Tools for monitoring the effectiveness of district maternity referral systems

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It is widely accepted that substantial reductions in maternal mortality and severe morbidity are impossible to achieve without an effective referral system for complicated cases. Early detection and referral to higher levels of care might also substantially reduce neonatal deaths due to the complications of childbirth. The general goal of such a referral system is that patients are dealt with in the right place with effective treatment provided at the minimum of cost. There are real challenges, however, in monitoring the effectiveness of such referral systems once put in place. This paper describes some of the tools used to review pregnancy-related referrals in Lusaka, Zambia. The tool-mix used provided information for monitoring five different aspects of the referral system: the distribution of births across levels of facility and population coverage; the use of essential obstetric care (EOC) level facilities by women with complications; the progress towards a reduction of maternal mortality at referral facility level; inappropriate use of EOC level facility; and perinatal outcomes at peripheral facility level. Apart from the information on coverage, the data came from routinely collected facility statistics, registers and medical notes. Findings for Lusaka are reported. Consideration is given to issues of interpretation of specific indicators, and to how such tools might be used in conjunction with others, in order to help district managers to monitor the effectiveness of district maternity referral systems.

Introduction

It is widely accepted that substantial reductions in maternal mortality and severe morbidity are impossible to achieve without an effective referral system for complicated cases. Early detection and referral to higher levels of care might also substantially reduce the complications of childbirth, including birth asphyxia, that have been found to contribute up to one-third of neonatal deaths in some developing countries (WHO 1994; Kusiako 2000). The World Health Organization (WHO), UNICEF and others have now put considerable work into defining the essential obstetric care (EOC) skills and resources required at the referral hospital and at health centres (Maine et al. 1992; WHO 1994a; Maine et al. 1997; Prevention of Maternal Mortality Network 1997; UNICEF/WHO/UNFPA 1997). Box 1 lists some of the prerequisites for a 'well functioning' referral system that have been identified in the literature.

The general goal of such a referral system is that patients are dealt with in the right place, with effective treatment provided at the minimum of cost (Stefanini 1999). However, there are real challenges in monitoring the effectiveness of such referral systems once put in place.

The need for monitoring tools

In their guide for district managers on reproductive health indicators, WHO recognizes that although much work has

Box 1. Requirements of an effective referral system

- An adequately resourced referral centre[1,2]
- Communications and feedback systems[1,3–5]
- Designated transport[1,3]
- Agreed setting-specific protocols for the identification of complications[4,6,7]
- Personnel trained in their use[4,8]
- Teamwork between referral levels[9,10]
- A unified records system[10]
- Mechanisms to ensure that patients do not bypass a level of the referral system i.e. good patient information, and structured fee and exemption systems[11]

[1]UNICEF 1994; [2]WHO 1992; [3]Campbell et al. 1997; [4]Aspara et al. 1994; [5]Williams et al. 1961; [6]Sauerborn et al. 1989; [7]Aitkin et al. 1985; [8]Mcguire et al. 1996; [9]Van Lerberghe et al. 1997; [10]Stefanini 1999; [11]Mwabu 1989.

gone into the definition and use of indicators at national and international levels, the specific needs at district level have been somewhat neglected (WHO 1997). This exploratory paper describes some of the tools used to review pregnancy-related referrals in Lusaka, Zambia, reports the findings, and discusses how these tools might be used, in conjunction with others, to monitor the effectiveness of district maternity referral systems.

Materials and methods

Study area

Zambia has a population of over 9 million people, of whom about 1.5 million live in the capital city, Lusaka. Nearly 50 000 babies are now born in the city each year. Since the mid-1980s there has been a decentralized maternity care system in Lusaka. At the time the study data were collected, there were 23 health centres that provided antenatal and postnatal care. In ten of these, professional midwives also provide 24-hour labour and delivery services. Nine of these clinics are run by the Lusaka District Health Management Board, and the tenth is a government clinic administered by a different Board. The partograph is used routinely to monitor progress in labour and to assist in the decision-making process with regard to referral to a higher level of care.

The UN indicators for monitoring availability of obstetric services define Basic Essential Obstetric Care Service facilities by six 'signal functions' and Comprehensive EOC as performing those six and a further two (surgery and blood transfusion) (UNICEF/WHO/UNFPA 1997). Because this is an urban setting with reasonable transportation, the District policy is that the Lusaka health centres with maternity beds do not perform all the six Basic EOC functions. They administer sedatives, and oxytocics post-delivery, but they do not administer parenteral antibiotics, perform manual removal of placenta or assisted (instrumental) vaginal delivery; nor at the time of the study did they perform manual vacuum aspiration. The policy in Lusaka is currently that all complicated cases are referred to the University Teaching Hospital, and that health centres deal with uncomplicated cases only. Essential obstetric care services (UNICEF/WHO/UNFPA 1997), including blood transfusions, instrumental deliveries, augmentation of labour and caesarean section, are provided at the referral centre – the University Teaching Hospital. Clinics are linked by radio to an ambulance service running a 24-hour service for emergency transfers. The farthest clinic is approximately 7 km from the University Teaching Hospital.

The data collection was carried out over August and September 1999. Ethical permission for the review of registers and patients' case notes was obtained from the University of Zambia Research Ethics Committee.

Sources of data

The data sources used in this paper are primarily routinely collected health service data such as monthly statistical returns from health facilities, health facility register reviews, and reviews of medical notes and partographs.

Monthly returns from clinics

The Lusaka Urban District Health Management Board (LDHMB) requires the Health Centre In-Charge of each clinic to return monthly records of numbers of admissions, deliveries, discharges, referrals to the University Teaching Hospital, maternal deaths, stillbirths (fresh and macerated), neonatal deaths, babies born before arrival at the health centre, and antenatal and postnatal check ups. At the time of the study this information was collated manually by LDHMB staff.

Referral hospital admission register review

There are three departments at the University Teaching Hospital where women might be admitted or referred for pregnancy-related problems: antenatal clinic, gynaecology 'filter' clinic and labour ward. Each has a register in which admissions are recorded by the receiving midwives on duty in each unit. The registers for all three were reviewed by one of the authors (SD) during August 1999 to identify pregnancy-related referrals from the satellite clinics. Data was extracted on reasons for referral and on the referring facility for January and February 1999. There were 2892 pregnancy-related referrals to the University Teaching Hospital (UTH) recorded during the 2-month period studied. This data was entered on EPI-INFO (version 6) for analysis.

Medical notes review

For information on Apgar scores, the traceable medical notes (684/1034) of women who had received labour care in two district clinics during the same 2-month period (January and February 1999) were reviewed by SD. The two clinics were selected on the basis of their intrapartum referral rates to the hospital. Data on numbers of deliveries at the clinics, taken from the LDHMB monthly returns, and numbers of labour referrals from each clinic, taken from the UTH registers, were used to calculate the intrapartum referral rate of each of the ten clinics with maternity beds. A high-referring clinic and a low-referring clinic were then selected for the notes review. This data was also entered on EPI-INFO.

Data quality issues

Incomplete recording of information on reason for admission in the UTH registers occurred in 7% of the admission cases. For the data on Apgar scores, medical notes had to be traced for two clinics. In one case (Clinic A) retrieval success was high, at 87%. In the other clinic (Clinic B) it was only 55%. Difficulty in tracing notes is a familiar problem in these types of studies, in contexts where filing is haphazard and storage inadequate. The success rate in Clinic B was disappointing, however we felt it was still 'good enough' to provide us with some useful information. Whereas this level of return might not be acceptable for a questionnaire response rate, because of concerns that non-responders may have different characteristics from respondents, on investigation we had no grounds to think that the untraceable cases were substantially different in their care characteristics from those we did review. Staff had no prior knowledge that the study was going to be carried out in their clinic. Space was at a premium at both clinics; both had limited convenient storage for the notes of past patients, which were kept in boxes and in cupboards in no particular order.

Our findings on the interpretability and usefulness of specific tools and indicators have been included in the results

section. Although this is not quite the conventional format for presenting results in quantitative research papers, we found it to be the format most suited to the exploratory nature of the paper.

Results

Drawing upon the requirements of an effective referral system listed in Box 1, the tool-mix used in this paper aimed at providing data for the baseline evaluation and monitoring five different aspects of the maternity referral system:

- the distribution of births across levels of facility, and population coverage of the maternity services;
- the use of EOC level facilities by women with complications;
- the inappropriate use of the Comprehensive EOC level facility;
- progress towards a reduction of maternal mortality at referral facility level;
- perinatal outcomes at peripheral facility level.

Each of these is dealt with in turn in the sections that follow.

Distribution of births across levels of facility, and population coverage by the maternity care system

The spread of places of birth in a district – across hospital, health centres/clinics and home – is important background information for assessing the functioning of a referral system. According to health service statistics for Lusaka for 1998, 10 525 women gave birth in UTH, the University Teaching Hospital which serves as the District Hospital for urban Lusaka, and 33 009 women gave birth at the midwife-run public clinics (Irish Aid Evaluation and Audit Unit 1999), i.e. over two-thirds of the births in the public sector care system took place in the satellite clinics. The desirable spread of deliveries between clinic or health centre level and referral centre level has to be a local decision. In the case of Lusaka the 1998 situation is clearly a great improvement to the situation pre-decentralization. In 1982, 24 000 deliveries took place in the overcrowded hospital (UTH) and 2000 in three peripheral public clinics (Nasah and Tyndall 1994).

The key information that this does not give us is the population coverage by maternity services, nor does it tell us about all the private sector components of care. Community surveys are necessary to obtain this information, although they can be quite expensive to perform. In 1999, with the assistance of the Central Statistics Office, we conducted a community survey of 1210 women who had been pregnant in the previous 2 years in urban Lusaka. This suggested that 24.5% give birth at UTH, 2% in private facilities, 63% at public clinics and 10.5% at home (MacKeith et al., submitted). Public sector maternity care coverage in Lusaka is therefore high, by the standards of urban health services in many developing countries.

Monitoring the use of EOC level facilities by women with complications

Pregnancy-related referrals to the EOC facility (UTH)

Admissions registers at UTH were reviewed for pregnancy-related referrals made during the months of January and February 1999. It should be acknowledged that such facility register data tends to be imperfect. In this case nearly 7% of cases did not have the reason for referral stated. Medical conditions may not be recorded in a consistent manner by all parties, and whether a referral was appropriate or not may not become apparent from the register. However, simple counts by category of clinical condition can be useful in giving information on workload and, in high service utilization populations such as Lusaka, they may give some indication of the frequency of certain conditions and complications.

During the 2-month study period there were 2820 referrals to UTH (Table 1), of which 2505 came from the 23 public sector urban clinics. A further 387 (13.4%) came from elsewhere, the majority from private for-profit and not-for-profit facilities within the city.

The predominance of pregnancy referrals demonstrated in Table 2 is perhaps surprising. If the majority of maternal deaths occur during or just after delivery, one might have expected to see this reflected in a higher proportion of referrals made intrapartum. Whether or not the current balance should be cause for concern rests in part upon whether or not the population needs for EOC are actually being met. One way of exploring this is taken up in the next section ('Met needs for EOC'). That 72% of referrals are made during pregnancy may be a reflection of local conditions and the relative ease of hospital access in an urban setting. As shown in Table 1, the highest proportion of pregnancy referrals was due to complications of abortion, accounting for 14.6% of the total number of referrals. At the time of the study UTH was the only centre with facilities to carry out manual vacuum aspiration (MVA) for abortion complications.

Hypertensive disorders and eclampsia accounted for 192 referrals in the 2-month period, the next biggest single antepartum category (6.6%). This tallies with the numbers we would expect to see if pre-eclampsia affects approximately 2% of pregnancies (Steer 2000). If an estimated 49 470 babies are born annually in Lusaka (based on the assumption that the 43 534 public sector births in 1998 constituted 88% of the total births), we would expect to see around 90 new cases of pre-eclampsia per month in the city, or 180 in the 2-month study period. Other referrals would include pre-existing hypertensive disease and possibly repeat admissions (as the referral figures in Tables 1 and 2 are for cases, not for women).

Malaria, an important indirect cause of maternal mortality and morbidity, accounted for an average of two referrals per day (n = 112, 3.9%).

The high proportion of referrals (16.1%, n = 465) of women in labour with apparently no complication requires some acknowledgement (Table 1). It indicates some of the

Table 1. Reasons for pregnancy-related referral, as recorded in UTH admission registers, January/February 1999

Reason for referral	No.	%
In labour, with no recorded complication	465	16.1
Complications of abortion	421	14.6
Maternal diseases non-specific to pregnancy (i.e. malaria, GI infection, respiratory tract infections)	257	8.9
Raised blood pressure/eclampsia	192	6.6
Foetal factors (presentation, position, multiple)	172	5.9
Maternal history (repeat C-section, grand multiparity, age <16, >35 years)	161	5.6
Threatened abortion	139	4.8
Ruptured membranes	110	3.8
Non-specific symptoms	101	3.5
Premature labour	93	3.2
Bleeding and associated conditions during pregnancy	92	3.2
Genitourinary infection and problems	70	2.4
Prolonged labour, cephalo pelvic disproportion, obstructed labour	68	2.4
Retained products post-partum	56	1.9
Foetal distress/death (intra uterine death, reduced movements, foetal distress, cord prolapse, etc.)	42	1.5
Post-term pregnancy	42	1.5
Ectopic pregnancy	41	1.4
Investigations (scans, confirmation of dates, etc.)	33	1.1
Post-partum sepsis	23	0.8
Trauma, etc. (assault, RTA, poisoning)	23	0.8
Foetal size – large or small for dates	18	0.6
Labour, with another problem	16	0.6
Baby born before arrival	13	0.4
Maternal post-delivery problems excluding sepsis (VVF, psychosis, wound/suture complications)	12	0.4
Existing medical conditions (cardiac, asthma, epilepsy)	11	0.4
Other complications of labour/delivery (ruptured uterus, third degree tear, etc.)	9	0.3
Growths/masses	7	0.2
Hyperemesis	3	0.1
Reason not stated in register	200	6.9
Total	2892	

Table 2. Pregnancy-related referrals to the University Teaching Hospital, grouped by time period, January/February 1999

Time period	No.	%
Pregnancy	2080	71.9
Intrapartum	678	23.4
Post-partum	89	3.1
Unspecified	45	1.6
Total	2892	100

difficulties of using admission register reviews of this kind. Incompleteness of the details entered in the admission register probably plays a large part in this figure. As discussed further in the section on 'Measuring inappropriate use of EOC level facility', just under one-third of these are known to have been self-referrals, but it is possible that there were other self-referrals that went unrecorded. It is also possible that complications, such as prolonged labour, were sometimes recorded only as 'in labour'.

Met need for EOC

A generally accepted estimate is that around 15% of pregnant women will require EOC (Maine et al. 1992; WHO 1994). The data on spread across public sector facilities and on the estimate of population coverage indicate that well in excess of 15% of pregnant women in Lusaka are giving birth at the EOC level facility (the University Teaching Hospital). However, it cannot tell us whether all the women in need of EOC received it.

Met need for EOC, the proportion of all women with complications who are treated in EOC facilities, has been suggested as a measure of the utilization of EOC services (UNICEF/WHO/UNFPA 1997). When we applied the UN working definition of a 'complicated case' requiring EOC, which uses the seven diagnostic categories given in Table 3 (UNICEF/WHO/UNFPA 1997, p. 31), we found that less than one-third of the referrals to the University Teaching Hospital fitted into these specific categories (842/2892, 29%). This is not to say that the other two-thirds of referrals were necessarily inappropriate. In some cases our register-derived information was not complete enough for us to allocate cases into the correct categories (as shown in Table 1, in 200 cases the reason for referral was not stated, and in 465, women were stated to be in labour but no complication was recorded). However, it is also possible that the 'EOC complicated case' indicator is best suited to the needs of comparative work in rural settings, such as that of Pathak et al. (2000) in Nepal, and to a lesser extent to those of an urban context, such as Lusaka. This is because, firstly, in the latter setting one would expect to see more pregnancy-related referrals for hospital level care for the treatment of morbidities, and not just cases with

immediately life-threatening conditions. Secondly, in Lusaka indirect causes play an increasingly important part in the maternal mortality statistics (Ahmed et al. 1999). In 1998, for example, of 159 maternal deaths in Lusaka, only one-third (n = 52) had a direct obstetric cause (Y Ahmed, personal communication).

Assuming that 15% of pregnant women require EOC for such diagnoses, then in order to achieve a 100% met need for EOC, approximately 7420 women (15% of 49 470) would have to be attended at the UTH with these diagnoses during the course of that year. If we extrapolate from the figures for January and February given in Table 3 (842 'complicated case' referrals over 2 months) to estimate that there are 5052 'complicated case' referrals to the UTH over the year, then this would give an estimated met need for EOC in Lusaka of around 68% (5052/7420). This estimate can only be seen as a rough approximation. Calculations are based upon extrapolation and there are likely, potentially conflicting, effects of deficiencies in data recording. On the one hand, some women who had actually originated from outside the city may be included within the complicated case figures, potentially inflating the estimated met need. On the other hand, reason for referral could not be derived from the admission register records in all cases, possibly contributing to an underestimate.

Intrapartum referral rates (health centres to EOC hospital)

A critical element in a maternity care system such as that in Lusaka is the efficient referral of women with complications arising in labour to the facility level with the required EOC functions. Intrapartum referral rate is one indicator that can be used in the monitoring of this activity, but interpretation of this rate has to be specific to the local context. In rural settings where distances are greater and transportation is more difficult, for example, clinical procedures such as manual removal of placenta or instrumental delivery might be carried out at clinic (health centre) level. Where that is the case one might expect the percentage of women referred to the next level to be lower than that in Lusaka.

Using the monthly clinic returns, collated by the District Health Management Board, on the numbers of deliveries at the clinics and the numbers of women referred to the University Teaching Hospital in the preceding calendar year, the intrapartum referral rates for the ten urban clinics providing 24-hour labour and delivery care were calculated. The monthly rates ranged from 8% (May to July) to 11% (October, November, January and February). The annual rate of intrapartum referrals per 100 labours was 9.7%

Whether an annual clinic-to-hospital intrapartum referral rate of 9.7% is an appropriate rate in the urban Lusaka setting can only be corroborated by its use along with a series of other indicators, such as case fatality rates (see below) and caesarean section rates (see below), and by in-depth review of case notes, which can tell us more about the quality of the referral decisions. Nasah and Tyndall (1994) describe the expansion of the Lusaka clinic delivery system from three to 10 clinics with maternity beds during the 1980s. From this account, it is interesting to note that, although the volume has changed, the proportion of their patients in labour transferred by clinics to hospital has apparently remained constant, at around 10% (Nasah and Tyndall 1994, p. 82).

Analysis of the intrapartum referrals to UTH for the first 2 months of 1999 did, however, reveal considerable clinic-to-clinic variations (Table 4). Monthly returns to the District for the previous year also confirmed that although month-by-month variations occur at all clinics, there are substantial inter-clinic variations in the rates of in-labour transfers. These may reflect differences in population sector served, in workloads, in proximity to referral centre of ambulance depot, as well as staff factors such as experience and skill, and further in-depth analysis of case notes would be useful to determine the reasons.

Caesarean section rate

A complicated obstetric case can be defined either in terms of the clinical condition or in terms of the procedure to be performed (WHO 1994). Because caesarean section is a procedure implemented in the treatment of many obstetric complications, including obstructed labour, it provides some indication about uptake of EOC. Caution does need to be exercised in using it as a measure of an effective referral

Table 3. Pregnancy-related referral admissions to the University Teaching Hospital meeting UN 'complicated case requiring EOC' criteria, January/February 1999

Diagnosis on admission	No.	%
Complications of abortion	421	50
Pre-eclampsia/eclampsia	192	22.8
Haemorrhage: antepartum or post-partum	95	11.3
Prolonged/obstructed labour	68	8.1
Ectopic pregnancy	41	4.9
Post-partum sepsis	23	2.7
Ruptured uterus	2	0.2
Total	842	100

Table 4. Intrapartum referral rates (intrapartum referrals per 100 labours) for each of the Lusaka clinics with maternity beds, January/February 1999

Clinic	Referral rate (%)
A	19
B	8
C	7
D	14
E	11
F	9
G	11
H	8
I	10
J	13
Mean	11

system. It does not provide information on the reason for the intervention, and therefore its appropriateness. It would be possible to have a hospital caesarean section rate of 8%, for example, but this might be generated by a high caesarean rate for social reasons among an urban elite, and might not be representative of the use of the intervention for EOC purposes in the population as a whole.

WHO uses a minimum acceptable *population* caesarean section rate of 5% and a maximum of 15% (Maine et al. 1992; WHO 1994). In 1998 UTH's institutional caesarean section rate was 17.9% (1880/10 525) deliveries. Using the estimate of 49 470 births per year in the city (see 'Pregnancy-related referrals to the EOC facility' above), this would give an estimated city-wide population caesarean section rate of around 3.8% (1880/49 470), on the low side according to the WHO standard.

Measuring inappropriate use of the EOC level facility

Implicit in Stefanini's definition of a 'well functioning referral system' are notions of 'over-utilization' and 'under-utilization' of different service levels. Under-utilization may have serious life-threatening consequences for the mother and her foetus if appropriate care is not accessed when complications arise; the sections on 'Distributions of births across levels of facility...' and 'Monitoring the use of EOC level facilities...' specified ways in which under-utilization can be monitored. The monitoring of over-utilization of higher level facilities, i.e. the district hospital, has received less attention because it is often assumed not to be a significant problem in under-served regions (McGinn 1997). However, in urban contexts such as Lusaka it is also important, because it has cost implications of particular significance in resource-constrained situations (Van Lerberge et al. 1997) and because it may be detrimental to quality of care if the referral centre becomes over-burdened.

The proportion of births at the EOC facility that were self-referrals arriving in uncomplicated labours, expressed as a proportion of labour referrals or deliveries, is a simple, if crude, indicator for monitoring inappropriate over-utilization of that level of facility. These are women who have by-passed the clinic level in the system, and have chosen to give birth at the hospital – where they are being charged a bypass fee of 25 000 Zambian Kwacha (approximately US$6) for labour and delivery care. At UTH in the months of January and February 1999, for example, there were 139 recorded self-referrals with uncomplicated labours out of 672 labour-related referrals to the Admissions Ward. This suggests that one-fifth (20.7%) of labour 'referrals' are, in fact, self-referring without an obstetric indication, comprising around 8% of deliveries in the hospital (139/1748 deliveries in January and February). If some of the 'labour with no recorded complication' category in Table 1 were also self-referrals, the actual proportion may even be higher. Whether this 'matters' must depend upon the resultant degree of strain on resources. An as yet unpublished study of 298 primigravidas in Lusaka found that many preferred a hospital delivery because of fear of unexpected complications (Margaret Maimbolwa, personal communication), and it may be that a certain level of 'inappropriate' utilization is acceptable if it provides peace of mind to such individuals.

Monitoring the progress towards a reduction of maternal mortality at referral facility level

Case fatality rates

Case fatality rate (CFR) is defined by WHO (1994) as the number of deaths from obstetric complications as a proportion of all women with obstetric complications. Derived from routine hospital data, to a large extent it measures the performance at that facility, but it may also reflect the condition of the woman on arrival and therefore the effectiveness of referral mechanisms. If the overall rate is no more than 1% then referral, and the care received at the facility, is generally considered to be effective (UNICEF/WHO/UNFPA 1997). If this minimum acceptable level is exceeded, it is difficult to know where the problem lies without some special kind of study such as case review. Complication-specific case fatality rates might, in theory, give useful pointers to where case management protocols at referring and referral facility might be reviewed. This might be calculated for conditions which account for a significant amount of maternal mortality, i.e. antepartum haermorrhage, post-partum haemorrhage, eclampsia/pre-eclampsia, sepsis, obstructed/prolonged labour, although even then single hospitals may have too few deaths for this to be a useful indicator for monitoring changes over time. Hypertensive diseases in pregnancy were the largest group of obstetric referrals to UTH in the time period we studied. In 1996 a departmental audit revealed a case fatality rate for eclampsia of just under 10% (10 deaths/101 cases of eclampsia; Y Ahmed, personal communication). Since then midwifery protocol for treatment and referral has been introduced for midwifery training in the district.

Maternal mortality reviews

Simple maternal mortality information on cause of death can be useful for aiding interpretation of referral statistics. For example, although haemorrhage is known to often be the major cause of maternal death in developing country settings, the proportions of haemorrhage cases among all pregnancy-related referrals to the UTH (3.2%, Table 1), and within the complicated case referrals in Lusaka (11.3%, Table 3), seem to be relatively small. This raises a concern that significant numbers of women in Lusaka might possibly be dying from haemorrhage before ever reaching the hospital as a referral case. A review of the causes of maternal death in the city helped us to interpret this data, and to get a better perspective on whether this was indeed a major problem within Lusaka at this time. In 1998 there were 13 maternal deaths due to haemorrhage, contributing a quarter of the maternal deaths from direct obstetric causes, but only 8% of the total of 159 recorded maternal deaths. Just under half of these haemorrhage deaths were antenatal. Only one death was due to a post-partum haemorrhage that had occurred at a clinic, and one to a secondary post-partum haemorrhage that had occurred at home. Although each of these deaths is still a cause for concern, these data do suggest that most women suffering major haemorrhage requiring hospital care probably do reach that level of facility.

The next question is whether that process of reaching care is as rapid and efficient as it could be. Detailed maternal mortality reviews can be used as tools for examining the reasons for delays in accessing appropriate treatment in individual cases. At UTH all maternal deaths are reviewed by the Head of Department, using the Three Delays model (Thaddeus and Maine 1990). In addition selected cases are normally presented at a weekly maternal mortality meeting attended by doctors and midwives, and at fortnightly inter-labour ward meetings, which have representation from all the city's clinics. Where possible the causes and events are related to the community, the family or the facility. Lessons learnt are incorporated into existing protocols, and any aspects related to the District services are passed on to them.

Perinatal outcomes at peripheral facility level

Perinatal mortality, either a stillbirth and or a death occurring in the first week of life, is associated with delivery and labour management (Bennett and Brown 1995). Complications of childbirth were found to account for nearly one-third of perinatal deaths in a study conducted in Matlab between 1987 and 1993 (Kusiako et al. 2000). A low perinatal mortality rate is, conversely, likely to reflect good intra-partum care and indicate the 'appropriateness' of non-referral decisions. It does, however, require relatively expensive data collection mechanisms such as a community survey. The incidence of fresh stillbirth and of low Apgar scores at clinic level is easier and cheaper to obtain, and could be used to give a window onto the standard of intrapartum perinatal care and referral within the maternity system, and set a baseline for future monitoring.

Intrapartum stillbirths

Lusaka District Health Management Board collates figures on fresh and macerated stillbirths occurring at their nine district clinics with delivery beds. These monthly returns make it possible to identify if any clinic has unduly high rates and to investigate the cause. In 1999, for example, there were 119 fresh stillbirths and 188 macerated stillbirths out of 28 344 deliveries that took place in the nine maternity clinics that year, giving a fresh stillbirth rate at these facilities of 0.4%.

Apgar scores

A high incidence of birth asphyxia could also indicate problems in labour management and failure to refer appropriately. In the Lusaka clinics Apgar scoring at 1 minute post delivery is recorded routinely, and repeated at 5 and 10 minutes if below seven. Apgar scoring is a system that was devised to assess the condition of a baby during its first minutes of life. The assessment is based on five criteria: heart rate, colour, respiratory effort, muscle tone and response to stimuli. While great precision may often be lacking when Apgar scoring is applied in practice in the delivery room, it is generally agreed that an Apgar of seven or below is suggestive of birth asphyxia. Table 5 gives the Apgar scores at 1 minute for babies born at Clinics A and B in January and February 1999. Low recorded scores were not common, with prematurity as a major complicating factor in the few cases that occurred during the time period reviewed.

Discussion

This paper is the report of an exploratory exercise. We are cautious of making any claims to having identified the best combination of tools for monitoring the maternity referral system in the Lusaka setting. Interpretation of indicators is often problematic, as we have shown in the text. Some of the tools might not work in other places. This said, we would recommend the overall approach suggested here as a useful one for the managers of district services who require a range of information in order to inform on-going decision-making on staffing, training and resource allocation.

At national (and international) level the needs are somewhat different, and interest tends to be focused on identifying a single or small set of defined indicators that could be applied universally and that will allow monitoring of major trends over time, or comparisons between districts and regions. The UN set of EOC indicators and minimum acceptable levels are an example of this (UNICEF/WHO/UNFPA 1997).

Table 5. Apgar scores at one minute for babies born at two Lusaka clinics (A and B), January/February 1999

Apgar scores	Clinic A	Comments	Clinic B	Comments
9	312	One infant died in the clinic 6 hours after birth. Identified as premature at the beginning of labour. Other 311 infants alive on discharge from clinic post-delivery.	364	All infants alive at discharge from clinic post-delivery.
8	1		1	Premature second twin. Died at clinic.
6	1	Premature. Alive on discharge from clinic post-delivery.	1	Premature first twin. Died at clinic.
5	1	Premature. Transferred to the neonatal intensive care unit at University Teaching Hospital. Details of transfer not recorded in the notes.	1	
1	2	Both died at the clinic, one premature, the other had cord compression with shoulder dystocia. Delivery took 35 mins to complete.	0	
Total	317		367	

Some other promising work has also been done on specific process indicators for the measurement of service use/ coverage by women with complications. The Observed Versus Expected Ratio (OVER) approach developed by Pittrof, for example, seeks to assess the pregnancy complication rates in conditions that are distinct and obvious, easy to diagnose and difficult to misclassify (Pittrof 1997), and to compare them with the expected number of complications for that geographical catchment area. OVER uses reference indices for pregnancy complications established from settings where more women deliver in institutions. The OVER for placenta praevia and placental abruption can then be used to assess coverage for emergencies requiring rapid management, and the OVER from twin and breech to assess coverage for conditions which can be diagnosed antenatally or during early labour.

Because many emergency obstetric conditions defy clear definition as clinical conditions, another approach that has been taken is to count the procedure to be performed. We have used caesarean section rates in this paper, but other clinical procedures that could be monitored include manual removal of placenta and assisted (instrumental) vaginal delivery. Building on the work of De Brouwere and Van Lerberghe, Ronsmans et al. (1999) have explored the use of Major Obstetric Intervention for an absolute maternal indication (MOI for AMI) as a proportion of expected live births. In low utilization districts in Indonesia they have found this a useful indicator of coverage of obstetric care ('met obstetric need'), assisting comparisons across districts.

Such indicators might be considered for incorporation into a district level monitoring tool-mix. We suggest that the choices are made locally, but that the aim should be a multiple data collection tool-mix that allows examination of different aspects of the referral system.

The tool-mix used in this paper provided information for monitoring five different aspects of the referral system: the distribution of births across levels of facility and population coverage of the maternity services; the use of EOC level facilities by women with complications; the progress towards a reduction of maternal mortality at referral facility level; the inappropriate use of EOC level facility; and the perinatal outcomes at peripheral facility level. While information on non-users of public sector services, and therefore on population coverage, can really only be gleaned by community survey, the rest of the data came from routinely collected facility statistics, registers and medical notes. These are low cost and could therefore be incorporated in a periodic audit cycle of the referral system.

The data we have reported in this paper establish a baseline for the monitoring of future trends in Lusaka's public sector services. More work still needs to be done, however, before some of the indicators can really be used as indexes of care quality within the referral system. Incidence of fresh stillbirth, for example, would seem to be useful in settings where records are kept and the distinction between fresh and macerated stillbirths is made, but further work still needs to be done on establishing minimum credible levels for this, and the cut-offs at which levels might be considered unacceptable.

The final decision on what combination of tools and indicators to use has to be made taking into account their relative importance, the time and resources they imply, their robustness, their ease of interpretation, and their usefulness to programme management. Poor quality of routine recording and inadequate storage of information remain major potential obstacles to collecting reliable baseline data and to ongoing audit. We have highlighted in this paper some of the problems with using data taken 'cold' from admissions registers. Staff sensitization and training might improve the quality of recording of specific pieces of information in time. We originally planned to review case notes in four clinics, but two of these had too many sets of medical notes missing for revision to be meaningful. At one of them women had been given their notes to take home following delivery, and had not returned them. At the other, there had been a flood during the rainy season and some notes had been destroyed. Any set of tools has to be tested in the real world context in which it is hoped they may be applied.

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