

Correlation of Obstetric Care Facility Density with Standard Emergency Obstetric and Neonatal Care Indicators in Tanzania Mainland

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Abstract: Tanzania's Primary Health Services Development Program (PHSDP) started in 2007 with the aim to establish and staff an additional 5162 dispensaries, 2074 health centres and 8 district hospitals by 2017 which would implicitly increase obstetric care facility density. However, currently obstetric care facility density is not a standard Emergency Obstetric and Neonatal Care (EmONC) indicator and data on its correlation with the standard EmONC indicators is scanty. In 2015 a cross-sectional survey of all hospitals, health centres and a random sample of dispensaries providing delivery services in all the 25 regions of Tanzania Mainland was conducted whereby the presence of EmONC functions in past 3 months was assessed using a standard tool. Where necessary, population data were based on the 2012 National housing and population Census and the 2010 Tanzania Demographic Health Survey (TDHS). Data were analyzed using IBM SPSS version 20 and STATA. Spatial Mapping was done using a calibrated Geographic Positioning System (GPS) Essential Software for Android and coordinates represented on digitalized map with Arc Geographic Information System (GIS). Ethical approval was granted by the Ethical Clearance Committee of Medical Research Council [MRCC], National Institute for Medical research. Of the confirmed 5207 obstetric care facilities 2405 (46.2%) were surveyed including 35.3% of all dispensaries. National Obstetric care facility density was 68/ 500,000 population, 7/500,000 of them provided all the 7 Basic Emergency Obstetric and Neonatal Care (BEmONC) functions in past 3 months. Among all the regions, 40% had attained or exceeded the international benchmark for EmONC facilities per 500,000 population. Institutional delivery rate was 79% and overall Caesarean Section rate was 5.6%. Improved obstetric care facility density was strongly correlated with improved institutional delivery; Caesarean section rate and met need for EmONC but not the quality of case management. In conclusion obstetric care facility density is well correlated with other standard EmONC indicators.

Keywords: Emergency Obstetric Care, Neonatal Care, Obstetric Care Facility Density, Indicator, Correlation, Tanzania

1. Introduction

Improving accessibility, quality and utilization of Emergency obstetric and neonatal care (EmONC) services reduces maternal and neonatal mortality and morbidity.

Evidence to support the usefulness of EmONC interventions in averting maternal mortality is overwhelming although mostly emanating from quasi-experimental, observational and ecological designs [1]. Interventions to reduce maternal and neonatal mortality need strong indicators to be able to

inform the progress, needs and overall monitoring of implementation. Since 1991 international indicators have been developed, revised and widely used under EmONC framework in programmes aiming at reducing maternal and neonatal mortality [2-10]. Standard EmONC indicators include the number of basic emergency obstetric and neonatal care (BEmONC) and comprehensive emergency obstetric and neonatal care (CEmONC) facilities as measured per 500,000 population; rate of EmONC institutional births; Met need for EmONC; population Caesarean section rate, direct and indirect case fatality rate and intrapartum and very early neonatal death rates [3, 4, 11-13]. Despite the wide application of the standard EmONC indicators, there are scanty published studies to describe the extent to which those indicators correlate with each other and with other program outcomes [9].

Tanzania has one of the highest maternal mortality ratio, estimated at 556/100,000 live births. In the past two decades there have been increased investments in health sector by the government and development partners. Among them the Primary Health Services Development Program (PHSDP) was introduced in 2007 with the aim to establish and staff an additional 5162 dispensaries, 2074 health centres and 8 district hospitals by 2017. A successful PHSDP would lead to having a dispensary at every village, a Health Centre at every ward and a District Hospital at every District [14]. This strategy would be expected to increase obstetric care facility density (OCFD). Nevertheless, increased OCFD is currently not considered one of EmONC indicators and its correlation with the standard indicators remains undetermined. The purpose of this study was to establish current OCFD in the 25 regions of Tanzania Mainland [henceforth termed as facility density], the status of standard EmONC indicators in Tanzania Mainland and to determine the correlation between OCFD and standard EmONC indicators. The results of this study are expected to inform policy makers, program managers and researchers on the current EmONC status in Tanzania and their correlation with OCFD.

2. Materials and Methods

This study was conducted in 2015 in all the 25 regions of Mainland Tanzania. An exhaustive list of 5207 obstetric care facilities was generated using data from the Ministry of Health Community Development Gender and Elderly and updates from the District Health Management Teams (DHMTs) in all the 110 district councils. It was agreed *a priori* to survey all obstetric care hospitals and health centres. In addition, 10 randomly selected dispensaries from each district council were added to make up a total of 2405 (46.2%) representative obstetric care facilities from which our data emanate. Multiple data sources were used, including interviews with facility Managers, interviews with healthcare workers, direct observations and review of records. In order to effectively address the study objectives, some extra demographic data were needed from recent (not older than 5 years) and reliable sources in compliance to international

guidelines (WHO, UNFPA, UNICEF, and AMDD, 2009). For the purpose of this survey, additional information based on the National population and Housing Census of 2012 was officially sought from the National Bureau of Statistics (NBS). This information included local population figures and crude birth rates (CBR). Field data were collected using a standard EmONC data collection tool which was modified to include locally relevant indicators[10]. The EmONC tool has been extensively used to collect such data and is internationally accepted [8, 10, 15-18]. All field data were directly entered in an electronic tool and promptly sent online along with the facility's Global Positioning System (GPS) location. A total of 280 data collectors were involved mostly junior doctors and professional nurses with experience in collection of similar data according to the National Institute for Medical Research (NIMR) database. Data collectors received refresher training on ethical issues and the practice of data collection using the electronic questionnaire and GPS. The study was ethically approved by the Ethical Clearance Committee of Medical Research Council (MRCC), National Institute for Medical Research (NIMR) of the Ministry of Health, Community Development, Gender, Elderly and Children.

2.1. EmONC Indicators

Obstetric care facilities were defined as all facilities that provide delivery service. EmONC indicators were determined according to international guidelines[10]. EmONC services were classified as either BEmONC (which include the provision of injectable antibiotics, uterotonics, anticonvulsants and conducting manual removal of placenta, evacuation of uterus, assisted vaginal delivery and basic neonatal resuscitation with bag and mask.) or CEmONC services if blood transfusion and Cesarean section functions are provided in addition to the 7 BEmONC functions. Based on this classification, BEmONC and CEmONC facilities were defined by virtue of their provision of the respective full set of functions in the past 3 months. Two indicators emanated from facility's EmONC status and were defined by the minimum number of EmONC facilities per 500, 000 population (ideally at least 5) and minimum number of Comprehensive CEmONC per 500,000 population (ideally should there be at least 1 among facilities that have provided a full set of BEmONC functions in past 3 months). Other indicators were the proportion of all births in EmONC facilities, Met need for EmONC, Cesarean section rate as a proportion of all births, direct obstetric case fatality rate (CFR) and the proportion of all maternal deaths due to indirect causes. In this study, the estimation of all births was calculated using regional and National level Crude Birth Rates (NBS, 2012). Met need for EmONC was defined as the proportion of all direct obstetric complications that were actually treated in obstetric care facilities [9, 10]. In calculating the Met Need, it was assumed that 15% of pregnant women develop severe direct obstetric complications [1, 9, 19, 20]. Institutional delivery and institutional deaths refer to the proportion of all births that

occurred in obstetric care facilities and all deaths in obstetric care facilities per 100,000 facility deliveries respectively. Annual Cesarean section rate was calculated as percentage of all births in a year that was delivered by Cesarean section. In this study intrapartum and very early neonatal death rates were not estimated due to incompleteness of data.

2.2. Data Analysis

Data were downloaded in Excel format and transferred into IBM SPSS version 20 and STATA programs for analysis. Spatial Mapping was done using a calibrated GPS Essential Software for Android and coordinates represented on digitalized map with Arc GIS software. For the purpose of current analysis, delivery in all obstetric care facilities as a proportion of all annual deliveries is referred to as *institutional delivery* and the annual direct and indirect causes of maternal deaths were combined and calculated as a proportion of 100,000 institutional deliveries to define *institutional deaths* since these two were considered relevant local indicators. Moreover, the number of Obstetric care facilities per 500,000 population (OCFD) was added as an important local indicator since the government has embarked on improved number of obstetric care facilities per population under the PHSDP which was introduced in 2007. Since data from dispensaries were not self weighted, all population based data were weighted. In the calculation of weights considerations were taken for the total number of facilities in the sampling frame for each level of facility in the country and the corresponding number of the initially sampled facilities. In the next step, field reports regarding the existed and accessed facilities for each level were considered. This information led to the calculation of corrected total number of facilities in the country and the corresponding corrected sample for each level of health facility. Weights were then calculated at each level of facilities by dividing the corrected total number of facilities by the corrected sample.

Weights were then used as inflating factors where necessary.

2.3. Correlation Coefficient

A region was the unit of analysis. Normality for all data variables was determined using the Shapiro-Wilk W test. Institutional delivery, OCFD, number of EmONC per 500,000 and Met need for EmONC were passed by this test. Scatter plots with 25 points and a fitted trend line were then created for all important pairs of indicators to determine the coefficient of determination (R^2). Additional significant linear trends were noted for the plots involving Cesarean section (R^2 range, 0.150-0.255) and plots involving institutional deaths (R^2 range, 0.207-0.505). These two indicators were added to the variables that passed Shapiro-Wilk W test. The correlation for relevant pairs of variables was determined by calculating Pearson Correlation coefficient (r) and p-values. Pearson's correlation coefficient (r) was interpreted based on absolute values of r as weak = $0.1 < r \leq 0.3$, moderate = $0.3 < r \leq 0.5$ and strong = $0.5 < r \leq 1.0$ inclusive[21].

3. Results

In total 2405 obstetric care facilities equal to 46.2% of all the 5207 obstetric care facilities in the country were surveyed including all health centres, all hospitals and 35.3% of the dispensaries in 25 regions. Overall 10.4% of the study sample facilities had provided all the seven BEmONC functions in the past 3 months including 100 (41.2%) out of 243 hospitals, 83 (13.0%) health centres out of 637 and 68 (4.5%) of the 1525 dispensaries. When all 5207 obstetric care facilities were considered and weighted data for dispensaries calculated, only 7.0% of all obstetric care facilities in the country had provided all the 7 Basic functions in the past 3 months. The availability of individual EmONC functions in the past 3 months is shown in Table 1.

Table 1. Proportion of facilities that performed each signal function in the past three months.

Signal function	All (n=2405)	Hospitals (n=243)	Health Centres (n=637)	Dispensaries (n=1525)	Public (n=1980)	Private (n=425)
Basic EmONC signal functions						
Parenteral antibiotics	71.4	86.8	79.9	65.3	70.3	76.5
Uterotonics	96.8	97.9	96.9	96.6	96.8	96.9
Manual removal of placenta	52.8	80.7	63	44.1	52.3	55.1
Parenteral anticonvulsants	52.3	79.4	66.6	42	50.9	58.6
Neonatal resuscitation	78.8	91.4	85.1	74.2	77.5	84.9
Removal of retained products	30.4	67.1	42.7	19.3	27.9	41.6
Assisted vaginal delivery	17.2	52.3	22	9.7	14.8	28.5
Additional comprehensive EmONC signal functions*						
Cesarean delivery	31.9	76.1	15.1	-	24.6	46.7
Blood transfusion	29.9	74.1	13.0	-	23.4	43.0

*Only hospitals and health centres were included in the denominator since dispensaries are not eligible for CEmONC functions

Table 1 summarizes the provision of EmONC functions in past 3 months by level and ownership of health facility. Overall, provision of uterotonics was the most commonly performed function in wholly 96.8% of all obstetric care facilities. Assisted vaginal delivery (17.2%) and evacuation of retained products of conception (30.4%) were the least

available services in past three months. Three quarters (76.1%) of hospitals and 15.1% of health centres performed Cesarean section in past three months. Of all the 880 hospitals and health centres, 248 (28.2%) facilities provided both Cesarean section and blood transfusion in the past three months. Only 130 (14.8%) of all the 880 hospitals and health

centres provided all the 9 EmONC functions (ie qualified as CEmONC facilities) including 95 (39.1%) of hospitals. Across all the 9 EmONC functions, private facilities performed above the National average.

Since facilities could have failed to perform EmONC functions due to the lack of patients in need of specific services, the analyses in Table 2 exclude facilities that lacked indicated cases during the evaluation period of three months. Among facilities that did not perform functions despite of availability of indicated obstetric complications, lack of

training was the most frequent reason for not performing assisted vaginal delivery (98.0%) and evacuation of products of conception (90.8%). Likewise policy issues that restrict performance of CEmONC functions were the main reason for failure to provide Caesarean section and blood transfusion. Nevertheless, overall lack of supplies equipment and drugs (59.2%) and training issues (47%) were the leading reasons for non-performance of the 7 basic EmONC functions in the presence of indicated obstetric cases.

Table 2. Number of facilities that did not provide signal functions when indicated and the given reasons for non provision.

Functions	Number of Facilities that:				% Facilities giving reasons for not providing an indicated function		
	Did not Provide function in last 3 months	Did not provide function because there was no indication	Did not provide function although indicated	Training issues	Lack of Supplies, equipment, drugs	Management issues that restrict providers	Policy issues restricting function provision
Inj. antibiotics	689	157	532	12.0	21.8	4.5	2.4
Uterotonics	77	45	32	21.9	96.9	12.5	3.1
Manual removal of placenta	1148	393	755	44.5	30.2	6.8	4.4
Neonatal resuscitation	510	210	300	38.0	57.3	9.3	6.0
Parenteral anticonvulsants	1135	313	822	23.5	27.6	6.0	3.3
Removal of retained products	1675	911	764	90.8	84.6	19.6	17.7
Assisted vaginal delivery	1988	1107	881	98.0	95.7	26.0	26.0
Cesarean delivery*	599	360	239	41.8	59.4	48.1	80.3
Blood transfusion*	617	372	245	30.2	57.6	40.4	78.8

* Only hospitals and Health centres were considered because dispensaries are not entitled to provide these functions.

3.1. EmONC indicators

The distribution of EmONC indicators by region is shown in Table 3. Overall, 21.5% of direct obstetric complications were managed in obstetric care facilities (the National level Met Need for EmONC) which are much below the ideal 100% according to United Nations (UN) benchmark. The National Caesarean section rate was 5.6% which is within the UN benchmark of 5-15%. However, wide variations in Caesarean section rates were encountered across regions.

There were 68 obstetric care facilities per 500,000 population in Tanzania Mainland, with only 7/500,000 population providing all the 7 BEmOC functions in past 3 months. This figure is above the minimum recommended UN benchmark of 5 per 500,000 population. Ten out of 25 regions (equivalent to 40%) had attained or exceeded the international benchmark of 5 EmONC facilities per 500,000 population.

Table 3. Distribution of some indicators of EmONC by region.

Region	Met Need for EmONC	Obstetric care facilities per 500,000 population	Institution delivery (%)	Institutional Deaths per 100,000 deliveries	BEmONC per 500,000 population	Annual Cesarean section (%)
Arusha	26.6	58	69	168	5	10.9
Dar es Salaam	33	16	98	62	3.7	13.3
Dodoma	10.3	73	73	115	2.2	6.5
Iringa	15	60	77	301	5.8	9.6
Katavi	9.6	55	68	346	4.4	1.7
Kilimanjaro	30.8	76	82	204	4.3	9.6
Lindi	38.3	121	102	331	6.4	7.2
Manyara	12.3	51	54	169	1.1	8.9
Mbeya	21.8	69	93	91	1.1	8.9
Morogoro	24.5	63	84	120	4.3	7.6
Mtwara	27.6	75	92	245	6.3	7.6
Njombe	2.7	150	110	426	11.4	19.3
Pwani	30.2	109	166	255	10	10.5
Rukwa	2.2	95	84	191	1.5	0.9
Ruvuma	49.5	74	93	197	5.1	14.3
Singida	24.7	71	68	152	2.2	5.9
Tanga	11.5	74	66	118	2.7	5.4
Kagera	21	53	63	92	5.9	3
Geita	6.7	33	51	101	4.3	0.1
Mwanza	21.7	44	72	75	3.6	3

Region	Met Need for EmONC	Obstetric care facilities per 500,000 population	Institution delivery (%)	Institutional Deaths per 100,000 deliveries	BEmONC per 500,000 population	Annual Cesarean section (%)
Mara	46.1	77	107	117	8	1.4
Shinyanga	34.4	52	82	148	6.8	1.4
Simiyu	7.6	48	46	121	4.3	0.3
Tabora	9.5	56	86	88	3.7	1.6
Kigoma	19.5	37	61	97	3.5	0.9
National	21.5	67.6	79	173.2	7.0	5.6

Overall annual rate of institutional delivery was 79% with four regions namely, Pwani, Lindi, Njombe and Mara exceeding 100% institutional birth rate (Table 3). Figure 1, shows the proportion of available CEmONC facilities

relative to what would be ideal by UN standards according to regional population. Figure 1, shows that 19 regions (76%) had either reached or exceeded the international threshold of at least 1 CEmONC facility per 500,000 population.

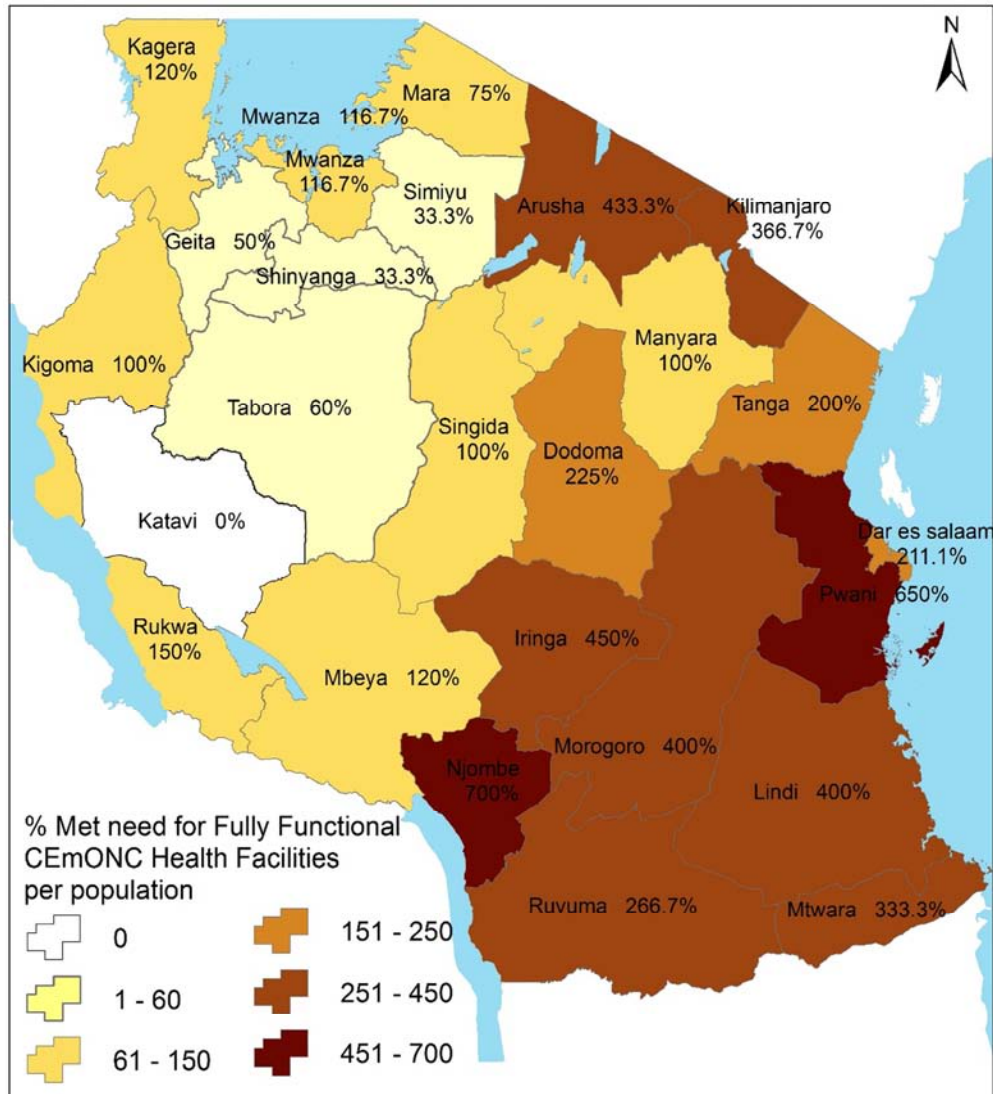


Figure 1. Proportion of available CEmONC facilities against UN benchmark per region.

3.2. Correlation Analysis

Table 4 is the correlation matrix for data in Table 3. An increase in Obstetric care facilities per 500,000 population (i.e, Facility density) was associated with increased institutional delivery, Met need for EmONC, Cesarean section rate and institutional deaths. An increase in number of BEmONC facilities per 500,000 population was also

associated with increased institutional delivery, institutional deaths and Caesarean section rate. Increased institutional delivery was associated with increased Caesarean section rate and institutional deaths. All the correlations were strong. There was an inverse correlation of Public-Private ratio with Caesarean section rate but this did not reach statistical significance ($R^2=0.155$, $r=-0.394$, $p=0.052$).

Table 4. Pearson Correlation coefficients for EmONC indicators.

	Institutional delivery per all births	Institutional Deaths per 100,000 deliveries	Annual Caesarean section rate	Met need for EmONC	No. of EmONC per 500,000 population
Facility density	0.599*	0.710*	0.461**	0.427*	0.534*
No. of EmONC per 500,000 population	0.623*	0.566*	0.509*		
CS rate	0.505**	0.455**			

*p<0.05, **p<0.005

4. Discussion

The results of this study support significant achievements so far made in EmONC delivery services in Tanzania Mainland. Among the achievements is the high obstetric care facility density (OCFD) of 68 per 500,000 population, an increased institutional delivery from 50% a decade ago and 63% five years back to the current 79% and the National level Caesarean Section rate of 5.6% up from the 5.0% which was previously reported by previous National survey (TDHS, 2010, TDHS 2015). Moreover, the observed levels of EmONC facility density of 7 facilities per 500,000 population and the 5.6% Caesarean section rate are both higher than the minimum recommended standards [2]. All these indicators were either comparable to or better than what have been recently reported for Zanzibar [22] and elsewhere in developing countries including Zambia, Malawi, Nigeria, parts of South Africa, Ghana and Afghanistan [3, 4, 7, 23-25].

Despite these impressive achievements in EmONC service availability at a National level, the distribution of EmONC indicators was not equitable across regions and facility levels. The availability of EmONC functions was inequitably distributed among regions whereby only 40% of them had attained an ideal minimum level of BEmONC. Moreover, the coverage of CEmONC services was far better than BEmONC with three quarters of the regions having attained or exceeded the ideal threshold. It is of note that most regions of the Lake and Western zones and the newly promoted regions of Geita, Simiyu and Katavi, CEmONC coverage was conspicuously the lowest. The wide discrepancy in BEmONC and CEmONC coverage is not unique for Tanzania Mainland as it is consistently reported by studies elsewhere in developing countries [4, 5, 7, 11, 22, 24-26]. In a systematic review of the global pattern of EmONC availability by Paxton *et al.*, it was concluded that CEmONC facilities are usually available to meet the minimum recommended but BEmONC facilities are consistently not available in sufficient numbers for countries with both high and moderate levels of maternal mortality [1, 27]. The observed patterns of EmONC services availability means safe maternity services are inequitably available to many women who seek such services in the health care system in some parts of the country, especially in the Lake and Western zones of the country. Future programmes and resources should be preferentially directed towards improvement of EmONC services in the most disadvantaged areas.

Overall, provision of uterotonics, neonatal resuscitation

and parenteral antibiotics were the most commonly available basic EmONC functions with the rest of basic functions being consistently provided by half or less of study facilities. Overall, assisted vaginal delivery and evacuation of products of conception were the least provided EmONC functions at a National level. Regarding CEmONC functions, only a third of eligible health facilities had provided the two CEmONC functions (i.e., Caesarean section and blood transfusion) in the past three months. The provision of EmONC functions in the current study was more consistent the higher the health facility level which is in support of the findings in a study of 12 districts of South Africa where evacuation of retained products of conception, assisted vaginal delivery, and CEmONC functions were among the least performed with better EmONC services available in higher than lower level health facilities [7]. A similar pattern of low performance and inequities in EmONC function performance has been also reported in Malawi and Afghanistan [4, 25] indicating inequitable allocation of resources.

Major reasons for non-provision of EmONC services have been broadly classified under policy, management, supply and training issues [2, 7, 13]. Working along these themes we explored what EmONC functions were not performed and for what reasons. In developing countries like Tanzania where haemorrhage and abortion complications claim most maternal deaths, the lack of manual removal of placenta, manual vacuum aspiration to treat abortion complications and assistance of vaginal delivery with vacuum should contribute significantly to maternal mortality. In the current study, the three most important reasons for non provision of EmONC functions were the lack of supplies and professional training for the basic EmONC functions and policy issues that restrict service provision for Caesarean section and blood transfusion. It is therefore implicit that reassured commodity supplies, strengthening continual professional education among healthcare professionals and ending policy bottlenecks that hinder CEmONC provision and equitable allocation of resources in facilities capable of providing such services would markedly improve EmONC standards. Tanzania mainland with 68 obstetric care facilities per 500,000 population possesses a huge potential to improve on if resources can be utilized to promote the existing facilities.

Since 2007 Tanzania has embarked on construction and staffing of new health facilities that would lead to having a dispensary at every village, a Health Centre at every ward and a District Hospital at every District by 2017 under the PHSDP [14]. The current study sought to establish if

increased OCFD would positively correlate with facility utilisation among other standard EmONC indicators. In support of the PHSDP strategy, a strong positive correlation between increased OCFD and institutional delivery was established. The increased institutional delivery rate from 50% in the past decade to the current 79% was impressive albeit this rise falls short of reaching the 90% National target which was set for 2015[28]. This increased utilisation could be at least partly explained by the minimized geographical distance between obstetric care facilities and communities, a factor which has been shown to promote institutional delivery elsewhere [29, 30]. Nevertheless, a wide variation in rates of institutional delivery across regions was observed from as low as 46% in Simiyu to above 100% in four regions of Mara, Pwani, Njombe and Lindi. The discrepancy in regional rates of institutional delivery is a reflection of the differences in the volume of maternity services provided. Institutional delivery more than 100% can indirectly reflect poor service availability in the regional neighbourhood forcing women to seek services outside their catchment, a situation that might lead to overcrowding of facilities in the host facilities as a consequence. In support to this connotation, all the regions with excessive institutional delivery (above 100%), also had the highest OCFD in the country which would be the attracting force for immigration of delivering mothers from the neighbourhood.

PHSDP could have improved the availability of obstetric care facilities in Tanzania Mainland but it seems unlikely that the existed staffing shortage of 56.4% of health care personnel at the onset of the program has been sufficiently improved [14]. This health personnel shortage adding to the established inconsistencies in availability of commodities and professional training must have negatively impacted on the quality of care. As a result, although OCFD was positively correlated with institutional delivery and Met Need for EmONC and Cesarean section rate it was also associated with increased institutional deaths. Thus, the increased institutional deaths could be partly explained by suboptimal quality of care and the increased number of women seeking medical attention due to direct obstetric complications leading to severely sick women increasingly more deaths occurring in facilities rather than in communities.

A low Met need for EmONC is an indication that still many direct obstetric complications are not managed in obstetric care facilities. The National met need of 21.5% in the current study is lower than the average Global Met need of 45% but just above the 21% for the low income countries that ranges 12% to 31% [9]. In the current study, we observed in-country variation among regions where Met Need ranged from 2.2% in Rukwa to 49.5% in Ruvuma. This range also accommodates the 33% Met need for Zanzibar which was recently reported in that part of the United Republic of Tanzania [22]. In the estimation of Met need for the current study we adopted a 15% rate of direct obstetric complications among live births. This estimate has been held by World Health Organization (WHO) as reasonable based on a series of studies conducted in India and the United

States of America (USA) [9, 31-33]. However, global adoption of the 15% figure has been criticized for not being reasonable in all settings owing to variations in the prevalence of various diseases, nutrition and age at first pregnancy [9, 34, 35]. Thus, the observed discrepancy between Institutional delivery and Met need in the current study could be explained at least partly by over diagnosis of serious direct obstetric complications in the community, poor documentation of complications in facilities or both.

Several limitations of the study design warrant to be discussed here. In a systematic review by Holmer et al, the global Met need was correlated with improved care by skilled birth attendance and inversely correlated with maternal deaths [9]. The current study further indicates that Met need strongly correlates with increased population Caesarean section rate, a proxy to improved quality care. As a result, where quality of service is questionable, many women with serious direct obstetric complications will not seek treatment in facilities. Nevertheless, there is need to understand other factors outside the healthcare system and address them along with improvement of quality services. Factors outside the health system were not sufficiently explored by this study design.

This study was based on the EmOC framework that has been criticised for not adequately capturing the quality of care received or the general condition of the patients at admission [9]. In real situation initial pre-referral care given in obstetric care facilities that do not qualify as EmONC could be even more important for life saving than the care given in EmONC facility. With this knowledge, we studied private and public obstetric care facilities in addition to designated EmONC facilities in order to give a more complete picture of obstetric care in Tanzania Mainland. However, the reliance on recorded hospital data and population estimates may have exposed this study to the inherent problems of documentation and reporting often leading to underreporting of complications. Nevertheless, enquiry about events that happened within the past 3 months was done to improve memorisation and minimize data loss [10] in efforts to mitigate this limitation.

The estimation of obstetric complications using 15% of live births as a population estimate has been supported by WHO, but questioned by other researchers [10, 35]. Nevertheless, this study has adopted this standard estimate to facilitate comparability with other international data with a risk of over or under-estimating the absolute number of direct obstetric complications that are actually happening in Tanzania Mainland. While the absolute numbers of direct obstetric complications could substantially differ from the actual, the value of our results as baseline for future follow-up of complication trends and comparability with other international data is enhanced owing to the wide international use of the indicator.

Despite the above limitations, this study provides a national wide current data on EmONC service utilisation and correlates of EmONC indicators that were unavailable before for Tanzania Mainland. The findings will inform policy,

program managers and researchers on strategies aimed at improving EmONC services in Tanzania Mainland.

5. Conclusion

Improved OCFD is strongly correlated with improved institutional delivery; Caesarean section rate and met need for EmONC but inequitable distribution of EmONC services especially in the newly promoted regions in Lake and Western zones and the low quality of care remain the major challenges.

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