

Current Set of Emergency Obstetric Care (EmOC) Indicators:
From “Monitoring emergency obstetric care: A Handbook” (WHO, 2009)

Indicator Brief #1:
Availability of EmOC: basic and comprehensive

INDICATOR	ACCEPTABLE LEVEL
1. Availability of EmOC: basic & comprehensive facilities	At least 5 EmOC facilities (including at least 1 comprehensive facility) for every 500,000 population
2. Geographic distribution of EmOC facilities	All subnational areas have at least 5 EmOC facilities (including at least 1 comprehensive facility) for every 500,00 population
3. Proportion of all births in EmOC facilities	Minimum acceptable level to be set locally
4. Met need for EmOC: proportion of women with major direct obstetric complications who are treated in EmOC facilities	100% of women estimated to have major direct obstetric complications are treated in EmOC facilities
5. Caesarean sections as a proportion of all births	The estimated proportion of births by caesarean section in the populations is not less than 5% or more than 15%
6. Direct obstetric case fatality rate	The case fatality rate among women with direct obstetric complications in EmOC facilities is less than 1%
7. Intrapartum and very early neonatal death rate	Standards to be determined
8. Proportion of maternal deaths due to indirect causes in EmOC facilities	No standard can be set

Indicator 1: Availability of Emergency Obstetric Care (EmOC)

This brief was written to describe the above indicator, the assumptions behind the indicator, methodological issues that have arisen since it was introduced, what we have learned in the 25 years since the indicator was first described and a few ideas related to the indicator as we go forward. Note that throughout this brief the term “EmOC” has been used since that was used in the 2009 *Handbook*; the acronym “EmONC” is used when referring to emergency obstetric and newborn care assessments and to UNFPA's work.

Background

Of all the indicators in the EmOC framework, this one is probably the most widely recognized and used for program design, planning and the monitoring of progress. During the Millennium Development Goals (MDG) period, it was a standard indicator for Countdown reports [1]. It continues to be used to assess stand-alone projects (Saving Mothers, Giving Life in Uganda and Zambia; Thamini Uhai in Tanzania) and in other initiatives such as Ending Preventable Maternal Mortality (EPMU).

The EmOC availability indicator was first defined in the 1997 *Guidelines for Monitoring the Availability and Use of Obstetric Services*; it recommended at least four basic EmOC (BEmOC) and at least one comprehensive EmOC (CEmOC) facility per 500,000 population [2]. This ratio of 5 EmOC facilities per 500,000 population was “based on the best data, estimates and assumptions” available at the time. The authors also recognized that “they could be adapted in light of individual countries’ circumstances.”

In 2009 when the *Guidelines* were revised in *Monitoring emergency obstetric care: a handbook*, the indicator was revised to “at least five EmOC facilities (including at least one comprehensive facility) for every 500,000 population” [3]. This was an acknowledgement that it was not uncommon to find some areas with a population of 500,000 with more than one CEmOC facility, and fewer than four BEmOC facilities.

The *Guidelines* and the *Handbook* were implicitly agnostic about where women gave birth, but they insisted that all women have access to emergency obstetric care. In the 25 years since the *Guidelines* were published, the proportion of births delivered in health care facilities has risen steadily and today approximately 70-80% of all births take place in facilities. But where women give birth tells another story. How many births take place in low volume facilities (<600 births per year) versus high volume facilities varies from country to country¹. For example, in Malawi 51% of facilities would be considered low volume facilities but only 17% of the facility births occur in those facilities, unlike Zambia where 72% of facilities are considered low volume but accounted for 40% of facility births (unpublished EmONC assessment data).

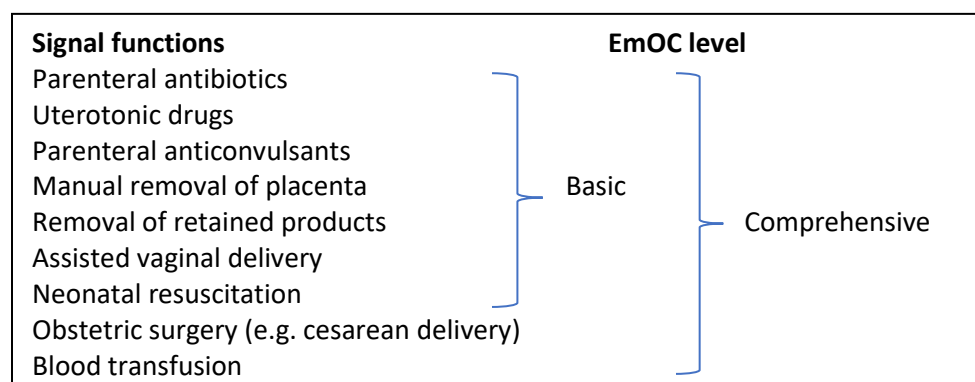
Definition and calculation of the indicator according to the 2009 Handbook

The availability of EmOC indicator sets out to answer the question “Are there enough health care facilities that provide emergency obstetric care?” [2]. Equally important, it also establishes the

¹ Based on unpublished EmONC assessment data, we determined that 53 births was the monthly median for non-hospitals that functioned at the BEmOC level, suggesting that facilities with a lower caseload have more difficulties achieving BEmOC status. The data from 7 countries can be seen in Figure 4.

definition of an EmOC facility based on the performance of a set of signal functions that indicate or “signal” the capacity of a healthcare facility to save women’s and newborns’ lives from major causes of maternal and newborn mortality. A facility is considered an EmOC facility only when it provides the full set of signal functions appropriate for its level of care at least once in the three previous months. This definition also distinguishes between two levels of care – basic EmOC and comprehensive EmOC, the former defined by seven basic signal functions and the latter by the seven basic signal functions plus two additional signal functions (Figure 1).

Figure 1: Current EmOC Signal Functions [3]



The number of EmOC facilities is then compared to a benchmark or minimum acceptable level of at least five EmOC facilities per 500,000 population, where at least one of the five is comprehensive.

Numerator: Number of EmOC facilities in a defined geographic/administrative area

Denominator: Number of recommended EmOC facilities in a defined geographic/administrative area $[(\text{Population} / 500,000) \times 5]$

More than one way of presenting the final calculation has been used. Most frequently, it is interpreted as a percentage of the minimum recommended number of EmOC facilities, with a parallel calculation for CEmOC availability. For example, overall availability in Malawi in 2020 was 42% of the recommended number of basic and comprehensive EmOC facilities while availability of CEmOC, frequently much higher, was 124% [4, page 19].

The sub-national calculation of this indicator, used as a proxy for geographic distribution, has been the second indicator of the set. (The indicator on geographic distribution is addressed in detail in a separate indicator brief.)

Assumptions

- The availability indicator is the first of a sequential set of indicators designed to monitor steps critical to reducing maternal and newborn mortality. The set moves from the existence of infrastructure with clinical capacity to the quality of care delivered. It should be interpreted along with the other indicators in the set.
- Signal functions are tracer clinical interventions that reflect the capacity of the facility to manage major obstetric complications; they are illustrative but do not reflect all aspects needed

for high quality care. For example, other items of clinical care (anesthesia) are important, as is non-clinical care (respectful care).

- Data collection is not burdensome (whether the signal functions were performed in the last 3 months).
- Signal functions must be available to women at any hour of the day, every day of the week, i.e. 24/7. If a signal function was performed in the last 3 months, it is assumed that it is available 24/7.
- If a signal function was performed in the last 3 months, the implication was that any drugs, supplies, equipment, or human resources required to provide the care were available.
- A 3-month reference period for measuring the performance of the signal functions was based on the principle that skills must be performed with some frequency in order to maintain competence and confidence as well as to minimize concerns about longer recall periods.
- CEmOC facilities with capacity for obstetric surgery and blood transfusion would provide “back-up” services for BEmOC facilities, which would be more numerous but provide fewer services. The latter would help decongest higher levels of care by resolving complications that do not require surgery or blood. The model was designed to make emergency care more widely available and closer to women; it was never considered a risk-stratification approach (i.e., it did not assume BEmOC was for low risk women and CEmOC for high risk women).
- A population of 500,000 assumed a crude birth rate of 40 or approximately 20,000 births per year; the equivalent ratio would be 5 EmOC facilities for every 20,000 annual births. A related assumption was that 15% of pregnant women would develop complications requiring EmOC, thus 3,000 annual complications, or 8 per day where about 3 would need obstetric surgery, and the other 5 would be distributed across the 5 EmOC facilities.
- Classification as an EmOC facility requires close inspection as many facilities are presumed to function at a certain level of care, but do not. For example, ministries of health often propose that all health centers should be functioning as BEmOC and hospitals as CEmOC. On close inspection of actual signal function performance, many health facilities fall short of these expectations.

Red flags that the indicator raises

- If the ratio of 5 EmOC facilities to 500,000 population falls short, the next steps are to identify where the need for facilities to be upgraded exists or locations that would benefit from the investment of a new healthcare facility and ensure equitable geographic distribution.
- If the ratio of 5 to 500,000 population is met at the national level, the distribution of those facilities (indicator 2) is the next aspect that the health system needs to examine to determine whether the distribution of EmOC services is equitable. Too often facilities are clustered together in urban or peri-urban settings while large swathes of a country are underserved.
- To identify which facilities to upgrade (or what to do once a facility is designated to provide EmOC), the analysis of individual signal functions and why they might be missing presents a roadmap to understanding the gaps in the readiness and capacity of the facility to provide EmOC. Common reasons for non-performance of a signal function include:
 - o Problems with infrastructure (e.g., operating theater not functional)
 - o Missing drugs/supplies/equipment – problems related to procurement, distribution, and/or maintenance
 - o Skilled personnel require further training/coaching/mentoring
 - o Additional skilled personnel / specific cadres with EmOC capacity are needed

- Facility, sub-national or national policies present barriers to the provision of care such as restrictive authorization of HR cadres to perform certain signal functions, or norms regarding what services are performed at what level, or deficits in pre-service curricula.
- No case requiring the signal function in the prior 3 months attended the facility; this could be because of very low caseload or women are by-passing the facility to go directly to higher levels of care.

Methodological issues and critiques

- *Integration of maternal and newborn signal functions:* The needs for mothers and babies must be considered together since the same medical facilities care for both. Despite the addition in 2009 of a newborn signal function (neonatal resuscitation with bag and mask), the array of signal functions predominantly reflects the treatment of direct obstetric complications. Since 2009 a number of researchers have expressed the need to identify a more complete set of newborn signal functions and integrate them into the current EmOC framework to have a true EmONC framework [5].
- *Maternal signal functions – are they the right ones?* Health systems in many low and middle income countries (LMICs) have evolved in the last 25 years. As a result, some maternal signal functions may be less frequently used (and others used more and without medical indication); decreased use could negatively affect the number of facilities that are classified as “fully functioning” basic and comprehensive EmOC:
 - Given the widespread use of active management of the third stage of labor, the incidence of retained placenta has probably declined [6]. This has likely affected the performance of the
 - “manual removal of retained placenta” as a signal function.
 - Globally, “assisted vaginal birth/delivery” (AVB/D) tends to be the signal function most likely to be missing due to a number of factors including lack of clinical capacity and functioning equipment; meanwhile, cesarean delivery rates continue to rise (when appropriate, AVB can eliminate the need for surgery, especially in the second stage of labor) [7].
 - These factors will be taken into consideration by Workstream #1 as they develop a revised set of emergency maternal and newborn signal functions.
- *Should we define availability (EmOC density) in terms of population (per 500,000 inhabitants), expected number of births or travel time to CEmOC or BEmOC?* Since pregnant women and births are at the core of the EmOC framework, births or pregnancies have been suggested as the most appropriate reference group. Originally, “population” was chosen over births because planners were accustomed to using population. Today, estimates of births are more accessible than they were. Pregnancies, on the other hand, are more difficult to estimate, requiring a pregnancy rate per 1000 women of reproductive age that is determined by the fertility rate, induced abortion rate and fetal losses.

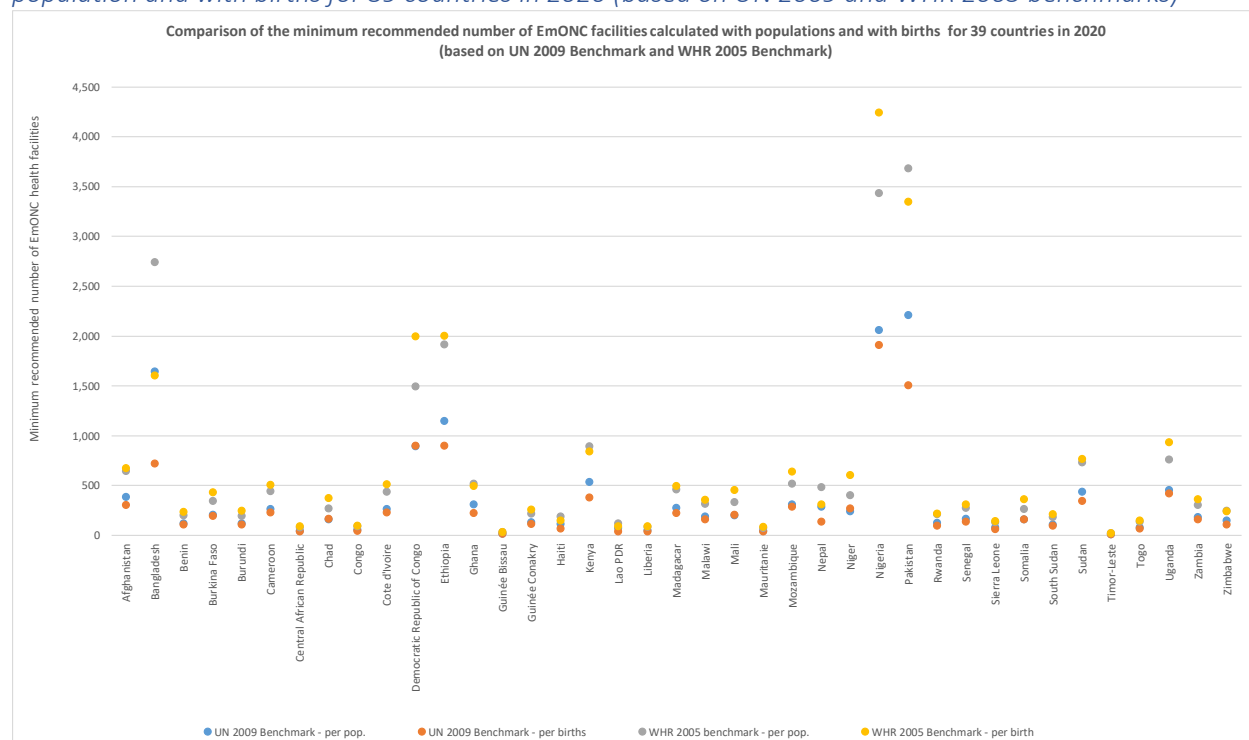
The original indicator was based on 20,000 births but because population figures were easier to come by than the number of births, researchers used a population of 500,000 and a crude birth rate of 40/1000 live births. As fertility declines it follows that the recommended number of EmOC facilities will decrease. See, for example in Figure 2 below, the country of Bangladesh, second country from the left; it is a country that reduced its total fertility rate by more than half

in the past three decades [9]. The recommended number of EmOC facilities varies from 700+ when based on births to 1600+ based on population. Most countries show a reduction in the number of recommended EmOC facilities when using births. A large number of EmOC facilities is not inherently bad when a country has sufficient resources. In fact, high income countries may have as many as one CEmOC per 100,000 population and rarely have BEmOC facilities [9].

However, most LMICs struggle to adequately support their health system. For this reason, researchers have argued in favor of basing the recommended number of EmOC facilities on births rather than population, especially as fertility is likely to continue to decline in most of these countries [10]. Another advantage of using births is to facilitate comparability among countries with varying levels of fertility.

Expected births is an estimate based on population and crude birth rates, which technically provides an estimate of “live” births, excluding stillbirths. Defining availability in terms of pregnancies would solve the problem of the stillbirth omission and it would help keep the need for treating complications of abortion in the forefront, but as stated above, the number of pregnancies is harder to determine.

Figure 2: Comparison of the minimum recommended number of EmOC health facilities calculated with population and with births for 39 countries in 2020 (based on UN 2009 and WHR 2005 benchmarks)



Source: unpublished data from UNFPA (Jean-Pierre Monet and Michel Brun)

In the last 25 years, planners have welcomed the use of geographical information systems (GIS) as a tool to measure access to healthcare facilities. Using GIS to identify facilities that can be upgraded is a refinement in the process of achieving an equitable distribution of healthcare facilities [11]. Its use in maternal and newborn health has spread widely and relatively quickly. In

2021, EPMM's global coverage target #4 for 2025 was launched as "the proportion of the population covered by EmOC facilities within 2-hour travel time" with a target of 80% of countries with >50% of the population able to physically access the closest EmOC health facility within 2h of travel time [12, 13]. Also, in a recent study to test the feasibility of introducing service delivery redesign in Kakamega County, Kenya (population 2 million), researchers mapped the test site to estimate the proportion of pregnancies that were within 2 hours, 1 hour and 30 minutes of a delivery facility under the proposed service delivery redesign model [14]. Based on these results, 10 facilities with surgical capacity were chosen such that 92% of women would be within 1-hour travel time to one of these surgical centers.

- *What is the right ratio? Does the evidence continue to support a density ratio of 5 EmOC facilities to 500,000 inhabitants/20,000 births?* The benchmark proposed in the *Guidelines* is not the only ratio that has been proposed for EmOC availability. The World Health Report 2005 proposed a different framework that assumed all women should deliver in EmOC facilities and proposed one birthing center per 1750 births and one hospital per 120,000 inhabitants, far more aspirational than the 5/500,000 ratio [15].

The ratio of 5 EmOC facilities to population/births, as stated earlier, was based on the best estimates of obstetric complications and data on the need for obstetric surgery in the early 1990s when many births took place at home. Several arguments support maintaining the current ratio or revising it to reflect changing behaviors.

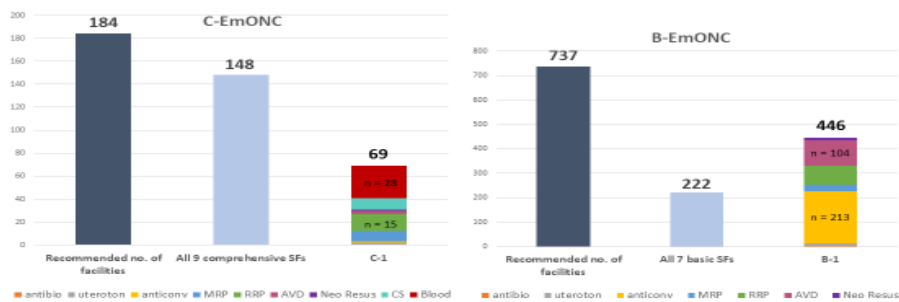
- Evidence suggests that this ratio is still aspirational for LMICs. To our knowledge, no LMIC has ever achieved this benchmark nationally, especially the BEmOC component as Figure 3 below shows. In fact, UNFPA's recent experience of setting up EmONC networks suggests that some governments are supportive of a lower, less aspirational number of EmONC facilities.
- Health systems are not as far away from reaching the benchmark as the indicator suggests. It is not uncommon for facilities to be missing only one signal function, and so the terms "B minus 1" (B-1) or "C minus 1" (C-1) have been coined, although this approach to classification is not widely disseminated [16]. Some argue that the "all or nothing" orthodoxy, the criteria that all 7 or all 9 signal functions be performed in the last 3 months, is too restrictive. It is possible that fully functioning could be redefined to include C-1 and B-1 facilities. Using unpublished data from the most recent Ethiopia 2016 and Malawi 2020 assessments (Figure 3) we can see in the graphs below that if B-1 and C-1 facilities were counted, the recommended number of EmOC facilities would almost be achieved (96% of recommended EmOC in Ethiopia and 85% in Malawi) while in other countries such as Zambia 2014-5, Mozambique 2012 and Ghana 2010, by including B-1 and C-1 facilities, each country would have exceeded 100% of the minimum recommended level (data not shown).
- A second point of "orthodoxy" relates to how long the recall / reference period is: 3, 6 or 12 months. The difference can be substantial as the case of Cambodia shows where they compared their national figure on EmOC availability for 3 months and for 12 months. At 3 months, the government health system had 2.62 (52%) of the recommended 5 EmOC facilities per 500,000 inhabitants; at 12 months, that ratio was 3.63 (73%) per 500,000 [17].

- Another argument in favor of keeping the 5 EmOC facilities is to minimize confusion between the 2009 guidance and the 2022 guidance.

Figure 3: Recommended EmOC facilities, number of “fully functioning” EmOC facilities and number of facilities missing only 1 signal function according to type of facility in Ethiopia and Malawi

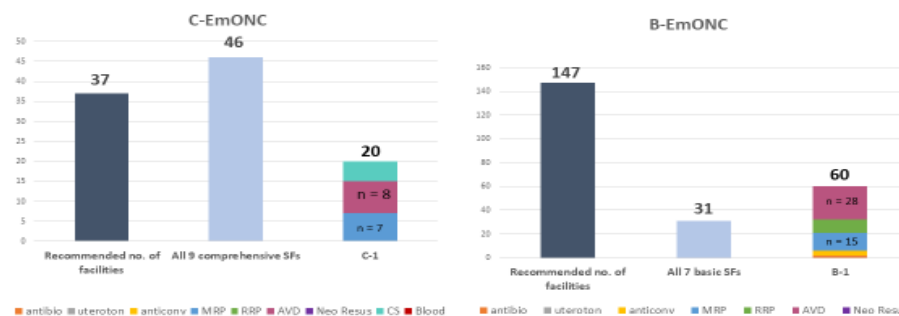
Ethiopia 2016

hospitals = 316; non-hospitals = 3488



Malawi 2020

hospitals=98; non-hospitals=384



- Arguments to increase 5 facilities to a higher number also exist: Institutional delivery rates are much higher today than 25 years ago and nearly all governments support a policy that all births take place in healthcare facilities with skilled health personnel. As institutional birth rates approach 100% more facilities may be needed in some countries, but the questions are what levels of care are needed and where should women give birth? Should all women deliver in EmOC facilities? Should we redefine BEmOC that is more achievable (proposing a minimum caseload for BEmOC and a less demanding array of signal functions)? Or, a first-level BEmOC and a second-level BEmOC? Should we recommend additional CEmOC facilities as service delivery redesign proposes? Or should we be thinking about a health system where women deliver where they want and determine a benchmark that reflects the women and newborns that develop complications? The bypassing literature by and large shows us that women prefer high quality birthing sites; it is equally clear that facility childbirth does not necessarily translate into high quality care.

- *Current guidance includes no criteria for caseload or staffing:* The current classification criteria of an EmOC facility rests entirely on the performance of the signal functions at two levels of care. Critics have noted that the 2009 *Handbook* does not specify facility capacity (number of births that should be managed at each level) or the appropriate staffing at the different levels of care [10]. Unpublished assessment data suggest that we can provide guidance around the minimum caseload (volume of births) needed to provide all 6 basic maternal signal functions. In Figure 4 we see that, on average, it takes a median of 53 deliveries per month for non-hospitals to perform all 6 BEmOC maternal signal functions (over a 3-month period). This is a relatively high bar for LMICs given that so many facility births take place in non-hospitals with fewer than 600 births per year (see Figure 5).

Figure 4: Median caseload by number of signal functions performed among selected countries

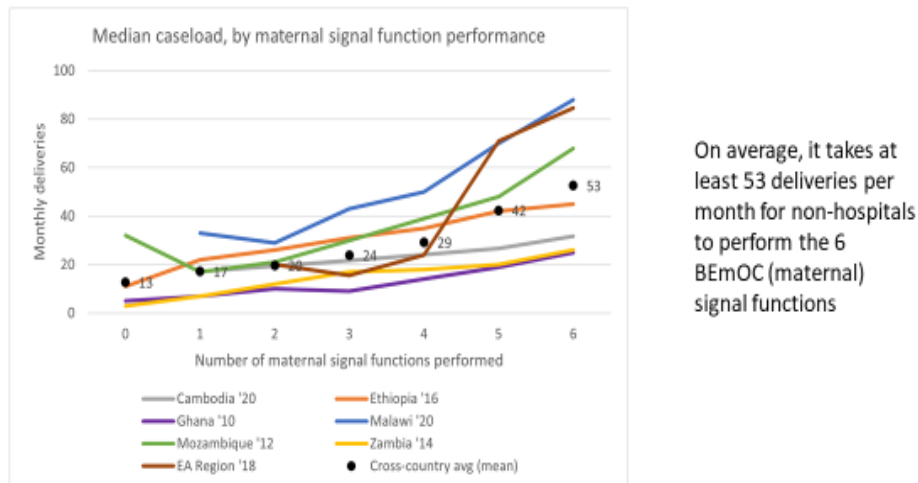
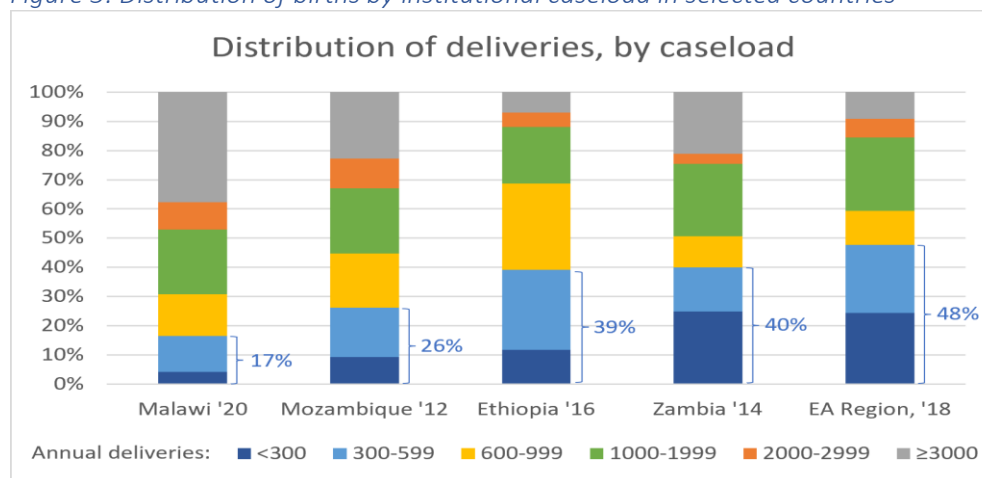


Figure 5: Distribution of births by institutional caseload in selected countries

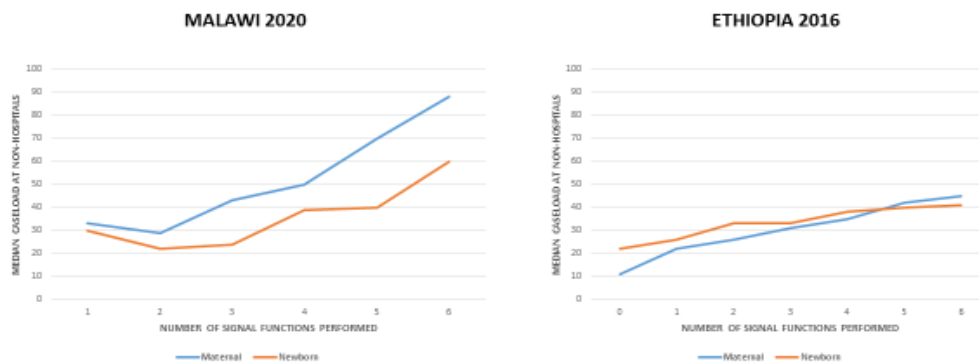


- *Does caseload align with both maternal signal functions and newborn signal functions?* Figure 6 below looks at 6 proposed newborn signal functions (resuscitation, antibiotics for pPROM and for neonatal sepsis, KMC, ARVs and alternative feeding) and how they track with the 6 maternal signal functions. It appears that in Malawi a higher caseload is required for the maternal signal functions

(median of 88) than for the newborn signal functions (median of 60), while in Ethiopia the two sets track closely and with lower caseloads than Malawi.

Figure 6: Comparison in caseloads according to the number of maternal and proposed newborn signal functions provided at non-hospitals in Malawi 2020 and Ethiopia 2016

Comparison between maternal SF caseload and newborn SF caseload among non-hospitals



- *Accuracy of reporting on the performance of signal functions:* Social desirability, reporting and recall biases are likely to play a role in the validity and reliability of signal function reporting, especially where frequent monitoring of signal functions takes place and pressure to report positive results to authorities or donors is high. Generally, data collectors in EmONC assessments interview the matrons-in-charge of a maternity to ask if the signal functions were performed in the last 3 months. In theory, data collectors verify recent performance in the registers or patient records. Data collectors are also trained to review the modules on site prior to departure to look for inconsistencies in responses. For example, if facility staff reported no vacuum extractor or forceps and yet elsewhere in the questioning process they reported that assisted vaginal birth had been conducted in the previous 3 months, interviewers are asked to resolve what appeared to be inconsistent. We know that a myriad of potential inconsistencies exists. Placing the onus on interviewers pressured to finish their work and move on to another facility is bound to lead to errors (a valid critique of all large facility surveys and the potential for interviewer and respondent fatigue). On the other hand, certain signal functions are more likely to be accurately recorded than others such as removal of retained products. Many facilities maintain separate logbooks or registers just for treatment of complications of abortion. Other signal functions such as assisted vaginal birth or removal of retained placenta may suffer from under-reporting because providers fail to document their work – anecdotally, these two signal functions in particular are thought to be under-reported. It is also possible that many of these inconsistencies can be cross-checked at the time of analysis.

As health information systems improve, planners will rely increasingly on HMIS/DHIS2 service statistics, which will enable more rapid access to data. In a verification exercise that compared HMIS data to the data collected in the 2016 Ethiopia EmONC assessment, 2/3 of the 2,425 facilities assessed were within 10% of the births reported in the HMIS (considered “good”) and ½ were within 5% (“very good”). Results were similar for cesarean deliveries. The authors concluded that HMIS data should be used more for research and policy decisions, especially for the absolute number of services [18].

Generic lessons learned from using the indicator

- The EmOC availability indicator is usually measured with cross-sectional health facility assessments, particularly EmOC assessments or rapid EmOC assessments; funding permitted, these have been conducted every 5 to 10 years. Since 2009, more than 50 countries have documented their EmOC availability at least once. However, given the heavy cost of full scale EmOC assessments, other health facility assessments such as the DHS Program's Service Provision Assessment (SPA) have harmonized their data collection instruments to include the capture of the signal functions, key to the calculation of the EmOC availability indicator. By 2017, however, only 21 of the 83 'Countdown countries' (25%) reported EmOC availability data in the Countdown report, some of which reported old data [1]. Thus, countries must search for cost-efficient strategies for collecting the data needed for this indicator. Integration into the DHIS2 is by far the best solution.
- The performance of signal functions and the EmOC status of a facility can vary from one quarter to the next for legitimate reasons. Key personnel can be transferred; stock outs or supply chain failures can occur under the best of circumstances; and caseloads can drop because of a disease outbreak. This raises the question of frequency of measuring facility EmOC status. If the data are available through the DHIS2 and they are updated routinely, frequency of reclassification can be determined on a quarterly or rolling basis. The frequency of EmOC status measurement should be dictated by need. If a sub-national manager wants to monitor how well the EmOC network is working and to identify location-specific problems, more frequent measurement might be warranted. But if stakeholders are conducting a facility prioritization process or carrying out a budgeting/planning task, measuring signal function performance may only be required once a year. Stakeholders should determine their own process.
- What recall period should we use for defining performance of the signal functions: 3, 6, or 12 months? Experience with the indicator shows us that reports are modestly higher for 6 or 12 month periods than they are for 3 months but recall is probably better at 3 months [17]. Concern for skilled health professionals' competence and confidence is another reason for using 3 months. If providers rarely perform a procedure such as AVB, it makes sense that they may lack the confidence and competence to do so. The recall period is not a very controversial issue because it is easy to ask about performance at multiple periods, for example, both 3 months and 12 months.
- Stratification of the availability indicator is as important as the single national figure; recommended stratifiers include sub-national level (region, province, state, etc.), managing authority, type of facility, EmOC designation and rural/urban location. Comparing actual performance of signal functions with facility designation can be particularly revealing, perhaps especially for hospitals assumed to perform at a high level.

Brief description of UNFPA's EmONC implementation and monitoring approach & lessons learned

Since 2010, UNFPA has been developing an approach to support the implementation of EmONC. This approach gained momentum in 2014 with funding from the Maternal and Newborn Health Thematic Fund and has been implemented in Burundi, Benin, Chad, Cote d'Ivoire, DRC, Guinea, Madagascar, Togo, Senegal, Timor Leste and Sudan. It is also used by the ministries of health in Burkina Faso and Congo.

The approach has 3 basic steps that enables stakeholders at every level of the health system to become agents of change [11]:

1. The development of a network of CEmONC and BEmONC facilities;
2. Proactive and regular monitoring of the RMNH services provided in these EmONC facilities;
3. Effective support to the staff working at these facilities to maximize their opportunities to innovate and address problems related to organizing services and improving quality of care.

Step 1 is the direct result of having observed how often governments assume that all hospitals should deliver CEmONC services and all health centers should provide BEmONC services; this exceeds by far the international benchmark of 5 EmONC facilities per 500,000 population. In an effort to encourage governments to strategically prioritize which facilities should function as BEmONC and CEmONC, the concept of an EmONC network emerged as a way of focusing on a limited number of facilities to be supported and monitored in environments that chronically suffer from a scarcity of financial and human resources and from high burdens of mortality and morbidity while keeping a good coverage of the population within 1h or 2h travel time. See Table 1 (columns below 1-3).

The prioritization process begins with a national workshop for national and sub-national political stakeholders, MNH decision makers from the Ministry of Health and partners, armed with baseline information from a health facility assessment – an EmONC assessment or rapid assessment. Several major aspects are considered when defining the EmONC network:

- Size or coverage of the network: this takes into consideration the benchmark of 5 EmONC facilities per 500,000 where at least one was a CEmONC facility as a basis for planning at subnational level (region/province). The distribution of the EmONC facilities is key to facility selection in order to maximize access to services. EmONC facility network, referral linkages between facilities and from home to facilities are also taken into consideration as is travel time. In fact, with GIS capacity, planning is facilitated by estimating the proportion of the population that is within 1 or 2 hours of an EmONC facility. With this capability, the need for the original benchmark is in question and an equitably distributed network based on travel time can be planned.
- Service utilization and capacity of the network: this takes into account the capacity to be open 24/7, which is usually limited by the number of staff, particularly midwives; the extent to which facilities already provided MNH services and emergency care; the caseload or volume of births, which is usually a determining factor of the number of midwives and nurses on staff. See the Implementation Manual for a chart on how gaps in human resources were taken into account [11].
- Capacity of the HMIS: the routine production of information is essential for managing the MNH program.

Step 2 is routine monitoring that embraces the HMIS for its potential sustainability. A one-page front and back paper format has been designed for providers and support teams to collect data, analyze and interpret results in their facilities on a quarterly basis. EmONC indicators are generated in all monitored networks. In Senegal, quarterly results and EmONC indicators have been introduced into the DHIS2. The indicators are used for program management at facility, district, regional and national scale.

Currently, the monitoring data are collected exclusively for the EmONC network, which by definition is made up of most hospitals and a selection of health centers. In Senegal, for example, this includes 46 designated CEmONC facilities and 96 designated BEmONC; these 142 facilities cover 92% of the population within a 2-hour travel time to one of these designated facilities. EmONC availability is then discussed in a very innovative way: how many quarters should be considered to upgrade the classification of a facility as a functioning EmONC facility?

Since 2016, UNFPA built into the monitoring form multiple cross-checks that expand the definition of whether a facility functions as an EmONC facility; “expanded availability” extends beyond the performance of the signal functions. The added information and cross-checks produce an “all or nothing” composite indicator that includes: 1) performance of the signal function; 2) whether key equipment is functioning and available and no stock outs for drugs/commodities were experienced in the last 3 months; 3) if the number of skilled staff meets the national accepted standard**; and 4) whether a complication requiring each signal function was reported in the register (confirming the plausibility that the signal function was performed).

An analysis using this more discriminatory composite measure from 16 countries shows that for most countries, the reported EmOC availability (based on the 2009 *Handbook* guidance) used by the Ministries of Health overestimates availability by 21 percentage points on average. See Table 1 (column 5).

Planning how to improve geographical access and human resources

At each workshop, participants used physical accessibility maps and travel scenarios specific to each subnational area to optimize equity in geographic access to EmONC facilities and to focus the deployment of their resources on the selected number of EmONC health facilities to make them function 24h/7d. They identified the EmONC health facilities using the 2009 Handbook’s population benchmark as a maximum reference target in the short/medium term (3-5 years planning cycle) and objective criteria such as the distribution of the population; the capacity of population to move and its different modes of transport (travel scenarios are defined for each region); and health facility attributes.

The results of this revision of the EmONC facility network is summarized in Table 1. Most countries reduced the number of designated/planned EmONC facilities, sometimes far below the proposed ceiling of 5 EmONC facilities per 500,000 population while maintaining good coverage of the population within 1h or 2h travel time. Across these nine countries, the number of designated EmOC facilities corresponds on average to 84% of the number recommended by the UN 2009 population benchmark. The average proportion of the population able to access the closest designated EmOC health facility within 2 hours travel time is 82%.

Human resources

While working on the staffing issue in EmONC health facilities with FIGO, UNFPA encouraged high burden countries to set up a national standard for 24/7 service delivery by answering 2 questions:

1. What is the minimum number of skilled health personnel needed (and affordable) in EmONC facilities?
2. What is the maximum number of births a skilled health worker can attend to ensure quality of care (regarding her/his tasks) and avoid burnout?

The outcome of their experience in designated BEmONC facilities is to aim at having at least 3 midwives on staff (1 per 8-hour shift) and to consider the workload in busy maternity units. Some countries began with fewer but have managed to achieve around the clock midwifery coverage.

Table 1: Number of EmONC health facilities recommended by the 2009 Handbook's benchmark (for population and births), number of designated EmONC health facilities (before and after prioritization by MoH) and percent of designated facilities that are fully functioning (expanded definition) in nine countries in sub-Saharan Africa

Country (date of the prioritization process for EmONC network)	Minimum number of EmONC health facilities recommended (5 EmONC facilities per 500,000 population*)	Minimum number of EmONC health facilities recommended (5 EmONC facilities per 20,000 live births**)	Number of designated EmONC health facilities by the MoH (before the prioritization process)	Number of designated EmONC health facilities by the MoH (after the prioritization process)	Expanded definition of EmONC Availability (used by the 9 countries after the prioritization process based on EmONC Assessment or monitoring data)
Benin (2018)	107	103	387	112 (105% of the pop.benchmark)	10% (11/112)
Burundi (2017)	113	105	400	112 (99% of the pop.benchmark)	5% (6/112)
Chad (2019)	158	165	545	109 (69% of the pop.benchmark)	6% (6/109)
Côte d'Ivoire (2019)	231	227	657	207 (90% of the pop.benchmark)	2% (5/207)
Guinea (2017)	118	109	446	105 (89% of the pop.benchmark)	17% (18/105)
Madagascar (2019)	221	218	499	173 (78% of the pop.benchmark)	14% (25/173)
Senegal (2018)	157	135	562	142 (90% of the pop.benchmark)	19% (27/142)
Sudan (2018)	396	333	690	158 (40% of the pop.benchmark)	43% (68/158)
Togo (2018)	74	65	109	73 (97% of the pop.benchmark)	26% (19/73)

*using official country population data

Lessons learned from UNFPA's monitoring approach

The expanded availability indicator addresses some shortcomings in a way that is suited to the realities of the countries in which UNFPA has worked (primarily francophone West Africa). Their process highlights adaptations by countries to certain principles of the EmONC framework as well as some departures. A list of the main innovations follows:

- The EmONC network configuration is loosely based on the ratio of 5 to 500,000 population, but 5 is considered a maximum target for the design of the national EmONC network for the next 4-5 years (most countries are far from reaching this target). The selection of the designated CEmONC and BEmONC facilities is determined to balance 1) a realistic number of designated EmONC facilities that can be made to function 24h/7d based on available resources, with 2) ensuring that the population can access an EmONC facility within 1h or 2h travel time (considered good coverage).
- Rather than be guided solely by the benchmark of 5 to 500,000, access to EmONC within 1 or 2 hours travel time provides increased objectivity to achieving equitable geographical distribution, while keeping in mind the gaps in signal functions and other characteristics of health facilities. The number of designated EmONC facilities is based on how many are needed to achieve broad (~90%) population coverage. Generally, this number is smaller than the traditional benchmark and when necessary, the coverage goal has been set at 80% rather than 90%.
- A related departure from the original framework is to consider the 5 per 500,000 benchmark (or any revision for a new benchmark) to be considered a “maximum” rather than a “minimum” in order to discourage countries from being overly ambitious (and spreading their resources so thinly that they achieve little or no results in EmONC facility upgrading) while being sensitive to the reality that health systems are dynamic and new EmONC facilities can and should be added to the network in the future program cycles.
- Integral to their implementation model is a robust monitoring system administered exclusively among the designated facilities in the network. Monitoring is quarterly, paper-based (one 2-sided page) and has been successfully integrated with the DHIS2 in some countries; Senegal is at the forefront with this national electronic monitoring system. Availability is thus defined as the percentage of designated EmOC facilities that are fully functioning.
- UNFPA has introduced new pre-requisites to the expanded definition of a functional EmONC facility. The standard definition has been to measure functionality by the performance of all the signal functions appropriate to its level of care in a 3-month reference period. UNFPA's expanded definition takes several important facility characteristics into account all at the same time. They are:
 - All signal functions were reportedly performed.
 - To confirm that each signal function was performed, the person completing the monitoring form must have evidence that in the 3-month period at least one complication had been recorded in maternity logbooks or patient notes that would have required the signal function to be performed.
 - Equipment must be functional and available and no stock-outs of key drugs or supplies occurred during the 3-month period.
 - The facility must have the number of midwives according to national norms (e.g. at least 1 per shift).

All pre-requisites must be assessed and met for the facility to be described as a functional EmONC facility. Their experience in multiple countries indicates that the approach used in the 2009 *Handbook* (based solely on performance of signal functions) overestimated availability on average by 21 percentage points compared to UNFPA's more rigorous approach (performance of signal functions plus all pre-requisites). In the case of Malawi 2020, for example, 42% availability of EmONC was reduced to 22% (only 14 basic EmONC and 21 comprehensive EmONC were classified as fully functioning) [4]. This methodology was proposed to ensure that EmONC availability is based on objective criteria as a step to improving the measurement of care received by women.

Going forward – thoughts and recommendations

- We will have to decide whether to adopt 20,000 births as the reference group or continue to use a population of 500,000 for a revised EmONC availability benchmark. Benchmarks are likely to change as the revised set of EmONC signal functions and levels of care are defined.
- We think it is important to maintain the assessment of availability based on a benchmark of “x” number of facilities per 500,000 population/ 20,000 births. Governments benefit from having a benchmark for planning how many EmOC facilities they need. Furthermore, the ratio should be somewhat aspirational.
- As a check on that benchmark, we also recommend adding a new indicator that will measure the geographical distribution of EmONC similar to EPMM's target 4: “proportion of the population covered by EmONC health facilities within 2 hours of travel time.” However, we suggest providing a range of travel time that includes one hour as well as 30 minutes and greater specificity regarding the beginning and end destinations for travel time [to be determined]. We also recognize that GIS data and the ability to analyze travel time and population coverage are not readily available in many high mortality countries.
- If program managers suspect that signal function performance is over-reported or under-reported, stand-alone monitoring processes, data quality improvement initiatives and supervision efforts could focus on the validation of reporting by cross-checking with registers and patient notes. This should be implemented as a constructive process. For example, assessment questionnaires or monitoring forms can be modified to include dates on which signal functions were last performed.
- A national process to select which facilities should provide EmONC (i.e., EmONC designation) is strongly encouraged. Caseload is critical for selection of potential BEmONC facilities (assuming we maintain a level of care called BEmONC). The evidence suggests that facilities that attend fewer than 600 births a year are not likely to perform the 6 basic maternal signal functions. One option in the re-visioning process is to incorporate a lower level of care into the framework that addresses smaller volume facilities (a “first level BEmONC”?).
- The revised EmONC framework should maintain core elements: levels of care defined by maternal and newborn signal functions that reflect clinical interventions to reduce maternal and newborn deaths and stillbirths. Non-clinical interventions or interventions that all women and newborns should receive will be addressed in the framework as readiness components. These items should be included in the DHIS2 for sustainable and efficient monitoring.

- EmONC availability defined simply by signal function performance does not specify the solution. Therefore, we propose a set of sub-indicators that will inform the implementation process with corrective actions as well as identify system-wide issues or more localized problems. We recommend beginning with signal function performance, supplemented with readiness to perform the signal functions (to be determined but may include general facility readiness, performance of routine services that all pregnant women and newborns should receive, whether the number and mix of human resources is adequate to provide 24/7 services, and whether “hardware items and software” are available). These factors contribute to what makes a facility well-functioning at the EmONC level and they should be analyzed independently and if desired, analyzed in a transparent cascade manner.
- Proposed definitions for better communication among ourselves:
 - o Readiness = describes necessary preconditions for delivering high quality care (TBD: what components should be included)
 - o Performance = refers to the signal functions having been done / executed at least once in a specified time period (TBD: measurement by report or by reporting plus written evidence in registers or patient notes)
 - o Functional/functioning/fully functioning/well-functioning (exact term TBD) = describes a facility that has performed all the signal functions in an environment with adequate readiness

What remains to be formally decided is how we determine EmONC status – by signal function performance or by functionality – for the purpose of calculating the remaining indicators in the set.

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