (60.0)	3(50)
anaesthetic machines	6	3(50)	2(66.7)	8	3 (37.5)	2(66.7)
Manual vacuum aspirator	13	5 (38.5)	4(80)	9	3 (33.3)	3(100)
Equipment for vacuum assisted delivery	16	5 (31.2)	5(100)	7	2 (28.5)	2(100)
New born resuscitation equipment	26	13 (50)	13(100)	11	4 (36.4)	3(75)
Maternal resuscitation equipment	10	1 (10)	1(100)	9	1 (11.1)	0(0.0)

Sterilising equipment was available in all health facilities but dysfunctional in 3 facilities (2 health centres and 1 district Hospital). Although there was only one anaesthetic machine at each facility, 3 of them were not functioning and 3 facilities reported them as inadequate. One key informant described the state of affairs in one hospital as:

"----the anaesthetic machine is available but not functioning. No one was trained to use it. It lacks some ac cessories for it to function well. Thus, the hospital only uses injectables as anaesthetic drugs----"

Manual vacuum aspirators, assisted vacuum delivery and new born resuscitation equipment, were all inadequate in all the health facilities. Maternal resuscitation was not even available. These inadequacies and dysfunctionality put mothers' and neonates' lives at risk.

Supplies and Medicines

In half of the facilities, blood had been out of stock for the past 3 months, implying that all cases needing C-Sections had to be transferred to the next referral hospital (Table 5). In Tanzania, blood collection is done at district and health centre levels in collaboration with National Blood Transfusion Services (NBTS).

Blood screening and blood processing are performed by NBTS to ensure quality standards in procurement, storage and transport of blood samples to zonal centres for testing and screening.

Health facilities are expected to order their supplies from NBTS but where shortages exist, patients are transferred to the next referral hospital.

Table 5 Number of reporting availability of essential supplies and medicines at selected health facilities, Tanzania, 2016

Medicines and supplies	**District Hospital n=3(%)**	**Health Canters n=3(%)**	**All facilities n=6(%)**
Blood	2(66.7)	1(33.3)	3(50)
Sutures	3(100)	2(66.7)	5(83.3)
Syringes	2(66.7)	2(66.7)	4(66.7)
Giving sets	3(100)	3(100)	6(100)
Antibiotics	3(100)	2(66.7)	5(83.3)
anaesthetic drugs	3(100)	3(100)	6(100)
Uterotonics	3(100)	2(66.7)	5(83.3)
Anticonvulsants	3(100)	3(100)	6(100)

Sutures were available in all facilities except one. Syringes were available in 4 facilities with one facility reporting limited supplies (2 months' stock only).

Intravenous infusion giving sets were the most available of all the supplies in all facilities. The most available medicines found in all the six health facilities were antibiotics. However, one hospital reported having limited choices as only one type was available (gentamycin). Anaesthetic drugs were available in 5 facilities while anticonvulsants for treatment of eclampsia were out of stock in 2 facilities for a whole month prior to data collection, again putting lives of mothers and neonates at grave risk.

On uterotonics for prevention of post-partum haemorrhage, oxytocin was out of stock in 2 facilities but ergometrine was available. Both drugs are effective in controlling haemorrhage although ergometrine may increase blood pressure in hypertensive patients.[39] There was no record of frequency of stock outs and when stock-outs were last reported, but the fact that some of the supplies and medicines were not found during the assessment, indicates that supplies were inconsistent.

Given the fact that AMOs are mostly deployed to work in health centres and district hospitals, a question was put to them as to what challenges they faced as they conduct C-sections at their workplaces. The majority mentioned shortage of nurses trained to work in theatre (91 %; n=21), theatres that were not functioning properly (61%; n=14), lack of blood supply (87%; n=20), shortages of midwives (87%; n=20) and inadequate equipment (96%; n=22).

AMO supervisors at the facility level, district and regional levels as well as policymakers at the national level, all concurred that there were challenges of inadequate infrastructure, staff, supplies and equipment. Key informants proposed an increase in enrolment and recruitment of essential staff for emergency obstetric surgery.

Sentiments were expressed for "*the establishment of new schools that train midwives only,* short *courses for nurses to train as theatre nurse specialists and anaesthetists* and *intensifying recruitment of critical service providers and specialists like medical doctors, obstetricians and gynaecologists"*. Many suggestions from key informants converged on the need to intensify community mobilisation for blood donations in addition to increasing budget allocation for equipment and supplies.

DISCUSSION

Essential skill mix

Skill mix in the context of this study refers to a combination or grouping of different categories of workers that are employed in health facilities to provide C-section services. The study found that all the six health facilities lacked the right number of essential cadres to perform C-sections.

Similar findings were reported by Manzi et al.[40] in a Tanzania study that examined the availability of staff and perceptions of workload. They found that only 14% of the recommended nursing staff and 20% of the clinical staff had been employed at the health facilities. Skill mix challenges were also reported in various studies.[41,42,43,44] Furthermore, the establishment of health centres according to the 2014 policy, did not have provision for posts of nurses trained to work in theatres and anaesthetists.[45] This was a clear indication of policy inconsistency where a facility is expected to conduct C-sections and yet skill mix policy was not supportive of such a mandate.

Inadequacies in skill mix mirror the country's human resource crisis. In 2014, there was only 47% of the required health workforce.[45] Medical doctors were 796 out of 3,196 required for health centres, district and regional hospitals giving a deficit of 74%. AMOs were 1,485 out of 4781 required for the same levels of care giving a deficit of 69%.[28] Shortages of qualified personnel coupled with shortages of drugs were reported to be among the major reasons for client dissatisfaction and reasons why clients by-pass primary care facilities.[46]

There was also an issue of inequitable distribution of health workforce with doctors, AMOs and nurses preferring to work in urban facilities rather than remote rural facilities. This was clearly demonstrated by the Nyenge and Kibaoni situation described earlier (Table 2). Simillar findings on inequitable distribution were also reported in several earlier studies.[40,41, 47, 48]

Infrastructure

We observed that none of the facilities had all the required infrastructure and amenities. Similar findings were reported in a study of 132 district health facilities in 8 low and middle-income countries (LMIC) in which Tanzania participated.[49] The study revealed that all health facilities had some shortfalls in basic infrastructure, water, electricity, oxygen, and functioning anaesthetic machines, although 44% of them performed caesarean sections.

Evidence of weak health systems such as lack of space in sub-standard labour wards, unavailability of maternity and post-natal wards were some of the infrastructural weaknesses found in this study. Lack of patient privacy, confidentiality, overcrowding, the risk of cross infections and demotivating work environments, all contribute to poor quality of care, disrespect and abuse of women seeking CEmONC.[50, 51]

The study found that the most neglected infrastructure was sanitation and waste disposal. In one facility, running water was also a challenge.

These findings corroborate those by the WHO[52] in their study on water, sanitation and hygiene in health care facilities. They found that 38% of health facilities from 54 countries did not have improved water source and 19% did not have improved sanitation facilities.

Poor sanitation in health facilities, especially where patients have fresh wounds after C-sections, increases the risk of nosocomial infections,[53] a fact that should be a cause of concern in Tanzania where infections account for 8%-9% of maternal deaths.[54, 55] Tanzania is one of the countries that recognises human rights to water and sanitation,[56] as enshrined in its constitution. Furthermore, Tanzania was found to have a high index of capacity to invest and absorb funds in implementation of water, sanitation and hygiene (WASH) projects. However, the situation on the ground was inconsistent with these commitments to improve water and sanitation in health facilities.

Equipment and essential supplies

None of the study health facilities had all the equipment and essential supplies in the right quantities always. Furthermore, facilities were not keeping records of stock outs. This made quantification of the problem impossible. However, frequent shortages of necessary equipment and consumables were reported in several studies in Tanzania.[16, 42, 57, 58,59] In situations of severe resource constraints where health facilities are provided with far less equipment and drugs than required, health workers find that they are not able to provide the services expected.[60] Stock-outs of life-saving drugs, blood and resuscitation equipment, known to be critical in serving lives in obstetric emergencies, should be a cause of great concern. Situations like these are likely to contribute to the delay in accessing life-saving care and treatment.

Policy incongruence

The Primary Health Services Development Programme noted that the health sector experienced inadequacies of skill mix, equipment, infrastructure, inadequate space and health coverage. In a bid to address accessibility and equity in health issues, Tanzania came up with various policies some of which include task sharing and staff establishment for various levels of care. Ten years, later, challenges of skill mix, equipment, and infrastructure continue. Furthermore, allocation of resources did not take into consideration the unique characteristics of each facility. For example, bed capacity (100-175) at all district hospitals was the same according to Ministry of Health policy.

In addition to that, all district hospitals had the same number of baby delivery kits despite the huge variation in the actual bed capacity and catchment population. Even for health centres, each one had only 2 C-section kits and yet one health centre had only 4 nurses with a bed capacity of 12. This shows inconsistency between policy pronouncements and policy translation.

A policy mal-alignment also emerged from the findings. Whereas the increased number of health centres was expected to improve accessibility to C-sections, the policy of 2014 neither had posts for anaesthetists nor those for nurses trained to work in theatre at that level of care. Given this discrepancy, it is not possible to determine needed staffing levels for these service providers.
With task sharing, having been introduced to address staffing needs, C-sections and other CEmONC service accessibility, supportive health system components continued to lag resulting in some facilities grossly understaffed, under-equipped and underutilised. A study in Tanzania highlighted the need for better alignment between policy and practice, support and training for cadres adopting surgical task sharing.[61] A more detailed policy analysis on task sharing for the provision of CEmONC is recommended.

Limitations

Data used for this study was mainly from observations especially on availability and functional status of equipment, infrastructure and amenities. This method is associated with observational bias. However, systematic use of well-structured checklists minimised the bias. Although there was no specific tool to interview medical doctors, some of them were recruited as key informants by virtue of them being Medical Officers in Charge and provided a doctor's perspective.

Key informants that provided information on issues of staffing and other health system components were purposively selected, thus introducing selection bias. However, that challenge was outweighed by the need to obtain data from people with typical experience of the practice environments that were being assessed.

CONCLUSION

The capacity of health facilities to provide caesarean sections was found to be suboptimal due to health workforce shortages, inadequate infrastructure, equipment and supplies. None of the health facilities had all the necessary resources required for the provision of quality CEmONC, thus increasing the risk of maternal deaths. These findings could be useful in informing policies and strategies to reduce maternal and neonatal mortality.

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REFERENCES

1. World Health Organisation. Trends in maternal mortality: 1990 to 2013 estimates by the WHO, UNICEF, UNFPA, The World Bank and the United Nations Population Division. Geneva, Switzerland: World Health Organisation. 2014.
2. United Nations Children's Fund. Levels and trends in child mortality 2012: Estimates developed by the UN Inter-agency Group for Child Morality Estimation. UNICEF, WHO, The World Bank and UN Population Division. 2012.
3. UNFPA. Urgent response: Providing emergency obstetric and newborn care updated with technical feedback. 2012.
4. World Health Organisation. WHO statement on caesarean section rates. Geneva, Switzerland: World Health Organisation. 2015. http://www.who.int/reproductivehealth/publications/maternal_perinatal_health/cs-statement/en/ (Accessed 17 May 2018)
5. Gibbons L, Belizán JM, Jeremy AL, Betrán AP, Merialdi M, Althabe F. The Global Numbers and Costs of Additionally Needed and Unnecessary Caesarean Sections Performed per Year: Overuse as a Barrier to Universal Coverage: World Health Report, Background Paper, No. 30. 2010.
6. UNFPA. Adding it up: The costs and benefits of investing in family planning and maternal and newborn health: Guttmacher Institute. 2009.
7. Ye J, Zhang J, Mikolajczyk R, Torloni MR, Gülmezoglu AM, Betran AP. Association between rates of caesarean section and maternal and neonatal mortality in the 21st century: a worldwide population-based ecological study with longitudinal data. *BJOG-Int J Obstet Gy.* 2016; Apr 1;123(5):745-53.
8. Betrán AP, Merialdi M, Lauer JA, Bing-Shun W, Thomas J, Van Look P, Wagner M. Rates of caesarean section: analysis of global, regional and national estimates. *Paediatr Perinat Epidemiol* 2007; 21 (2):98-113.
9. Dogba M and Fournier P. Human resources and the quality of emergency obstetric care in developing countries: a systematic review of the literature. *Hum Resour Health* 2009; 7.7
10. Gerein N, Green A, Pearson S. The implications of shortages of health professionals for maternal health in sub-Saharan Africa. *Reprod Health Matters* 2006; **14(27):** 40-50.
11. Ologunde R, Vogel JP, Cherian MN, Merialdi M, Yeats J. Assessment of caesarean delivery availability in 26 low- and middle-income countries: a cross-sectional study. *Am J Obstet Gynecol* 2014; 211 (5): 504.e1-12.
12. Melman S, Schreurs RH, Dirksen CD, Kwee A, Nijhuis JG, Smeets NA, Scheepers HC, Hermens RP. Identification of barriers and facilitators for optimal cesarean section care: perspective of professionals. *BMC pregnancy and childbirth.* 2017 Dec; 17(1):230.
13. Chaillet N, Dubé E, Dugas M, Francoeur D, Dubé J, Gagnon S. et al. Identifying barriers and facilitators towards implementing guidelines to reduce caesarean section rates in Quebec. *Bull World Health Organ*. 2007;85(10):791-797. doi:10.2471/BLT.06.039289.
14. Harrison MS and Goldenberg RL. Cesarean section in sub-Saharan Africa. *Matern Health Neonatol Perinatol* 2016; 2:6. doi:10.1186/s40748-016-0033-x.
15. Manashan A, Saleem S, Koso-Thomas M, Althabe F, Pasha O, Chomba E, et al. Assessment of obstetric and neonatal health services in developing country health facilities. *Am J Perinatol*. 2013;30(9):787–94. doi: 10.1055/s-0032-1333409.
16. Ellard DR, Shemdoe A, Mazuguni F, Mbaruku G, Davies D, Kihaile P, et al. A qualitative process evaluation of training for non-physician clinicians/associate clinicians (NPCs/ACs) in emergency maternal, neonatal care and clinical leadership; impact on clinical services improvements in rural Tanzania: the ETATMBA project. *BMJ Open*. 2016;6(2).
17. World Population Review Tanzania Population 2018. http://worldpopulationreview.com/countries/tanzania-population/ (Accessed 18 May 2018)
18. National Bureau of Statistics (NBS) [Tanzania] and ICF Macro. 2011. *Tanzania Demographic and Health Survey 2010.* Dar es Salaam, Tanzania: NBS and ICF Macro.
19. Ministry of Health Community Development, Gender Elderly and Children (MoHCDGEC) [Tanzania Mainland], Ministry of Health (MoH) [Zanzibar], National Bureau of Statistics (NBS), Office of the Chief Government Statistician (OCGS), and ICF. 2016. *Tanzania Demographic and Health Survey and Malaria indicator Survey (TDHS-MIS) 2015-2016*. Dar es Salaam, Tanzania.
20. Mmbaga BT, Lie RT, Olomi R, Mahande MJ, Olola O, Daltveit K. Causes of perinatal death at a tertiary care hospital in Northern Tanzania 2000–

2010: a registry-based study. *BMC Pregnancy and Childbirth* 2012; 12:139
21. Hanson C, Cox J, Mbaruku G, Manzi F, Gabrysch S. Schellenberg D, Tanner M, Ronsmans C, Schellenberg J. Maternal mortality and distance to facility-based obstetric care in rural southern Tanzania: a secondary analysis of cross-sectional census data in 226 000 households. *Lancet Glob Health* 2015; 385: e387–95
22. Maro EW, Mosha NR, MJ, Obure J, Masenga G. Ten years trend in maternal mortality at Kilimanjaro Christian Medical Center Tanzania, 2003–2012: A descriptive retrospective tertiary hospital based study. ***Asian*** Pac J Reprod 2016;) 214-220
23. Ministry of Health and Social Welfare. The National Road Map Strategic Plan to Accelerate Reduction of Maternal, New-born and Child Deaths in Tanzania 2008 – 2015. 2008
24. Ministry of Health and Social Welfare. Primary Health Services Development Programme- MMAM 2007-2017. Ministry of Health and Social Welfare, Dar es salaam, Tanzania. 2007 *http://ihi.eprints.org/792/1/MoHSW.pdf_(15).pdf* (Accessed 18 March 2018)
25. Pemba SK. Training of Assistant Medical Officers in Tanzania by SK Pemba, TTCIH, March 2008. http://www.ttcih.org/uploads/docs/Assistant_Medical_Officer_Course_Profile_01.pdf (Accessed 18 May 2018)
26. Ministry of Health and Social Welfare. Assistant Medical Officers training curriculum. 2008.
27. McCord C, Mbaruku G, Pereira C, Nzabuhakwa C, Bergstrom S. The quality of emergency obstetrical surgery by assistant medical officers in Tanzanian district hospitals. [Comparative Study Research Support, Non-U.S. Gov't]. *Health Affairs (Millwood).* 2009; 28(5):876-85.
28. Ministry of Health, Community Development, Gender, Elderly and Children. Task sharing policy guidelines for health sector services in Tanzania. 2016.
29. Sirili N, Kiwara A, Gasto F, Goicolea I, Hurtig AK. Training and deployment of medical doctors in Tanzania post-1990s health sector reforms: assessing the achievements. *Hum Resour Health* 2017; 15:27.
30. United Republic of Tanzania. Ministry of Health and Social Welfare. Human Resource for Health and Social Welfare Country Profile 2012/2013. Human Resources Development Directorate, Dar es Salaam 2013.
31. United Republic of Tanzania. Mid-term analytical review of the performance of the health sector strategic plan III 2009-2015. Dar es Salaam: United Republic of Tanzania; 2013.
32. National Bureau of Statistics (NBS) [Tanzania] and ORC Macro. 2005. Tanzania Demographic and Health Survey 2004-05. Dar es Salaam, Tanzania: National Bureau of Statistics and ORC Macro.
33. Fontes N and Guardalabene N. Structural-Functionalism: An Introduction to the Literature. *Hum Commun Res* 2006; 2(3) 299–310, https://doi.org/10.1111/j.1468-2958.1976.tb00489.x (Accessed 17 May 2018)
34. Potts R, Vella K, Dale A, Sipe Exploring the usefulness of structural–functional approaches to analyse governance of planning systems. *Planning Theory* 15 (2) 162 - 18
35. Lund Research Ltd. Total population sampling. 2012. *http://dissertation.laerd.com/total-population-sampling.php*. (Accessed 17 May 2018)
36. Green JC and Buell J. Ethnography Step by Step (2nd Ed., by Fetterman DM. Thousand Oaks, Ca: Sage. *Am J Eval.* 1998; 21(3) 389-90 Fall 2000.
37. Graneheim UH and Lundman B. Qualitative content analysis in nursing research: concepts, procedures and measures to achieve trustworthiness. *Nurse Educ Today*. [Review]. 2004; 24(2):105-12.
38. Elo S, Kääriäinen M, Kanste O, Pölkki T, Utriainen K, Kyngäs H. Qualitative Content Analysis. *SAGE Open*. 2014;4(1):2158244014522633.
39. De SK, Saha D, Koley AK, Saha A, Ganguly TK, Dey BC, et al. A comparative study of ergometrine with oxytocin in controlling third stage blood loss – a randomized control trial. *Sch. J. App. Med. Sci*. 2013; 1(5): 595-599
40. Manzi F, Schellenberg JA, Hutton G, Wyss K, Mbuya C, Shirima K, et al. Human resources for health care delivery in Tanzania: a multifaceted problem. *Hum Resour Health* 2012; 22; 10:3.
41. Prytherch H, Kakoko DC, Leshabari MT, Sauerborn R, Marx M. Maternal and newborn healthcare providers in rural Tanzania: in-depth interviews exploring influences on motivation, performance and job satisfaction. *Rural Remote Health* 2012; 12:2072.
42. Shemdoe A, Mbaruku G, Dillip A, Bradley S, William J, Wason D, et al. Explaining retention of healthcare workers in Tanzania: moving on, coming to 'look, see and go', or stay? *Hum Resour Health* 2016; 14:2.
43. Kwesigabo G, Mwangu MA, Kakoko DC, Warriner I, Mkony CA, Killewo J, et al. Tanzania's health system and workforce crisis. *J Public Health Policy*. 2012;33: s35-s44.
44. Kahabuka C, Moland KM, Kvale G, Hinderaker SG. Unfulfilled expectations to services offered at primary health care facilities: experiences of caretakers of underfive children in rural Tanzania. *BMC Health Serv Res*. 2012; 14;12:158
45. United Republic of Tanzania. Staffing levels for Ministry of Health and Social Welfare departments, health service facilities, health training institutions

and agencies 2014-2019, Revised; 2014. Dar es salaam, Tanzania. 2014.
46. Bradley S, Kamwendo F, Chipeta E, Chimwaza W, de Pinho H, McAuliffe E. Too few staff, too many patients: a qualitative study of the impact on obstetric care providers and on quality of care in Malawi. *BMC Pregnancy Childbirth*. 2015; 21; 15:65.
47. Araújo E, Maeda A. How to recruit and retain health workers in rural and remote areas in developing countries: A guidance note. HNP discussion paper. 2013. World Bank, Washington, DC. https://openknowledge.worldbank.org/handle/10986/16104 (Accessed 19 May 2018)
48. Munga MA, Songstad NG, Blystad A, Mæstad O. The decentralisation-centralisation dilemma: recruitment and distribution of health workers in remote districts of Tanzania. *BMC Int Health Hum Rights*. 2009; 9:9.
49. Kushner AL, Cherian MN, Noel L, Spiegel DA, Groth S, Etienne C. Addressing the Millennium Development Goals from a surgical perspective: essential surgery and anesthesia in 8 low- and middle-income countries. *Arch Surg.* 2010;145(2):154-9
50. Bowser D and Hill K. Exploring Evidence for disrespect and abuse in facility-based childbirth: report of a landscape analysis. USAID 2010.
51. World Health Organisation. The prevention and elimination of disrespect and abuse during facility-based childbirth. WHO statement. 2015.
52. World Health Organisation. Water, sanitation and hygiene in health care facilities; status in low- and middle-income countries and way forward; Geneva, 2015.
53. Fehr J1, Hatz C, Soka I, Kibatala P, Urassa H, Smith T. et al. Risk factors for surgical site infection in a Tanzanian district hospital: a challenge for the traditional National Nosocomial Infections Surveillance system index. *Infect Control Hosp Epidemiol*. 2006; 27(12):1401-4.
54. Pembe AB, Paulo C, D'mello BS, van Roosmalen J. Maternal mortality at Muhimbili National Hospital in Dar-es-Salaam, Tanzania in the year 2011. *BMC pregnancy and childbirth*; 2014; 14 32
55. Illah E, Mbaruku G, Masanja H, Kahn Causes and risk factors for maternal mortality in rural Tanzania-case of Rufiji Health and Demographic Surveillance Site (HDSS). *Afr J Reprod Health.* 2013;17(3):119-30.
56. GLAAS. Investing in Water and Sanitation: Increasing Access, Reducing Inequalities — Special report for africa.2014.
57. Kruk ME, Paczkowski M, Mbaruku G, de Pinho H, Galea S. Women's preferences for place of delivery in rural Tanzania: a population-based discrete choice experiment. *Am J Public Health*. [Research Support, Non-U.S. Gov't]. 2009 Sep;99(9):1666-72.
58. Sato M, Maufi D, Mwingira UJ, Leshabari MT, Ohnishi M, Honda S. Measuring three aspects of motivation among health workers at primary level health facilities in rural Tanzania. *PLoS One* 2017;12(5): e0176973.
59. Dovlo D. Using mid-level cadres as substitutes for internationally mobile health professionals in Africa. A desk review. *Hum Resour Health* 2004; 2(1):7.
60. Songstad NG, Moland KM, Massay DA, Blystad A. Why do health workers in rural Tanzania prefer public sector employment? *BMC Health Serv Res* 2012; 12:92.
61. Lobis S, Mbaruku G, Kamwendo F, McAuliff E, Austin J, de Pinho, H. Expected to deliver: Alignment of regulation, training and actual performance of emergency obstetric care providers in Malawi and Tanzania. *Int J Gynaecol Obstet*, 115(3): 322-327. doi:10.1016/j.ijgo.2011. 09.008 ✪