How can we monitor progress towards improved maternal health?

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Summary

Measuring change resulting from safe motherhood programmes presents its own challenges. Not only are the desired outcomes of mortality and morbidity difficult to ascertain, even the measurement of service utilisation is far from straightforward because of the complex issues related to the conceptualisation and definition of need for obstetric care. Moreover, because evaluation in safe motherhood is concerned with monitoring the achievements of large-scale programmes rather than individual interventions, attributing changes to the programme per se may be difficult, and providing 'scientific' proof of programme effectiveness may not be achievable. This paper is particularly concerned with addressing the monitoring and evaluation of results of large-scale safe motherhood programmes whose components have been shown or are assumed to be efficacious. It will review the overall approach to evaluation of safe motherhood programmes and the strengths and weaknesses of indicators for measuring progress, and will briefly discuss the design implications of assessing large-scale programmes. Examples are drawn from the literature, and from the recent experience of a Safe Motherhood Programme in three districts in South Kalimantan, Indonesia, supported by MotherCare, USA.

Introduction

Since the launch of the Safe Motherhood initiative in 1987, governmental and non-governmental agencies have joined forces to reduce the huge burden of maternal mortality in the world. Awareness has been raised of the extent of maternal ill-health, and knowledge has become available on interventions that are effective in reducing this burden. The task is now to develop effective and affordable programmes that make the interventions accessible to women, and in doing so, to monitor whether the strategies put into

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place are achieving the goals and objectives specified in the programme.

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This paper is particularly concerned with addressing the monitoring and evaluation of results of large-scale safe motherhood programmes whose components have been shown or are assumed to be efficacious. It will review the overall approach to evaluation of safe motherhood programmes and the strengths and weaknesses of indicators for measuring progress, and will briefly discuss the design implications of assessing large-scale programmes. Examples are drawn from the literature, and from the recent experience of a Safe Motherhood Programme in three districts in South Kalimantan, Indonesia where the author took part in the monitoring and evaluation activities over a five-year period (Mothercare 2000).

What should be evaluated?

The main objective of an evaluation is to influence decisions to continue, change, expand or end a project or programme (Habicht 1999). How complex and precise the evaluation must be depends on who the decision-maker is and on what types of decisions will be taken as a consequence of the findings. Different decision-makers demand not only different types of information but also vary in their requirements of how informative and precise the findings must be. Hospital managers for example, may be interested in knowing what the quality and cost of their services is in order to decide what needs to be done to improve them. District managers, on the other hand, may need data on provision and utilisation of safe motherhood services to plan further amendments to the numbers and types of such services within their district. National agencies may require assessments of coverage or impact to justify further investments in their programme. And finally, international agencies may wish to make global comparisons in coverage and impact to understand

global trends in maternal health, for advocacy or to justify continued funding.

It is not possible to design an evaluation strategy that will provide sufficiently valid and precise information for decisions to be taken at all the various levels of decision-making (facility, district, regional, national and international). Rather, evaluations need to be tailor-made to satisfy the specific needs of each level of decision-making. Unfortunately, evaluation efforts in Safe Motherhood have for many years searched for a universal blueprint of evaluation, largely focusing on what to measure (i.e. indicators) rather than on what to evaluate (i.e. who is the information for, what will it be used for). This has resulted in an over-emphasis on indicators that may be of little use in designing or managing effective health care strategies within countries. Only recently has there been a shift in emphasis from indicators of health to indicators of use of obstetric care but there is relatively little experience so far with the use and interpretation of such indicators.

Table1. Example of indicators to evaluate safe motherhood programmes

Indicator	Question	Example of indicators
Provision	Are the services available and accessible?	Number and distribution of Essential Obstetric Care (EOC) facilities EOC functions performed at facilities Cost of services
Quality	Is the quality of the services adequate?	Case fatality rate Proportion of cases fulfilling pre-defined criteria of quality
Utilisation	Are the services being used?	Proportion of births attended by skilled health personnel Proportion of births in EOC facilities Caesarean sections as a proportion of all births
Utilisation by those in need	Are the services being used by the sub-group with specific needs?	Proportion of all women with complications who are treated in EOC facilities Major obstetrical interventions for specific maternal indications, as a proportion of all births Observed versus expected obstetric complications
Impact	Are there improvements in morbidity or mortality?	Proportion of births with severe morbidity Maternal mortality ratio

One of the first questions to address when designing an

evaluation is whether one is evaluating the performance of the intervention delivery or its impact on health or behaviour (Habicht 1999). One may evaluate the provision, quality or utilisation of services, their coverage and impact. Table 1 presents in a logical order the types of information that one may wish to gather on safe motherhood services. First, the services must be available and accessible to the target population, and of adequate quality. Second, the population must accept the services and use them. Third, if service provision, quality and utilisation are high this may result in an impact on health or behaviour. In addition, the recognition that not all women need specialist obstetric care to prevent maternal death has led to the search for indicators measuring the met (or unmet) need for obstetric care in a sub-group of the population. Examples of such indicators are described in detail below.

What can be measured?

PROVISION OF SERVICES

Services must be provided so that they are available and accessible to the target population. It is difficult to assign standard indicators of service availability, although WHO and UNICEF have suggested a few, such as the number of essential obstetric care (EOC) facilities per 500,000 population, or the percentage of hospitals with caesarean section and blood transfusion (UNICEF, WHO and UNFPA 1997). Service availability will clearly be context-specific and a number of tools exist that may guide the assessment of provision of care. WHO, for example, has developed a Safe Motherhood needs assessment for use by managers, policy-makers and other interested parties at national and district level (WHO 1998). This document provides a comprehensive list of survey materials that can be adapted for local use.

Documenting service provision is the cornerstone of programme eva-luation as other measures of programme success crucially depend on it. Although this is obvious, service provision is often overlooked in programme evaluation and more efforts should be made to carefully document the inputs in care that will ultimately determine sustained service use and impact. In Indonesia, for example, the Government's commitment to post a trained midwife in each village prompted us to document the service delivery by village midwives as one of the central elements of our evaluation (Mothercare 2000). By the end of the programme, availability of skilled attendants had increased dramatically (to one midwife per

1200 population), attesting to the success of the Government's actions. However, the midwifery programme had a number of features that tempered our expectations of programme success, particularly for the long term. Not only was there a high turnover of midwives (19% left the area within 3 years of employment), their formal contracts were of very short duration and they attended very few deliveries (1 to 2 per month). The lack of stability and clinical experience of the workforce is likely to affect the possible benefits of interventions such as in-service training, and the Government is currently taking these constraints into account in redesigning its programme.

Accessibility of services does not only imply geographical accessibility, - say, the percentage of the population within one hour travel time of an EOC facility, - but also financial access. Although the WHO has specified a tool for the assessment of costs of services in its needs assessment document (WHO 1998), documentation of costs of antenatal and delivery services is remarkably scant. In the current context of nearly universal fee-for-services, the costs to the patient cannot be ignored in any evaluation of safe motherhood services. In Indonesia, women reported a median expenditure of Rp 600,000 (US$ 240) for a caesarean section. We believe that the high costs of emergency obstetric interventions was one of the main reasons why women failed to use specialised care when they needed it (see below), despite the government's efforts to overcome financial constraints for the poor during the economic crisis.

Quality of services

Increasing access to obstetric care is only a first step towards the reduction in maternal mortality, as the services offered cannot be assumed to be effective. There is increasing evidence that the services offered in obstetric facilities fall short of acceptable standards, and substandard obstetric care is now known to be an important contributor to maternal mortality and near miss morbidity in poor countries (Egypt Ministry of Health 1994, Mantel *et al.* 1998, Filippi *et al.*1998). Examining the quality of the care is thus an essential part of any programme evaluation.

There is no general agreement as to what constitutes high quality care (Pittrof & Campbell 2000). All definitions of quality of care agree that biomedical outcomes are important, but agree on little else. Over time, definitions of quality of care have become more inclusive, and now address patient and provider satisfaction, social, medical and financial outcomes as well as aspects of equity and

performance according to standards and guidelines. Pittroff and Campbell (2000) propose a comprehensive definition of high quality maternity care which includes: (i) the provision of a minimum level of care to all pregnant women and their newborn babies and (ii) a higher level of care to those who need it; (iii) obtaining the best possible medical outcome; (iv) providing care that satisfies women, their families and care providers and (v) maintaining sound financial performance and developing existing services to raise the standards of care provided to all women. The notion of a minimum level of care for all and a higher level of care for some is an important one, as most users of maternity services are well and do not need specialised care. Unmet need for obstetric care for those who need it might go hand in hand with over-treatment and over-medicalisation for those not needing such care, and quality of care assessments in maternal health have to address both these issues, even where access to care is poor.

In general, our ability to measure the quality of care has advanced substantially and measurement tools are now available (Brook *et al.* 1996). The framework that is most commonly used to assess quality of care is that of structure, process and outcome (Donabedian 1988). Structure refers to the question: 'what facilities, equipment, staff etc. were there', process implies 'what was done to the patient' and outcome questions 'what was the result for the patient'. Examples of outcome indicators in the context of maternity care include the case fatality and perinatal mortality rates. Examples of process data include the proportion of women with eclamptic seizures who have received magnesium sulphate or the proportion of women with severe morbidity in whom an observation chart has been maintained according to protocol. Process data are usually more sensitive measures of quality than outcome data because a poor outcome does not occur every time there is an error in the provision of care and outcome may not always be under the control of the health care providers.

The field of obstetrics has in many ways been privileged because evidence-based practice guidelines have been developed based on scientific literature (Chalmers *et al.* 1989).In addition, explicit criteria of quality of obstetric care have been established for those processes for which we have sound scientific evidence or a formal consensus of experts that the criteria, when applied, lead to an improvement in health (Benhow *et al.* 1997). Such process criteria have been developed in a number of countries,including more recently in two developing countries (Graham *et al.* 2000).Although

these criteria are by no means exhaustive,they are certainly a useful starting point for establishing the technical performance of care in EOC facilities.

Apart from the above process criteria there are as yet no satisfactory standard tools to compare the quality of obstetric care across health facilities (Pittrof & Campbell 2000). Ready-to-use tools exist for infrastructure and supplies, but comprehensive testing of management (particularly non-clinical), knowledge, skills, interpersonal relations and attitudes is difficult. Although UNICEF and WHO advocate the use of health outcome indicators such as the case fatality rate, uncritical interpretation of such indicators in comparisons between health facilities may lead to erroneous conclusions (Richardus *et al.* 1997). Health outcome indicators depend on a number of factors that are unrelated to quality of care and that need to be assessed separately before reaching conclusions about quality of care issues, including the case definition, the efforts put into case finding, and the case mix. In addition, the number of maternal deaths is generally small in any health facility and the lack of precision in the measurement of case fatality rates precludes meaningful comparisons. Although the measurement of severe obstetric or near-miss morbidity has been proposed as a promising alternative outcome measure of quality of obstetric care, experience with such indicators is still in its infancy, and much more work needs to be done in the definition and interpretation of near-miss events and their incidence (Ronsmans & Filippi in press).

The search for standard tools for the measurement of quality of care has been largely driven by the highly competitive health care industry in industrialised countries and its relevance for developing countries is questionable. In developing countries, the aim of quality assessment is primarily to improve services rather than acquire the best share in a competitive market. Investigations that have been set up just to explore whether the care is adequate will in general not bring about change should the care prove not to be adequate, and assessments of quality have to be linked to mechanisms for finding and implementing solutions (Crombie *et al.* 1997). Closing the cycle of quality assurance, or in other words auditing care, is now seen as a promising way to improve quality of services, even in developing countries. Preliminary findings from a number of ongoing projects in developing countries suggest that audits of obstetric care in health facilities may indeed induce change in the quality of the services (Graham *et al.* 2000, Ronsmans & Filippi 2000).

Service use

Numerous documents have reviewed indicators of service use for obstetric care, and only two of the most commonly used indicators are reviewed here: the proportion of births attended by skilled health personnel and population-based caesarean section rates.

### PROPORTION OF BIRTHS ATTENDED BY SKILLED HEALTH PERSONNEL

As it has now become clear that effective delivery care by a skilled attendant is needed to prevent the majority of maternal deaths, the 'proportion of births attended by skilled health personnel' has become one of the most widely promoted indicators of service use. Skilled health personnel refers to doctors or persons with midwifery skills who can manage normal deliveries and diagnose and treat, or refer, obstetric complications (WHO 1997). Trained traditional birth attendants, long seen as one of the cornerstones of maternal health care, no longer qualify as skilled attendants, and are excluded from the numerator (WHO 1997).

This indicator is a valid and useful reflection of global international trends in access to delivery care. It may also provide useful local information in settings where specific efforts have been made to increase skilled attendance at birth, particularly when birth attendance is broken down by type of attendant and place of delivery (Campbell *et al.* 1997). In Indonesia for example, the Government's strategy of a midwife in every village has clearly resulted in a dramatic increase in skilled attendance at birth (Mothercare 2000). In the three districts where we were able to evaluate this strategy, skilled attendance at delivery increased from 37% to 59% and the strongest increase was in home deliveries with a village midwife present (figure 1).

While there is a clear correlation between the proportion of skilled attendants at delivery and maternal mortality when comparing countries at a world scale, it is still uncertain whether relatively small changes in this indicator are a sensitive marker for changes in maternal mortality. Even in Indonesia it remains unclear whether the dramatic increase in skilled attendance at birth has resulted in reductions in maternal mortality, particularly since the substantial need for specialised obstetric care has not yet been met (see below).

Changes in this indicator alone should be interpreted with caution, and firm conclusions towards improved health should only be drawn if the reported improvements agree with those observed in service quality and met need for obstetric care.

Figure 1. Trends in percent of births with skilled attendants among home and facility births in three districts in South Kalimantan, Indonesia
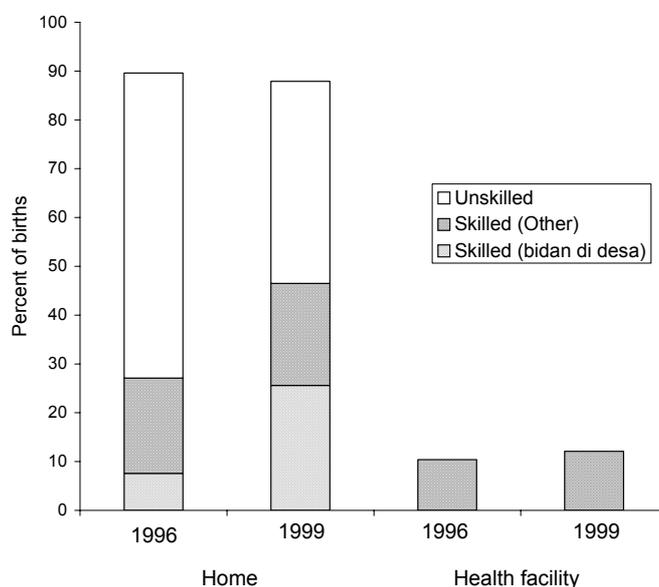
CAESAREAN SECTION RATES

Population-based estimates of the proportion of births which are caesarean sections may reflect, at least in part, the extent to which pregnant women have access to life saving obstetric care. In settings where access to surgical facilities is very low, the majority of caesarean sections may well be carried out to save the life of the mother, and caesarean rates may be accurate tracers of use of essential obstetric services[2]. In a study conducted in a refugee population in Guinea, for example, the baseline population-based caesarean section rate (including hysterectomies) was 0.03%, and

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[2] Caesarean sections are not the only interventions with life-saving potential and ideally all major obstetric interventions rather than just caesarean sections should be included in the numerator (e.g. interventions such as a laparatomy to repair a uterine rupture, hysterectomy to stop an unremitting haemorrhage, symphysiotomy, craniotomy or embryotomy). Excluding such interventions under-estimates the use of life-saving delivery care.

such procedures were carried out almost entirely for life-threatening maternal complications (Van Damme *et al.* 1998). Implementing a refugee-assistance programme led to a four-fold increase in the caesarean section rates, reflecting clear progress towards meeting the need for obstetric and other care.

As caesarean section rates rise, however, the assumption that the majority are done for maternal reasons is no longer valid. As coverage of services increases there is a broadening of the indications to include a majority of foetal problems and, possibly, unnecessary caesarean sections (Barrett *et al.* 1990). In some countries, up to 80% of caesarean sections may afford no benefit to either mother or baby (LoCicero 1993). Even where caesarean rates are extremely low, a substantial proportion may not have maternal indications (Bouillin *et al.* 1994).

Nevertheless, the WHO and UNICEF promote the use of an all-cause caesarean section rate setting a minimum acceptable level of 5% without any specification of the reasons for the caesarean sections (UNICEF, WHO and UNFPA 1997, WHO 1997). However, examples exist that show that all-cause caesarean section rates much lower than 5% may be sufficient to meet the needs of women and achieve low maternal mortality. The Netherlands had maternal mortality ratios as low as 20 per 100,000 with a caesarean section rate not exceeding 2% (De Brouwere & Van Lerberghe 1998). Similarly, England and Wales reached maternal mortality ratios of 60 per 100,000 with caesarean section rates of 2%. In Harare, Zimbabwe, a maternal mortality ratio of 71 per 100,000 was reported with emergency caesarean section rates of 2.7% (Munjanja *et al.* 1996) and in St Louis, Senegal maternal mortality was 148 per 100,000 with a caesarean section rate of 2.4% (MOMA group 1998). These data suggest that setting an arbitrary minimum caesarean section rate of 5% may enhance an over-interventionist culture, and may cause more harm than good. It is easy to imagine 5% being achieved without reaching those who need it, and data from some settings, for example Egypt, suggest that this is already occurring. For the reasons outlined above, one can not infer from rises in caesarean section rates that progress is made towards reducing maternal mortality.

Service use in a sub-group with specific needs

The recognition that some women need specialist obstetric care to prevent maternal death has led to the search for indicators measuring the met (or unmet) need for obstetric care (WHO 1998, De Brouwere & Van Lerberghe 1998, WHO 1994, De Brouwere *et al.* 1996, Pittrof 1997, Belghiti *et al.* 1998). Such indicators aim to identify the pool of users (or non-users) of obstetric services among the pregnant women thought to require such services. Obstetric service use is measured among a sub-group defined by health professionals as requiring such services, by virtue of their having a maternal complication, assuming the needs can be met by the stated obstetric service. There are three distinct indicators which deserve attention: the 'proportion of all women with complications who are treated in EOC facilities' suggested by WHO and UNICEF (1997)(UNICEF,WHO & UNFPA 1997, WHO 1997), 'major obstetrical interventions for maternal indications' suggested by De Brouwere and colleagues (1996)(De Brouwere & Van Lerberghe 1998, De Brouwere *et al.* 1996, Belghiti *et al.* 1998) and 'observed over expected complications' suggested by Pittroff (1997).

PROPORTION OF ALL WOMEN WITH COMPLICATIONS WHO ARE TREATED IN EOC FACILITIES

The proportion of all women with complications who are treated in EOC facilities is an indicator which has been widely promoted as an indicator of "Met Need for EOC" (UNICEF,WHO & UNFPA 1997, WHO 1997)). The assumption behind this indicator is that the proportion of the pregnant population expected to have a complication requiring life-saving obstetric care is relatively stable across populations and can be estimated at at least 15% of pregnant women. This enables the need for life-saving obstetric care to be easily quantified across populations. While intuitively appealing, there are a number of problems that warrant caution in the interpretation of this indicator.

First, the conditions that are included as complications vary from one study to the next, and although it is implied that the listed complications are severe, imprecise and unreliable case definitions introduce considerable heterogeneity. The equivocal nature of the definition of entities such as 'dystocia' or 'prolonged labour' is well known (Crowther *et al.* 1991, Lomas & Enkin 1989). Moreover, complications due to abortion and ectopic pregnancy, although important causes of maternal death, are not necessarily appropriate

indicators of the need for obstetric care, since their incidence bears little relationship to access to and quality of obstetric care. If the indicator is intended to measure progress towards improved delivery of services, then a more careful selection and definition of life threatening complications is certainly warranted.

Second, the assumption that at least 15% of all births are expected to be 'complicated' has never been empirically verified, nor is there any reason to believe, a priori, that the incidence of obstetric complications is constant across population groups (even after excluding abortions and ectopic pregnancies). In the National Birth Center study in the US, 8% of the mothers or infants had serious complications in pregnancy; 12% were transferred to higher level care in labour and 4% after delivery (Rooks *et al.* 1992). In a Stockholm trial, 14% of low risk mothers assigned to birthing centre care were transferred antenatally, 23% of the remaining women were transferred in labour and 3% during the postpartum (Waldenstrom *et al.* 1997), bringing the total requiring higher level care to nearly 40%. There are minimal comparable data published for developing countries; one of the few studies, the MOMA study from seven urban sites in West Africa, shows that 3-9% of pregnant women experienced severe obstetric morbidities (MOMA group 1998). In a population-based study from Bangladesh, about one quarter (26.2%) of the women experienced a labour or delivery complication, including 21 women who died as a consequence (Vanneste *et al.* 2000). The range of incidences reported from these studies illustrates that it is simply not known what proportion of women are likely to develop severe morbidities.

Finally, a major flaw in this indicator is the assumption that, for the broad range of complications specified, obstetric care can only be delivered in health facilities. Historical data refutes this assumption. Sweden in the years 1861-1895 reduced maternal mortality from 580 to 230 per 100,000 with only a moderate increase in facility-based births from 1 to 3% (Hogberg *et al.* 1986). If the assumption is made that all births in facilities were complicated this could be interpreted as a modest increase in "met need for EOC" from 5% to 18% (figure 2). The key factor enhancing the decline in mortality appears to be the sharp rise in professional attendance at home births (from 40% to 78%). If the Swedish policy makers in 1861 had taken their indicator of 5% of "met need for EOC" to imply that access to hospital care was greatly deficient, they may have never arrived at their highly effective policy of professionalising midwifery. In settings where qualified midwives perform life-saving actions, the

indicator proposed by UNICEF et al may grossly under-estimate the extent to which the need for obstetric care has been met. Although UNICEF et al state that they are not encouraging institutional deliveries, assuming that obstetric care can only take place in health facilities may well do exactly that.

## MAJOR OBSTETRICAL INTERVENTIONS FOR MATERNAL INDICATIONS

The proportion of major obstetrical interventions (MOI) for so-called "absolute maternal indications" (AMI) among all births is another indicator that attempts to estimate service use among a sub-group with specific needs. By specifying the indication of the MOI, and selecting only those performed for maternal indications this indicator addresses the concerns raised about caesarean section rates (Bouillin *et al.* 1994, De Brouwere & Van Lerberghe 1998, Van Lerberghe *et al.* 1988, Van den Broek *et al.* 1989, Criel *et al.* 1999). De Brouwere and Van Lerberghe have explicitly used the term "unmet obstetric need" (UON) for this indicator (De Brouwere & Van Lerberghe 1998). The authors also insist on the involvement of health personnel and decision makers in the calculation and interpretation of the indicator, as this may be the most important stimulus for change.

In general, the conditions thought to compromise the mother's life include severe antepartum haemorrhage due to placenta praevia or abruptio placentae, severe postpartum haemorrhage, major foeto-pelvic disproportion (due to a small pelvis or hydrocephalus; including uterine pre-rupture and rupture), transverse lie and brow presentation (De Brouwere & Van Lerberghe 1998, Belghiti 1998). Whether or not eclampsia should be included as an absolute maternal indication is a matter of debate (Ronsmans *et al.* 1999). While the diagnoses listed as absolute maternal indications are clearly more specific than those suggested by UNICEF and WHO, they may still be dependent on subjective "physician" factors (particularly cephalo-pelvic disproportion) and care has to be taken that standard definitions are agreed.

There exists no absolute target rate for MOI for AMI. De Brouwere and colleagues estimate that between 1% and 2% of pregnant women are expected to need a major intervention to save their lives, based on historical data and observations from areas in developing countries with good access to care (De Brouwere & Van Lerberghe 1998). As with the 15% of women expected to have obstetric complications, it may be inaccurate to assume that the

incidence of life-threatening obstetric complications requiring a major intervention is constant across populations. In the absence of universal reference rates, the use of a local reference may be more relevant. In Morocco, for example, the difference in the MOI for AMI rate in urban (0.9%) and rural areas (0.3%) highlights the strong deficits in obstetric care in rural areas (Belghiti 1998). Similar discrepancies were observed in South Kalimantan in Indonesia, where the rate in the most urban district was 1.2%, compared to 0.4 and 0.7% in more remote districts (Ronsmans *et al.* 1999).

Figure 2. Trends in maternal mortality, deliveries by midwives and 'met need' for obstetric care in Sweden (1861-1895)
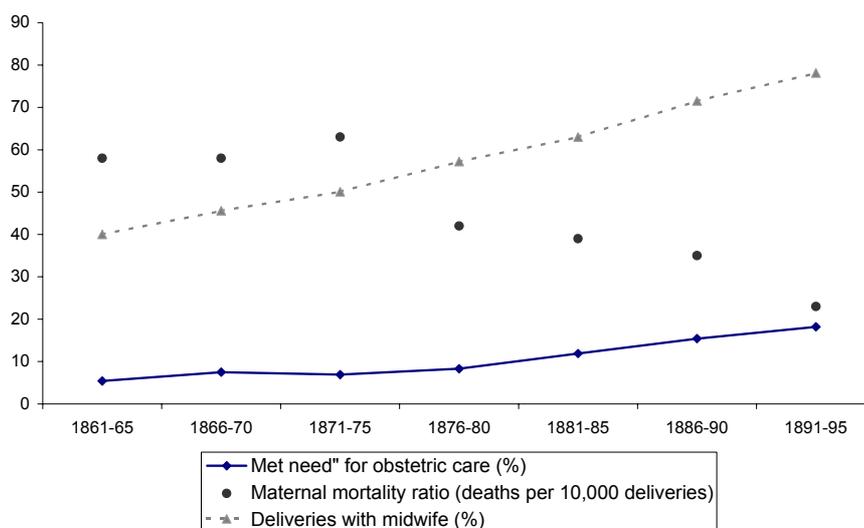
The MOI for AMI rate is a powerful indicator of need for obstetric care and of the functioning of the health system. By focusing on complications for which - or thresholds of severity above which – facility-based interventions are absolutely needed to save the mother's life, the indicator provides information on one of the most critical components in the reduction of maternal mortality: access to specialised obstetric care. In Indonesia, for example, the picture which emerged from the assessment of met need for specialised obstetric care was very different from that obtained from the trends in skilled attendance at delivery. While the proportion of births with a skilled attendant dramatically increased over time (figure 1), the proportion admitted to hospital with a complication requiring a life-saving intervention declined from 1.1% to 0.7%

(p<0.001). Trends were consistent across districts (figure 3). Although the midwives may have treated more complications at home, it is unlikely that they could have prevented most of the severe complications that require a major hospital intervention to save the woman's life. Despite the government's efforts to overcome financial constraints for the poor during the economic crisis, the high costs of emergency obstetric interventions may well have remained the most important obstacle to the use of hospital care.

One drawback to MOI for AMI may be the lack of statistical robustness for monitoring changes over relatively short periods of time. In RDC, for example, pooling data from extended periods of five years was required to ensure sufficient statistical power (Criel *et al.* 1999). Large populations need to be compared to have sufficient power to measure meaningful changes in this indicator.

OBSERVED VERSUS EXPECTED COMPLICATIONS

Pittrof provides a simple and conceptually appealing approach for assessing the need for obstetric care (Pittrof 1997). The indicator, called OVER (observed versus expected ratio), measures the ratio of the number of specific obstetric complications presenting at an EOC facility to the numbers expected in the target population. The obstetric complications of interest (breech at delivery, multiple pregnancy, placental abruption, and placenta praevia) were selected because (1) their correct management requires admission to an EOC facility; (2) their incidence may be relatively stable across populations of similar ethnic origin and (3) they are highly specific and can be measured reliably.
The expected numbers of complications are obtained from published data on populations with a similar ethnic background.

The major strength of this indicator is that the frequency of conditions such as breech and multiple pregnancy is largely determined by genetic (as opposed to environmental) factors, and can hence be assumed to be constant within groups of similar ethnic origins. The twinning rate, for example, tends to be higher among black than Caucasian populations, but remains constant within populations. Even if the absolute value of the reference rates is not entirely accurate, the stability of the incidence allows for valid comparisons over time or between groups of a similar ethnic origin. Local reference data from urban populations with good access to EOC may therefore provide highly valid comparison groups.

While management of breech and twin delivery at an EOC facility may only be desirable, it is absolutely mandatory for

pregnancies complicated by placenta praevia and placental abruption. For the latter conditions, a lower than expected number of admissions at EOC facilities clearly highlights an unmet need for delivery care. Whether the incidence of placenta praevia and abruptio placentae is constant across population groups is uncertain, however, and caution is required in the interpretation of the magnitude of the unmet need based on arbitrary incidence rates.

Figure 3. Percent of births with a life threatening complication (MOI for AMI) admitted to hospital in three districts in South Kalimantan, Indonesia
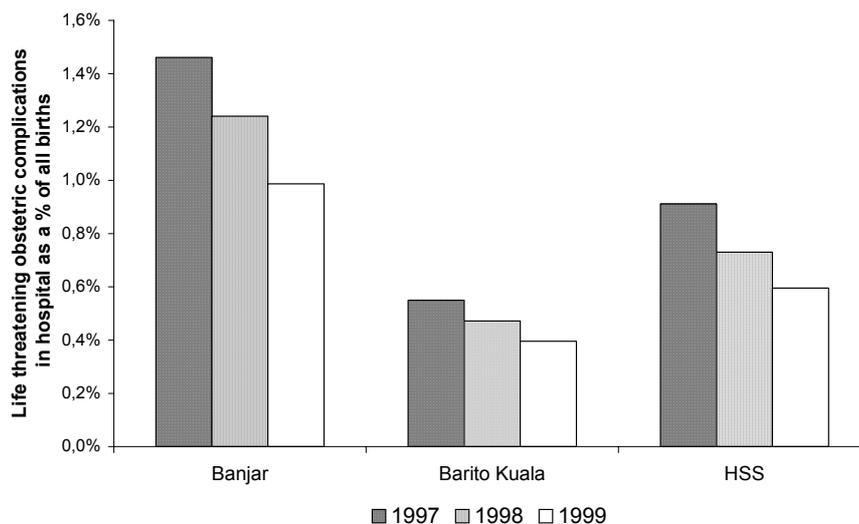
The conceptual and practical simplicity of the OVER method make it very attractive. As the definition of complications relies on clear-cut and well-defined medical entities it avoids the intricate investigation of severity and increases credibility among providers. Conditions such as placenta praevia and abruptio placenta may also be less prone to misclassification than, for example, cephalo-pelvic disproportion. Finally, as separate indicators are computed for each indication, large variations in the specific incidence of specific complications can be investigated directly. A major drawback of this method, however, may well be its lack of statistical robustness, as the complications under study are relatively rare.

## *Multiple indicators of use of and need for obstetric care*

Many authors promote the use of a single indicator of use of and

need for obstetric care and few studies have assessed how the various indicators compare in their capacity to capture the use and need for obstetric care. In Indonesia, because we were uncertain as to the reliability and precision of any single indicator, we preferred to base our evaluation on a number of indicators. Figure 4 shows a comparison between districts at baseline in the proportion of complications admitted to EOC facilities, caesarean section rates, MOI for AMI rates, and OVER for breech and twin deliveries (figure 4). The consistency of the pattern across various indicators is striking. All the indicators suggested that there was substantial inequality between districts in the degree to which the need for obstetric care was met, with one of the districts (Barito Kuala) showing a constant deficit compared to the other districts. The consistency of the pattern regardless of indicators strengthened our conclusions when the findings were presented to the health authorities, as weaknesses in one indicator could not be used to explain away the real differences. Since all these indicators rely on data from the same hospital registers, and since the marginal cost of obtaining the data on all rather than one indicator was small, we recommended the use of a number of indicators for continued monitoring of the safe motherhood programme in Indonesia.

Health impact

Maternal mortality, for many years the preferred indicator of success of safe motherhood programmes, is not anymore recommended as an outcome measure against which to assess programme successes (Inter-agency group1997). The reasons for this are multiple, but mainly relate to measurement issues, including the under-reporting and misclassification of pregnancy as a cause of death and the relatively small numbers of maternal deaths involved (in statistical terms). Many pregnancy-related deaths still go unnoticed or unreported, and substantial errors in the estimates of maternal mortality persist, even in industrialised countries (Bouvier-Colle *et al.* 1991, Campbell & Graham 1991). Correctly measuring maternal mortality not only requires a complete registration of deaths in women of reproductive age, which in many countries may be lacking, but also the recognition that the woman was pregnant or recently delivered at the time of her death.

Figure 4. Multiple indicators of service use in three districts in South Kalimantan Indonesia (December 1996 – November 1997)
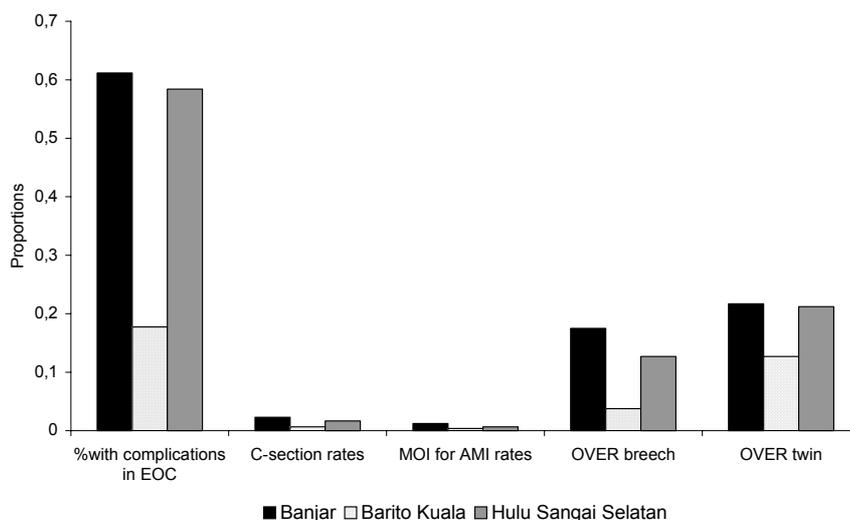
Deaths during early pregnancy such as those due to abortion or ectopic pregnancy are often not recognised or reported as pregnancy-related, and death certificates often omit the notion of pregnancy. In addition, the verbal autopsy techniques on which many cause of death assignments are based may have poor reliability, and field workers may not correctly identify a pregnancy-related death (Ronsmans *et al.* in press). The main difficulty with the measurement of maternal mortality, however, is its relative rarity, and as a result, the huge populations that have to be surveyed to get accurate estimates. Even promising methods such as the sisterhood method are not adequate to monitor programme effectiveness over relatively short time periods because of lack of precision in the levels of mortality, and because the estimates obtained precede the date of the survey by as much as 10 years. WHO and UNICEF are now using models to estimate levels of maternal mortality in countries without reliable data, but these cannot provide information on short term progress in reducing maternal mortality (Inter-agency group 1997).

Although hopes were raised that morbidity would be a good alternative measure for programme effectiveness, it has proven very difficult to measure the prevalence of maternal morbidity at the community level in settings where many women deliver at home (Stewart 1996, Ronsmans 1997). This holds true even when very severe obstetric morbidity – the so-called near-miss – are measured (Filippi in press). In settings where all women deliver in a health

facility, facility-based data can be used to study trends in the incidence of severe obstetric or near miss morbidity. However, experience with such indicators has so far been limited and measurement problems persist (Ronsmans & Filippi in press). Conceptually, the interpretation of trends in morbidity is not straightforward as declining trends in mortality may be associated with an increased incidence of severe morbidity.

## How can we attribute the observed changes to the programme?

The design of an evaluation will largely depend on the kind of inference decision makers wish to make as well as how confident they need to be that any observed effects are in fact due to the project or programme (Habicht *et al.* 1999). For large-scale programmes, the most relevant question is whether the expected changes have occurred. Demonstrating change will largely depend on how easily and accurately the desirable indicators can be measured. Inferences depend on the comparison with previously established criteria, between geographical areas or over time. For example, to determine the trends in met need for specialised obstetric care in the three districts in Indonesia, we compared the observed proportion of admissions for MOI for AMI with the reference standard of 1%, between the districts and over time (figures 3 and 4). This evaluation not only revealed that one of the districts (Barito Kuala) fell far short of the 1% reference and of the rates in the two other districts at baseline but also that there was a worrying decline in the trend in met need for obstetric care over time. Presentation of the findings to the local and national health authorities generated enormous interest and debate. Although the above assessment merely describes whether or not the expected changes have occurred, one may often reasonably ascribe an observed success (or the lack thereof) to the programme being evaluated. In Indonesia, for example, the dramatic increases in skilled attendance at birth over time provided the Government with the necessary reassurance to continue its support for the training and posting of midwives in every village. The failure of the programme to lead to an increase in the use of specialised care in hospitals, on the other hand, highlighted areas for further improvement. The midwives had little in terms of referral support (the ambulance resides at the health centre, but the driver may not always be there), cost of transport is high, and the fees for

emergency medical care are high. Policy decisions and actions are still required to increase referral and ensure quality services at referral level. Most importantly, concerted efforts and commitment will be needed to contain costs of maternal health services, and to make services affordable for the poor.

One of the main criticisms of the above design is its inability to causally link programme activities to observed changes since there is no external control group to verify whether these changes would not have taken place anyway. More complex evaluation designs, however, not only demand additional time, resources and expertise, the existence of an external control group does not necessarily rule out all alternative explanations for the observed changes (Campbell *et al.* 1997). Non-randomly selected control groups are likely to be systematically different from the intervention areas, and efforts to exclude outside influences in both control and intervention groups will still be necessary. Only randomised controlled trials can provide ultimate proof of causality, but these are neither feasible nor desirable for the evaluation of large-scale safe motherhood programmes. From a practical point of view, less stringent designs are often sufficient to decide about the future of a safe motherhood programme.

While the evaluation should deliver the answers in time for the decision- makers to incorporate the findings in the design and planning of interventions, sufficient time should be given to allow the programme to have an effect. As a general rule, no less than 3-5 years are required for an intervention to have an effect (Habicht *et al.* 1999). Experience from the Prevention of Maternal Mortality (PMM) network suggests that even longer time periods may be needed to substantially increase the numbers of women using obstetric services. Time trends from the 5 hospitals supported by the PMM network show that despite intense efforts to improve delivery care, the annual numbers of admissions for complications did not increase, or observed rises were not sustained (Ifenne *et al.* 1997, Ande *et al.* 1997, Leigh *et al.*, 1997, Olukoya *et al.* 1997, Oyesola *et al.* 1997)(figure 5). Although this should not be seen as a failure of the intervention, since admissions were influenced by factors beyond their control, such as the general economic status or hospital fees, it illustrates the difficulties in interpreting trends in hospital admission rates for obstetric complications over a relatively short period of time.

Figure 5. Annual trends in admissions for obstetric complications in four PMM sites (1990-1995).
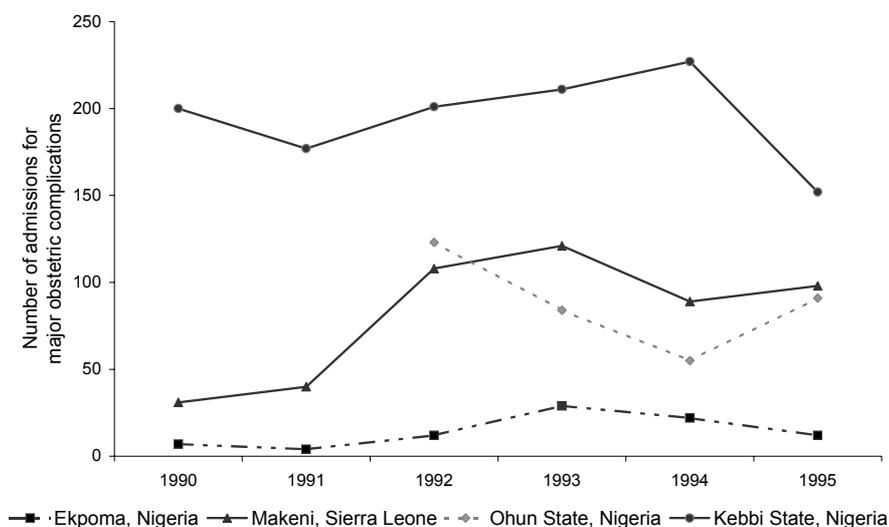
Conclusion

There exists no blueprint for the evaluation of safe motherhood programmes and the choice of indicators and evaluation design depends on who the decision-maker is, and on what types of decisions will be taken as a consequence of the findings. Maternal mortality is not anymore recommended as a measure against which to assess the success of safe motherhood programmes, and little is known about the value of morbidity as an alternative indicator. In contrast, adequate tools exist to assess the provision, coverage and utilisation of safe motherhood services. Because none of the indicators are perfect and none are able by themselves to point to the actions required for improving access to and use of obstetric care, the assessment of safe motherhood services must rely on a variety of indicators. For the evaluation of the quality of obstetric care, it may be preferable to focus on small-scale facility based efforts that incorporate mechanisms for improvements rather than attempt to measure complex processes or outcomes across facilities or providers.

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