This annotated bibliography is the result of an evidence review of more than 160 articles on essential obstetrical and newborn care (EONC) topics. After an extensive technical review, the 22 most relevant articles are abstracted in Section 1 to highlight the key findings and implications for public health programming. Other useful articles are listed as references in Section 2.

To guide the use of this document, the following table identifies where to find key evidence:

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This annotated bibliography was prepared by Jessica Alderman, MCHIP consultant.
SECTION 1: ABSTRACTS

A. Statistics

**Full citation:** McClure EM, Goldenberg RL, Bann CM. Maternal mortality, stillbirth and measures of obstetric care in developing and developed countries. *Int J Gynaecol Obstet.* 2007; 96(2):139–46.

**Background:** Countries with the highest maternal mortality also have the highest stillbirth rates, with 99% of cases occurring in developing countries. As noted through observation, stillbirths and maternal mortality occur as a result of similar causes; however, a numeric relationship does not exist to describe this association.

**Objectives/Aims:** This study aimed to understand the relationship among maternal mortality, stillbirths and three measures of obstetrical care (cesarean section rates, skilled delivery attendance and four or more antenatal visits) to determine the underlying causes of maternal health outcomes.

**Key Points:** McClure et al. originally hypothesized that the percentage of skilled attendance and the percentage of cesarean section deliveries would correlate closely with both stillbirth and maternal mortality rates, and that the relationship of each measure of care to both outcomes would be similar. To this end, national surveys from the World Health Organization (WHO) from 188 developed and developing countries were analyzed retrospectively.

Of these measures, skilled attendance at delivery and cesarean section rate were the most strongly related to health outcomes. Analysis showed a strong correlation among cesarean section rates and both maternal mortality and stillbirth rates. The sharpest decline occurred where cesarean rates increased from 0% to 10%. Skilled delivery attendance was not associated with significant reductions in maternal mortality or stillbirth rates until coverage rates of about 40% were achieved. A decline in maternal deaths was also associated with the percentage of women seeking more than four antenatal visits if coverage rates were above 55%.

McClure et al. postulate that skilled delivery coverage above 50% correlates strongly with greater treatment resources. These data suggest that increasing skill levels of care during delivery, and the ability to provide safe cesarean sections to a level of about 10%, will be an effective strategy to substantially reduce both maternal mortality and stillbirth.

**Key Figure:**

![Graph showing relationship between cesarean sections and maternal mortality](image-url)
Background: While maternal mortality is generally considered a global indicator of development, little is known about the more than 9 million women who survive obstetric complications. More information is needed to determine how obstetric complications can affect health and other long-term economic outcomes.

Objectives/Aims: The aim of this study was to determine how severe obstetric complications in Burkina Faso affect a range of health, social and economic indicators in the first year postpartum.

Key Points: A prospective cohort study was conducted to examine health outcomes during the year after pregnancy in seven rural and urban hospitals in Burkina Faso. Researchers compared the health experiences of women whose pregnancies ended in severe obstetric complications with two unmatched controls of women with an uncomplicated childbirth. Medical examinations were performed at six and 12 months after delivery to identify fever, incontinence, fistula, urinary infections, prolapse, anemia, hypertension, low body-mass index and orthopedic problems.

Results showed that women with severe obstetric complications were poorer and less educated than women with an uncomplicated delivery. They also reported higher likelihood of maternal mortality, infant mortality and a more frequent rate of negative physical health outcomes and negative impacts on their lives. Women with severe obstetric complications also were more likely to report a sign or symptom of illness at six to 12 months, more likely to report seeing a health care worker, and were at a higher risk for mental health problems, such as depression and anxiety, at three months.

Women with severe obstetric complications should be considered an at-risk group, and resources need to be devoted both before and after discharge to ensure that they receive adequate care.
B. Advocacy


**Background:** Emergency obstetric care (EmOC) and delivery by a skilled birth attendant are two strategies promoted for the reduction of maternal mortality in developing countries. While both of these strategies have many overlapping features, there are key differences in the timing and phasing of policy implementation in resource-poor settings.

**Objectives/Aims:** The aim of this paper was to provide evidence to support the prioritization of EmOC as a maternal health strategy to influence policy-making decisions.

"Initial efforts, when mortality was high, focused on availability of services, achieved through an expanding network of appropriately staffed rural health facilities that were able to treat and refer emergencies. Once basic availability was in place, efforts focused first on utilization and then on quality improvement."

**Key Points:** A systematic review was conducted to evaluate population-based EmOC interventions with a maternal mortality outcome variable. The article provides examples of reductions in maternal mortality in a multitude of different studies involving EmOC.

An experimental study in Matlab, Bangladesh, showed decreased rates of maternal mortality in areas with improved EmOC facilities despite the lack of trained midwives. Similarly, in rural Guinea-Bissau, distance to a health facility was the strongest predictor of maternal mortality. An observational study in rural India with a program to raise awareness about EmOC facilities produced low-cost (US$0.83 per woman of childbearing age) reductions in maternal mortality below half of the average rate for India.

While access is important, studies in the Dominican Republic and Mali, demonstrated that poor quality of EmOC care also contributed to high rates of maternal mortality. Maternal mortality trends from as far back as 150 years show declining rates with an increasing ability to treat obstetric complications. Ecological studies also concluded that services involving treatment of EmOC and access to safe abortion were more highly correlated with maternal mortality than with antenatal care, delivery care or skilled birth attendance. Maternal mortality was also inversely related to the amount of “EmOC met need” across different countries. In conclusion, while there is little evidence of one strategy in absence of another, it is critical that dilapidated health systems with high maternal mortality rates be given priority attention.

**Key Figure:**

[Graph showing correlation between maternal mortality ratio (AMR) and met need for EmOC (12 countries).]
C. Policy


Background: While it is generally known that the vast majority of maternal and neonatal deaths can be prevented with access to skilled attendance, essential EmOC and newborn care, there is still debate surrounding the use of these strategies, the evidence-base and how they are measured.

Objectives/ Aims: The aim of this study was to show the effectiveness and use of the individual components of essential EmOC, and how it is measured to support its critical inclusion in the implementation of policies and programs.

Key Points: Kongnyuy et al. examine quasi-experimental studies, observational studies and ecological studies to explain the components of EmOC. Currently, there are six process indicators, which measure the availability, utilization and quality of EmOC.

Availability is measured through the number BEmOC and CEmOC facilities and their geographic location among the sub-population. Utilization is defined as the proportion of births in an essential obstetric care (EOC) facility (target 15%), the met-need for EOC (target 100%) and the population-based cesarean rate. Quality is measured by the case fatality rate—the proportion of women with direct obstetric complications who are admitted to EOC facilities and die. Access to EOC is limited by countries that have not prioritized maternal health and lack both program and human resources policies. Barriers of service provisions to EOC facilities and barriers to women seeking care further compromise access to EOC. Improving the availability of and access to EOC requires a functioning health system.

Supportive policies included: free or subsidized services and transport; an upgrading of infrastructure and equipment; and an effective referral system. Human resources planning, management and capacity are necessary for training and retaining high-quality health professionals. Strengthening existing health information systems and reducing financial barriers also improve access to EmOC. Improving quality for both the providers and patients is essential to the delivery of services. Evidence supports the use of obstetric audits, delivery standards and guidelines, near-miss review, and continued in-service training to monitor quality of care. Finally, health-seeking behavior needs to be improved through health education, community mobilization and a supportive environment for men’s participation. The authors call on reducing barriers to improved EmOC as a critical matter of urgency.

Key Figure:

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Definition</th>
<th>Numerator</th>
<th>Denominator</th>
<th>Recommended level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Availability of EOC</td>
<td>Number of BEmOC and CEmOC facilities per 100,000 population</td>
<td>Number of BEmOC and CEmOC facilities</td>
<td>Total population</td>
<td>At least 4 BEmOC and 1 CEmOC facility per 100,000 people</td>
</tr>
<tr>
<td>Geographical distribution of EOC facilities</td>
<td>Ratio of EOC facilities to population for each subnational geographical area</td>
<td>Number of BEmOC and CEmOC facilities</td>
<td>Subnational population</td>
<td>100% of all subnational areas have the minimum acceptable number of BEmOC and CEmOC facilities</td>
</tr>
<tr>
<td>Proportion of births delivering in EOC facilities</td>
<td>Proportion of expected births delivering in EOC facilities</td>
<td>Number of deliveries in EOC facilities</td>
<td>Total number of expected births</td>
<td>100%</td>
</tr>
<tr>
<td>Met need for EOC</td>
<td>Proportion of pregnant women expected to have complications who are admitted for treatment in EOC facilities</td>
<td>Number of women with direct obstetric complications admitted in EOC facilities</td>
<td>Total number of expected complications</td>
<td>5-15%</td>
</tr>
<tr>
<td>Population-based Cesarean Section Rate</td>
<td>Cesarean delivers as a proportion of all births</td>
<td>Number of Cesarean sections</td>
<td>Total number of expected births</td>
<td>5-15%</td>
</tr>
<tr>
<td>Case Fatality Rate</td>
<td>Proportion of women with direct obstetric complications admitted to EOC facilities who die</td>
<td>Number of maternal deaths from direct obstetric complications in EOC facilities</td>
<td>Total number of direct obstetric complications admitted in EOC facilities</td>
<td>5%</td>
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</table>
Background: Successful strategies for reducing maternal mortality are often complicated by the diversity of individual country contexts and multiple determinants of maternal health. Despite this intricacy, there are a few uniform policy decisions that can be applied across nations to reduce maternal mortality.

Objectives/Aims: The aim of this report is to inform stakeholders at the country and international levels about effective key strategies for reducing maternal mortality.

Key Points: This literature review examined strategies for reducing maternal mortality in either systematic reviews or program evaluations from published sources or in the gray literature. The authors found that there were no successful interventions that worked in isolation and recommend that solutions to reduce maternal mortality must be implemented through a package, distributed through multiple means, with the highest likelihood of coverage. Programs will be the most sustainable if they are accepted by both the government and the population. Of the different target populations and methods of implementation, the authors recommend the prioritization of a facility-based intrapartum care strategy. This strategy targets all intrapartum women and focuses on BEmOC to maintain normality during pregnancy, as well as the maintenance of CEmOC facilities to be prepared for emergencies in pregnancy. The authors affirmed that the “close-to-client” model for both essential and emergency obstetric care were the most cost-effective to implement.

The authors argued that the effectiveness of strategies focusing on skilled home attendants were limited by the lack of transport to EmOC facilities, which can compromise the community’s confidence in the midwife. Strategies focusing on community health workers are not a realistic solution because the workers do not have the training to deliver the majority of elements of an intervention package. Although the authors do not recommend prioritizing these approaches, they maintain their importance in their implementation as complementary strategies. Complementary strategies directed on antenatal care, postpartum care, family planning and safe abortion are effective at reaching other target groups such as pregnant women or those not desiring pregnancy.

The authors propose that the choice to deliver in a health facility should be the main priority and investing in alternative strategies should be viewed as an opportunity cost for the health center intrapartum care strategy.
An evaluation was conducted of Family Care International’s Skilled Care Initiative in Burkina Faso between 2002 and 2006 revealing a poor maternal health outcome. This paper provides a critical view of the policies implemented during the program to learn for future policy decisions.

Objectives/Aims:
The aim of this paper was to review the policy implications from the program evaluation to identify more effective strategies for future strategies.

Key Points:
Evaluation results demonstrated a consistent and unacceptably high level of maternal mortality. Although the proportion of skilled attendants increased in the project areas, the number of cesarean sections barely outnumbered maternal deaths, indicating a supply deficiency in EmOC. Despite the launch of the Safe Motherhood Initiative in 1987, rates of maternal mortality have stalled with much of the attention given to health care systems and policymakers. However, situations with good policies, strong political will and commitment to reducing maternal mortality have been shown to transcend failures in health systems.

Success in achieving the Millennium Development Goal for maternal health will require a combination of the right policies, implemented at the right time—specifically the availability of CEmOC and skilled attendance at birth. While both Asia and Latin America have been successful in these efforts, sub-Saharan Africa needs to focus more attention on professional human resources, user fees and access to maternity care.

Five key strategies are recommended:
1. Countries with shortages in health care professionals need to direct resources into large-scale training and accreditation as opposed to relying on non-professional health workers.
2. To address geographic barriers, efforts should be focused less on outreach and more on providing 24-hour coverage of BEmOC within a five kilometer distance.
3. Improving access also requires that referral-level services should plan and be prepared for performing emergency procedures.
4. Utilization of services can be increased through social mobilization programs.
5. Implementing user fees has been shown to widen the poverty gap. Policies should abolish user fees to prevent the poorest mothers from accessing care.

Most importantly, these measures should be adapted to local resource situations and implemented as a long-term package, as there is no “quick fix” solution.
Background: Given unacceptably high rate of maternal mortality, there has been a greater interest in reforming maternal health measurement methods and identifying evidence-based approaches strategies for improving safe motherhood.

Objectives/Aims: The aim of this study was to show the value in systematically describing safe motherhood programs to examine gaps in the planning and provision of care. “A systematic overview of safe motherhood programs in a country can help to set priorities and aid in decision-making for the allocation of resources toward contextually relevant strategies to curtail maternal mortality and severe morbidity.”

Key Points: This study was conducted in Burkina Faso, where several recent health care reforms have taken place including antenatal exemptions, decentralization and the use of a sector-wide approach. The study investigated safe motherhood public health programs using a cross-sectional survey. Investigators were given a list of implementing organizations from the Ministry of Health and used a structured questionnaire to interview 20 program managers throughout the country.

The results of the study showed that all of the 20 programs invested in training and community-based interventions. While most of the programs had a BEmOC component and improved transportation to a health facility, few programs developed strategies to improve blood availability for transfusions. Only two of the 20 programs targeted the availability of emergency surgery and were able to target all of the “skilled attendance at delivery” components. None of the programs promoted magnesium sulfate nor the use of misoprostol. In terms of monitoring and evaluation, only two programs collected baseline data. While all 20 of the program managers stated that their programs were being delivered as planned, most did not consider how these outcomes would be measured. Geographic mapping demonstrated that rural districts were receiving less coverage by nongovernmental organization (NGO) safe motherhood programs than other districts.

These key findings, the gaps in the delivery of BEmOC and CEmOC components, uneven distribution, and weak monitoring and evaluation measures, were presented to key policymakers and stakeholders in Burkina Faso. As a result of the study, the government was able to confirm the findings and direct program efforts to the implementation of a nationwide strategy to increase the availability of CEmOC. Thus by reviewing the program systematically and presenting the findings to key stakeholders, Hounton et al. were able to influence policy decisions.

Key Figure: [Image of the SAFE conceptual framework]
D. Training and Human Resources


Background: In a desire to meet the acute shortage of health professionals in low-resource settings, many countries have resulted to innovative strategies, one of which is the shifting and sharing of medical tasks. Concerns have been raised that the national policy to define the scope of practice for this cadre of professionals differs from the actual practice.

Objectives/Aims: The aim of this study was to clarify the EmOC signal functions each cadre was expected to provided and contrast these findings with the specific EmOC services performed by clinical staff.

“An equally important finding... is the underutilization of existing expertise within some cadres. In Tanzania, our finding that only half of the doctors and medical assistants surveyed are performing all nine signal functions despite being trained to do so requires further investigation to understand the barriers to optimal performance among these cadres.”

Key Points: This study was conducted in Malawi and Tanzania using a mixed method approach through key informant interviews and a cross-sectional survey. The scope of the work was defined as either seven BEmOC or nine CEmOC signal functions. If 80% or more of the districts and health care providers stated that they performed a specific signal function that the Ministry of Health expected, it was considered an alignment with national policy.

The results in Malawi showed a general alignment for higher skilled cadres with the expected national policy (doctors 82%, clinical officers 60%) to perform all nine CEmOC signal functions. However, lower cadres (registered nurses, midwives, nurse technicians and medical assistants) were performing fewer of the seven BEmOC signal functions than expected by national policy. This difference in practice was attributed to the recent decision to task-shift to lower cadres, which might have not yet filtered down to all the districts. This difference in assumption is especially dangerous for medical assistants who are now expected to perform all seven BEmOC signal functions when these skills are not currently incorporated with pre-service education.

Tanzania exhibited even more misalignment between national policy and actual performance. Overall, there was a lack of clarity between all levels of the health care system. While doctors and medical assistants were the only professionals expected to perform all nine CEmOC signal functions, less than half (43% and 49% respectively) actually performed all of the tasks. Among lower level cadres, there was better alignment between what the district level expected of providers and the expectation from national-level policies. Clinical officers were performing more than their expected functions, while registered nurse/midwives were performing less (14%). Specifically, there was a lot of confusion surrounding assisted vaginal delivery. Doctors and medical officers do not perform this function, while the lower cadres are not expected to perform this function.

The ineffective use of cadres to provide EmOC and the lack of clarity and alignment in the health care system could be contributing to low performance. When implementing task-shifting, a system-wide approach needs to be implemented to ensure the decision is thoroughly implemented.

**Background:** Health care professionals form the base of EmOC interventions and their productivity, availability and competence affects the performance of the health care system. The nature of the interaction between patients and providers makes human resources an important component of EmOC, but little is known about the role of human resources in providing high-quality services.

**Objectives/ Aims:** The aim of this literature review was to investigate the role of human resources in providing high-quality EmOC and understanding the gaps in performance.

"This review leads to three main conclusions:
1) Staff shortages are a major obstacle to providing good-quality EmOC;
2) Women are often dissatisfied with the care they receive during childbirth; and
3) The technical quality of EmOC has not been adequately studied."

**Key Points:** This literature review explored this role of human resources using a framework of: EmOC structure including human resources issues; human resources and EmOC process (including patients perceptions of quality of care); and results. It found three main results surrounding human resources relating to: staff shortages; patient dissatisfaction; and lack of information about the technical quality of EmOC.

Related to structure, the lack of material resources was the topic that emerged the most frequently as affecting the quality of EmOC delivery. Often key interventions, such as assisted vaginal delivery and the manual removal of the placenta, were not performed due to limited staff and equipment. The lack of availability of qualified staff often led to an increased workload on the providers and longer patient waiting times. Studies on professional competence demonstrated a gap between the provider’s knowledge and skill due to inadequate training methods, the unavailability of equipment and a lack of an opportunity to practice skills post-training. Incentives were not being utilized, and provider’s motivation was negatively impacted by working in remote rural areas and overcrowded work environments. Reports from Tanzania concluded that patients’ perceptions of quality and use of service are affected by lack of staffing of skilled professionals.

Related to process, the authors concluded, “Although evaluating staff skills independently of their working conditions is difficult, clinical audits by multidisciplinary teams seem appropriate to distinguish organizational dysfunctions from staff-related problems.” The review also explored patients view of the quality of EmOC. Women who used EmOC services were often dissatisfied with the care they received because of the poor interpersonal communication, intimidating clinical environment, excessive gynecological examinations and mistreatment by the staff. This dissatisfaction and perception of poor quality of EmOC causes women to seek hospital-based care only for emergencies.

Dogba and Fournier suggested that professional competence could be addressed by using a more skilled-based training approach, supported by regular clinical supervision. They also recommended focusing on deficiencies in organizational resources by strengthening staff managerial skills. Making equipment available, using clinical audits to evaluate staff, and revising the medical paradigm for more culturally sensitive situations could improve clinical aspects of delivery. To meet the preferences of the female patients, a greater emphasis needs to be placed on the training and retention of female staff in rural areas who are from a similar class and ethnic background.

Background: Maternal mortality in Ethiopia is highest in rural areas, which are inhabited by the most deprived populations, where the shortage of health care providers is the greatest. One solution to this crisis has been the task-shifting and training of non-physicians to provide CEmOC services to maximize available human resources.

Objectives/Aims: The aim of this study was to document the proportion of obstetric interventions conducted by non-physicians and compare the performance with that of physicians in the Tigray region of Ethiopia.

"Only four physicians performed emergency obstetric surgical procedures before task-shifting was implemented in Tigray, and the addition of 11 non-physicians is obviously making a difference in the quality of care."

Key Points: This retrospective study evaluated the records from 11 hospitals and two health centers in the Tigray region of Ethiopia.

Non-physician clinicians (NPCs) conducted 63% of 11,059 obstetric interventions and more cesarean deliveries, uterine evacuations and manual placental removals than physicians. The researchers calculated that NPCs performed 55.5% of the cesarean procedures with 63.9% of physicians performing elective cases and 59.9% of NPCs performing emergency cases. There was no association among the type of staff and the cesarean delivery outcome, post-operative hospital stay or mortality.

Tigray exceeds the United Nations ratio of facility to population benchmark with 13 CEmOC health care facilities in the region. With NPCs performing the majority of procedures, the evidence supports task-shifting as an effective method of increasing the availability, quality and equity of emergency services.

Key Figure:

<table>
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<th>Table 4</th>
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<tr>
<td>Length of hospital stay and maternal and fetal deaths among the women who underwent a cesarean delivery by type of staff who performed the procedure at the 13 CEmOC facilities in Tigray, Ethiopia, from January 1, 2006 through December 31, 2008.</td>
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<tr>
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<tr>
<td>Variable</td>
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<tr>
<td>Hospital stay, d</td>
</tr>
<tr>
<td>Maternal deaths</td>
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<tr>
<td>Fetal deaths</td>
</tr>
</tbody>
</table>

Abbreviation: NPC, nonphysician clinician.

a Values are given as mean ± SD or number (percentage) unless otherwise indicated.

b By the Fisher exact test.
E. Services and Quality of Care

<table>
<thead>
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<tbody>
<tr>
<td>Background:</td>
<td>There are eight(^1) key interventions to treat direct obstetric complications. While strategies of reducing maternal mortality are being implemented in different stages across nations, the availability of EmOC interventions at health facilities has yet to be explored.</td>
</tr>
<tr>
<td>Objectives/ Aims:</td>
<td>The aim of this study was to examine the availability of basic and comprehensive EmOC interventions provided in health facilities to determine the area with the greatest need for improvement.</td>
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<tr>
<td>Key Points:</td>
<td>This study considered 24 national-level needs assessments conducted in Asia, Africa and Latin America by the Averting Maternal Death and Disability Program. The results of the review demonstrated three key messages:</td>
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<tr>
<td></td>
<td>1. The availability of comprehensive EmOC facilities generally met the recommended minimum number per population in the least developed countries. While the comprehensive EmOC facilities are adequately available in number, there are concerns about the quality of care, equity of service delivery, geographic distribution and financial accessibility of these facilities. Many of these facilities are clustered in urban areas creating an even greater need for peripheral services in rural areas.</td>
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<tr>
<td></td>
<td>2. There is a consistent lack of available basic EmOC facilities in countries with both moderate and high maternal mortality. Many factors contribute to this limited availability, including government regulations and prioritization of resources, as well as the difficulties maintaining equipment and retaining qualified staff in rural locations.</td>
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<tr>
<td></td>
<td>3. Of the existing rural EmOC facilities, the majority were not performing all six necessary signal functions to qualify as a BEmOC facility. This lack of quality and availability of services conveys a lack of confidence in the system and leads women and their families to completely bypass these services.</td>
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<tr>
<td></td>
<td>4. Paxton et al. recommend prioritizing the upgrading potential BEmOC facilities by identifying, repairing and renovating essential equipment, conducting in-service training of staff, and providing both supportive supervision and improved management systems. Paxton et al. also recommend a goal of upgrading facilities at a ratio of four BEmOC facilities to every population of 500,000.</td>
</tr>
</tbody>
</table>

\(^1\) When newborn resuscitation is added, there are nine signal functions in the current definition. This article did not include newborn resuscitation in its review.

**Background:**
In the last decades, it is being increasingly recognized that the availability of high-quality EmOC services is essential in reducing maternal mortality. United Nations Process Indicators have been constituted to measure program baselines and are used to plan and revise national policies and implementation strategies.

**Objectives/Aims:**
The aim of this study was to establish a baseline measurement in EmOC availability, identify gaps in providing services, and make recommendations to governments in Kenya, Rwanda, Sudan and Uganda.

**Key Points:**
This study was conducted by reviewing clinical records, faculty observation, interviews of key staff and focus group discussions with participants. Results showed a large gap in the coverage of BEmOC services across all four countries. Most facilities were not able to perform assisted vaginal delivery and the removal of retained products. Facilities were clustered in urban areas, leaving inadequate coverage in rural areas. The case fatality rate was above the recommended 1% level in all surveyed countries indicating low quality of services. Rural areas lacked basic infrastructure including water, electricity, communication, a means of referring patients and poor security for female staff—which prevent the facility from functioning 24 hours. Health centers also lacked critical drugs and equipment that prevented staff from performing BEmOC signal functions. Vacuum-assisted deliveries and manual aspirations were recorded as the two most frequently missing services. Women who were surveyed identified cost and distance to be among the greatest barriers to seeking care. Women also suggested clinics needed to improve essential supplies and increase qualified staff along with improving the attitude of health providers.

The authors propose eight key recommendations to improve the quality and availability of 24-hour EmOC service:
1. Health centers need to be upgraded to provide BEmOC functions to shorten the distance between communities and services to improve access.
2. Improving the use of vacuum-assisted deliveries requires the review of national policies to delegate the function to mid-level providers with supervision and backup.
3. Health system development should be the focus, not a vertical approach.
4. The skills and competency of staff need to be upgraded and maintained through an environment with supportive supervision.
5. Health management information systems need to be improved and standardized.
6. Strengthening referral systems and informing the community about major obstetric danger signs can shorten first and second delays.
7. Process indicators should be measured regularly.
8. A team of motivated staff are essential for high-quality EmOC, which requires both financial and occupational incentives in hardship areas.

**Key Figure:**

<table>
<thead>
<tr>
<th>Table 2 Utilization of EmOC services</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Country</strong></td>
</tr>
<tr>
<td>Year of assessment</td>
</tr>
<tr>
<td>Areas assessed</td>
</tr>
<tr>
<td>Proportion of deliveries in EmOC facilities (%)</td>
</tr>
<tr>
<td>Proportion of obstetric complications treated (%)</td>
</tr>
<tr>
<td>Proportion of births by Cesarean section (%)</td>
</tr>
</tbody>
</table>
14 ANNOTATED BIBLIOGRAPHY | Essential Obstetric and Newborn Care


Background: In light of the high maternal mortality rate in five selected countries (Ethiopia, Rwanda, Tanzania, Tajikistan and Peru), CARE implemented a four-year program to improve the availability and quality of EmOC services. The program addressed barriers at both the health facilities and district health systems.

Objectives/Aims: The aim of this article was to describe the package of interventions implemented in the three African countries of Ethiopia, Rwanda and Tanzania.

Key Points: CARE first facilitated a baseline assessment of 10 project hospitals examining: functional capacity; equipment and drug availability; existence of policies and guidelines; technical competency; and management system capability. Results showed that the majority of facilities were not performing many of the six basic signal functions due to a lack of functioning operating room and poorly maintained facilities.

CARE used the Averting Maternal Death and Disability “Implementation Stages Framework” model to guide the project implementation in two stages of preparation and service delivery. The project focused on upgrading infrastructure and facilities by balancing material inputs with training and system strengthening. Each health center upgrade was locally tailored to the needs identified by facility staff to improve its overall function. On-the-job training was used for quality and performance improvement at hospitals. CARE worked with the government to develop standards of protocols, adapt training materials and data collection tools, and promote evidence-based practices. Hospital registries were revised, using the United Nations Process Indicators to track data. CARE conducted competency-based training for EmOC teams.

Results showed improvement in quality across all three countries—halving case fatality rates and increasing met EmOC need. In Tanzania, partnerships were greatly strengthened and achievements were attributed to local ownership of the project. In Rwanda, complications were better managed, facilities were more equipped to address complications, and hospital staff commitment to maternal health increased. In Ethiopia, external issues of distance and cost still remained a barrier. Kayongo et al. concluded that the multifaceted causes of maternal mortality need to be addressed by improving EmOC services. The best strategy is to use an integrated and comprehensive package of interventions and coordinate partnerships across all levels.

Key Figure:

"Teams oriented other hospital staff to EmOC, identifying problems, finding solutions and reinforcing changes in attitudes."

2 Excludes newborn resuscitation from this review.

Background: While reduction of maternal mortality has been a priority political agenda item in the past 20 years, the burden is still large in developing countries. Multiple methods have been employed to reduce this burden; however, little change has been observed.

Objectives/Aims: The objective of this study is to review the evidence, interventions and factors influencing the implementation of maternal health services in developing countries. "...no single magic bullet intervention exists for reduction of maternal mortality and that all interventional programs should be integrated in nature in order to bring significant changes."

Key Points: The authors conducted a systematic review of the literature compiling 58 articles, which included randomized controlled trials and quasi-experimental studies. Results demonstrated that 52–65% of programs employed training in EmOC, motivating care providers, and improving existing facilities, drugs and supplies. Interventions involving community-based education were implemented in 37% of the programs. Countrywide reduction of maternal mortality involved targeting high-burden rural regions, developing health facility accountability and removing financial barriers by providing community-based funds. Maternal mortality and EmOC service indicators were among the most frequently used to measure impacts of interventions.

The failure of implementation of a maternal health intervention was generally attributed to a deficit in leadership and management, resources and end-user relation barriers. Success in implementation was attributed to strong political commitment and the presence of enabling policies. The most successful programs established functioning maternal health systems focusing on the accessibility and utilization of services. These included access to improved facilities, equipment, drugs, referral system and skilled attendants. Health system responsiveness has a greater relationship to the maternal mortality ratio than all other factors including wealth.

The authors recommend that maternal health interventions should be integrated with a package but the individual components should be adjusted and varied according to the community’s need. Political will needs to be mobilized as leadership is a key change agent, and more proactive leaders are required to transform commitments into actions.

Background: After a needs assessment identified quality of care as one of the major barriers to reducing maternal mortality in Malawi, the government developed a road map to improve the quality of EmOC. To further address this problem, facility-based maternal death reviews and criterion-based clinical audits were introduced in three districts in the central region of Malawi.

Objectives/ Aims: The purpose of this study was to determine if audit and feedback could improve the availability, utilization and quality of EmOC.

Key Points: This observational study was conducted by comparing the availability, utilization and quality of EmOC services to the baseline results in 73 health facilities in three districts over two years, after audits and feedback were introduced. During the program intervention, workshops were conducted at each hospital and quality improvement teams were established to meet and review cases every time there was a maternal death.

While the number of CEmOC facilities was adequate in two districts and slightly below the minimum recommendation in the third district, there was only one functional BEmOC facility that provided all six3 signal functions. There was also uneven distribution of the facilities, which did not change throughout the course of the study, leaving rural areas with poor access. Although accessibility did not change, utilization improved, with an increase in institutional delivery and met need for EmOC. There were also improvements in quality with decreased rates of maternal mortality, facility-based mortality and case fatality.

Kongnyuy et al. note that audits and feedback were effective in improving quality in the hospitals; however, there are major barriers to availability and accessibility. Barriers such as distance to the facility, shortage of skilled health workers and affordability can affect the utilization of services. Kongnyuy et al. recommend that efforts need to be channeled to upgrading health clinics to BEmOC facilities to increase the availability and accessibility to skilled attendants. This is best accomplished through the training of staff and provision of equipment.

Key Figure:

![Figure 1 Case fatality decreased while Caesarean section rate did not change over 3 years.](image)

3 Newborn resuscitation as a signal function was not included in this review.

<table>
<thead>
<tr>
<th>Background:</th>
<th>After documentation of a high unmet need for EmOC services in Uganda, the government has taken measures to prioritize EmOC policies to reduce maternal death. This includes increasing access to EmOC, family planning and skilled attendance at delivery. To measure this countrywide scale-up of EmOC services, a baseline needs assessment was developed to measure signal functions of EmOC.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objectives/Aims:</td>
<td>The aim of this study is to highlight the health system factors from the needs assessment and emphasize priority on human resources and availability of EmOC.</td>
</tr>
<tr>
<td>Key Points:</td>
<td>The needs assessment was conducted in 87 hospitals, 107 CEmOC health centers and 259 BEmOC health centers in 54 districts across Uganda. Data were collected on: the number of health workers; EmOC signal functions; maternal deaths and complications; status of infrastructure; and the availability of essential drugs and equipment. Level III health centers are supposed to be able to provide BEmOC services while level IV health centers should provide CEmOC services. Results showed that only 3.1% of level III health centers were offering BEmOC services: 98.6% of health clinics had no running water and 97.8% lacked electricity. Most clinics had functioning laboratories, approved midwife positions and key drugs. Most level IV centers performed signal functions to qualify as a BEmOC facility (7.1%), but most failed to offer blood transfusions or cesarean sections to qualify as a CEmOC facility. Most of the hospitals surveyed were able to offer all CEmOC services. While almost half of maternal deaths took place in the hospital, the majority of complications were also treated in a hospital (58.9%), compared with level III (23.8%) and level IV (17.2%) facilities. The highest risk of maternal death was in level IV health facilities. The presence of a functioning operating theater and the availability of midwives, electricity and sulfadoxine-pyrimethamine offered protective effects on maternal death. Despite the resent construction of operating theaters in level IV health centers, the facilities do not have the staffing or the equipment to provide CEmOC services. Level III and IV centers are the most accessible to pregnant women and must be fully operational to reduce maternal mortality. With the highest case fatality among HIV-positive women, more effort needs to made to integrate voluntary counseling and testing with antenatal care. The high facility-based death rate of 671/100,000 also suggests a problem with the poor quality of services at health facilities. Mbonye et al. conclude by recommending a prioritization and allocation of resources to the development of infrastructure and human resources to improve the quality of care.</td>
</tr>
</tbody>
</table>

*Most (97.2%) health facilities expected to offer basic EmOC services were not able to do so at the time of the study.*
F. Access and Referrals


Background: Process evaluation is becoming a more common and effective tool to monitor progress in maternal health. Maternal mortality is one of the most popular measures of maternal health, but the data are very costly to obtain and often imprecise to measure access. While creating access to maternal health services is essential in reducing maternal mortality, there is little evidence linking maternal mortality reduction to specific programmatic inputs.

Objectives/ Aims: The purpose of this study was to examine the link among maternal mortality and indicators of access to obstetric care.

Key Points: This ecological study was conducted by evaluating data from two population-based studies (MAMOCWA and MOMA) in 18 sites among eight West African countries. Five indicators of access to EmOC were used to measure the percentage of women giving birth: with a skilled attendant; in any health facility; in a non-hospital health center; in a hospital that can perform surgery; or with a cesarean section.

Results showed a range in the Maternal Mortality Ratio (MMR) from 129 to 1,267 deaths per 100,000 live births in varying locations. Maternal mortality differed greatly between 628 deaths per 100,000 in rural areas and 241 deaths per 100,000 in urban settings. These rates are lower than those estimated by both WHO and UNICEF for 1995.

Access indicators showed a greater number of births in a health facility than births delivered by a skilled attendant—suggesting not all health facilities are adequately staffed. There was a sharp contrast in delivery between urban and rural areas. In urban areas, 83% of births took place in a health facility and 55% took place in a hospital. Only 11% of births in rural areas occurred in a hospital, and 80% of women delivered in their home. These data also show a close link among maternal mortality and levels of hospital use, skilled attendant use and the cesarean section rate. There was, however, no association between MMR and health center use, suggesting poor quality of care and the lack of ability to prevent maternal death.

Ronsmans et al. caution that the association between the lower MMR and hospital births should not be interpreted as a strategy to promote hospital births, but highlights that professional labeling is not a good proxy for competence or skill, and the enabling environment needs to be considered. Findings from this study suggest that even small increases in cesarean section rates below 5% can have a drastic effect on maternal mortality. Ronsmans et al. conclude that none of the examined indicators are good enough to be a proxy for maternal mortality as the variation in mortality remained unexplained. More research is needed to find a combination of indicators that can accurately measure improvements in maternal health.

Key Figure: 

- Figure 2: Scatter diagram of maternal mortality and the percentage of births in hospital.
- Figure 3: Scatter diagram of maternal mortality and the percentage of births with a Cesarean section.

Background: Increasing access to emergency and surgical care has been identified as a critical goal in improving health care systems. Whereas most of the literature focuses on the shortage of health care workers, this study examines facility infrastructure and training gaps. To meet the minimum access standards set by WHO, the capabilities of health care facilities need to be identified.

Objectives/Aims: The aim of this study is to examine the key barriers in the provision of access to emergency surgical care in sub-Saharan Africa.

Key Points: This observational study conducted by evaluating data from the Demographic and Health Survey examined a sample of 891 health facilities and hospitals across five sub-Saharan countries in Africa: Ghana, Kenya, Rwanda, Tanzania and Uganda. The authors evaluated basic physical infrastructure, equipment, medicine storage capability, infection control, education and the quality of the system.

Results of the study demonstrated that the majority of the health centers and many of the hospitals lack the basic infrastructure and capabilities to provide 24-hour emergency care. While many of the hospitals have a system to repair infrastructure, many did not have a competent staff to use the equipment at the facility. Similarly, many facilities had the capability to properly store medicines, but when observed, few facilities implemented the monitoring of the storage of medicines. There was a low proportion of hospitals with sufficient infection control, management and referral systems, and educational programs in place.

Hsia et al. recommended establishing a procurement process to ensure the availability of equipment. They also recommended creating a structure to support maintenance personnel and periodic maintenance costs. Infection control measures need to be established, and management systems should be improved to ensure health centers can track the progress of delivering care. Finally, continuing education should be a priority to increase both patient safety and the morale of rural providers. Hsia et al. proposed the creation of a basic facility and a surgical checklist to improve the delivery of care.

Key Figure:
**Background:**
As many women live in rural areas far from the availability of lifesaving care, distance becomes a giant obstacle to accessing high-quality health care. Pregnancy complications are unpredictable, and referral interventions attempt to address these problems.

**Objectives/Aims:**
The aim of this article was to review the literature on referral interventions involving the transfer of women with emergency obstetric complications to understand which components enable women to reach an EmOC facility.

“...studies using modeling techniques have predicted that maternal mortality will reach a threshold of less than 35% decline if access to emergency obstetric care is not provided, and that referral and transport strategies, alongside other interventions, could contribute to as much as an 80% reduction in maternal mortality.”

**Key Points:**
This study investigated 19 randomized control trials or quasi-experimental studies with a control group of rural settings of developing countries. Six organizational interventions educated women, community members and traditional birth attendants. Five studies generated emergency funds for transport. Seven studies examined structural interventions, which established maternity waiting homes. The rest of the studies looked at mixed interventions that involved both structural and organizational methods.

None of the studies demonstrated statistically significant reductions in maternal mortality. Four studies showed reductions in neonatal death and an increase in health services utilization; however, these interventions comprised multiple components and the specific effects from referrals are unclear. Upon a sub-group analysis, the authors found some evidence supporting maternity waiting homes as a method of reducing stillbirths.

As reducing maternal mortality is complex in its nature, the authors recommend interventions that continue to include referral. Greater efforts need to be made to monitor and evaluate specific referral components of interventions. Finally Hussein et al. recommend focusing future studies not on what works for referrals, but why certain interventions are successful.
G. Monitoring and Evaluation


Background: Started in 2000, Millennium Development Goal 5 attempts to reduce maternal mortality by three-quarters by the year 2015. The two indicators that have been chosen to measure the progress toward this target are the Maternal Mortality Ratio (MMR) and the proportion of births attended by skilled health personnel.

Objectives/Aims: The objective of this paper is to present an additional indicator to measure the availability of EmOC in respect to the maternal health Millennium Development Goal. “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%.”

Key Points: The authors acknowledge that maternal deaths are often costly and difficult to measure and identify due to under reporting and misclassification. The proportion of skilled attendance at birth is considered easier to measure due to wide spread coverage of the Demographic and Health Survey and other population studies; however, the significance of a “skilled” provider is not universally accepted. While most studies report attendance, the skill level of the providers is not clear. Increases in skilled attendance may not reduce maternal mortality due to the lack of training, inability to refer people or provide emergency obstetric care.

Bailey et al. recommend that an additional indicator is needed that will capture the development of the health system in reducing maternal mortality. They propose the use of an indicator to measure the availability or coverage density of EmOC. This indicator is defined as the number of facilities that provide basic and comprehensive EmOC for every 500,000 population. The recommend target is to have four basic facilities, performing six signal functions, and one comprehensive facility, performing eight signal functions, for a population of this size. This indicator would serve to measure the number of facilities providing lifesaving services and their geographical distribution, as well as the enabling environment around the institution.

This tool is useful for governments in planning policies, budgets and resource allocations. Using this indicator to map, EmOC facilities can demonstrate bottlenecks and where areas need improvement. Common use of this indicator can guide priorities for filling gaps in services, determine the lack of specific signal function performance, and alert management about breakdowns in equipment, education and communication systems. The indicator also allows changes to be monitored over a short period of time.

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4 Newborn resuscitation is not included as a signal function in this article.
Key Figure:

![Bar chart showing upgraded EmOC facilities by project and year.](image)

**Figure 1** Upgraded EmOC facilities by project and year.
The six EmOC United Nations Process Indicators have been used to monitor the progress of maternal health for the past decade. Two of the indicators measure the availability of EmOC, three measure the utilization of services and one addresses the quality of care.

Objectives/Aims: This paper examines the experience of using these process indicators and whether they are appropriate measures for maternal health.

"Despite these potential barriers, if the facility has a reasonable reputation for quality service, women with complications are more likely to seek those services. The EmOC status of a facility, thus, is affected not only by what drugs, supplies, equipment and staff are available, but the management of the facility so that women with emergencies seeking care at night are attended to, the quality of care is reasonable, and the cost, including informal costs, are not too great for the community being served."

Key Points: The review found all indicators to be appropriate measures of maternal health progress, but suggested some revisions for improvement. The first indicator of availability addresses the number of EmOC facilities per 500,000 population. Experience indicates that this measure should be revised to target at least five EmOC facilities with at least one comprehensive facility per 500,000 population. The proportion of births in facilities should include all facilities regardless of EmOC status.

The authors addressed concerns about the other five indicators and made suggestions to improve data collection techniques. The number of signal functions performed in each facility in the past three months should be counted and presented in a scale of 0–8. Treatment of non-complicated abortions should be analyzed separately from met-need of EmOC services and case fatality rate but retained for complicated abortion cases. Indicators can be further supplemented by information from audits and special studies. In areas where there is one or more indirect cause of maternal mortality, such as HIV/AIDS and malaria, the case fatality rate and number of cases treated should be calculated separately from the EmOC indicators. In more developed health care systems, data collection should prioritize complications treated as opposed to those referred, while referring facilities should not double-count these cases as met need.

Paxton et al. cautioned that these process indicators were developed to monitor operations and health systems research but are not precise enough for epidemiological research. While met need should not be assumed as an approximation of the Maternal Mortality Ratio, there was a strong correlation between the two in all facilities.

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5 Newborn resuscitation is not included as a signal function in this review.
H. Cost Effectiveness


Background: Maternal health has been provided more political attention with the creation of the Millennium Development Goals. However, there is still debate about devoting resources to maternal health interventions with limited country budgets.

Objectives/Aims: The aim of this study is to examine the economic argument to invest in maternal health services and demonstrate the relative cost effectiveness.

“A long-term research project in West Africa found that relatively small investments in obstetric services, typically through the renovation or upgrading of equipment and theatres in district hospitals and health centers, could have a significant impact on maternal mortality.”

Key Points: Reviewing the literature, Jowett discussed the consequences of unsafe motherhood and the determinants of maternal death. He also presented the positive externalities of investing in maternal health. The cost of reducing maternal mortality is estimated at US$1 per capita, and using the comprehensive Mother-Baby Package (MBP) developed by WHO, the maternal component is estimated at a cost of US$2 per capita. The greatest input costs are personnel (40%), annualized capital costs (15%) and drugs (11.8%). In low-income countries, antenatal care costs approximately 30% of the MBP and reduces maternal mortality by 26%, while essential obstetric services have the potential to reduce maternal mortality by 74% at only 24% of the MBP costs.

Investing in maternal health is important on many different levels as maternal mortality has a direct negative impact on the welfare of children, who are three to 10 times more likely to die within the first two years without a mother. Of the six most cost-effective interventions, family planning and antenatal care are considered the most cost effective. Access to primary health services could reduce maternal mortality from 450 to 350 per 100,000 live births. With the addition of referrals to high-quality health centers, the numbers could be reduced to 65 per 100,000 live births. There is a growing consensus that responding to appropriate complications is more effective than risk screening. A 10-year study also showed that small investments in upgrading obstetric services could have a significant impact on maternal mortality.

Jowett concluded by recommending the diverting of funds away from ineffective procedures and interventions, such as the provision of routine episiotomy or the targeting of traditional birth attendants. Spending should be increased on interventions targeting EOC, as well as the quality and quantity of that care as a cost-efficient and effective approach.

Key Figure:

Fig. 1. Maternal mortality: the impact of interventions.
SECTION 2: CITATIONS

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B. Advocacy


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E. Services and Quality of Care


**F. Access and Referrals**


**G. Monitoring and Evaluation**


H. Cost Effectiveness


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