



AVERTING MATERNAL DEATH AND DISABILITY

Measuring progress towards the MDG for maternal health: Including a measure of the health system's capacity to treat obstetric complications

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Abstract

Objective: This paper argues for an additional indicator for measuring progress of the Millennium Development Goal for maternal health—the availability of emergency obstetric care. *Methods:* MDG monitoring will be based on two indicators: the maternal mortality ratio and the proportion of births attended by skilled personnel. Strengths and weaknesses of a third indicator are discussed. *Results:* The availability of EmOC measures the capacity of the health system to respond to direct obstetric complications. Benefits to using this additional indicator are its usefulness in determining an adequate distribution of services and showing management at all levels what life-saving interventions are not being provided, and stimulate thought as to why. It can reflect programmatic changes over a relatively short period of time and data requirements are not onerous. *Conclusion:* A measure of strength of the health system is important since many interventions depend on the health system for their implementation.

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1. Introduction

The Millennium Development Goals (MDGs) were established in 2000 to focus the efforts of governments and development organizations to improve the health, education and well-being of people in the most impoverished countries of the world. One of the eight Millennium Development Goals addresses the public health and social problem of maternal mortality, defined as the death of a woman during pregnancy, childbirth or in the postpartum period. The target of the goal is to reduce by three-quarters the maternal mortality ratio between 1990 and 2015.

Two indicators have been chosen to measure progress towards attaining this target: the maternal mortality ratio (MMR) and the proportion of births attended by skilled health personnel. Much has been written regarding the difficulties inherent in measuring the MMR [1,2]. Maternal deaths are difficult to identify and are routinely underreported in vital registration systems due to the underreporting of deaths and the misclassification of the cause of death. Survey techniques developed to estimate MMR in countries with weak vital registration systems (which includes most countries with a high MMR) are costly and subject to wide confidence intervals and imprecise estimates. These techniques average experience over a period of time and provide a retrospective estimate between 3 and 12 years before the survey [1]. Thus, survey estimates are inappropriate for measuring change over short periods of time. Although WHO, UNICEF and UNFPA have developed modeling estimates of the MMR every 5 years beginning in 1990, the authors warn against using these estimates to analyze trends due to the wide confidence intervals and modifications in the methods used at different time periods [1]. Even these estimates are not available until several years later. Thus, it will be difficult to measure in 2015 the extent to which countries met the MDG target of maternal mortality reduction using MMR estimates.

The proportion of births attended by skilled health personnel, sometimes abbreviated as “skilled attendant at delivery”, is considered easier to measure and data are available in low-income countries where surveys are carried out every 5 years or so, such as the Demographic and Health Surveys, Reproductive Health Surveys, PAPCHILD and the MICS Surveys (multiple indicator cluster surveys) sponsored by UNICEF. Although international standards of the skills required of skilled attendants have been set by the Safe Motherhood Inter-Agency Working Group and international organizations, what constitutes “skilled” has not

been universally accepted [3–5]. Furthermore, surveys measure women’s reports of the presence of a professional attendant and not their skill level. Finally, the definition of “attended” and who is considered a professional are not always straightforward. How many people attended the birth and when in the birthing process an attendant actually participated are other subtleties often unaccounted for and which contribute to the potential for incorrect identification [6].

Several recent initiatives have begun to systematically address the nuances of improving the measurement of the skill levels of birth attendants [7–9] and their reports confirm a wide range of competencies that fall under the rubric of “skilled attendant”. They also show that the most highly trained individuals are not always the most highly skilled at attending births.

Skilled attendant at delivery correlates with estimated mortality, although this correlation loses much of its strength when data from countries with a low MMR (such as the United States and European countries) are excluded or when the skilled attendant variable is stratified by type of provider—physician vs. midwives [10]. The inverse relationship between mortality and “attended by a physician” is strong but is weaker when attendants are midwives. Since most physicians attend deliveries in hospitals, this correlation is likely to be measuring skilled attendant and the enabling environment of a hospital where most if not all emergencies can be treated. An “enabling environment” is defined by adequate supplies and equipment, functional infrastructure, supportive regulations and policies, and communication and referral mechanisms to reach a higher level of care [11].

Although intuitively appealing, it is not clear whether moderate increases in births attended by skilled attendants alone will result in decreases in maternal mortality. Maternal mortality could remain high in a country with a large cadre of providers trained to assist women with normal delivery. If the attendants are unable to treat obstetric complications that arise (either from a lack of training or lack of an enabling environment), or they are unable to refer women with complications to a level where they will receive adequate care in a timely way, their impact on maternal mortality may be minimal.

Freedman et al. discussed the utility of the two indicators chosen to measure a reduction in maternal mortality in the first background report of the Millennium Task Force for Child Health and Maternal Health [12]. As the authors report, “an ideal indicator will perform two functions well: (1) it will vary with the outcome of interest and so

serve well as a proxy measurement of change, and (2) it will be causally related to the outcome of interest, so that it can serve as a guide to policy and program, and as an accountability tool...” Neither indicator performs both functions equally well; the MMR is the outcome of interest, but it is a poor guide to policy or program since it tells us nothing about what interventions are needed, only the extent to which they are needed. The Task Force recommended that the two indicators be supplemented with a measure that captures the development of the health system over time. Without such a measure, “the push to meet the skilled attendant indicator is likely to have distorting policy effects that can jeopardize the very efforts it is intended to promote”. In practice, what is counted is often what gets done and where the resources go. A policy strongly guided by increasing skilled attendants in isolation may result in semi-skilled professionals and neglect the back up system critical for treating obstetric and newborn complications.

This paper builds on our experience with an indicator that has been called “availability, coverage or density” of emergency obstetric care (EmOC) and argues that by complementing the two existing indicators, it should be added as a third to measure progress towards reducing maternal mortality. We do this by addressing the rationale behind this particular indicator and examining its strengths and limitations.

2. Rationale for a new indicator: availability of EmOC

In countries where government has embraced the challenge of the MDGs, the majority of maternal deaths are due to direct obstetric causes such as postpartum hemorrhage, sepsis, hypertensive disorders, prolonged and obstructed labor, and complications of abortion, although this is changing where the prevalence of HIV is high [13,14]. An estimated 15% of women will experience a direct, obstetric complication during pregnancy, delivery or the postpartum period [15]. Because obstetric complications can arise suddenly, even during or after an otherwise healthy pregnancy or delivery, emergency intervention is needed to prevent a woman from dying. For the most part, the interventions are facility based. Many can be performed in maternities and health centers staffed by skilled personnel such as midwives (e.g. parenteral antibiotics or oxytocics). Other services depend on the availability of an operat-

ing theater to perform a cesarean delivery or on the blood supply for transfusion. Whether women deliver in homes, hospitals or maternity centers, with skilled or semi-skilled attendants, some percentage will need specialized obstetric care in order for maternal mortality to decline [16,17].

3. The proposed indicator

The indicator of EmOC availability is defined as the number of facilities that provide basic and comprehensive EmOC for every 500,000 population [15]. A population of this size should have access to four basic facilities and one comprehensive facility as a minimum. A facility qualifies as functionally basic if six specific life-saving interventions have been performed in the 3 months prior to the assessment. They are parenteral antibiotics, oxytocics, anticonvulsants, manual removal of retained placenta, removal of retained products and assisted vaginal delivery (forceps or vacuum extraction). A functionally comprehensive facility provides these six signal functions as well as cesarean delivery and blood transfusion. This list clearly does not exhaust all life-saving procedures but is a short list designed for monitoring.

An earlier version of this indicator was described in terms of “every 20,000 annual births in the population” instead of 500,000 inhabitants, but population has been preferred since so much of health planning is done in relation to population [18]. Another early version of the indicator was “the number of facilities providing essential obstetric services divided by a population of 500,000”, the latter was proposed by a WHO Technical Working Group that convened to develop indicators to monitor maternal health [19] before the concepts of basic and comprehensive obstetric care were articulated. It was probably at this meeting that the 500,000 was chosen. The ratio of facilities to a population of 500,000 may be somewhat arbitrary, but it should be considered a minimum, as should the ratio of one comprehensive to four basic facilities.

This indicator is often used in conjunction with five other indicators that are referred to as the “UN process indicators for emergency obstetric care” [15]. Together, they tell us if there are enough facilities providing life-saving procedures, how many women are using the facilities, if women with complications are using the facilities, how many critical life-saving procedures are performed and if the quality of care is adequate. These indicators have been used in more than 40

countries as part of a needs assessment in emergency obstetric care or for monitoring the progress of maternal mortality reduction in the Program Averting Maternal Death and Disability (AMDD) of Columbia University. Recently, where trend data are available, this set of indicators has been used to estimate the number of maternal deaths averted [20]. Since the Millennium Development Goal for maternal health already has two indicators, only the first indicator of the UN set is recommended for inclusion.

4. Strengths of the EmOC availability indicator

Like the percentage of births attended by skilled personnel, the link to maternal mortality is inferred. It indicates the capacity of the health system to respond to obstetric and newborn emergencies and informs us if facilities have provided life-saving services in recent months. Its strength lies in its usefulness to guide policy and program and as an accountability tool. It can be used to assess availability at multiple levels: from the national level of the entire health system, to regional or subregional levels, down to the individual facility.

The indicator is a useful tool for governments and policy makers to assist in planning, budget allocation and capital investments. At the national or subnational level, government can assess the strength of the health system by looking at the amount of EmOC facilities, examining the geographical distribution of basic and comprehensive facilities, mindful that access to services is an equity issue. Are there enough services? Are they located where the people are? Are they disproportionately in urban areas? (All of these questions are also critical for pediatric care and general medical practice.) The mapping of EmOC facilities can lead to decisions about which facilities would benefit from upgrading to achieve the optimal location and distribution of facilities to serve the population. Findings from EmOC assessments globally show a consistent lack of basic EmOC facilities, especially in rural areas, but usually the minimum recommended number of comprehensive facilities is available [21].

Often systemic service provision bottlenecks can be identified by analyzing the missing signal functions that are required to construct this indicator. This can lead to policy reviews on such topics as:

1. Training curricula that limit who can be trained to perform the signal functions and

ancillary functions such as anesthesia, which can produce or exacerbate a human resources shortage,

2. Inefficient procurement and distribution systems,
3. Supervisory channels that lack support,
4. Blood banking regulations and blood supply shortages, and
5. The appropriate level of the health system to use magnesium sulfate or assisted vaginal delivery.

Field experience with this indicator has led to thoughtful discussions, actual changes in policies, and recognition and positive reinforcement of pragmatic and innovative training policies. In Peru, midwives have been trained to perform manual vacuum aspiration, usually the domain of physicians [22]. In Bangladesh, modifications in the distribution system of supplies and equipment reduced the time to delivery from 10 months to 2 [23]. In Nicaragua, health centers treated virtually no women with obstetric complications but referred them all to the nearest hospital. Now that health centers have emergency drugs and staff with the skills to treat complications, the referral rates to comprehensive facilities in project areas have declined as much as 70% [24].

Before this indicator was ever conceptualized, institutions took what some consider exceptional steps to address the availability of EmOC; today, they are seen as policy models that promote greater access and equity of services and that have strengthened the health system's capacity in underserved areas. The scarcity of specialist anesthesiologists in India led the Emmanuel Hospital Association to train nurse anesthetists to provide anesthesia in obstetric and laparoscopic surgery and in Mozambique the Ministry of Health promoted the training of surgical technicians to perform cesarean deliveries in rural hospitals [25–27].

At the district level, an understanding of which of the eight signal functions are chronically missing and why can direct planners and management to the interventions that are needed to upgrade existing facilities. Is it training, better logistics systems for supplies and equipment, revising staffing patterns or patient flow/volume? In Uganda, the results of an EmOC needs assessment guided priority setting for how the “common basket funds” would be utilized nationwide to fill the gaps in the availability of signal functions [28].

At the individual facility level, knowing which life-saving procedures are provided and which are

not can also alert management to problems. The missing signal function may flag problems such as frequent drug stock outs, broken equipment, insufficient training, poor supervision or a weak information system [29]. In Mozambique monitoring, the EmOC status of facilities every 6 months led to a change in training practices. Despite the upgrading efforts to train staff, distribute supplies, drugs and equipment, some facilities still were not functioning fully. Probing revealed that the recently trained staff had received minimal hands-on experience because the training group had been too large. This led to an immediate reduction in the size of training groups

and staff became more confident at performing new skills [30].

Another critical feature of this indicator is its ability to monitor changes over relatively short periods of time. Field programs that focused on upgrading existing facilities have increased their EmOC availability between two- and four-fold generally in 3 years [21]. Fig. 1 illustrates the monitoring of availability of EmOC in three projects in Sofala, Mozambique, Ayacucho, Peru and Rajasthan, India as part of the AMDD Program [31–33]. The recommended minimum levels of basic and comprehensive obstetric care in these project areas were:

	Mozambique	Peru	Rajasthan
Population	1.5 million	527,000	13.4 million
Recommended minimum number	12 basic+3 comprehensive	4 basic+1 comprehensive	104 basic+26 comprehensive
Change as % of minimum coverage (see Fig. 1)	33% to 107%	48% to >100%	34% to 64%

In some facilities where this indicator has been used for several years, it is possible to see a facility go back and forth between one where all the signal functions are performed in a given time period—6 months or a year—and one where only some of the functions are performed. This happens most frequently where patient volume is not high and some of the less frequent complications such as retained placenta or eclampsia are not seen. If facility staff also record why these fluctuations occur, the use of this indicator can help management monitor patient flow and volume.

We also advocate for the inclusion of the indicator on availability of EmOC because of its measurability; the required data are not difficult

to collect, even in countries with relatively weak health information systems. Teams can be deployed to all or samples of facilities in a short period of time and at relatively low cost to determine the EmOC status of their sample (several national scale assessments of EmOC undertaken by AMDD partners cost approximately \$40,000, with a range from \$11,500 to \$51,000). These data can be gathered at intervals of 1 to 3 years to monitor change in availability. A less costly option would require facilities to monitor their own performance and EmOC status on a regular quarterly or semiannual basis, making these data available to inform ongoing system management. The results of the data are easy to interpret, as long as teams understand the impor-

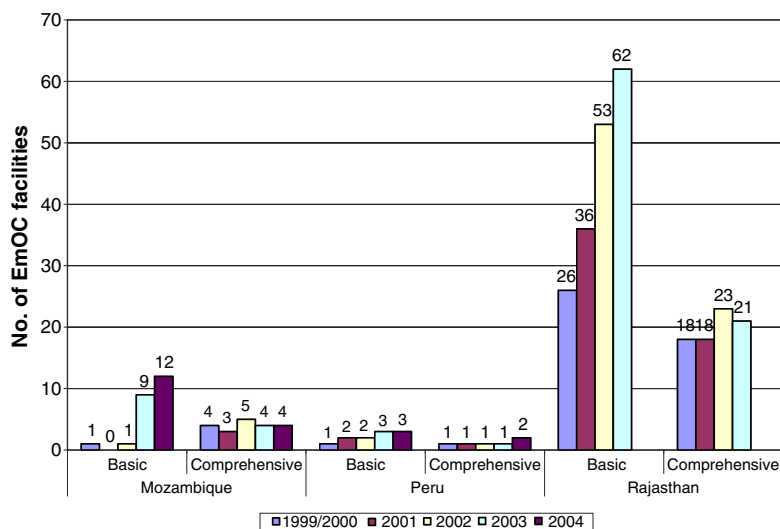


Figure 1 Upgraded EmOC facilities by project and year.

tance of documenting current functioning, and not theoretical functioning.

Because the EmOC availability indicator is relatively easy to measure, it lends itself to serving as a mechanism with which interested civic groups or multi-sector committees can hold local governments accountable to the people they should serve. With this indicator, society can “ensure that decision-makers take the steps that will actually have impact on the ultimate goal” [12]. They can discuss and monitor priority actions such as specific investments in training, staffing, supervision, management, rehabilitation and upgrading.

5. Limitations of the indicator

The EmOC availability indicator has been criticized for its “unforgiving nature” [34]. The concern is that the beneficial services provided in facilities that have some but not all six of the basic EmOC signal functions, i.e., those facilities that would be designated non-EmOC facilities, are discounted implicitly in this indicator. Although the availability indicator was designed to prioritize the full range of signal functions that treat the five leading direct causes of maternal mortality, when used by decision-makers the information on non-EmOC facilities is equally valuable.

A second concern is the lack of an “institutional home” for this indicator, which implies that a mechanism to collect the indicator on a regular basis in a large number of countries is missing. While it is true that most of the information to date on EmOC availability has been supported directly or indirectly by AMDD, other groups have begun to gain experience in operationalizing the indicator. One is the Service Provision Assessment (SPA) module of the Demographic and Health Surveys; EmOC signal functions were added to the Kenya SPA in 2004 and could be included in new surveys in the future [35]. The Service Availability Mapping tool within WHO is another possible institutional home for this indicator [36]. The technical and operational merits of the indicator make it reasonable to assume that it could be easily incorporated into existing global data collection efforts given demand by national governments and political will from the international community.

Like the indicator for skilled birth attendant, the availability of EmOC is a process indicator that does not fulfill all the parameters of an ideal indicator. The coverage data currently available suffer from a

selection bias, i.e., we do not have many data points from countries with a low maternal mortality ratio. But with the data at hand the relationship between availability of EmOC and maternal mortality appears to be inversely correlated, but not significant. The availability indicator is more distal than skilled attendant since the latter explicitly describes utilization.

There is little evidence to show that the ratio of one comprehensive facility and four basic facilities is better or worse than two comprehensive facilities and three basic facilities. However, two comprehensive facilities in an area are likely to mean greater access than a single facility. Thus, we could recommend that the one-to-four ratio remain fluid, but that one or more facilities be comprehensive.

The same argument used against the validity of the skilled attendant indicator can also be applied to the indicator for the availability of EmOC. We do not really know how skilled the birth attendants or the EmOC providers are. All providers of EmOC should be skilled birth attendants and proficient at the upper end of the continuum of skill level. But we know only that providers are performing certain procedures. We assume that performance has meant training and that the training has been adequate. Quality of services is best measured with other indicators.

6. Discussion

In summary, the availability of EmOC indicator is a measure of:

1. Adequacy and sufficiency of the number of facilities providing specific life-saving treatments and procedures at different levels of the health system;
2. The geographical distribution of these facilities and equity of access; and
3. An enabling environment (drugs, equipment, infrastructure and personnel).

As a tool to guide policy and program, it can be used for budget allocations, to identify and address deficiencies, and for monitoring and evaluation. Not only does the indicator describe the capacity and strength of the health system to handle newborn and obstetric emergencies, to some extent it also informs decision-makers where to intervene.

The skilled birth attendant indicator provides a measure of utilization and coverage of a range of maternity care services, both within and outside of

health facilities. Since availability of skilled attendants and emergency obstetric care are recognized as two essential strategies to reducing maternal mortality [4], having both indicators reinforces the complementarity and linkages between the two strategies. The inclusion of an indicator of EmOC availability would have the effect of orienting policy towards critical aspects of the health system that need to function properly, in addition to the attention on training, deployment and retention of skilled birth attendants.

The health systems of most low-income countries are fragmented and weak and cannot deliver the volume and quality of services that are needed [37]. If the system inadequately addresses obstetric services, it is likely that it does an equally poor job of providing the curative or preventative measures needed for integrated management of childhood illness (IMCI), immunizations, prevention and treatment for malaria, HIV or tuberculosis—all of which are targeted by the MDGs. How well many of these interventions work depends upon the strength of the health system responsible for their implementation [38]. Thus, the reduction of maternal mortality is not unique in this respect. Although the availability of EmOC would not be a proxy for the health system and its ability to deliver, for example, IMCI or Tb services, at least one MDG indicator would reflect this important component to improving the health status of women and infants.

The indicators for the MDGs will be used to judge the extent of our success at linking outcomes to a long-term investment in the health system—the infrastructure composed of human, physical and administrative elements—that ensures a continuum of care [12]. With good measures that tell countries how they are performing and more importantly, what needs to be done, we will make headway towards seizing the opportunity of the millennium to reduce maternal and newborn mortality.

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