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AVERTING MATERNAL DEATH AND DISABILITY

Can the process indicators for emergency obstetric care assess the progress of maternal mortality reduction programs? An examination of UNFPA Projects 2000—2004

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Abstract

Background: In view of the disappointing progress made in the last 20 years in reducing maternal mortality in low-income countries and before going to scale in implementing the new evidence-based strategies, it is crucial to review and assess the progress made in pilot countries where maternal mortality reduction programs focused on emergency obstetric care. *Objective:* To review the process indicators recommended for monitoring emergency obstetric care and their application in field situations, examining the conditions under which they can be used to assess the progress of maternal mortality reduction programs. *Methods:* Five of the six UN recommended process indicators were monitored annually for 5 years in selected districts of Morocco, Mozambique, India and Nicaragua. Trends are presented and discussed. *Results:* With specific variations due to different local situations in the four countries and in spite of variations in quality of data collection, all indicators showed a consistent positive trend, in response to the inputs of the programs. *Conclusions:* The UN process indicators for emergency

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obstetric care should continue to be promoted, but with two important conditions: (1) data collection is carefully checked for quality and coverage; (2) efforts are made to match process and outcome indicators (maternal and perinatal mortality, incidence of complications).

1. Introduction

In view of the disappointing progress made in the last 20 years in reducing maternal mortality in low-income countries [1] and before going to scale in implementing the new evidence-based strategies [2], it is crucial to review and assess the progress made in pilot countries where maternal mortality reduction programs focused on emergency obstetric care. According to the latest UN (WHO—UNICEF—UNFPA) estimates, 529,000 women still die each year from complications of pregnancy and childbirth, and millions are disabled, the vast majority in developing countries [3]. Seventy percent of all maternal deaths are due to five major obstetric complications: hemorrhage, sepsis, unsafe abortion, hypertensive disorders of pregnancy and obstructed labor. It is now well established that, if the majority of severe obstetric complications cannot be predicted, many can be prevented and all can be treated if emergency obstetric care (EmOC) is available, accessible and of good quality [4]. Therefore, skilled attendance at all births and round the clock readiness to provide EmOC to all women with obstetric complications in appropriate facilities are keys to preventing death and life long disabilities, and reach the fifth Millennium Development Goal (MDG). This is a significant strategic change, departing from the earlier focus on home deliveries with trained traditional attendants and antenatal detection of risk, which have not decreased maternal mortality. Recent analyses have confirmed that health systems-related determinants remain dominant over poverty reduction-related or women empowerment-related determinants for inducing a maternal mortality transition [5].

But the impact of such strategies and its relation to program inputs are difficult to measure. Most international health initiatives are now using process indicators, more readily available, to monitor progress. These indicators measure the ability of health systems to provide the set of services required to reach the desired outcome. In this paper, we present the trends of selected process indicators before and after the implementation of EmOC in four project countries, and we review these indicators in terms of their relevance, appropriateness and validity to assess progress of EmOC programs.

2. Background

In 1999, with funding from the Bill and Melinda Gates Foundation, the Columbia University's Mailman School of Public Health, New York, launched an initiative aiming at averting maternal death and disability (AMDD) by implementing large scale EmOC projects [6]. Based on the three delays model [7] and focusing on the third delay, the objective was to improve availability, access, use and quality of EmOC in selected facilities capable of performing six basic or eight comprehensive life-saving EmOC functions. An underlying assumption for this focus on the third delay is that individuals, families and communities will be more likely to use EmOC facilities if they are available, accessible and offer good quality care as well as a welcoming attitude.

In partnership with AMDD, the UN Population Fund (UNFPA) implemented the approach starting in 2000 in selected districts of 4 pilot countries: Morocco, Mozambique, India (State of Rajasthan) and Nicaragua, under the title "Making Safe Motherhood a Reality". The program had four objectives: (a) increase the knowledge of EmOC, (b) integrate EmOC into national maternal mortality reduction strategies, (c) improve understanding and use of EmOC process indicators, and (d) increase the availability, accessibility, utilization and quality of EmOC services. The program also recommended use of the six "UN EmOC process indicators", which assess whether women who develop serious obstetric complications receive the appropriate EmOC services.

The EmOC process indicators were proposed in 1997 after a process of consultation between several UN agencies and experts in the field [8]. They focus clearly on the third delay, although the indicators of utilization also reflect the decision by families and communities to refer parturients to the health system (first and second delays). These indicators include the number of

facilities offering basic and comprehensive EmOC functions, their geographic distribution, the proportion of all births occurring in EmOC facilities, the percentage of women with complications treated in those facilities (met need), the cesarean section rate and the obstetric case fatality rate (OCFR, an indicator of the quality of care). Table 1 summarizes their definition and recommended levels. Indicators 1 and 2 deal with coverage or availability and, to some extent, accessibility, answering the question: Do enough EmOC services exist to serve the population? Indicator 3 deals with utilization, answering the question: Are the EmOC services being used by pregnant women? Indicators 4 and 5 also deal with utilization, but focus on the question of complications: Are the EmOC services being used by women who *really* need them, i.e. women with obstetric complications? And indicator 6 deals with the quality of services, by answering the question of whether the facilities are saving the lives of the women presenting with obstetric complications.

3. Data and methods

The study covers 5 years, from baseline in 2000 through 2004. EmOC was implemented using the same strategy and the same indicators in selected districts or provinces of the four countries, but the inputs were not introduced at the same time in all project areas. The *inputs* included physical upgrading of maternities in facilities dedicated to EmOC, procurement of appropriate equipment, provision of appropriate supplies and drugs, review of staffing and redeployment of obstetric care providers, competency-based training of obstetric care providers, a limited number of community-based promotion interventions, a limited number of communication improvements (radios, transport) and training in the use of the EmOC process indicators. We emphasized the provision of EmOC by non-specialists such as general practitioners, nurse—midwives, nurse—anesthesiologists, especially where specialists were lacking or unwilling to work at peripheral facilities. The guidelines also emphasized respect for human rights throughout.

Table 2 shows some demographic and health characteristics of the project areas in 2000.

Population data to calculate the denominators were provided by the most recent census, to which the investigators applied the average growth rate of the country in order to adjust for population growth over time. This was used to estimate the number of expected births (population multiplied by crude birth rate) and expected obstetric complications (assumed to be 15% of expected births).

Table 1 The six UN EmOC process indicators and recommended levels

EmOC process indicator	Definition	Recommended level
1. Amount and density of facilities providing EmOC services	Number of facilities that provide EmOC, defined as having performed 6 functions (basic) or 8 functions (comprehensive) in the last 3 months	Optimum: one comprehensive EmOC facility per 500,000 people. Optimum: 4 basic EmOC facilities per 500,000 people
2. Geographical distribution of EmOC facilities	Facilities providing EmOC well-distributed at sub-national level (see note)	Optimum: 100% of sub-national areas have the minimum acceptable numbers of basic and comprehensive EmOC facilities
3. Proportion of all births in EmOC facilities	Proportion of all expected births in the population that took place in EmOC facilities	Minimum: 15%, assuming that they are the complicated ones
4. Met need for EmOC services	Proportion of women with obstetric complications treated in EmOC facilities	Optimum 100%
5. Cesarean sections as a percentage of all births	Cesarean deliveries as a proportion of all births in the population	Minimum 5%, maximum 15%
6. Obstetric case fatality rate (CFR)	Proportion of women with obstetric complications admitted to a facility who died	Less than 1%

The geographical distribution is most clearly seen by plotting the EmOC facilities on a map, that ideally should also show population density and roads.

Table 2 Demographic and health data at baseline (2000) for the four UNFPA project areas

Project area	Population (2000) (millions)	Percent rural (%)	Expected births per year	Expected obstetric complications per day	Percent births attended by skilled personnel (urban/rural)	National TFR (urban/rural)	MMR (for whole country)
India (Rajasthan) 7 districts	13.05	75	404,550	175	42 (73/34)	3.3 (2.3–4.1)	440
Morocco 13 provinces	5.36	48	150,130	63	40 (80/19)	3.4 (2.2–4.5)	230
Mozambique 1 province	1.45	70	65,430	30	44 (81/34)	6.3 (5.1–6.8)	980
Nicaragua 3 SILAIS	0.74	55	19,800	9	65 (95/83)	4.3 (3.1–5.4)	250

Service data were collected at baseline during visits to all facilities providing delivery services by examining all available registers (admission, labor room, operating theater, emergency units, etc.). In most countries, the project involved simplifying recording methods and recording all necessary information in a single maternity admission register. The revised registers have been used from the second or third year of the project, a fact that may affect the consistency of the data. None of the project countries could include the private sector, whether for-the-profit or charitable, nor military hospitals. This is of particular concern because the private sector may perform more cesarean sections than the public sector, as is the case in India. This concern, however, did not apply in the rural settings covered by the projects in Mozambique, Nicaragua and Morocco.

4. Results

The trends of EmOC process indicators for the four countries are shown in Figs. 1–6. For practical reasons, maps not being available, the presentation is limited to five of the six indicators.

In India, the project was implemented in seven districts of the State of Rajasthan, covering a population of 13 million. As expressed quantitatively by the changes in process indicators, progress was slow and limited. There was some progress in the number of accredited facilities, but the progress in percent delivery in EmOC facilities was marginal, gaining 0.5 point (+3%), remaining at about 12% of deliveries. Meanwhile, the progress of met need was more substantial, gaining 6.3 points (+68%), though ending only at 15% as against an "optimum" of 100% of all complications. This suggests a more rational use of facilities, with more women with complications now that in the past. Similarly, the progress in cesarean section rate (CSR) was marginal, with a gain of 0.1 point (+17%), remaining $<1\%$ of deliveries, while the progress in obstetric case fatality rate (CFR) was more significant, losing 0.7 point (-54%) and achieving the goal of $<1\%$ of all obstetric complications.

In Morocco, the project was implemented initially in 13 provinces (equivalent to districts) scattered in non-contiguous parts of the country. In 2002, it was decided to regroup the provinces concerned by the project into two contiguous administrative regions, abandoning three provinces and integrating a new one. The data are affected by this discontinuity and must, therefore, be interpreted with caution, but overall the

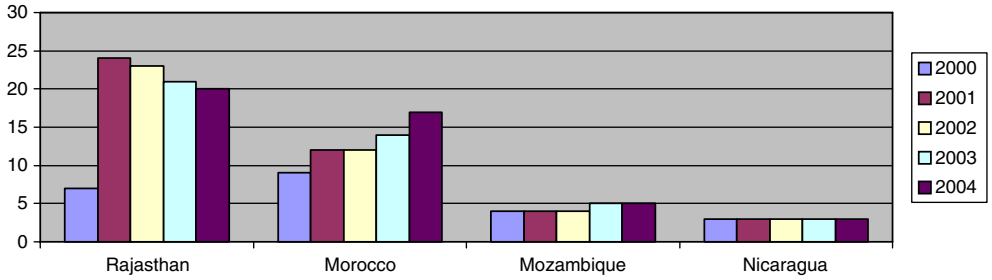

Figure 1 Trends in the availability of comprehensive EmOC facilities, UNFPA Projects, 2000—2004 (on vertical axis is the total number of accredited facilities in the project area).

baseline data of the affected provinces showed remarkable comparability. Progress as measured by the EmOC process indicators was modest, although consistently positive: percent delivery in EmOC facilities gained 3 points (+9%) to reach 36% of births. Met need gained 1.6 points (+5%) to reach 33%. The CSR gained 1.2 points (+75%) to reach 2.8%. However, if we examine the 2003 data (instead of 2004, before the modifications of the study area), the percent delivery in EmOC facilities and the met need gained 10 points each (+33%). The CFR remained below 1%.

In Mozambique, the population in the single province covered by the project (Sofala) was 1.5 million and the baseline levels were the lowest of the four countries. Most inputs were implemented in 2001 and 2002. Yet the progress over 4 years was considerable: percent births in EmOC facilities gained 23 points (+180%), met need gained 19 points (+231%) and the CFR lost 1.5 points (−47%). The CSR, however, did not gain more than 0.3 point (+27%).

In Nicaragua the project covered 740,000 persons, in three health districts (called SILAIs). Baseline levels were relatively high and therefore progress relatively modest. Percent births in EmOC facilities gained 15 points (+62%) to reach almost 40% of births. Met need gained 14 points (+38%) to reach 51% of all complications. The CSR gained 1.5 points (+20%) to reach 9% and the CFR lost 0.4 point to reach 0.1%, with only one maternal death recorded in project facilities in 2004 (−80%).

We must point out that, in addition to these quantitative results, the project also achieved qualitative and policy-related results of great value, which are reported and discussed elsewhere [9]. These results concern the formulation of national maternal health strategies (Mozambique), the revision and publication of standards and protocols for EmOC (Nicaragua, Morocco), the revision of national monitoring processes (Morocco, India), and the use of lessons learned to shape the scaling up of national reproductive and maternal health program (India).

5. Discussion

Despite country-to-country variations, there was a positive trend in all five process indicators in all project areas, indicating an overall positive effect of the approach. A similar conclusion was drawn from the preliminary examination of the data in Senegal where a similar project was implemented in two provinces in 2002 after a needs assessment conducted in the year 2000 (data not shown). In spite of these impressive results, the *absolute* values of the process indicators after 5 years remain far from satisfactory in four out of five countries. The first question coming to mind is how much

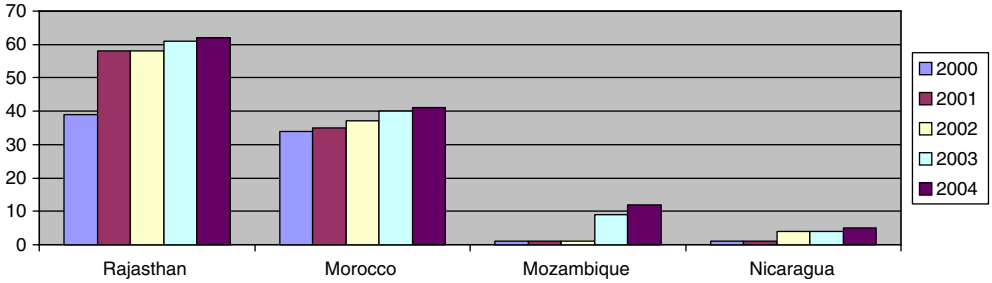

Figure 2 Trends in the availability of basic EmOC facilities, UNFPA Projects, 2000—2004 (on vertical axis is the total number of accredited facilities in the project area).

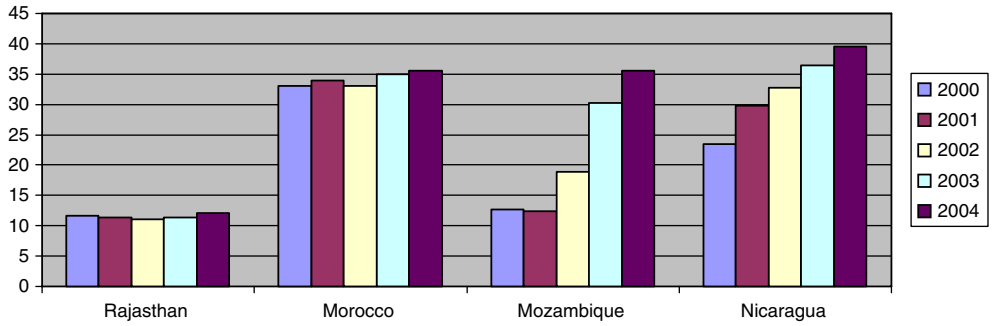

Figure 3 Trends in deliveries in EmOC facilities (percent of all deliveries), UNFPA Projects, 2000—2004.

change can one expect with a limited set of inputs and for a limited duration? Obviously, the inputs of the program were limited in scope and did not cover all components of the health system. And 4 years is a very short time. The answer can only come from a longer time of observation, and if possible a broader range of interventions. The case of Mozambique, with the greatest changes in process indicators, suggests that sustained inputs are strongly recommended.

In any case, this overall success in these countries must be considered an encouragement to continue using the indicators to measure the progress of EmOC programs. It also suggests that these process indicators should be systematically introduced in the routine health monitoring and information systems in all countries. Nevertheless, we should exercise caution in interpreting the data for several reasons related to the nature of the indicators, the quality of the data and the potentially confounding factors. These issues are discussed below in generic terms and should be addressed when detailed analyses of pilot projects are conducted.

6. Limitations of the process indicators

There are several potential sources of bias in the way the process indicators have been calculated to date. Consideration should be given to making data requirements more stringent.

1. The definition of basic and comprehensive EmOC facility, related to the use of either six or eight signal life-saving functions in the 3 (or 6) months preceding the assessment. Ideally, the classification requires a process of accreditation that would need to be repeated every 3 (or 6) months, which was done in some countries but not all. Once facilities were accredited, it was difficult to reclassify or downgrade them. Some basic facilities do not see enough complicated deliveries to effectively perform all the signal functions in the given period.

If midlevel providers are not allowed to perform some functions, this limits the number of signal functions (e.g. manual vacuum aspiration). In particular, the function of assisted vaginal delivery, which according to recommendations is limited to vacuum extraction, is either unknown or not performed routinely in many countries. A recent international survey indicates that only 48% of 108 developing countries promote generalized use of vacuum extractor when indicated; two-thirds of these countries allow midwives to use it [10] (personal communication). There is a tendency during needs assessment surveys to over-report the number of basic EmOC facilities, when several of them actually do not match the criteria of the definition because those with the capacity to perform all the signal functions do not see a

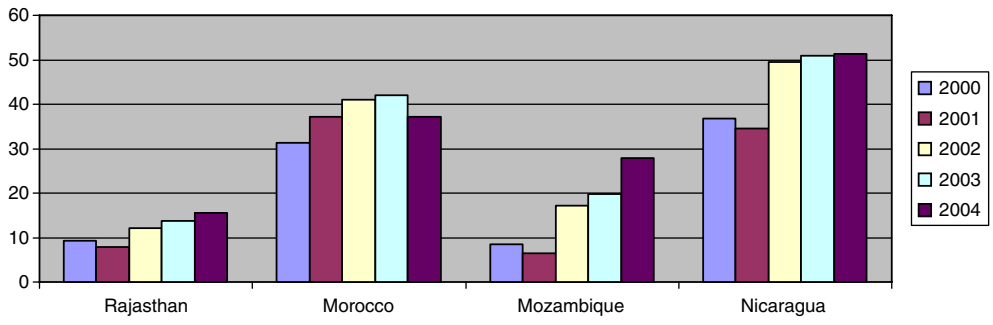

Figure 4 Trends in the met obstetrical need in EmOC facilities (percent of expected obstetric complications received in EmOC facilities), UNFPA Projects, 2000—2004.

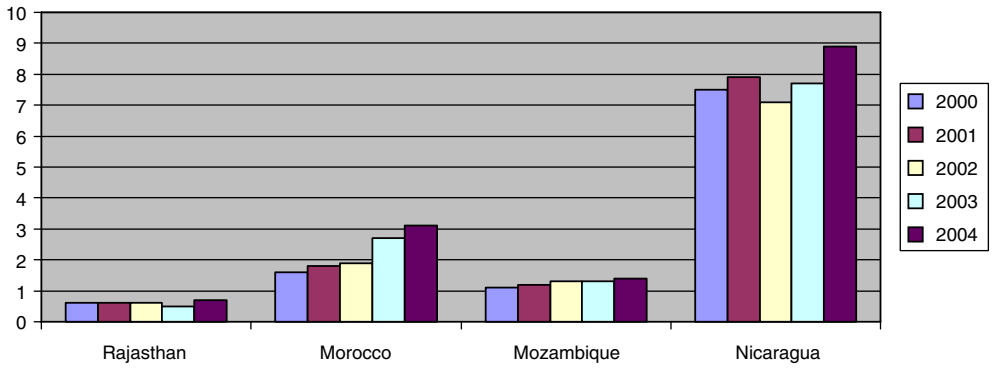

Figure 5 Trends in the cesarean section rates in EmOC facilities (percent of expected births), UNFPA Projects, 2000—2004.

sufficient number of complicated cases to perform them during each 3-month period. In this case, they are sometimes termed "potential EmOC facilities" (and can be recorded as "B minus 1" for example). In the same way, comprehensive facilities performing cesarean sections sometimes lack the function of "safe blood transfusion" because they do not respond to the legal requirements imposed by the country and may be termed "potential CEmOC facilities" or "C minus 1".

In the future, it might be useful to ask program managers to record the reason why the number of basic and comprehensive facilities fluctuates over the years. Fluctuation could be due to a supply-failure (lack of drugs or absence of a provider, or recent upgrading of a maternity), or to demand-failure (insufficient attendance or by-pass by clients, or circulation of negative rumors).

2. The definition of "births in EmOC facilities". This may be confused with the MDG indicator "births assisted by skilled attendants" [11]. While all births in EmOC facilities should be assisted by skilled attendants (or at least have easy access to skilled attendants in case of complication), the inverse is not true. The two indicators actually mean two different things, but there is a tendency to confuse them in reporting. The agreed definition of a skilled attendant at birth [12] does not specify the place of delivery and can apply to home delivery as well as those in EmOC facilities. Surveys, whether population-based or facility-based, do not offer a clear distinction. Both indicators should continue to be used but the distinction made clear. We propose a more rational definition of a skilled birth attendant, specifying that such providers have actually performed with the optimal quality of care the six basic EmOC functions. Indeed, in too many cases, the term "skilled" is applied to providers that have been trained, or have a medical degree, but do not necessarily have the competence (hence the insistence on "competency-based training").

3. The source of service-related data used to calculate the EmOC process indicators: Ideally, data should come from a single source—the maternity admission registers. But often several registers are used, causing confusion, inconsistency and incompleteness. In particular, calculation of the CSR may be compromised in two possible ways: (1) most data do not specify whether the operation was elective or emergency. For better comparability, there should be a recommendation to take into account C-sections done for life-saving purposes only. (2) Private clinics (which may have higher CSRs than the public sector) are often not included in the numerator. While this was not the case in Mozambi-

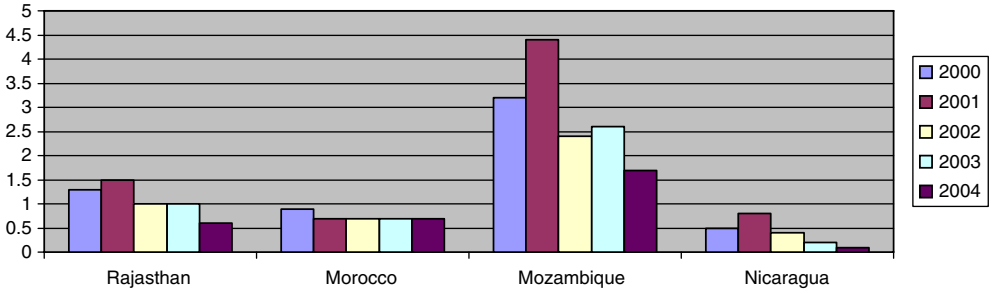

Figure 6 Trends in the obstetric case-fatality rates in EmOC facilities (percent of all obstetric complications seen in the facilities), UNFPA Project, 2000—2004.

que, Nicaragua and Morocco, it could have affected the data from India.

4. The quality of data: If the quality of the registers was checked and improved over the course of the project, it was not ensured at the baseline. This is particularly crucial for the definition of "obstetric complications" used for calculating indicators 4 and 6. The seven obstetric complications are ante- and post-partum hemorrhage, pre-eclampsia and eclampsia, prolonged and obstructed labor, sepsis, uterine rupture, ectopic pregnancy and complications of abortion. The number of complications may be either under- or over-reported, with implications for both met need and CFR. For example in Morocco, hypertension, sub-normal hemorrhage and episiotomy were reported as complications. Reporting of maternal deaths remains another limitation, for example those that took place in the surgical department or in the intensive care unit, or in the medical wards may not be recorded. There may be errors in recording of the cause of death for assessing the obstetric case fatality rate (the only indicator for which the denominator is facility based). Ideally, this rate should be calculated for each type of complication, but numbers are often too small.

5. The source of population data to be used as denominators (catchment population). Normally, these data are provided by the last available population census. In practice, the non-availability of census data, the inconsistencies in the definition of the catchment area of an EmOC facility (usually not consistent with administrative boundaries) and the changes in population size are potential sources of confusion. A particularly difficult case is the assessment of the "catchment population" of a third level referral hospital: in practice, the population using such a hospital is very large, ignoring all administrative boundaries.

6. The geographic distribution of EmOC facilities, one of the six UN process indicators, remains globally under-used or misused. Lacking the technology (digital maps, geographic information systems), most projects have difficulty in assessing and expressing this important indicator of equity. Some countries have tried to calculate the radius around a given facility, others the distance by road, others the travel time (using the most common means of transportation), but there is no consistent methodology.

7. Conclusions and recommendations

The challenges associated with the calculation of the EmOC process indicators should not deter program managers, but encourage them in taking measures to avoid falling in the traps. Some country programs (e.g. Morocco) have already given instructions to their district managers and health information system managers to regularly report on the EmOC process indicators. Others (e.g. Rajasthan, Morocco) have introduced changes in the maternity admission registers to allow easier data collection. An important objective is that managers and heads of facilities, at basic and comprehensive levels, are involved and take an active role in reporting and interpreting the indicators, and take measures to improve their local situation. Supportive supervisory visits were encouraged throughout the projects, but they have a problem of sustainability.

To provide a more complete picture of the progress of EmOC programs, it might be wise to examine the convergence of a broader range of additional process indicators, on a model similar to that of the Maternal and Neonatal Program Effort Index proposed to measure the strength of maternal health programs in developing countries [13].

The Millennium Project recommends that new indicators are introduced to monitor the MDG5, particularly the indicator of availability of EmOC facilities [14], but also indicators of coverage of reproductive health services, such as the contraceptive use rate [15].

It might be useful to introduce other indicators of quality of obstetric care, including cause-specific case fatality rate (requiring large numbers of complications), in-depth investigation of maternal deaths (at the hospital or in the community) [16], criterion based audits [17], waiting time at the facility before being treated, and indicators of quality from the view point of the fetus or the newborn. But also indicators of performance of the referral and transport systems (the second delay), using radio communications, ambulances, time to reach facilities, etc.

Other indicators useful in the convergence analysis are related to the measure of met need for life-saving surgery [18], the measure of the cost of interventions, and the measure of equity in access to maternal health services. All surveys should be able to classify respondents in socioeconomic categories such as wealth-based quintiles, for analyzing access to and utilization of maternal health services. It is indeed crucial to assess and monitor how the needs of the most vulnerable are met, both in terms of poverty and in terms of severity of the complications.

Ideally, however, the evaluation of safe motherhood programs should be done using impact indi-

cators, maternal mortality ratio, perinatal mortality rate and maternal morbidity rates (such as measure of chronic sequelae, such as obstetric fistula). Although both impact and process indicators are needed to tell the story, an important question remains the nature and the strength of the linkages between process and outcome [19, 20]. Very few settings in the developing world are equipped to analyze this linkage [21]. Unfortunately, none of the outcome indicators were measured at baseline in our pilot projects.

At a time when the international health community presses countries, particularly the high mortality countries, to engage in scaled up maternal mortality strategies, it is timely to introduce the six UN process indicators everywhere [22], and also to make further advances in the choice, use and evaluation of additional indicators for monitoring and evaluating these strategies.

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