Part III.D
Safe Motherhood

- Existence of a safe motherhood strategic or operational plan to promote access and/or quality of safe motherhood services
- Maternal Neonatal Program Index (MNPI)
- Number of facilities per 500,000 providing essential obstetric functions
- Percent of facilities that conduct case review/audits into maternal death/ near miss
- Percent of pregnant women attending antenatal clinics screened for syphilis
- Percent of women with obstetrical complications treated within two hours at a health facility
- Cesarean sections as a percent of all live births
- Case fatality rate (CFR) – all complications
- Percent of audience that know three primary warning/danger signs of obstetric complications
- Percent of women attended at least once during pregnancy for reasons related to the pregnancy
- Percent of women who were given or purchased malaria prophylaxis/treatment during their most recent pregnancy
- Percent of pregnant women who receive antihelminthic treatment during pregnancy
- Percent of births attended by skilled health personnel
- Percent of women attended during the postpartum period by skilled personnel
- Maternal mortality ratio (MMR)
- Met need for essential obstetric care (EOC)

Part III.D

Safe Motherhood

The inauguration of the Safe Motherhood Initiative in Kenya in 1987 marked the beginning of concerted international efforts to reduce maternal mortality. Since that time, reducing maternal mortality has continued to be the goal of many international health programs. International efforts aim to achieve a 75 percent reduction in maternal mortality ratios between 1990 and 2015 (WHO, 2001c).

Although safer motherhood has remained high on the political agenda, the scope of what constitutes safer motherhood has changed considerably over the past 13 years. A major factor has been the incorporation of a human rights approach into the definition of Safe Motherhood following the agenda set at the International Conference on Population and Development (ICPD). By defining maternal death as social injustice, programs for "Safer Motherhood" are able to invoke a much broader range of political, social, and economic initiatives than was previously possible (UNFPA et al., 1997).

Policies and strategies to achieve safe motherhood have also changed as knowledge and understanding about the determinants of maternal health have become clearer. Major new policy initiatives based on the lessons learned after the first decade were condensed into a series of ten action messages or "Priorities for the Next Decade" by an international panel of experts in Sri Lanka in 1997 (UNFPA et al., 1997). Two of these lessons warrant particular mention because of their subsequent role in redefining safe motherhood policy and strategy.

The first of these – that the difficulty of predicting complications means that "every pregnancy faces a risk" – has shifted the emphasis from targeting women "at risk" towards providing universal access to care. With the understanding that maternal survival is an issue of access to health infrastructure and timely emergency care, current program efforts have redirected towards providing all women with a basic "minimum package" of services. At the first-referral level, basic essential obstetric care (BEOC), should include services for a normal pregnancy as well as the early detection and management of complications. The provision of surgery and blood transfusion should be made available at the secondary level in comprehensive essential obstetric care (CEOC) facilities (UNICEF, WHO, and UNFPA, 1997).

The second lesson – that the strategy of training traditional birth attendants (TBAs) with limited midwifery skills has not reduced maternal mortality – underlies the current global initiative to increase the proportion of deliveries that take place with a skilled birth attendant (Berer and Ravindran, 2001; Graham and Bell, 2000).[1] The assumption behind this approach is that a skilled attendant (a doctor, midwife, or nurse with midwifery skills) with a higher level of training and expertise should be able to manage and refer pregnancy complications more effectively and hence should reduce maternal deaths. Because the majority of both maternal and newborn deaths occur between the onset of labor and the early postnatal period, ensuring the presence of a skilled attendant at birth is widely seen as the single most critical intervention for reducing both maternal and newborn mortality (Graham, 2001).

Over the past 13 years, many other new priorities and challenges have also emerged that need to be addressed under the safe motherhood umbrella. Foremost among these is the HIV/AIDS pandemic, which in some African countries affects up to 30 percent of antenatal patients and which urgently require major new interventions (Berer and Ravindran, 2001). Another major development is the increasing focus on newborn care. Awareness that relatively simple interventions both before and after birth may substantially reduce the estimated eight million perinatal and neonatal deaths has given rise to many more programs that target improving newborn survival. For further discussion of newborn care, see Part III.E.

[1] The term "skilled attendant" refers exclusively to people with midwifery skills (for example, doctors, midwives, nurses) who have been trained to proficiency in the skills necessary to manage normal deliveries and to diagnose or refer obstetric complications (WHO, 1999b.).

In 1992, WHO, UNICEF, UNFPA, and the MotherCare Project began to advocate using program-level indicators[2] to measure aspects of facility care, such as the quality of services, women's access to services, and women's utilization of those services. Program-level indicators have several advantages over population-based measures. They can be used for short term monitoring; they provide suitable information for local management decision making; and they can be derived from existing data at low cost. Several indicators suggested by these groups are included in this manual. Until recently, experience with using these indicators has been limited, but many countries are now currently carrying out needs assessments and program monitoring using these indicators. The number of publications describing the strength and limitations of the indicators is growing (Bailey et al., 2001; Pathak et al., 2001; Ronsmans et al., 1999)

Conceptual Model

Several different models or frameworks exist to help program managers and communities understand the determinants of maternal mortality (Campbell et al., 1997; McCarthy and Maine, 1992; Thaddeus and Maine, 1994; Koblinsky et al., 2000). The "Three Delays Model" identifies the points at which delays can occur in the management of obstetric complications at the community and facility level.

The first "delay" (the delay in deciding to seek care) may relate to a number of factors, including the lack of knowledge about obstetric danger signs, community perception of poor quality facility care, or the lack of health services availability which increases the opportunity costs and therefore reduces the likelihood of care seeking.

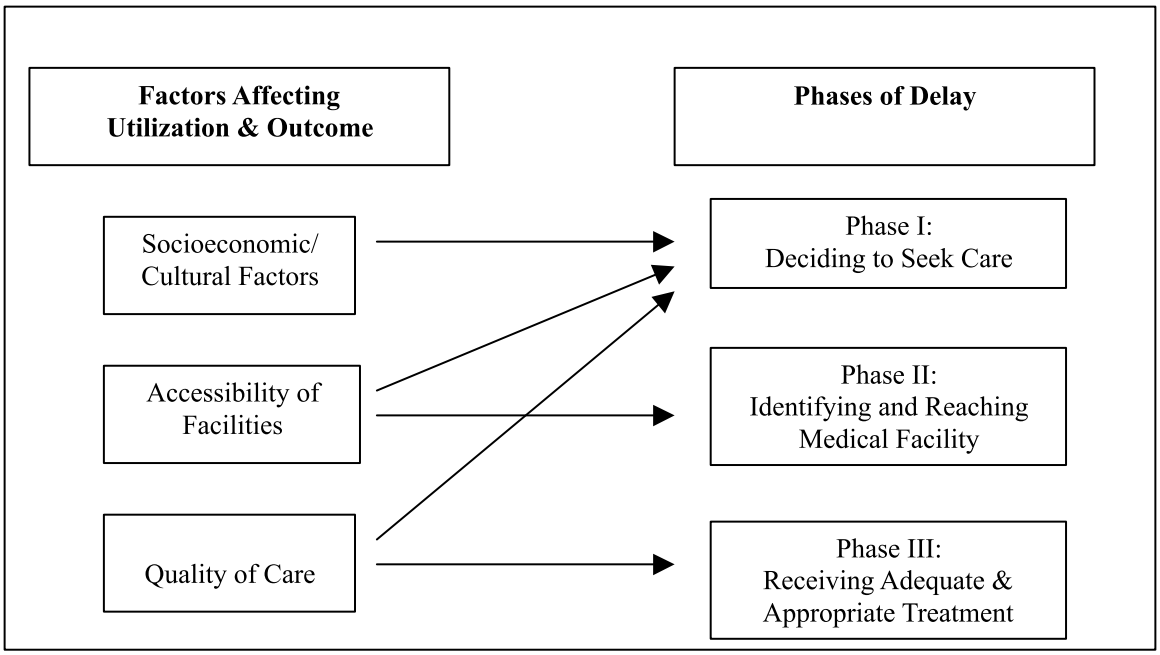
The second "delay" (the delay in identifying and reaching a medical facility) relates to the geographical proximity and accessibility of health services, and includes factors such as the availability of transportation.

The third "delay" (delay in receiving appropriate care at health facilities) is related to factors in the health facility, including the availability of staff, equipment, and resources as well as the quality and (in some cases) the cost of services.

Indicators for measuring aspects of each of these delays can be found in the following section as well as in other parts of the *Compendium*.

[2] Examples include met need and unmet need for obstetric care, the cesarean section rate, percentage of women with a trained assistant at delivery, and place of delivery (as measures of women's access to and utilization of services), and the case fatality rate and referral rate (for quality of care).

Figure III.D.1 The Three Delays Model



Source: Thaddeus and Maine, 1994

Methodological Challenges of Evaluating Maternal Health Interventions

In addition to the changes in the definition, policies, and strategies as well as the emergence of new public health problems that drive the need for an increasingly wide range of indicators, monitoring and evaluating safe motherhood programs pose a number of inherent methodological challenges. These include, but are not limited to, the following issues.

- **Maternal mortality is difficult to measure, and estimates of maternal mortality should not be used for monitoring purposes.**

Maternal mortality estimates are valuable for advocacy purposes because they directly measure progress towards the goal of reducing maternal mortality. Mortality estimates do, however, have a number of inherent methodological weaknesses that limit their use for monitoring purposes; they are costly, they do not explain the causes of maternal deaths, and they cannot detect short-term change (Graham, 2001).

Few developing countries have registration systems with sufficiently wide coverage to provide accurate national estimates of maternal mortality. Alternative approaches to deriving estimates, such as surveys and the sisterhood method, also have limitations in that the estimates are relatively imprecise and relate to periods several years before the survey. Even in countries where the maternal mortality is high, maternal deaths are rare events; therefore, surveys are very costly because of the need for large sample sizes to provide a statistically reliable estimate. The wide confidence limits on the estimate also make it very difficult, if not impossible, to assess whether change has occurred over time. For these reasons, maternal mortality estimates, if required, should be measured only infrequently (e.g., once a decade), and program-level indicators that measure the availability, use, and quality of care are recommended for monitoring purposes (AbouZahr, 1999).

- **Maternal morbidity is difficult to define, interpret, and measure.**

Maternal morbidity is much more common than maternal death; thus, the prevalence of maternal morbidity provides a conceptually appealing alternative outcome to measure. Moreover, relatively little is known about the burden of reproductive morbidity; more work is needed to explore the dimensions and determinants of

the problem as well as to evaluate the effectiveness of interventions (UNFPA et al., 1997).

The link between morbidity and mortality is not straightforward. Safe motherhood interventions primarily offer secondary prevention; that is, they prevent deaths from complications rather than preventing the complications themselves. Furthermore, unlike death, which has a very defined outcome, measures of morbidity are difficult to define and thus to measure. Even persons with medical training may misclassify complications; consequently, generating any meaningful comparative measures is difficult (Fortney and Smith, 1999).

- **Outcomes need to be measured for two individuals, the mother and baby.**

Safe motherhood programs need to consider the outcomes for two individuals: the mother and baby. Under most circumstances interventions that benefit or harm the mother similarly affect the baby and vice versa. Some exceptions are notable. For example, a cesarean section for fetal distress may be critical to ensure a good neonatal outcome but may more negatively influence the mother's health than a normal vaginal delivery will.

- **The provision of appropriate maternity care is a complex process that requires multiple indicators to monitor.**

Unlike most areas of public health, providing appropriate maternity care is a complex process that involves a wide range of preventive, curative, and emergency services as well as several different levels of care (from the community to the facility and beyond). The occurrence of an emergency sets into motion a complex chain of events to ensure that a woman receives adequate care. First, the family needs to recognize the problem and be able to access the appropriate services. Second, the equipment, supplies and medicines must be available at the facility to enable the care provider to make the correct diagnosis and to provide appropriate treatment promptly. If definitive care cannot be provided at the first level, then transport needs to be available quickly to take the woman to a higher level of care that must also deliver the appropriate services. Problems at any one of these stages may mean that the woman receives substandard care, which may be of critical importance in determining the outcome. From a program perspective, a series of indicators is required to reveal whether a problem occurs on the "demand" or "supply" side of the equation, and hence, whether the interventions need to address community mobilization, behavior change, health system performance, or a combination of these factors.

- **Interpreting whether outcomes are attributable to program interventions is difficult, because most interventions consist of "bundled" services.**

Demonstrating change as a result of a safe motherhood program is difficult because programs usually provide a package of care to communities rather than providing one single intervention. Therefore, such programs do not lend themselves easily to two common experimental designs: randomized control trials or cluster randomized community-based trials. Many programs adopt "before-after" designs for evaluation purposes that can demonstrate "plausible association" but that fall short of determining causality (UNFPA et al., 1997).

The Selection of Indicators

The indicators in this section of the *Compendium* are intended mainly for use at the national level or in the context of large-scale programs. However, many can serve in a much wider monitoring and evaluation context. A small expert group currently working in monitoring and evaluation of safe motherhood/newborn health programs selected these indicators in wide consultation with other experts working in the field of maternal health on the basis that they:

- Are widely used by international organizations or ministries of health;
- Have a relatively strong link to health or mortality outcomes; and
- Will likely provide valid comparisons at a national and international level.

Not all indicators included in this section are equally strong or provide the same quality of information. Certain indicators (for example, **Percent of Pregnant Women Attending Antenatal Clinics Screened for Syphilis**) are included because of the potential importance of the information, even though the feasibility of collecting valid information at a national level may be low. At least one indicator is included to represent each element of the proposed safe motherhood framework (see Figure III.D.1), and under some headings, no "strong" indicators were available. In addition, the program-level indicators are included because they are now

used rather widely, and they provide useful information about local planning and decision-making. However, several are clearly not intended for national level use.

The indicators included in this section focus on a rather narrow definition of safe motherhood; they do not address related issues of HIV/AIDS, STIs, or nutritional status, even though these factors clearly have a profound impact on maternal and newborn health outcomes. Priority is given to those indicators currently in use to monitor safe motherhood programs and those most closely related to maternal outcome. Although we recognize the close links between safe motherhood and these other areas of reproductive health, indicators in these related areas appear in their respective sections.

Ideally, those working in safe motherhood will eventually arrive at a consensus as to which indicators should serve for national monitoring of safe motherhood programs, as has been achieved for monitoring national AIDS programs (UNAIDS, 2000). The indicators in this section represent one step toward such consensus. However, programs need to develop their own set of indicators according to the objectives of the program and the interventions designed to achieve those objectives.

Indicator

Existence of a Safe Motherhood Strategic or Operational Plan to Promote Access and/or Quality of Safe Motherhood Services

Definition
The degree of explicit support for access to and/or quality of safe motherhood programs on the part of the government and other bodies, including service delivery organizations

Most, but not all, developing countries now have some national FP/RH law, policy, or strategy in place. Safe motherhood policies and plans may be separate from or included within the larger RH policies or strategic plans.

Data Requirements
This qualitative indicator is based on the existence of a safe motherhood plan. Evaluators assign a "yes" value if a strategic or implementation plan exists. Sometimes safe motherhood strategies are incorporated into reproductive health or maternal and child health implementation plans; thus, evaluators should assess these plans to determine if the objectives and corresponding strategies adequately address safe motherhood.

Evidence of an approved plan for safe motherhood with evidence for approval (or submission for approval). In addition, supporting documentation should include the plan, where and by whom it was issued or published, and how the plan promotes access and/or improves the quality of safe motherhood services.

Data Source(s)
Documents from the government organization designated as responsible for coordinating safe motherhood or reproductive health. Content analysis of the plan document should determine whether the plan: (1) defines the objectives of the country's safe motherhood program; (2) defines a clear strategy for attaining these objectives; (3) establishes an organizational structure for the program which is consistent with the strategy and which covers both public and private sectors, including women's groups; and (4) estimates and projects the resources required to implement the strategy, and specifies how these resources are to be secured.

Purpose and Issues
This indicator measures the degree of explicit support for access to and/or quality of safe motherhood programs on the part of the government and other bodies, including service delivery organizations. This indicator tells us if policy is translated into a strategic or implementation plan. Its purpose is to measure whether the safe motherhood or pregnancy program has developed a clear view of its mission and objectives and the strategies for attaining them. Strategic implementation planning at the national level requires the participation of various government ministries or departments, including the health, finance, planning, information, education, interior ministries, as well as important private groups (NGOs and commercial establishments), women's groups, and religious and civic organizations.

Indicator

Maternal Neonatal Program Index (MNPI)

Definition
This indicator is a score (ranging from 0-100) that measures the strength of the national maternal and neonatal health program of a given country based on five main areas: policy and support services, facility capacity, access to services, care received, and family planning. The five main areas cover 13 components:

- Capacities of health centers;
- Capacities of district hospitals;
- Percent of women with access;
- Care at antenatal visits;
- Care at delivery;
- Care for newborns;
- Family planning at health centers;
- Family planning at district hospitals;
- Policies toward safe pregnancy;
- Resources;
- Information, education;
- Training; and
- Monitoring and evaluation.

Within each component, the researcher averages items to produce a component score, and converts these scores to a 0-100 scale. The index also yields a total score, which is simply the mean for the 13 components with equal weight for each component (Bulatao and Ross, 2000).

Data Requirements
Responses to a detailed questionnaire composed of 81 items from selected key informants (experts from Ministries of Health, medical schools and universities, non-governmental and community organizations, and donors). Besides rating current program adequacy, experts rate each item on the questionnaire as of three years prior to the survey.

Data Source(s)
The MNPI questionnaire completed by 10-25 individuals per country.

Purpose and Issues
The purpose of the MNPI is to assess the strength of a national maternal and neonatal program and measure changes over time. More specifically, the MNPI is intended to measure the effort put into reducing the maternal/neonatal mortality and morbidity in a given country. The index is designed to assess only the program inputs, processes, and outputs as they relate to the "supply" or program side of the conceptual framework (Ross, Campbell and Bulatao, 1999). The MNPI also provides a measure by which to make cross-country and regional comparisons. The MNPI is not designed to provide a single measure of the quality of maternal care; rather, it provides many measures that collectively define a broad standard programs should meet (Bulatao and Ross, 2000).

The MNPI instrument relies on expert judgments, replicating an approach used in family planning and HIV/AIDS. (See **Family Planning Program Effort Index** and **AIDS Program Effort Index (API)** in Parts III.B and III.C, respectively.) Standards, however, are ultimately subjective, resting on the knowledge and expertise of the raters, who are different in each country. Whereas the data collection protocol calls for using raters with varying backgrounds (at least ten per country), validating their ratings is difficult (Ross, Campbell and Bulatao, 1999).

Another limitation is the difficulty of correlating the index closely to a reduction in maternal mortality, largely because maternal mortality levels are hard to determine accurately (Bulatao and Ross, 2001).

Indicator

Number of Facilities per 500,000 Providing Essential Obstetric Functions[3]

Definition
The number of facilities providing essential or emergency obstetric signal functions per 500,000 population

Essential obstetric signal functions are defined as:

- Administration of parenteral antibiotics;
- Administration of parenteral oxytocic drugs;
- Administration of parenteral anticonvulsants for pregnancy induced hypertension;
- Performance of manual removal of placenta;
- Performance of removal of retained products (e.g., vacuum aspiration);
- Performance of assisted vaginal delivery (e.g., vacuum extraction, forceps);
- Performance of surgery (e.g., Cesarean section); and
- Performance of blood transfusion.

Facilities are divided into those that provide "basic" essential obstetric care (EOC) and "comprehensive" EOC. If a facility has performed each of the first six functions *in the past three months*, it qualifies as providing basic EOC. If it has provided all eight of the functions, it qualifies as a "comprehensive" EOC facility.

Data Requirements
Count of the facilities meeting the requirements for "basic" and "comprehensive" EOC

Data Sources
Facility surveys that examine medical records or service statistics. Ideally, records should provide the essential obstetric signal functions. Personal interviews with knowledgeable staff who attend obstetric patients are a second, albeit, potentially more biased source of information than written records are.

Purpose and Issues
This indicator demonstrates the existence of life-saving obstetric care services. It distinguishes between "basic" and "comprehensive" care services to emphasize that maternal lives can be saved not only in hospitals providing all the services listed above, but also at health centers or smaller hospitals that do not.

The list is intentionally brief to facilitate assessment and monitoring; it does not constitute the complete list of services that either a basic or comprehensive EOC facility should provide. Valuable services are omitted in the definition of an EOC facility. For example, use of anesthesia is not included, although assumed necessary for obstetric surgery.

To qualify as providing quality services, a facility must have a safe and secure blood bank with universally accepted screening tests and a supply of blood. Ideally, the facility has the signal functions available 24 hours a day, 7 days a week, at least in the comprehensive facilities.

The causal link between maternal deaths and this indicator, although logical, has not been demonstrated. Clearly, EOC services must exist to save many women's lives.

This indicator is relatively easy to produce, but it should reflect how facilities are actually functioning and not how they are supposed to function. For example, providers may lack confidence in their skills and refer patients to a higher level, although they are otherwise equipped to treat these patients.

Generally, facility-based assessments cover all the facilities in a specific area. Private facilities may be more reluctant to collaborate than may public facilities. Also, samples of facilities generalizable to a national level such as the Service Provision Assessment (SPA) are possible, but may not always include all the signal functions listed above (MEASURE DHS+, 2000).

[3] Much of the text for this indicator comes from Maine, McCarthy, and Ward, 1992 and UNICEF, WHO, and UNFPA, 1997.

This indicator should respond to changes within a fairly short period of time (e.g., 6-12 months).

Generally, this indicator applies to a large region or country. UNICEF/WHO/UNFPA recommend (as a minimum acceptable level for every 500,000 population) one or more facilities providing comprehensive EOC and four or more facilities providing basic EOC. If areas fall short of this overall minimum level, they may upgrade existing facilities and/or build new ones. If the minimum level is met, evaluators should study the geographical distribution by looking at smaller divisions of the population. National summary measures may hide important sub-national disparities. Disaggregation by geographic (urban/rural) and by administrative (public/private) divisions is recommended (Bertrand and Tsui, 1995).

The use of this indicator in a wide variety of countries has alerted us to at least three difficulties in its application. First, where geographical terrain is particularly challenging and transportation is precarious (such as in the mountains of Nepal or Bhutan), the ratio of facilities to population may require adjustment for local use. Second, the reference period for assessing whether a signal function or procedure has been performed is generally three months, but when patient volume is low, one or more of the signal functions may not be performed, because an occasion did not present itself, not for lack of infrastructure or provider skills. Finally, a third situation concerns normative medical practice that fails to include one of the procedures, for example, assisted vaginal delivery. In some countries, vacuum extraction or a forceps delivery is no longer taught to medical students or midwives and only a few older providers are experienced at performing these procedures.

To solve these problems, one may consider preparing the indicator in several ways. But, to compare facilities across space and time effectively, we recommend maintaining the original operational definitions of these ratios. Evaluators should well document alternative calculations, and should report the adjusted ratio of population to facility; the length of the new reference period, (if it is extended); the way a category of "potential" basic EOC was created (if a procedure is generally performed, but during the study period was not); or the way country-specific criteria were established (if the criteria omits a particular signal function).

Evaluators can also calculate the "number of EOC facilities" for smaller geographical areas to show the distribution of EOC facilities at a sub-national level.

Indicator

Percent of Facilities That Conduct Case Review/ Audits into Maternal Death/Near Miss

Definition
The number of facilities that conduct case review/audits into maternal death/near miss

This indicator is calculated as:

$$\frac{\text{\# of facilities conducting case review/ audits into maternal death/near miss}}{\text{\# of facilities at the appropriate level*}} \times 100$$

* Certain facilities will be too small to conduct their own audits, but may participate in established procedures.

Case review refers to a detailed review of the management of a particular patient or "clinical case."

An audit is the systematic and critical analysis of the quality of care. Audit differs from case review because it looks at the whole process of care and at conformity with specified standards of care as part of an iterative cycle of quality improvement (Graham et al., 2000). The different types are as follows:

- Maternal death audits are detailed reviews of the events leading up to a maternal death. The audit may encompass record reviews and staff reports or interviews as well as interviews of relatives/community members;
- Criterion-based audits assess the quality of the clinical management of obstetric complications against defined standards of best practice;
- "Near-miss" audits are performed after the occurrence of a life-threatening event in which a woman is deemed to have nearly died. Criteria for the definition of "near-miss" need clear definitions. (Koblinsky et al., 2000).

Data Requirements
Number of facilities conducting or participating in audits of maternal death and near-miss cases; number of facilities in a specific geographic area

Data Source(s)
Health-facility surveys; district health-management team records

Purpose and Issues
Audit is one of many established mechanisms for improving provider performance in developed countries, and recent studies have shown that it also applies to developing countries.

Evidence of the effectiveness of clinical audit varies, partly because of the differing nature of the interventions assessed (NHS Centre for Reviews and Dissemination, 1999).

This indicator may be collected as part of a facility survey (MEASURE DHS+, 2001), although most programs will need to set up their own monitoring system for assessing the coverage and quality of effective audit practices.

This indicator measures only the proportion of facilities conducting audit or case reviews and does not measure the quality or the impact of the review process. Although case reviews are a routine part of many facility activities, effective audit is not. For this reason, programs may want to collect complementary information on the quality and effectiveness of the process.

In most cases, smaller facilities will find it impractical to conduct their own audit or case reviews. Staff representatives from these facilities, however, should participate in the audit cycles of larger facilities or districts.

Indicator

Percent of Pregnant Women Attending Antenatal Clinics Screened for Syphilis

Definition
The percent of pregnant women attending antenatal care screened for syphilis

This indicator is calculated as:

$$\frac{\text{\# of pregnant women attending antenatal clinics screened for syphilis}}{\text{\# of pregnant women attending antenatal clinics}} \times 100$$

This indicator is usually calculated for women attending for their first antenatal visit but may also be collected after delivery.

The most common screening tests for syphilis include rapid plasma reagin (RPR) and venereal disease reference laboratory (VDRL) blood tests.

Data Requirements
The number of women attending antenatal clinics during a reference period (e.g., one year) who were screened for syphilis; the number of women attending the same antenatal clinics during the same reference period

Data Source(s)
Clinic registries (data on first visit) or individual prenatal records (individual ANC records/cards after births or immediately postpartum)

Health facility exit interviews and provider observations are useful for evaluation purposes but not for ongoing monitoring.

Purpose and Issues
The purpose of this indicator is to measure the extent to which ANC clients are screened for syphilis. Since all women attending for ANC should be screened for syphilis at least once during pregnancy, the measure can also potentially serve as a proxy measure of the quality of antenatal care services (UNFPA, 1998a). Furthermore, when an explicit standard exists that all women should be tested at least once during pregnancy, the indicator may also be used as a benchmark to audit provider (or system) performance against compliance with local screening policy.

Syphilis infection is a major cause of maternal morbidity and perinatal morbidity and mortality in the developing world. For many African countries, reported prevalence of syphilis among pregnant women at sentinel surveillance sites ranges between 10-15 percent, with over half these pregnancies resulting in an adverse outcome, such as abortion, stillbirth, low birth weight, premature delivery, or congenital infection (WHO, 1991b). Because adverse outcomes from syphilis are preventable, and screening and treatment in pregnancy are highly cost effective, many countries have adopted universal syphilis screening for pregnant women as a national policy (Gloyd, Chai, and Mercer, 2001).

Screening programs by themselves cannot help reduce the adverse outcomes associated with syphilis and must be linked to efforts to increase ANC coverage and to improve follow up and treatment of women and their partners who test positive.

Researchers may routinely collect data to calculate this indicator if antenatal clinic registries record completed syphilis screening. Most often, however, the information is collected in the context of special surveys that review the antenatal clinic cards of women who have had a recent birth. Researchers may conduct these surveys in facilities or in the community, if women keep their antenatal cards.

Health facility exit interviews and provider observations (MEASURE DHS+, 2001; WHO, 1998a) may provide a baseline measure for evaluation purposes, but are limited because they assess women who have not yet com-

pleted antenatal care and who theoretically could still be tested (MEASURE DHS+, 2001; WHO, 1998a).

The percentage of women screened for syphilis should respond quickly to changes in provider practice, particularly if the indicator is used in a local audit of facility quality of care.

This indicator is a facility-based measure and does not represent the general population, particularly when ANC coverage is low. In addition, where the indicator is obtained by record review, the validity of the findings depends on the quality and completeness of the data. Incomplete data recording may also further indicate low service quality.

Adequate syphilis screening does not equate with adequate syphilis treatment, because studies show that despite effective screening, inadequate treatment can be an important cause of preventable perinatal death. In high prevalence areas, even when syphilis testing is theoretically universal, most women are not tested (Gloyd, Chai, and Mercer, 2001).

Indicator

Percent of Women with Obstetrical Complications Treated within Two Hours at a Health Facility

Definition:
The percent of women with obstetric complications who are treated within two hours of admittance to a health facility measured during a given reference period

Obstetric complications include:

- Hemorrhage: antepartum, intrapartum or postpartum;
- Prolonged/obstructed labor;
- Postpartum sepsis;
- Complications of abortion;
- Pre-eclampsia/eclampsia;
- Ectopic pregnancy; and
- Ruptured uterus.

Treatment for obstetric complications depends on the complication and local protocols for treatment.

This indicator is calculated as:

$$\frac{\text{\# of women with obstetric complications treated within 2 hours of admittance to a health facility}}{\text{\# of women admitted at a health facility with obstetric complications}} \times 100$$

Data Requirements
Numerator: date and time of admission; date and time of treatment/delivery; total number of women admitted with complications and their diagnosis at the time of admission; and information on the time and nature of treatment given

Denominator: number of women admitted to the health facility with obstetric complications

Data Source(s)
All registers that record where women are admitted to a facility (e.g., labor ward register, antenatal, emergency room or postnatal ward register); registers that record where definitive treatment is administered (e.g., operating theatre register, specific complications registers); case records

Purpose and Issues
The purpose of this indicator is to provide a measure of the quality of maternity care, because maternal mortality is directly related to the effectiveness and timelines of treatment for emergency complications (Koblinsky, et al., 1995).

This indicator is most appropriate at a facility level for those facilities interested in auditing their own care practice. It is less suitable for comparison purposes across facilities because of variation in the services provided and in case mix at different facilities as well as variations in the definitions of the indicator.

Information required to construct the indicator should be available directly from facility registers and case notes. The lack of certain information may signal suboptimal care/management. The feasibility of the indicator also critically depends on standard definitions of admission-to-treatment-time-interval (ATTI) for each obstetric complication. For example, does admission time mean time of first arrival at the hospital, time seen by the admissions clerk, or something else? What is the treatment time for an obstetric hemorrhage? Is it when an intravenous drip is inserted, when a blood transfusion starts, when an oxytoxic is given, or when the hemorrhage stops?

This indicator should respond rapidly to changes in staff or facility administration practice. Early rapid response may simply be due to a Hawthorne effect (i.e., apparent improvement simply because of an observation taking place), but this type of improvement will not be sustained. To maintain improvement, programs should regularly audit ATTI. Better still, ATTI could be incorporated into routine management practice (e.g., discussed routinely in all case reviews). (See indicator, **Percent of Facilities that Conduct Case Reviews/ Audits into Maternal Death/Near Miss**).

This type of indicator has several ambiguities and deficiencies, as follows:

- The recording of the actual admission time may be seriously delayed if the facility lacks a triage system, and women must wait a long time on first arriving at the facility;
- The ATTI should be reviewed for all women developing obstetric complications. If the admissions register serves as the sampling frame to identify women with complications, then the register will exclude those women who had a complication but whose diagnosis was missed at the time of admission;
- The severity of the complication and hence the need for rapid treatment may be difficult to ascertain retrospectively for all cases (a further reason for facilities to set their own realistic standards);
- The indicator fails to capture the timeliness of treatment for those women who develop complications while in the hospital;
- Women who arrive at the hospital, but who are not admitted for a variety of reasons (e.g., they cannot afford the treatment), will be omitted from both the numerator and denominator. This omission may be a potentially important source of bias if poorer patients have a disproportionately high complication rate; and
- The indicator does not measure the appropriateness of the type of treatment given.

Because of these limitations, evaluators can best measure ATTI in combination with other indicators or approaches that measure complementary aspects of the quality of care, for example in the context of care reviews or near-miss audits.

Indicator

Cesarean Sections as a Percent of All Live Births

Definition
The percent of pregnant women who have a cesarean section in a specific geographical area and reference period

This indicator is calculated as:

$$\frac{\text{\# of cesarean sections performed}}{\text{\# of live births}} \times 100$$

Data Requirements
The number of cesarean sections performed in a defined population during a reference period; total number of live births in the same reference period

Data Source(s)
Numerator: clinical registries for data in a given geographical area on the number of C-sections performed; estimates of the number of births in that area; and population-based surveys for self-reported C-sections only

Denominator: all live births during the reference period. Where data on the numbers of live births are absent, evaluators can calculate total estimated live births using census data for the total population and crude birth rates in a specified area. *Total expected births = population x crude birth rate.*

Household demographic surveys often produce national and disaggregated estimates of the self-reported C-section rate.

Purpose and Issues
This indicator demonstrates the extent to which a particular life-saving obstetric service is being performed in EOC facilities. It reflects the accessibility and utilization of services as well as the functioning of the health service system. The appropriate use of a cesarean section leads to a decrease in maternal mortality and morbidity, as well as a decrease in perinatal morbidity and mortality. While cesarean sections may be performed solely for the health of the fetus or newborn, in developing countries the vast majority relate to maternal indications.

Many of the major pre- and intrapartum causes of maternal mortality and morbidity require the use of this procedure to save the woman's life or to prevent serious morbidity.

Of all the procedures used to treat the major obstetric complications, C-sections may be the easiest to study because record-keeping for C-sections is more reliable than that for other procedures or obstetric complications (MotherCare, 2000b; UNICEF, WHO, UNFPA, 1997). However, it is critical that evaluators include information for all facilities performing C-sections in the area under study in the numerator.

Changes in the ability of the health care system to provide cesarean sections can have an impact within six to nine months.

UNICEF/WHO/UNFPA recommend a C-section rate between 5 and 15 percent of all births, based on estimates from a variety of sources. Rates less than 5 percent may indicate inadequate availability and/or access to EOC. Rates above 15 percent suggest overuse of the procedure for non-emergency reasons. Excessive use unnecessarily exposes women to anesthesia and surgery with their concomitant risks. Moreover, it drains scarce health-care resources. Most of the countries with excessively high C-section rates are also highly litigious societies such as the United States, where 22 percent of all births are cesareans (Lancet, 2000). However, Brazil has a rate of at least 36 percent of all live births (BEMFAM and Macro International, 1997).

Disaggregation of the rate allows one to evaluate access to the procedure. Rates are often inconsistent between urban and rural environments, public or private sectors, different payment schemes, or across regions. Thus, sub-national estimates are encouraged (Maine, McCarthy, and Ward, 1992).

Crude birth rates produce estimates of live births only, whereas some cesarean sections are performed on pregnancies that result in stillbirths. If the number of C-sections performed for stillbirths is low, the use of live births should be acceptable as the denominator.

An alternative indicator, the proportion of facility deliveries that are C-sections, will vary by the case mix of patients and will be biased by referral patterns of women with complications requiring the procedure. Specifying an appropriate range of target percentages within a facility is impractical.

The procedure of cesarean section usually occurs at the end of a complex series of events, possibly including pre-existing and pregnancy-specific medical factors, identification of complications, transportation to health-care facilities and availability of necessary technology. When using this indicator, managers and evaluators may also want to employ more in-depth techniques, such as case audits, to investigate what clinical indicators are being used for cesarean section and if the appropriate women are receiving this service. By itself, the indicator reveals nothing about the appropriateness of the procedure.

Indicator

Case Fatality Rate (CFR) – All Complications[4]

Definition
The proportion of women with major obstetric complications who die in a facility within a reference period

This indicator is calculated as:

$$\frac{\text{\# of deaths from specified obstetric complications in a facility}}{\text{\# of women with specified obstetric complications attended in the facility}} \times 100$$

Where deaths from the following complications are included:

- Hemorrhage: antepartum, intrapartum or postpartum;
- Prolonged/obstructed labor;
- Postpartum sepsis;
- Complications of abortion;
- Pre-eclampsia/eclampsia;
- Ectopic pregnancy; and
- Ruptured uterus.

All cases in the numerator also appear in the denominator. All complications specified in the list above appear in both the numerator and denominator. By definition, a CFR is cause-specific, but in this case, a single facility may only see a small number of women with any one complication.

Data Requirements
The number of deaths from the specified complications in the facility during the specified time period; the number of women diagnosed with one or more of these complications attended at the EOC facility during the specified time period

Data Sources
Facility records

Purpose and Issues
This indicator measures facility performance, in particular, quality and promptness of care. It is most useful when comparisons are made over time for the same facility. It is not useful for comparisons across facilities of different types because of variations in the characteristics of the client populations and in the services provided by the facilities. Women with more severe complications are more likely to present at referral hospitals, whereas women with less severe complications may access district hospitals or health centers (MotherCare, 2000a). Even comparisons among "same level" or "like" facilities may be difficult to interpret, as the population profile can vary dramatically because of socio-cultural factors or other circumstances outside the control of the health sector, such as transportation and road systems.

The CFR has an extremely strong causal link to maternal mortality at the facility level. Its relationship to maternal mortality in the general population depends on the proportion of women with obstetric complications who are managed in facilities. The higher the number of these women managed in facilities is, the closer the relationship between CFRs and the level of maternal mortality in the general population (Bertrand and Tsui, 1995).

If the facility treats obstetric complications and collects data on obstetric complications and maternal deaths, this indicator is easy to calculate. Case fatality rate should respond to changes within a fairly short period of time (e.g., 6-12 months).

Whether a woman dies in the hospital will depend not only on the quality and readiness of the hospital's response to a woman with an obstetric emergency, but

[4] Much of the text for this indicator comes from Maine, McCarthy, and Ward, 1992 and UNICEF, WHO, and UNFPA, 1997.

also on her condition on admission to the hospital. Thus, the hospital could function well and still have a high CFR because women in need of EOC arrive in such poor condition. Where a facility's CFR is low, the quality of care is not necessarily high; instead, few women with obstetric complications may use services. For these reasons, one should have other indicators of quality of care (e.g., the time interval between admission and treatment for women with complications) or more in-depth information on the woman's status at admission (e.g., pulse, blood pressure, and temperature).

Finally, this indicator is helpful with the other four to five "program-level" indicators that UNICEF/WHO/UNFPA recommend. For example, if the percentage of all births in EOC facilities or met need is low, the CFR may be relatively meaningless.

UNICEF/WHO/UNFPA recommend a maximum acceptable value for the indicator of less than 1 percent. However, a study of US hospitals showed a CFR of 0.03 percent in 1978 (Petitti et al., 1982). Certainly, countries meeting even a level of 1 percent should strive to reduce the rate.

Where the number of maternal deaths or complicated cases is small, the CFR will not be sufficiently robust to be meaningful. However, where the number of cases is large, evaluators can calculate CFRs for individual complications.

Indicator

Percent of Audience that Know Three Primary Warning/Danger Signs of Obstetric Complications

Definition
Community knowledge and awareness of the warning/danger signs of obstetric complications

"Audience" is the intended population for the program (e.g., pregnant women, husbands or other members of the community who influence decisions about care seeking at the time of delivery).

"Know" refers to the percentage who can spontaneously name at least three primary warning signs of specific obstetric complications, which in a wide range of settings include:

- Antepartum bleeding;
- Labor >12 hours (obstructed labor);
- Placenta retained > 1 hour;
- Convulsions or fit or swelling of the hands or face (pre-eclampsia/eclampsia); and
- Fever and vaginal discharge (puerperal sepsis)[Filippi et al., 2000].

This indicator is calculated as:

$$\frac{\text{\# of audience who know at least three warning/danger signs of obstetric complications}}{\text{Total \# in the intended audience}} \times 100$$

Data Requirements
Number of the audience who can name at least three of the warning signs of obstetric complications (listed above); total population defined as the intended audience

Data Source(s)
Population-based surveys

Purpose and Issues
The purpose of this indicator is to assess community knowledge and awareness of the warning/danger signs of obstetric complications in order to plan and monitor the impact of BCC initiatives at a community level. Knowledge of the danger signs of obstetric complications is the essential first step in the appropriate and timely referral to essential obstetric and newborn care services (Perreira et al., 2001).

Improvement in knowledge of obstetric complications is usually much smaller than improvements in other health-education messages such as self care (MotherCare, 2000a and 2000b).

Knowledge of the danger signs of an obstetric complication is only one aspect of obstetric-problem recognition at the community level. Knowledge about the severity of an obstetric complication (i.e., knowing when to take action) and knowledge about the appropriate life-saving action for each complication are also important. Moreover, adequate knowledge does not guarantee that an individual will recognize a complication in practice. Certain obstetric complications that evolve from a normal to an emergency state (e.g., postpartum hemorrhage) may be particularly difficult to recognize. Care seeking is also strongly influenced by cultural beliefs about the etiology of an illness. These beliefs may more powerfully influence an individual's action than will his/her recent knowledge of the appropriate action to take (MotherCare, 2000a and 2000b).

Evaluators should combine knowledge of pregnancy danger signs with other indicators measuring related aspects of knowledge and behavior to assess the real impact of any BCC program. Complementary indicators can include, for example, the percentage of the population who know the location of emergency obstetric services and the percentage of the population who intend to use these services in the event of emergency (See Part II.F).

Indicators of knowledge of danger signs and related indicators should be complemented by good quality formative research and, where appropriate, qualitative methodologies such as illness narratives (MotherCare, 2000a and 2000b).

Gender Implications of this Indicator

Most maternal deaths are due to sudden and unexpected complications. To reduce the nearly 600,000 deaths occurring each year from largely preventable causes, much effort has focused on training health workers and pregnant women to recognize danger signs so that serious complications are recognized soon enough to receive medical attention. Few efforts have been made to educate men about the risks of pregnancy, even though men often control decisions to seek medical attention and often arrange and pay for transport to a health facility. If men as well as women understood that all pregnancies carry some risk, complications would be recognized and treated.

Indicator

Percent of Women Attended at Least Once During Pregnancy for Reasons Related to the Pregnancy

Definition
The percent of women attended at least once during pregnancy by skilled health personnel for reasons related to the pregnancy

This indicator is calculated as:

$$\frac{\text{\# of pregnant women attended by skilled personnel at least once during their pregnancy for reasons related to the pregnancy}}{\text{Total \# of live births occurring within the reference period}} \times 100$$

A skilled attendant is a professional care giver who possesses the knowledge and a defined set of cognitive and practical skills enabling the individual to provide safe and effective health care during childbirth to women and their infants in the home, health center, and hospital settings. Skilled attendants include midwives, doctors, and nurses with midwifery and life-saving skills[5] (Inter-Agency Group for Safe Motherhood, 2000).

Data Requirements
Numbers of women who are seen by skilled personnel during pregnancy; all live births in a reference period

The number of live births is a proxy for the numbers of all women who need antenatal care (ANC). Evaluators should include all births, but they usually use only live births because of the difficulty in obtaining information about non-live births (Graham and Filippi, 1994).

Where data on the numbers of live births are unavailable, evaluators can calculate total estimated live births using census data for the total population and crude birth rates in a specified area. *Total expected births = population x crude birth rate*

Data Source(s)
Routine health services data, population-based surveys

Routine health service data typically lack information on pregnancies or births that take place outside the public health sector, for example in homes or private facilities.

Purpose and Issues
The main purpose of an indicator of antenatal care is to provide information on women's use of antenatal care services. ANC coverage provides a crude measure of antenatal care utilization (Rooney, 1992), but it does not capture the number and timing of visits, the reasons for seeking care, the skills of the provider, or the quality of care received. Therefore, evaluators should not infer that similar rates of ANC coverage mean similar levels of care.

Although epidemiological studies tend to show an association between improved maternal health outcome and ANC, most fail to control for selection biases that would positively influence the outcome (Villar and Khan-Neelofur, 2000). The association between one antenatal visit (with care provision of unknown quality) and maternal mortality is weak (WHO, 1999b). However, women's use of ANC is more strongly associated with improved perinatal survival (McDonagh, 1996); therefore, measures of ANC coverage may have a greater role in the monitoring and evaluation of programs addressing newborn health and survival (Graham and Filippi, 1994).

This indicator is responsive to change in the short term. Annual monitoring is only feasible when the data are derived from routine data sources. For international comparisons, periods of three to five years are probably sufficient. Evaluators should avoid frequent surveys, because sampling error makes it difficult to assess whether small changes are real or due to chance variation.

[5] A trained traditional birth attendant is NOT included in the definition of skilled personnel

For comparison purposes, one must know whether the denominator used reflects all births, the most recent birth, or all women. A birth-based analysis represents all births in the survey period but over-represents women who have more than one birth. Women with more than one birth are also more likely to have other risk factors, such as high parity and lower rates of health services use. Hence, ANC coverage is likely be lower using a birth-based estimate than a woman-based estimate, and this difference will be greater the longer the survey period used. One can obtain a women-based estimate by using ANC coverage for the most recent birth (Graham and Filippi, 1994); this format is now used in DHS reports. Because programs target women, using a woman-based denominator may be conceptually more appealing to program managers. However, a birth-based analysis for all births (live births and stillbirths) is essential for determining the impact of ANC on pregnancy outcomes.

Differences in the categorization of skilled personnel, in particular whether auxiliary staff or traditional birth attendants (TBA) have been included, may also account for discrepancies between countries. In practice, most large surveys now use the standard WHO definition of skilled health personnel.

Discrepancies may arise because the estimate relates either to all antenatal visits or only to those occurring "for reason related to the pregnancy." In practice, information on women's care-seeking motives is rarely collected except in Pan Arab Family Health Surveys (PAPFAM).

Antenatal care coverage is one of four mutually supportive indicators in the minimal list measuring maternal health service coverage. The other three indicators are:

- **Percent of Births Attended by Skilled Health Personnel;**
- Availability of basic essential obstetric care; and
- Availability of comprehensive essential obstetric care.

In combination, these indicators measure progress towards the goal of providing antenatal care, trained attendants during childbirth, and access to essential obstetric care for all pregnant women. ANC coverage is associated with newborn health and survival and weakly associated with maternal mortality. In sum, antenatal care coverage appears to influence newborn health and survival, but its effect on maternal mortality is unclear.

Gender Implications of this Indicator

Because some countries deem it culturally inappropriate for women to discuss issues related to their bodies with men, women may not be able to communicate pregnancy-related problems to male providers. In addition, where women lack access to household resources or where they lack the autonomy to seek health care on their own, husbands or other family members may not be willing to invest resources in antenatal care, particularly if a given pregnancy is progressing "normally."

Indicator

Percent of Women Who Were Given or Purchased Malaria Prophylaxis/Treatment During Their Most Recent Pregnancy

Definition
The percent of women who were given or who purchased malaria medication, according to national policy, during their most recent pregnancy

This indicator is calculated as:

$$\frac{\text{\# of women who were given or purchased malaria medication during their most recent pregnancy}}{\text{\# of women who had a recent live birth}} \times 100$$

Malaria medication (prophylaxis or presumptive intermittent treatment [PIT]) will vary according to local susceptibility and national policy. Most country policies in highly endemic areas advise a treatment dose of chloroquine followed by weekly chloroquine throughout pregnancy or PIT with sulphadoxine-pyrimethamine at the beginning of the second and third trimester in areas of chloroquine resistance. Other regimes are less common.

Data Requirements
Number of women who were given or who purchased malaria medication during their most recent pregnancy; number of women with a recent live birth

For both the numerator and denominator, evaluators should specify the time periods for the recent live birth. In surveys, this period is normally restricted to three to five years before the survey.

Where data on the numbers of live births are absent, evaluators can calculate total estimated live births using census data for the total population and crude birth rates in a specified area. *Total expected births = population x crude birth rate*

Data Source(s)
Population-based surveys; facility records of antenatal patients

Purpose and Issues
Malaria poses a serious health risk to pregnant women and newborns, particularly in areas where *p. falciparum* is endemic. Malaria is a major cause of maternal anemia and of low birth weight, (independently, low birth weight is the single most important determinant of neonatal mortality). It is often the primary cause of intrauterine growth retardation in the absence of severe maternal malnutrition. As research demonstrates, both PIT with sulphadoxine-pyrimethamine and routine chemoprophylaxis with chloroquine reduce these complications, although the evidence is weaker for chloroquine because of worsening drug resistance. In 2000, the African summit, "Roll Back Malaria," established a goal that at least 60 percent of women at risk of malaria should have access to chemoprophylaxis or PIT.

Some large household surveys, such as in the DHS core questionnaire, routinely collect data for this indicator. In addition, some health facility surveys that conduct record reviews, direct observation of ANC consultations, or exit interviews with ANC clients yield this information for client populations. Because malaria varies within communities, evaluators should disaggregate population-based data by area, where possible. This will also help to monitor drug resistance.

Many facilities routinely record tetanus-toxoid coverage and numbers of ANC visits, and HIS could collect this information with little additional effort. However, as far as we are aware, routine collection of this indicator only occurs in the context of special studies.

One major limitation with the indicator is that current data collection approaches lack information on the completeness of the drug regimen taken during pregnancy. In addition to determining the type of malaria medication taken, information on the frequency and timing of drug administration is required to determine whether pregnant women are adequately protected against malaria.

Information on the frequency and timing of drug administration could theoretically be obtained if clinics maintained records on the numbers of patients attending and on the number of women given first, second, and third courses of PIT or the number of packets of chloroquine dispensed. An alternative indicator reflecting the adequacy of the program in meeting the needs of specific clients is

- Number of tablets distributed per eligible woman.

The questions asked in most population-based surveys assume that women are able to report on malaria treatment reliably, but few validation studies have tested this assumption. Population-based studies also rely on self-reported data, which are subject to recall bias likely to increase with the length of the recall period.

Facility records or provider observation measures the proportion of women given or prescribed malaria medication but does not reflect the proportion of women who took the medication. Compliance with treatment will rarely be 100 percent and will vary depending on many different local factors.

Where malaria is sporadic or seasonal, programs focus on screening women who present with symptoms and on treating those who are infected. Alternative indicators in this case include

- Number of pregnant women presenting with malaria symptoms; and
- Percent of pregnant women treated for malaria according to locally established protocols.

Alternative indicators for both endemic and sporadic areas are:

- Percent of pregnant women living in a household with treated mosquito nets; and
- Percent of pregnant women living in a household with treated mosquito nets that report having slept under the net the previous night.

Indicator

Percent of Pregnant Women Who Receive Antihelminthic Treatment during Pregnancy

Definition

In areas of moderate to high endemicity: the percent of pregnant women who receive presumptive antihelminthic treatment during their pregnancy. According to the 1998 IVACG/WHO/UNICEF "Guidelines for the Use of Iron Supplements to Prevent and Treat Iron Deficiency Anemia," treatment should be done once in the second and third trimester.

In areas of low endemicity: the percent of pregnant women who received prescribed treatment during their pregnancy.

This indicator is calculated as:

$$\frac{\text{\# of pregnant women who receive presumptive antihelminthic treatment}}{\text{Total \# of pregnant women}} \times 100$$

Data Requirements

Information on the number of pregnant women who receive presumptive/prescribed anthelminthic treatment and the total number of pregnant women.

Data Source(s)

Program records (on number of pregnant women, number of pregnant women who receive treatment, either presumptive treatment or therapy for identified helminths, and number of pregnant women reported to be infected); population-based surveys represent an alternative source of data, but will yield different results in terms of coverage. If the source of data is a population-based survey, the evaluator should calculate the indicator for the last pregnancy.

Purpose and Issues

Helminths such as hookworm and schistosomes can cause blood and iron loss and thus anemia. In areas of low endemicity, treatment in the second trimester is recommended. In areas of moderate to high endemicity, treatment should occur in the second and third trimester. Treatment in the first trimester is not recommended.

This indicator only measures whether women have received any anthelminthic therapy, without reference to adequate dosing. Because treatment of helminths depends on the availability of medication to clients in the program, this indicator may reflect inadequacies in the flow of drugs to service distribution points in the system and/or poor provider performance at the SDP.

An alternative indicator reflecting the adequacy of the program in meeting the needs of specific clients is the dosage (number of tablets) distributed per eligible woman.

Indicator

Percent of Births Attended by Skilled Health Personnel

Definition
The percent of births attended by skilled health personnel

This indicator is calculated as:

$$\frac{\text{\# of births attended by skilled personnel during the reference period}}{\text{Total \# of live births occurring within the reference period}} \times 100$$

The skilled attendant is a professional care giver who possesses the knowledge and a defined set of cognitive and practical skills that enable the individual to provide safe and effective health care during childbirth to women and their infants in the home, health center, and hospital settings. Skilled attendants include midwives, doctors, and nurses with midwifery and life-saving skills[6] (Safe Motherhood Inter-Agency Group, 2000).

Data Requirements
Number of births attended by skilled health personnel in a defined time period; number of live births in the same geographic area and reference period

The number of live births is a proxy for the numbers of women who need delivery care. Evaluators should count all births but usually only use live births in calculating this indicator, because of the difficulty in obtaining information about non-live births (Graham and Filippi, 1994).

Where data on the numbers of live births are unavailable, evaluators can calculate total estimated live births using census data for the total population and crude birth rates in a specified area. *Total expected births = population x crude birth rate*

Data Source(s)
Routine health service data; population-based surveys

Routine health service data typically lack information on pregnancies or births that take place outside the public health sector, for example in homes or private facilities.

Purpose and Issues
The main purpose of an indicator of the skilled attendant at delivery is to provide information on women's use of delivery care services.

Many argue that increasing the proportion of deliveries with a skilled attendant is the single most critical intervention for reducing maternal mortality. Moreover, the proportion of births with a skilled attendant is a benchmark indicator for monitoring progress towards the ICPD goals (WHO, 1999b).

The evidence that delivery with a skilled attendant reduces maternal mortality comes from a number of clinical, historical, and epidemiological sources that indicate an association but not a causal link. In general, births with a skilled attendant are associated with lower rates of maternal mortality. However, confounding factors, such as the strong correlation between skilled attendant and institutional delivery, make assessing the impact of skilled attendant alone difficult to determine.

Annual monitoring is only feasible when the data are derived from routine data sources. For international comparisons, periods of three to five years are probably sufficient. Frequent surveys are generally undesirable because the survey periods may overlap, and sampling error makes it difficult to assess whether small changes are real or due to chance variation.

Evaluators should not infer that similar rates of skilled attendant deliveries between countries reflect similar levels of care; major differences are likely to exist between countries in how providers are trained, in what providers are allowed to practice and do practice, and

[6]A trained traditional birth attendant is NOT included in the definition of skilled personnel.

in what resources, equipment, and supplies are at their disposal.

Differences in what definitions are used and in how skilled attendants are reported may also account for discrepancies between countries. Most surveys such as the DHS rely on women's self-report but how women interpret the question "who assisted with the delivery?" and whether they accurately identify the health staff attending is unknown.

This indicator uses a birth-based analysis (similar to the previous ANC indicator), and the sample will overrepresent women with multiple births in the survey period. Women with more than one birth are also more likely to have other risk factors, such as high parity and lower rates of health services use. Delivery coverage may therefore be underestimated, although this underestimate is likely to be small.

Since the denominator for this calculation includes only women with live births and excludes women with fetal deaths and stillbirths, the only valid association will be with neonatal mortality and not with perinatal mortality. (See Part III.E Newborn Health.)

Evaluators can disaggregate skilled attendant at delivery by place to further document the degree of care received at the time of delivery. This measure of care or "skilled attendance" will vary by setting and attendant. A skilled attendant conducting a delivery in hospital, for example, provides a higher level of "skilled attendance" than does a skilled attendant conducting a delivery at home.

The percentage of births with a skilled attendant is one of four mutually supportive indicators in the minimal list measuring maternal health services coverage. The other three indicators are:

- **Percent of Women Attended at least Once during Pregnancy for Reasons Related to the Pregnancy;**
- **Availability of basic essential obstetric care; and**
- **Availability of comprehensive essential obstetric care.**

In combination, these indicators measure progress towards the goals of providing antenatal care, trained attendants during childbirth, and access to essential obstetric care for all pregnant women.

Indicator

Percent of Women Attended During the Postpartum Period by Skilled Personnel

Definition
The percent of pregnant women seen during the postpartum period by a skilled attendant

This indicator is calculated as:

$$\frac{\text{\# of women attended during the postpartum period by skilled personnel}}{\text{Total \# of live births}} \times 100$$

The postpartum period is defined as the time from the delivery of the placenta until 42 days after delivery.

Data Requirements
Number of women within the postpartum period who are attended by skilled personnel during a fixed time period (Note: One must specify whether the visit was a first or subsequent visit); all live births during the same time period

The number of live births is a proxy for the numbers of all women who need postnatal care. Evaluators generally count all births, but usually use only live births to calculate this indicator because of the difficulty in obtaining information about non-live births (Graham and Filippi, 1994).

Where data on the numbers of live births are unavailable, evaluators can calculate total estimated live births using census data for the total population and crude birth rates in a specified area. *Total expected births = population x crude birth rate*

Data Source(s)
Routine health service data; population-based surveys

Routine health service data typically lack information on pregnancies or births that take place outside the public health sector, for example in homes or in private sector facilities.

Purpose and Issues
The main purpose of an indicator for postpartum care is to provide information on women's use of postpartum services in the postpartum period.

Although most maternal and newborn deaths occur around the time of delivery and in the immediate postpartum period, postpartum care (PPC) has been a relatively neglected area of maternity-services provision. Recent WHO guidelines recommend that the first postpartum visit take place within the first week, preferably within the first two to three days, with a second visit at four to six weeks. The visit should include the early detection and treatment of complications and preventive care for both mother and baby[7] (WHO, 1998a; WHO, 2001b).

Because pregnancy complications occur unpredictably, the likelihood is low that one postpartum visit of unspecified content, quality, and timing may influence maternal mortality. A postnatal care visit may reduce the likelihood of severe morbidity if pregnancy complications are detected early and if effective treatment is available (Child Health Research Project, 1999). Further research in this area is required.

Some large surveys such as DHS routinely collect data on postpartum care. Routine HIS may also collect data, although historically more programs have collected data on postnatal care for the baby (for immunization coverage) than for the mother.

This indicator is responsive to change in the short term. Annual monitoring is only feasible when the data are derived from routine data sources. For international comparisons, periods of three to five years are probably sufficient. Frequent surveys are probably undesir-

[7] Preventive care for mothers may include vaccination against tetanus; provision of vitamin A and iron; and counseling on appropriate newborn care, hygiene, breastfeeding, malaria prevention and nutrition. Preventive care for babies may include early BCG, and polio and hepatitis immunization.

able because sampling error makes it difficult to assess whether small changes are real or due to chance variation.

Postpartum care is a package of services instead of one single intervention. Because no widely accepted operational definition of postpartum care exists and because the content and quality of care are likely to vary between settings, similar coverage rates between countries do not reflect similar levels of care.

Furthermore, after delivery, the two individuals need very different care and attention. Postpartum care statistics should make explicit whether care was provided principally for the mother or baby or both mother and baby, because this information may be difficult to determine retrospectively. The current DHS questionnaire, for example, specifies postpartum care for the mother. WHO distinguishes between care for the mother and for the baby by using the term postpartum to refer to care exclusively for the mother and the term postnatal care for the baby.

Some surveys present only postpartum coverage for women who delivered outside a facility on the assumption that women who deliver in facilities receive some degree of postpartum care (Rutstein, 1999).

In settings where postnatal coverage is relatively high, evaluators can stratify this indicator by time of visit (e.g., within two or three days, one week or later) to better measure women's use of services.

Indicator

Maternal Mortality Ratio (MMR)

Definition[8]
The number of maternal deaths per 100,000 live births

A maternal death (as cited in International Classification of Disease or ICD-10, [WHO, 1992]) is the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and the site of the pregnancy. Death can stem from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes. Maternal deaths fall into two groups, direct and indirect, as follows:

Direct obstetric deaths
Direct obstetric deaths result from obstetric complications of the pregnant state (pregnancy, labor, and puerperium), from interventions, omissions, incorrect treatment, or from a chain of events resulting from any of the above.

Indirect obstetric deaths
Indirect obstetric deaths result from previous existing disease or disease that developed during pregnancy and which was not due to direct obstetric causes, but which was aggravated by physiologic effects of pregnancy.

The maternal mortality ratio is calculated as:

$$\frac{\text{All maternal deaths occurring within a reference period (usually 1 year)}}{\text{Total \# of live births occurring within the reference period}} \times 100{,}000$$

Data Requirements
Information on all maternal deaths occurring in a period (usually 1 year) and information on the total number of live births occurring in the same year

Including all pregnancies in the denominator gives a true indication of the total population of pregnant and delivering women at risk of maternal death, but researchers and evaluators more commonly use live births since these data are more readily available and are easier to collect.

Where data on the numbers of live births are absent, evaluators can calculate total estimated live births using census data for the total population and crude birth rates in a specified area. *Total expected births = population x crude birth rate*

Data Sources:
Many countries have three main sources of data with which to calculate the maternal mortality ratio:

- Vital registration;
- Service statistics; and
- Population based surveys or surveillance.

The serious limitations of these sources, in both the developing and developed world, have been well documented elsewhere. (AbouZahr, 1999; Berg, Danel, and Mora, 1996; Campbell and Graham, 1990).

Purpose and Issues
The maternal mortality ratio is the most widely used measure of maternal deaths. It measures obstetric risk (i.e., the risk of dying once a woman is pregnant). It therefore omits the risk of being pregnant (i.e., fertility, in a population, which is measured by the maternal mortality rate or the lifetime risk) (Graham and Airey, 1987).

Maternal mortality is widely acknowledged as a general indicator of the overall health of a population, of the status of women in society, and of the functioning of the health system. High maternal mortality ratios are thus markers of wider problems of health status, gender inequalities, and health services in a country. The maternal mortality ratio is therefore useful for advocacy

[8] The text for this indicator draws heavily on the forthcoming WHO publication, "Indicators for Reproductive Health Monitoring," WHO.

purposes, but lacks information on the causes of high maternal mortality or the interventions required to reduce maternal deaths.

Maternal deaths are difficult to investigate because of their comparative rarity on a population basis, as well other context-specific factors, such as reluctance to report abortion-related deaths, problems of memory recall, or lack of medical attribution (Campbell and Graham, 1991). Thus, no single source or data collection method is adequate for investigating all aspects of maternal mortality in all settings.

Few developing countries have vital registration systems sufficiently complete to provide reliable population estimates (AbouZahr, 1998).

The main drawback of health services data relates to the selectivity of the service-using population. Without detailed knowledge of the catchment population, it is hard to gauge whether the maternal mortality ratio under or over estimates the level for the general population (which also includes non-users of the service). Other problems related to using health services information include inaccuracies in routine registers and omission of deaths occurring outside maternity wards.

Population based surveys are the primary source of information for calculating the maternal mortality ratio in many developing countries. These types of surveys include:

- **RAMOS** (Reproductive Age Mortality Surveys) studies seek to identify all female deaths in the reproductive period, using a combination of approaches, such as cross-sectional household surveys, continuous population surveillance, hospital and health center records, and key informants (WHO, 1987).

- **Direct estimation** relies on asking questions about maternal deaths in a household during a recent interval of time, say one to two years. These questions can be asked in the context of a household survey or a census of all households, although as yet experience with the latter is fairly limited (Campbell, 1999).

Both these types of methods provide up-to-date estimates but are time-consuming and costly because they require large sample sizes to obtain single-point estimates with sufficiently narrow confidence intervals to enable monitoring of time trends.

- **The sisterhood method** goes some way to overcoming large sample size requirements by interviewing adult respondents about the survival of all their sisters. The indirect method (Graham, Brass, and Snow, 1989) involves fewer questions to respondents but provides a pooled estimate that relates statistically to a point around 10-12 years prior to the survey. The direct method (Stanton, Abderrahim, and Hill, 2000) provides a more current estimate at about 3-4 years prior to the survey, but requires more questions and is more costly and time consuming.

Because of the imprecision in these estimates, modeling methods have also been developed, (WHO, UNICEF, and UNFPA, 2001; AbouZahr and Wardlaw, 2001; UNFPA, 1998b).

Maternal mortality ratios are only a broad indication of the level of maternal mortality, rather than a precise measure, because of the limitations inherent in most measurement methods. The use of confidence intervals around the estimates helps raise awareness that a point estimate is usually too imprecise to be used to monitor trends (AbouZahr and Wardlaw, 2001). Furthermore, the data sources and collection methods described above have very different strengths and weaknesses and yield estimates of varying reliability. For this reason, surveys to estimate maternal mortality should occur no more frequently than every 5-10 years. Evaluators must take into account the large confidence intervals in interpreting the maternal mortality ratio.

Distinguishing between real and artificial changes in the maternal mortality ratio is complicated because observed differences do not necessarily indicate improved maternal health status (Graham, Filippi, and Ronsmans, 1996). Other important issues to consider include:

- Non-sampling errors such as changes in the accuracy of reporting or of classification over time or between districts or populations (Stanton, Abderrahim, and Hill 2000);
- Changes in the definition of a maternal death between ICD-9 and -10 (WHO, 1977; WHO,

1992). Presentation of the maternal mortality ratio should thus clearly state which version it used. In the case of ICD-10, one must specify which of the three categories (direct and indirect maternal deaths up to 42 days postpartum, late maternal deaths, pregnancy-related deaths[9]) the numerator includes;

- Aggregate levels may hide wide differentials between population subgroups; and
- Apparent differences in the maternal mortality ratio between rural and urban areas may simply reflect differences in the pattern (not level) of fertility, with more rural women who are grand multiparous and for whom the risk of death will likely be higher. Other possible confounders include general health status, such as levels of anemia or malaria, and socio-economic factors.

[9] Late maternal deaths: direct or indirect obstetric causes more than 42 days but less than one year after the termination of pregnancy. Pregnancy-related deaths: deaths while pregnant or within 42 days of the termination of pregnancy, irrespective of the cause.

Indicator

Met Need for Essential Obstetric Care (EOC)[10]

Definition
The percent of all women with major obstetric complications who are treated in EOC facilities in a given reference period

This indicator is calculated as:

$$\frac{\text{\# of women with major obstetric complication treated in EOC facilities}}{\text{Estimated \# of women with obstetric complications from the geographical area served by the EOC facilities}} \times 100$$

Where the direct or major obstetric complications include:

- Hemorrhage: antepartum, intrapartum, or postpartum;
- Prolonged/obstructed labor;
- Postpartum sepsis;
- Complications of abortion;
- Pre-eclampsia/eclampsia;
- Ectopic pregnancy; and
- Ruptured uterus.

Number of women with a major obstetric complication includes both women admitted with the complication and women who develop the complication in the facility.

EOC facilities include both "basic" and "comprehensive" levels of essential obstetric care.

Data Requirements
The number of women with a major obstetric complication treated in EOC facilities during the reference period; (an estimate of) the number of women with major obstetric complications in the population during the reference period

Data Sources
Facility records (for number of women treated)

The number of pregnant women who develop obstetric complications requiring medical care to avoid death or disability is estimated to be 15 percent (WHO, 1994a). The number of live births frequently serves as a proxy for all births or pregnancies; when data on the numbers of live births are absent, evaluators can estimate them from *total expected births = population x crude birth rate*.

Purpose and Issues
The purpose of this indicator is to gauge the level of use of EOC services by women experiencing a major obstetric complication in a specified time period and geographical area.

Facility record-keeping systems may require adjustments for the routine collection of data on obstetric complications. A useful system will record major complications in the patient register or maternity logbook. Evaluators must ensure that they gather information from all relevant parts of the facility (e.g., gynecology ward, surgical ward, abortion ward, morgue) and not just from the maternity ward. They must also include complications from all EOC facilities in the area under study in the numerator.

UNICEF/WHO/UNFPA has set the minimum acceptable level of "met need" as 100 percent, but in most developing country settings, this target is unrealistic. If evaluators find less than 100 percent, they conclude that some women with complications are not receiving the necessary medical care. However, if "met need" is low, researchers should seek other data to determine whether the problem lies in the availability, accessibility, qual-

[10] Much of the text for this indicator comes from "Indicators for Reproductive Health Program Evaluation," The EVALUATION Project, (Bertrand and Tsui, 1995), originally based on *Guidelines for Monitoring Progress in the Reduction of Maternal Mortality*, (Maine, McCarthy and Ward, 1992), and the 1997 version *Guidelines for Monitoring the Availability and Use of Obstetric Service*s (Maine et.al, 1997).

ity of care provided, or other factors, such as cultural factors, that determine the utilization of services.

Theoretically "met need" can exceed 100 percent, if more than 15 percent of pregnant women in the population develop major obstetric complications. In developed countries, the proportion of women with complications managed in EOC facilities may be greater than 15 percent of all births. Over-diagnosis of complications, which is seen in parts of Eastern Europe, can also cause this ratio to exceed 100 percent.

One difficulty with "met need" is that complications are subject to numerous recording biases and, even when standard definitions are in place, results can vary greatly with the data collection system being used and the training of the staff.

"Met need" is also particularly sensitive to the number of abortions included in the numerator. If the incidence of unsafe abortion is high, "met need" is likely to be high. The inclusion of all abortions can cause "met need" to be twice or three times as high as it would be without the abortions. Given this inflation of "met need" as a result of the inclusion of all abortion complications, a growing number of advocates for the indicator calculate it both ways, with and without all abortions. By excluding postabortion complications, estimates may be more comparable.

The appropriateness of using 15 percent of all births/pregnancies to estimate the number of women who experience obstetric complications is also open to discussion. WHO's estimates of births with complications may be higher than 15 percent: hemorrhage, 10 percent of pregnancies; sepsis, 8 percent; hypertensive disorders of pregnancy, 5 percent; obstructed labor, 5 percent (WHO, 1996a). However, prospective data from West Africa suggest that 6 percent more reasonably estimates severe obstetric complications (Prual, 2000). The narrower the definition of what is considered a direct or major obstetric complication, the more reliable and comparable the estimates will be (MotherCare, 2000a). However, birth records and registries will likely lack sufficient detail on complications to allow much refinement regarding the severity of a complication.

The issue of double-counting a woman in the numerator (one who is admitted to the same facility more than once during her pregnancy or postpartum period or one who is admitted to more than one facility) is unlikely to seriously bias the results. If this situation were to occur, it would bias the indicators by presenting a more positive view of the health system than merited.

Given that the crude birth rate (CBR), the total population, and 15 percent are all estimates and that the accuracy of the CBR and population may vary according to the source, "met need" will likely be imprecise and may over- or underestimate the true value. To make the indicator useful for comparisons across facilities and districts or over time, one must use the same definitions and document the criteria used in each definition.