

# Severe maternal morbidity from direct obstetric causes in West Africa: incidence and case fatality rates

A. Prual,<sup>1</sup> M.-H. Bouvier-Colle,<sup>2</sup> L. de Bernis,<sup>3</sup> & G. Bréart<sup>4</sup>

Data on maternal morbidity make it possible to assess how many women are likely to need essential obstetric care, and permit the organization, monitoring and evaluation of safe motherhood programmes. In the present paper we propose operational definitions of severe maternal morbidity and report the frequency of such morbidity as revealed in a population-based survey of a cohort of 20 326 pregnant women in six West African countries. The methodology and questionnaires were the same in all areas. Each pregnant woman had four contacts with the obstetric survey team: at inclusion, between 32 and 36 weeks of amenorrhoea, during delivery and 60 days postpartum. Direct obstetric causes of severe morbidity were observed in 1215 women (6.17 cases per 100 live births). This ratio varied significantly between areas, from 3.01% in Bamako to 9.05% in Saint-Louis. The main direct causes of severe maternal morbidity were: haemorrhage (3.05 per 100 live births); obstructed labour (2.05 per 100), 23 cases of which involved uterine rupture (0.12 per 100); hypertensive disorders of pregnancy (0.64 per 100), 38 cases of which involved eclampsia (0.19 per 100); and sepsis (0.09 per 100). Other direct obstetric causes accounted for 12.2% of cases. Case fatality rates were very high for sepsis (33.3%), uterine rupture (30.4%) and eclampsia (18.4%); those for haemorrhage varied from 1.9% for antepartum or peripartum haemorrhage to 3.7% for abruptio placentae. Thus at least 3–9% of pregnant women required essential obstetric care. The high case fatality rates of several complications reflected a poor quality of obstetric care.

**Keywords:** Africa, Western; labour complications, mortality; labour complications, epidemiology; maternal mortality; risk factors; prospective studies; longitudinal studies.

*Voir page 599 le résumé en français. En la página 600 figura un resumen en español.*

## Introduction

The Safe Motherhood Initiative was launched in 1987 with the goal of halving maternal mortality by the year 2000 (1, 2). A decade later, estimates of maternal mortality in sub-Saharan Africa suggested no improvement, although in 1985 a panel of experts had estimated that 88–98% of maternal deaths could be avoided even in the circumstances of most developing countries at that time (3, 4).

In West Africa the latest estimate of maternal mortality was of 1020 maternal deaths per 100 000 live births, a ratio 38 times higher than in more developed regions (3). Data on the incidence and characteristics of the morbidity leading to this

high rate are extremely scarce, in spite of a growing awareness of their value (5–9). Morbidity data are vital for policy-makers and health planners, who need to know how many women require essential obstetric care. Moreover, maternal mortality ratios are difficult to use for assessing the success of programmes because of obstacles to measurement (10, 11). Maternal morbidity data are assumed to be better indicators for designing, monitoring, following up and evaluating safe motherhood programmes. They are most often estimated on the basis of hospital studies, and are retrospective rather than prospective (5, 12). Until recently, estimates of maternal morbidity patterns relied on a small population-based study conducted in a rural community in India (13). In recent years, several studies have been designed to assess the reliability of maternal morbidity data obtained by interviewing women or midwives in the community (14–17). It now appears that interview data do not yield results that are clinically valid or reliable for measuring the incidence of major causes of obstetric morbidity (18).

We conducted a multicentre, prospective, population-based study to measure the incidence of maternal morbidity, the frequency of risk factors in the population and the predictive value of risk factors commonly screened during prenatal consultation in

<sup>1</sup> Adviser, Direction de la Planification, de la Coopération et de la Statistique, Ministère de la Santé et des Affaires Sociales, Mauritanie.

<sup>2</sup> Directeur de Recherches, Institut National de la Santé et de la Recherche Médicale (INSERM), Unité 149, Recherches Épidémiologiques en Santé Périnatale et Santé des Femmes, 123 Boulevard de Port Royal, 75014 Paris, France (email: bouvier-colle@cochin.inserm.fr). Correspondence should be addressed to this author.

<sup>3</sup> Former Adviser, Direction de la Santé Maternelle et Infantile, Ministère de la Santé et des Affaires Sociales, Dakar, Senegal.

<sup>4</sup> Professeur des Universités-Praticien Hospitalier, Université Paris VI and Directeur de l'Unité 149, Institut National de la Santé et de la Recherche Médicale (INSERM), Paris, France.

West Africa (19). In the present paper we propose operational definitions of severe maternal morbidity and report incidence data and case fatality rates for the main direct obstetric causes of such morbidity.

## Materials and methods

### Study population

This survey included all pregnant women living permanently in defined geographical areas during the study period (December 1994 to June 1996). The study areas were: Ouagadougou (Burkina Faso); Abidjan (Côte d'Ivoire); Bamako (Mali); Nouakchott (Mauritania); Niamey (Niger); and, in Senegal, two small towns (Fatick and Kafrine, Kaolack Region) and a major city (Saint-Louis). In each city and town several neighbourhoods were selected to represent, as far as possible, the socioeconomic and demographic diversity of the area concerned. The women in each neighbourhood had easy access to a maternity ward staffed with midwives. Except at Fatick and Kafrine, essential obstetric care was available in a nearby referral hospital. However, blood transfusion was not a common practice in most of these hospitals because of shortages of blood or poor performance of blood banks. Drugs, anaesthetics, antiseptic solutions, and basic consumables such as surgical gloves and sutures were not available in referral hospitals in Bamako, Nouakchott and Ouagadougou and had to be bought in pharmacies by the women's families, even in emergency situations. Access to referral hospitals was difficult at night in some neighbourhoods because of a lack of transport.

Of the 21 557 pregnant women identified in the study areas, 20 326 were included (94.3%). The remaining 1231 women (5.7%) could not be completely followed up because they moved away from these areas. There were few refusals to participate.

### Survey methodology

The methodology and questionnaires were the same in all areas. A door-to-door census of all pregnant women living in each area was conducted by a survey team composed of social workers, qualified midwives, midwives' assistants or nurses. Preliminary sensitization of the populations was carried out through the administrative and traditional authorities and the local women's associations. The persons conducting the surveys identified the pregnant women, who, after consent had been obtained, were included in the study and followed up at home from the time of recruitment until the end of the second postpartum month. All women of reproductive age were visited by the survey teams at regular intervals to identify new pregnancies. Each pregnant woman had four contacts with a survey team.

- The first contact, at inclusion, consisted of an interview on sociodemographic characteristics, obstetric history, previous contraceptive use and

anticipated use of health services during the current pregnancy.

- At the second contact, between 32 and 36 weeks of amenorrhoea, a physical examination was performed at home which included the measurement of fundal height, blood pressure and proteinuria, and checking the fetal heart. Information was also obtained on the pregnancy by interview.
- The third contact was at delivery. Questionnaires were completed by the midwives on the maternity wards and collected every day by the heads of the survey teams, who verified the validity of the information by interviewing the staff who had performed the deliveries. Where delivery occurred at home a member of the survey team interviewed the woman here, together with her relatives and the birth attendant if there was one, usually within a few days. Recall bias was thus limited, and as half of the home deliveries (18.5%) were performed by birth attendants it was possible to collect more precise medical information in these instances. All questionnaires were systematically reviewed on a weekly basis by doctors. In the event that insufficient information had been obtained an additional visit was made.
- The fourth contact involved a home visit at 60 days after delivery. A general physical examination was performed, and if any problem was reported a gynaecological examination was also conducted. The questionnaires of women with any complications were carefully checked and discussed by the local coordinating team, which included an experienced obstetrician. When necessary, more information was sought at the health centres and from the women concerned or their relatives.

The women were advised that these contacts were for the purposes of the survey and were urged to attend for antenatal and postnatal care in health centres as if they had not been participating in the study. All women with mild conditions were encouraged to attend a medical consultation. If a severe problem was detected the woman concerned was taken by a member of the survey team to be examined by an obstetrician.

### Definitions of severe maternal morbidity attributable to direct obstetric causes

Direct obstetric complications mainly involve haemorrhage, dystocia, hypertension, sepsis or abortion (12). The latter was not included because West African women do not usually declare being pregnant before the second trimester. Severe haemorrhage included prepartum, peripartum and postpartum haemorrhage leading to blood transfusion or hospitalization for more than four days (normal deliveries are never hospitalized more than three days in these settings) or to hysterectomy, caesarean section or death. Abruption placentae was included but uterine

rupture (severe dystocia) was not. Severe hypertensive disorders of pregnancy included eclampsia, severe pre-eclampsia (clinical diagnoses) and hypertension (diastolic blood pressure  $\geq 90$  mmHg) leading to hospitalization or death. Sepsis included septicaemia, peritonitis, odorous vaginal discharge leading to hospitalization in the interest of the mother's safety, or to hysterectomy or death. Severe dystocia included obstructed labour or prolonged labour requiring either instrumental fetal extraction or caesarean section, and uterine rupture and other complications of prolonged labour such as laceration of the perineum, pelvic fistulae or death. Caesarean sections performed for other purposes, such as fetal distress or scarred uterus, were also included here because it was assumed that this intervention carried significant risks for mothers in West Africa. Other complications that required caesarean sections, hysterectomies and/or blood transfusion were classified as other direct obstetric causes.

### Maternal mortality

We collected information on all deaths of women included in the study and followed up for 60 days after delivery. In the event of maternal death a special questionnaire (20) was completed by a doctor in the survey team, who contacted the family concerned and the health care providers for this purpose. All deaths were analysed and classified (27). In accordance with the definition of maternal mortality we excluded all accidental causes and maternal deaths that occurred more than 42 days after delivery.

### Statistical analysis

Using the number of live births as the denominator we calculated the maternal morbidity ratio, the numerator being the number of diseases attributable to direct obstetric causes during pregnancy or within 42 days of the termination of pregnancy. We report also the case fatality rates of severe complications, computed by dividing the number of deaths by the number of severe direct and indirect obstetric complications.

The 95% confidence intervals of ratios were calculated using the Poisson distribution, which best approximates the binomial distribution of maternal morbidity (22). The  $\chi^2$  test was used to compare proportions. A *P* value below 5% was considered significant.

## Results

### Sociodemographic data

The mean gestational age at inclusion was  $27.1 \pm 7.8$  weeks of amenorrhoea, the mean duration of follow-up was  $22.2 \pm 8.5$  weeks, and the mean age of the women participating in the study was  $25.7 \pm 6.4$  years. A significant proportion of the entire population (29.7%) fell into the age groups classically at risk for obstetric complications (under 20 years;

35 years and over); 6.7% of the women were single and 46.8% were unable to read or write. Approximately 20% declared their current pregnancy to be unwanted. The mean parity was 2.7, excluding the index pregnancy, and roughly 40% of the population were either nulliparas or grand multiparas, i.e. of parity 5 or more. There was a history of caesarean section in 2% of the women and in 8.7% there was a history of stillbirth.

### Health service utilization

By week 36 of amenorrhoea the women had attended 2.2 antenatal consultations on average; 7% had had no antenatal care; 81% of women delivered within health services but were not always assisted by qualified personnel; 25% of these women were assisted by trained or untrained traditional birth attendants or by family members (Table 1). Among the 18.5% of women who delivered at home, fewer than 5% were assisted by qualified personnel (midwives or medical practitioners). Overall, 62% of women received qualified medical assistance at delivery. Caesarean sections were performed on 329 women (1.67%).

### Severe maternal morbidity

Direct obstetric causes of severe maternal morbidity were diagnosed in 1215 women, giving a ratio of 6.17 per 100 live births (Table 2). The ratio was significantly lower in Bamako (3.01%) than in all other study areas.

Table 1. Birth attendants and place of delivery

Birth attendants	Place of delivery (%)	
	Home	Health services
Doctors	1.4	2.8
Midwives	3.1	72.2
Trained traditional birth attendants	24.4	20.9
Untrained traditional birth attendants	13.2	0.6
Others	57.8	3.6
<b>All attendants</b>	<b>3666 (18.5%)</b>	<b>16 099 (81.5%)</b>

Table 2. Severe maternal morbidity ratios per 100 live births according to study areas (direct obstetric causes)

Study area	Cases	Live births	Maternal morbidity ratio per 100 live births <sup>a</sup>
Abidjan (Côte d'Ivoire)	244	3351	7.28 (6.4–8.2)
Bamako (Mali)	101	3355	3.01 (2.4–3.6)
Niamey (Niger)	168	3089	5.44 (4.6–6.2)
Nouakchott (Mauritania)	248	3218	7.71 (6.7–8.7)
Ouagadougou (Burkina Faso)	179	3050	5.87 (5.0–6.7)
Saint-Louis (Senegal)	189	2088	9.05 (7.8–10.3)
Kaolack (Senegal)	86	1543	5.57 (4.4–6.7)
<b>Total</b>	<b>1215</b>	<b>19 694</b>	<b>6.17 (5.8–6.5)</b>

<sup>a</sup> Values in parentheses are 95% confidence intervals.

Saint-Louis had significantly higher ratios than all other areas except Nouakchott. Niamey, Ouagadougou and Kaolack had similar ratios, which were significantly lower than in Nouakchott (7.71%) and Saint-Louis (9.05%). These differences remained after adjustment of the socioeconomic variables with frequencies differing significantly between study sites (marital status, women's education, income-generating activities, sources of income, rates of unwanted pregnancies) (19).

Table 3 indicates pooled ratios, incidence rates and case fatality rates of all direct obstetric causes. Severe haemorrhage was the most frequent direct cause of severe obstetric morbidity, accounting for 601 cases (46.0%). Its incidence rate was 2.96 per 100 pregnant women. More than half the cases (342) occurred in the postpartum period. The other cases consisted of abruptio placentae (54 cases) and antepartum or peripartum haemorrhage (205 cases), among which there were 12 cases of placenta praevia. There were 193 cases of peripartum haemorrhage with the defined criteria for severity but of undiagnosed cause.

The second commonest cause was severe dystocia (404 cases accounting for 30.9% of overall morbidity). This mainly involved fetopelvic disproportion (100 cases), fetal malpresentation (53 cases) and prolonged labour with the defined criteria for severity. Twenty-three uterine ruptures were observed in this group.

Severe hypertensive disorders affected 125 women, 38 of whom had eclampsia.

There was a very low incidence of sepsis, only 18 cases being found, of which five followed caesarean section.

Other direct obstetric causes included caesarean sections performed for scarred uterus, fetal distress and premature rupture of the membranes. Some women presented two associated conditions: antepartum haemorrhage was associated with postpartum haemorrhage in 48 cases, with obstructed labour in 21 cases, and with hypertensive disorders in 4 cases.

A general ratio of 1 death for 32 cases of severe morbidity was found (41/1307). Case fatality rates varied considerably with the complications that occurred (Table 3): 33.3% for sepsis, 30.4% for

Table 3. Direct obstetric causes of severe maternal morbidity: ratios and case fatality rates according to complications

Complication	No. of cases (n)	% total	Maternal morbidity ratio per 100 live births <sup>a</sup>	Number of deaths	Case fatality rates (%)
<b>Haemorrhage</b>	<b>601</b>	<b>46.0</b>	<b>3.05 (2.81–3.30)</b>	<b>17</b>	<b>2.8</b>
of which					
ante/peripartum	205		1.04 (0.90–1.19)	4	1.9
abruptio placentae	54		0.27 (0.21–0.36)	2	3.7
postpartum	342		1.74 (1.56–1.93)	11	3.2
<b>Dystocia</b>	<b>404</b>	<b>30.9</b>	<b>2.05 (1.86–2.26)</b>	<b>7</b>	<b>1.7</b>
of which					
rupture of the uterus	23		0.12 (0.07–0.17)	7	30.4
<b>Severe hypertensive disorders</b>	<b>125</b>	<b>9.6</b>	<b>0.64 (0.53–0.76)</b>	<b>7</b>	<b>5.6</b>
of which					
eclampsia	38		0.19 (0.14–0.26)	7	18.4
<b>Sepsis</b>	<b>18</b>	<b>1.4</b>	<b>0.09 (0.05–0.14)</b>	<b>6</b>	<b>33.3</b>
<b>Other direct obstetric causes</b>	<b>159</b>	<b>12.1</b>	<b>0.80 (0.69–0.94)</b>	<b>4</b>	<b>2.5</b>
109 caesarean sections for:					
scarred uterus	55		0.28 (0.21–0.36)		
fetal distress	40		0.20 (0.14–0.27)		
premature rupture of membranes	14		0.07 (0.04–0.12)		
thromboembolisms	4		*	2	50
compression syndrome	5		*		
perineal laceration	4		*		
puerperal psychiatric disorders	4		*		
vesicovaginal fistulae	2		*		
miscellaneous <sup>b</sup>	31		*		
<b>Total cases</b>	<b>1307</b>	<b>100</b>	<b>6.64 (6.3–7.0)</b>	<b>–</b>	<b>–</b>
<b>Total number of women</b>	<b>1215</b>	<b>–</b>	<b>6.17 (5.8–6.5)</b>	<b>41</b>	<b>3.40</b>

<sup>a</sup> Values in parentheses are 95% confidence intervals. \*, calculations not performed since values too small.

<sup>b</sup> Ill-defined diagnosis but criteria of severity.

uterine rupture, 18% for eclampsia, and only 2.8% for severe haemorrhage.

## Discussion

Obstetric morbidity has been defined as morbidity in a woman who has been pregnant (regardless of the site or duration of the pregnancy), from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes (12). However, many problems of classification remain, especially in developing countries where the investigations indispensable for accurate diagnosis are limited. These problems and the weakness of the conceptual framework underlying the study of maternal health may explain why there have been so few studies on obstetric morbidity (23). We have focused on direct obstetric causes of severe maternal morbidity because they account for 80% of maternal deaths in developing countries and because appropriate and cost-effective actions are available for dealing with them (24, 25). Moreover, their epidemiology has been little studied compared with that of indirect causes such as anaemia, malaria or hepatitis.

The main difficulty in measuring the frequency of direct obstetric morbidity is that its definition is linked to the health care system: direct obstetric morbidity is said to result from obstetric complications of the pregnant states (pregnancy, labour and the puerperium), from interventions, omissions, incorrect treatment, or from a chain of events resulting from any of the above (12). Our criteria were selective in order to ensure that the obstetric complications classified as severe were actually so. They were chosen in such a way as to avoid any approximation and were therefore more dependent on health care than would otherwise have been the case. Consequently, they are likely to be slightly underestimated. Our definition is close to the concept of the near miss (life-threatening condition) recently used in Benin (16). The present study has allowed us to identify and document all cases of direct obstetric causes of severe maternal morbidity in a large cohort of women, even where delivery took place at home. This differs significantly from what was done in most other studies on maternal morbidity. Some were not designed to measure the incidence of obstetric complications but rather to validate interview data. Those studies are most often retrospective and/or based on women's interviews, thus leading to recall bias and diagnostic uncertainty (14–18). Of the few population-based studies designed to measure the incidence of obstetric morbidity, two were retrospective and based on women's interviews, and two were prospective, one of these being concerned with a very small population (13, 26–28).

In our study, the constant monitoring of all the obstetric facilities, the close relationships between the survey teams, the health personnel, the population of pregnant women and the traditional birth attendants,

and the systematic visiting of all included pregnant women in their homes until 60 days postpartum allowed us to gather all the pieces of information necessary for the diagnosis of severe obstetric morbidity and for limiting bias. It is most likely that almost all women with a life-threatening condition were identified. To our knowledge, no other study has combined all these advantages.

Although severe maternal morbidity ratios varied significantly between study areas, ranging from 3% in Bamako to 9% in Saint-Louis, we decided to present pooled data. The goal of the study was to measure the incidence of severe maternal morbidity in a large cohort of pregnant women so as to obtain the greatest possible precision. A very large sample of pregnant women from West Africa was therefore selected from several study sites chosen on demographic grounds in order to represent a wide variety of settings and sociodemographic characteristics. Moreover, the study was designed so that the greatest possible number of pregnancies occurring at the study sites could be detected and followed up. As a result, 94.3% of the 20 326 included pregnant women were completely followed up. It is intended to analyse the differences between sites later with a view to giving important information to health planners in the various countries.

We observed 5.97 cases of severe direct obstetric morbidity per 100 pregnant women. This is not very different from the ratio found in a hospital-based retrospective survey in Benin, where 8% of deliveries were considered to be near misses (16). In a previous study in Niamey the rate of severe obstetric morbidity was 6.45 per 100 live births (29). In a population-based retrospective study in India, 8% of respondents reported that they had experienced one potentially life-threatening condition (28). The global ratio in our study, although lower, is of comparable magnitude to those in the above studies. The ratio we found was probably an underestimate. Severe problems that did not receive adequate care, without leading to death, might not have been classified as severe (e.g. postpartum haemorrhage without transfusion). All of these rates, however, differed widely from the rate reported for a rural population in Burkina Faso (3.7 per 100 deliveries), although in the latter instance a broader case definition was used, including such syndromes as immense fatigue and continuous aches and a substantial proportion of other diagnoses (27). The difference may be explained by the objective of that study, namely to assess the proportion of morbidity which traditional birth attendants would detect in the field.

The results suggest that the frequency of morbidity might differ between areas. However, differences in the quality of health services and in the qualifications of health providers might have played a role, even though we standardized the definitions and methodology. The definition of severe morbidity obviously depends on the level of health services, since maternal morbidity is defined both on medical diagnosis and on provision of care (e.g. the availability

and/or practice of blood transfusion and cesarean section). Severe haemorrhage, the leading cause of maternal morbidity as well as mortality, illustrates this limitation. The frequencies of severe haemorrhage in our study (1.0 and 1.7 per 100 pregnant women for antepartum and postpartum haemorrhage respectively) were slightly higher than the rate found in the Benin hospital-based study (2.3 cases per 100 deliveries) and much higher than those found in two population-based studies (1.3 in India and 0.8 in Burkina Faso) (16, 27, 28). In a demographic survey in the Philippines, the frequency of haemorrhage was 8.3%, and in the Zaria survey in Nigeria it was 6.4% (3.5% for antepartum and 2.9% for postpartum haemorrhage) (26, 30). We studied only severe haemorrhage in a context where blood transfusion (one of the criteria for severity) was not commonly performed because of a shortage of blood. However, all these rates seem low, since studies in industrialized countries found that postpartum haemorrhage alone was seen in 10–20% of deliveries in the absence of physiological management of the third stage of labour (blood loss  $\geq$  500 ml) (31), an uncommon practice in our settings. In the North-West Thames Region of the United Kingdom, 1.3% of deliveries were complicated by substantial postpartum haemorrhage (blood loss  $\geq$  1000 ml) (32). Observed differences may be principally attributable to diagnostic differences because the volume of blood loss is very difficult to assess in practice.

Similar issues arise for dystocia, the second most common complication in our survey (1.98% of pregnancies). Previously reported rates ranged from 18.02% of pregnancies over a three-year period (1976–79) in Zaria (Nigeria) to 9.1% of deliveries in a hospital-based study in Dakar (1971–75) (30, 33). When only severe cases are counted, however, the rates vary little, from 4.5% of deliveries in Benin to 3.6% in Niamey (16, 29). Moreover, hospital-based studies, especially in teaching hospitals, can be expected to yield much higher rates. In the Benin study the rate was twice ours but this was a retrospective investigation, making comparison difficult (16). We think that some of these discrepancies result from differences in clinical evaluation of the severity of complications and in data collection (interview versus prospective). On the other hand, the rate of uterine rupture observed by us (0.12%) was the same as those reported in the Indian and Niamey studies (0.1%) (28, 29). These rates are lower than those reported from Nigeria (0.18–0.9%) during the 1970s and from Uganda (1.0%) during 1952–58 (6).

Our survey revealed an eclampsia rate (0.19%) in the approximate range of incidences reported from India, Kenya, and the United Republic of Tanzania, where 0.1–0.2 cases per 100 deliveries occurred (6). This rate was also similar to that for Glasgow during the 1970s (0.14%) but this decreased to 0.07% recently (34). Our rate was consistent with those reported by the WHO Collaborative Group on Hypertensive Disorders of Pregnancy in Asian countries (0.17–0.93%), but was half that estimated

for the United Kingdom in 1992 (0.49% of deliveries) (35, 36). Considerably higher rates have been reported: 1% in Benin, 2% in the Philippines and Niamey, and 2.3% in Zaria (16, 26, 29, 30).

We found very few cases of puerperal sepsis (0.09 per 100 pregnant women). Moreover, five cases (27.8%) occurred after caesarean section, which, given the context, yields a low postoperative infection rate (1.5%). However, we reported only severe cases, namely ones of sepsis. With regard to longer-term puerperal infections, all women were interviewed on the sixtieth day postpartum and it was most unlikely that a severe infection went unreported. Comparisons with other incidence studies are very difficult, since most of these measured fever and did not report specifically on puerperal sepsis. Ratios varied greatly in the population-based studies. In Burkina Faso, 0.5% of deliveries were complicated by a persistent fever, whereas the corresponding ratios were 1.8% in the Philippines and 3.3% in India (26–28). In the two other studies using the same concept as ours (near miss or life-threatening condition, or severe morbidity), puerperal sepsis was the least frequent life-threatening condition: 5.4% of cases in Benin (0.04 per 100 deliveries) and 3.4% in Niamey (0.02 per 100 live births) (16, 29). This low rate of puerperal infection was perhaps attributable to an extensive use of antibiotics by the population and by health staff. Generic antibiotics were widely available at low cost in all the study sites, and, in several of them, women were systematically prescribed antibiotics, usually amoxycillin, during and after delivery. Furthermore, the geographical accessibility of health services has improved greatly, and the hygienic practices of health personnel have also improved over the last decade in urban areas.

Our results revealed about 30 severe direct obstetric complications for each maternal death. The rate most often cited is 16.5 cases of pregnancy-related complication for one maternal death. This is based on the results of the small prospective study from India which also included all pregnancy-related episodes of sickness (13). Recent studies report higher proportions: 12.9 severe delivery complications per maternal death in Burkina Faso, 11.7 life-threatening events per maternal death in Benin, and 11 cases of severe obstetric morbidity per maternal death in Niamey (Niger) (16, 27, 29). The large variations in this ratio may be attributable to dissimilar protocols and/or definitions of severe maternal morbidity, or to substantial differences in the quality or efficiency of maternal health care. Furthermore, our prospective study and the close follow-up of women may have had a beneficial effect on the attention given to maternal complications by health personnel, thus improving the quality of care and creating intervention bias. However, the rate of uterine rupture, an excellent indicator of the quality of maternity care is, in our study, comparable to previously published rates and has a very high case fatality rate (30.4%), as have sepsis (33.3%) and eclampsia (18.4%). The comparison of case fatality

rates with those in other studies would throw some light on this matter but comparable data are scarce.

In addition to the scarcity of data on maternal morbidity, the following problems make comparisons extremely difficult.

- The absence of a standardized definition of maternal morbidity.
- The classification of cases as severe morbidity, also called life-threatening conditions or near misses, is relatively subjective and depends on the level of care in the country concerned. A condition that is life-threatening in a country where no appropriate response can be given may not be classified in this way where such a response can be offered.
- In the life-threatening category, certain conditions depend almost entirely on the level of care (e.g. uterine rupture) while others are much less dependent on this (e.g. eclampsia).

The level of care was assumed to be fairly uniform in the six countries where the present study was carried out. However, notwithstanding considerable efforts to standardize both definitions and methodology, there may have been slight differences in the assessment of the severity of cases. Nonetheless, differences in incidence rates between study areas were possibly attributable to genetic, nutritional, environmental or other factors.

## Conclusion

Our longitudinal population-based study of a large cohort of pregnant women has shown that 3–9% of pregnant women experienced severe maternal morbidity attributable to direct obstetric causes (nearly 30 times more frequently than maternal mortality). This gives an estimate of the number of women requiring essential obstetric care or, as De Brouwere et al. suggest (37), of the expected number of obstetric interventions for absolute maternal indications, which they estimated to be 1% on the basis of a literature review.

The study showed that certain complications, i.e. sepsis, uterine rupture and eclampsia, carried a very high risk of death for pregnant women in West Africa, even in large urban settings where there was good access to health care and its utilization by pregnant women was of a high order. This suggested

an unsatisfactory quality of maternal health care (38). The fact that a quarter of the 81% of women who delivered within health services were not attended by qualified health personnel, even though such personnel were present in sufficient numbers, indicates significant malfunctioning of public health services, as previously described (39).

This study should help to improve maternal health care through improved assessment of needs and identification of the conditions carrying high risks of maternal death. Further analysis is in progress concerning the relationship between the different severe obstetric conditions, the level of care and the individual risk factors. It is to be hoped that a better understanding will emerge of severe maternal morbidity in West Africa, eventually leading to a major decline in maternal and perinatal mortality. ■

## Acknowledgements

This paper has been prepared on behalf of the MOMA group:

*Burkina Faso:* Charlemagne Ouedraogo, Blaise Sondo, Jean Testa, Bibiane Koné.

*Côte d'Ivoire:* Thierry Barbé, Thierry Berche, Marcelin Bohoussou, Philippe Eono, A.S. Koffi, Pascal Ortiz, Jean-Luc Portal, Aka Tano-Bian, K. Touré-Coulibally, Christiane Welfens-Ekra, F. Zadi.

*Mali:* Christophe Decam, Arkia Doucouré-Diallo, Jean-Luc Duponchel, Dominique Huguet, Alain Prual.

*Mauritania:* Patrick Cunin, Dahada Ould El Joud.

*Niger:* Daouda Alfari, Noma Mounkaila, Charles Vangeenderhuysen.

*Senegal:* Luc de Bernis, Dominique Bouillin, Jean-Pierre Dompnier, Abdoulaye Gueye.

*Ministère de la Coopération (France):* Jean-Marie Laure, Madeleine Leloup.

*INSERM:* Marie-Hélène Bouvier-Colle, Gérard Bréart.

This study was funded by the Ministère de la Coopération et du Développement, France. It would not have been possible without the cooperation of the health authorities of the countries and regions in which it was carried out. We wish to thank all surveyors and midwives who participated in the study. We would especially like to thank all the pregnant women who kindly accepted to be included in the study.

## Résumé

### Morbidité maternelle grave par causes obstétricales directes en Afrique de l'Ouest : incidence et létalité

Depuis le lancement en 1987 de l'initiative pour la maternité sans risque, on a beaucoup appris sur l'épidémiologie de la mortalité maternelle. Cependant, il existe peu d'études épidémiologiques sur les causes obstétricales de cette mortalité. Les données relatives à la morbidité maternelle, permettant d'estimer le nombre

des femmes qui réclameront des soins obstétricaux essentiels, et nécessaires aux planificateurs sanitaires pour pouvoir organiser, surveiller et évaluer les programmes de maternité sans risque, sont rares. En outre, il s'agit généralement de données hospitalières, plus souvent rétrospectives que prospectives. Dans le

présent article, nous rapportons les taux d'incidence et de létalité de la morbidité grave par causes obstétricales directes, enregistrées au cours d'une vaste étude en population, prospective et multicentrique, effectuée en Afrique de l'Ouest. L'enquête a été menée sur toutes les femmes enceintes résidant dans des zones géographiques précises, entre décembre 1994 et juin 1996. Sur les 21 557 femmes enceintes recensées dans les zones d'étude, 20 326 ont été incluses dans l'enquête (94,3 %). Les zones d'étude étaient les suivantes : Ouagadougou (Burkina Faso); Abidjan (Côte d'Ivoire); Bamako (Mali); Nouakchott (Mauritanie); Niamey (Niger); et, pour le Sénégal, deux petites villes (Fatick et Kafrine, région de Kaolack) et une grande ville (Saint-Louis). La méthodologie et les questionnaires employés ont été partout les mêmes. Chaque femme enceinte a été en contact à quatre reprises avec l'équipe d'enquête : au moment de son enrôlement dans l'étude, entre 32 et 36 semaines d'aménorrhée, lors de l'accouchement et 60 jours après l'accouchement. Une définition opérationnelle des pathologies maternelles graves est proposée. L'hémorragie sévère est une hémorragie de l'ante-partum, du per-partum ou du post-partum ayant entraîné une transfusion sanguine ou une hospitalisation de plus de quatre jours (les accouchements normaux n'impliquant jamais une hospitalisation de plus de trois jours dans ces pays), une hystérectomie, une césarienne, ou le décès. L'hématome rétro-placentaire (HRP) ou décollement prématuré du placenta normalement inséré, a été inclus dans ce groupe, mais pas la rupture utérine (dystocie grave). Ont été inclus dans les troubles graves de l'hypertension gravidique l'éclampsie, la pré-éclampsie sévère et toute hypertension (tension diastolique

$\geq 90$  mmHg) ayant entraîné une hospitalisation ou le décès. Ont été retenus dans les infections la septicémie, la péritonite, l'écoulement vaginal nauséabond, ayant entraîné une hospitalisation, une hystérectomie, ou le décès. La dystocie grave a regroupé les cas de travail dystociques ou prolongés ayant conduit à une manœuvre instrumentale ou une césarienne, les cas de rupture utérine et autres complications de la dystocie telles que les déchirures du périnée, les fistules pelviennes ou les dystocies ayant entraîné le décès. La morbidité grave par causes obstétricales directes a été observée chez 1215 femmes (6,17 cas pour 100 naissances vivantes). Ce rapport varie de façon importante selon les régions, passant de 3,01 % à Bamako à 9,05 % à Saint-Louis. Les principales causes directes de morbidité maternelle grave sont : l'hémorragie (3,05 pour 100 naissances vivantes); la dystocie (2,05 %), 23 cas ayant entraîné une rupture utérine (0,12%); l'hypertension gravidique (0,64 %), 38 cas ayant entraîné une éclampsie (0,19 %), et l'infection (0,09 %). Les autres causes obstétricales directes ont représenté 12,2 % des cas. Les taux de létalité sont très élevés pour l'infection (33,3 %), la rupture utérine (30,4 %) et l'éclampsie (18,4 %); ceux dus à l'hémorragie varient entre 1,9 % pour l'hémorragie de l'ante-partum et du per-partum et 3,7 % pour le HRP. La mesure de la morbidité obstétricale est rendue difficile par l'absence de normes et parce que les définitions sont fonction du système de santé. Toutefois, selon nos définitions, nous montrons que 3 à 9 % des femmes enceintes requièrent des soins obstétricaux essentiels. En outre, les taux élevés de létalité, enregistrés pour plusieurs complications, reflètent la mauvaise qualité des soins obstétricaux.

## Resumen

### Morbilidad materna grave por causas obstétricas directas en el África occidental: incidencia y tasas de letalidad

Desde el lanzamiento de la Iniciativa para una Maternidad sin Riesgo, en 1987, se ha avanzado mucho en el conocimiento de la epidemiología de la mortalidad materna. Sin embargo, son pocos los estudios realizados sobre las causas obstétricas de esa mortalidad. Los datos sobre la morbilidad materna, datos que los planificadores sanitarios necesitan para evaluar el número de mujeres que requerirán atención obstétrica básica, así como para organizar, vigilar y evaluar los programas de maternidad sin riesgo, son muy escasos. Además, normalmente proceden de hospitales y son retrospectivos más que prospectivos. En el presente artículo informamos sobre la incidencia y las tasas de letalidad correspondientes a la morbilidad obstétrica directa grave, sobre la base de un amplio estudio multicéntrico, prospectivo y basado en la población efectuado en el África occidental. Se llevó a cabo una encuesta que abarcó a todas las mujeres embarazadas que vivieron de forma permanente en determinadas zonas geográficas entre diciembre de 1994 y junio de 1996. De las 21 557 mujeres embarazadas identificadas en esas zonas, 20 326 fueron incluidas en el estudio (94,3%). Las zonas estudiadas fueron las siguientes: Ouagadou-

gou (Burkina Faso); Abidján (Côte d'Ivoire); Bamako (Mali); Nouakchott (Mauritania); Niamey (Níger); y, en el Senegal, dos pueblos pequeños (Fatick y Kafrine, en la región de Kaolack) y una ciudad importante (Saint-Louis). La metodología y los cuestionarios fueron los mismos en todas las zonas. Cada mujer embarazada tuvo cuatro encuentros con el equipo obstétrico del estudio: al ser reclutada, al cabo de entre 32 y 36 semanas de amenorrea, con ocasión del parto, y a los 60 días del parto. Se propusieron definiciones operacionales de la morbilidad materna grave. Así, la hemorragia grave abarcaba toda hemorragia, antes, durante o después del parto, que requiriese transfusión sanguínea, hospitalización por espacio de más de cuatro días (pues en las circunstancias en cuestión los partos normales nunca requerían más de tres días de hospitalización), histerectomía o cesárea, o que entrañase la defunción de la paciente. Se incluyó en ese grupo el desprendimiento prematuro de la placenta, pero no la ruptura uterina (distocia grave). Entre los trastornos hipertensivos graves del embarazo se incluyeron la eclampsia, la preeclampsia grave y la hipertensión (presión diastólica  $\geq 90$  mmHg) que conllevasen la hospitalización o la defunción. En el



concepto de sepsis se incluyeron la septicemia, la peritonitis y el flujo vaginal maloliente cuyo resultado fue la hospitalización de la madre, la histerectomía o la defunción. La distocia grave comprendía el parto obstruido o el trabajo de parto prolongado que conllevaron la extracción instrumental del feto o la cesárea, la ruptura uterina, otras complicaciones del trabajo de parto prolongado, como el desgarro perineal y la fístula pélvica, o la defunción. Se observaron las causas obstétricas directas de la morbilidad grave en 1215 mujeres (6,17 casos por 100 nacidos vivos). Esta razón varió significativamente de una zona a otra, desde el 3,01% de Bamako hasta el 9,05% de Saint-Louis. Las principales causas directas de la morbilidad materna grave fueron las siguientes: hemorragia (3,05 por 100 nacidos vivos); parto obstruido (2,05 por 100), con 23 casos de ruptura uterina (0,12 por 100); y

trastornos hipertensivos del embarazo (0,64 por 100), con 38 casos de eclampsia (0,19 por 100) y sepsis (0,09 por 100). Otras causas obstétricas directas representaron un 12,2% de los casos. Las tasas de letalidad fueron muy altas para la septicemia (33,3%), la ruptura uterina (30,4%) y la eclampsia (18,4%); las asociadas a hemorragia variaron entre un 1,9% para la hemorragia prenatal o peripartum y un 3,7% para el desprendimiento prematuro de la placenta. La medición de la morbilidad obstétrica se ve dificultada por la falta de normalización y porque las definiciones dependen del sistema de atención sanitaria. Sobre la base de nuestras definiciones, hemos demostrado que un 3%-9% de las mujeres embarazadas requirieron atención obstétrica básica y que las altas tasas de letalidad de varias complicaciones son el resultado de una deficiente calidad de la atención obstétrica.

## References

- Mahler H. The Safe Motherhood Initiative: a call to action. *Lancet*, 1987, **8534**: 668–670.
- Starrs A. *Prévenir la mort tragique de la mère. Rapport sur la Conférence internationale sur la Maternité sans Risque. Nairobi, Kenya, February 1987*. Washington DC, World Bank Publications, 1987.
- Revised 1990 estimates of maternal mortality. A new approach by WHO and UNICEF. Geneva, World Health Organization, 1996 (unpublished document WHO/FRH/MSM/96.11; available on the Internet at: <http://www.unicef.org/reseval/pdfs/revmm.pdf>).
- World Health Organization. Mortalité maternelle: soustraire les femmes à l'engrenage fatal. D'après le rapport de la Réunion interrégionale sur la Prévention de la Mortalité maternelle. Geneva, 11–15 November 1985. *WHO Chronicle*, 1986, **40**: 193–202.
- Howard D. Aspects of maternal morbidity: the experience of less developed countries. In: Jelliffe DB, Jelliffe EFP, eds. *Advances in International Maternal and Child Health*, 1987, **7**: 1–21.
- Liskin LS. Maternal morbidity in developing countries: a review and comments. *International Journal of Gynecology and Obstetrics*, 1992, **37**: 77–87.
- Causes of maternal deaths. In: Royston E, Armstrong S, eds. *Preventing maternal deaths*. Geneva, World Health Organization, 1989: 75–104.
- AbouZhar C, Royston E. *Maternal mortality: a global factbook*. Geneva, World Health Organization, 1991.
- Maine D et al. *Prevention of maternal deaths in developing countries: program options and practical considerations*. Washington DC, World Bank, 1987 (paper prepared for the International Conference on Safe Motherhood, 10–13 February 1987).
- Graham WJ, Filippi V. *Monitoring maternal health goals, how well do the indicators perform?* London, London School of Hygiene and Tropical Medicine, 1994 (Publication No. 5 of the Maternal and Child Epidemiology Unit).
- Graham WJ, Filippi V, Ronsmans C. Demonstrating programme impact on maternal mortality. *Health Policy and Planning*, 1996, **11** (1): 16–20.
- Measuring reproductive morbidity. Report of a technical working group. Geneva, World Health Organization, 1989 (unpublished document WHO/MCH/90.4; available upon request from Family and Community Health, World Health Organization, 1211 Geneva 27, Switzerland).
- Datta KK et al. Morbidity patterns amongst rural pregnant women in Alwar, Rajasthan; a cohort study. *Health Population-Perspectives and Issues*, 1980, **3** (4): 282–292.
- Stewart MK, Festin M. Validation study of women's reporting and recall of major obstetric complications treated at the Philippine General Hospital. *International Journal of Gynecology and Obstetrics*, 1995, **48** (Suppl.): 1–118.
- Zuryak H et al. Concepts and measures of reproductive morbidity. *Health Transition Review*, 1993, **3**: 17–39.
- Filippi V et al. Near misses: maternal morbidity and mortality. *Lancet*, 1998, **351**: 145–146.
- Fortney JA, Jason BS, eds. *The base of the iceberg: prevalence and perceptions of maternal morbidity in four developing countries*. Research Triangle Park, NC Family Health International, 1996.
- Statement from a task force meeting on validation of women's reporting of obstetric complications in national surveys. *MotherCare Matters*, 1997, **6** (2): 15–16.
- Bouvier-Colle MH et al. *Morbidity maternelle en Afrique de l'Ouest. Résultats d'une enquête en population à Abidjan, Bamako, Niamey, Nouakchott, Ouagadougou, Saint-Louis, et Kaolack*. Paris, Ministère des Affaires étrangères, Coopération et Francophonie, 1998.
- Verbal autopsies for maternal deaths. Geneva, World Health Organization, 1995 (unpublished document WHO/FHE/MSM 95.15; available upon request from Family and Community Health, World Health Organization, 1211 Geneva 27, Switzerland).
- International statistical classification of diseases and related health problems. (Volume 1, Tenth Revision). Geneva, World Health Organization, 1992.
- Jouglé E. [Statistic tests concerning population based indicators of mortality]. *Revue d'Epidémiologie et de Santé Publique*, 1997, **45**: 78–84 (in French).
- Graham WJ, Campbell OMR. Maternal health and measurement trap. *Social Science and Medicine*, 1992, **358**: 967–977.
- Mother-baby package: implementing safe motherhood in countries. Geneva, World Health Organization, 1994.
- Tinker A, Koblinsky MA. *Making motherhood safe*. Washington DC, World Bank, 1993 (World Bank Discussion Paper No. 202).
- Ballweg JA, Pagtolom-An IG. *The risk of childbearing: a Philippine study of pregnancy complications and maternal mortality*. Paper presented at the Seminar on Innovative Approaches to the Assessment of Reproductive Health. International Union for the Scientific Study of Population and University of the Philippines Population Institute, Manila, September 24–27 1996.

27. **Wollast E et al.** Detecting maternal morbidity and mortality by traditional birth attendants in Burkina Faso. *Health Policy and Planning*, 1993, **8** (2): 161–168.
28. **Bathia JC, Cleland J.** Obstetric morbidity in South India: results from a community survey. *Social Science and Medicine*, 1996, **43** (10): 1507–1516.
29. **Pruai A et al.** Severe obstetric morbidity of the third trimester, the delivery and the puerperium in Niamey (Niger). *African Journal of Reproductive Health*, 1998, **2** (1): 10–19.
30. **Harrison KA.** Child-bearing, health and social priorities: a survey of 22,774 consecutive hospital births in Zaria, Northern Nigeria. *British Journal of Obstetrics and Gynaecology*, 1985, **92** (Suppl 2): 1–118.
31. *The prevention and management of post partum haemorrhage. Report of a technical working group.* Geneva, World Health Organization, 1989 (unpublished document WHO/MCH/90.7; available upon request from Family and Community Health, World Health Organization, 1211 Geneva 27, Switzerland).
32. **Stones RW, Paterson CM, Saunders NJ.** Risk factors for major obstetric haemorrhage. *European Journal of Obstetrics, Gynecology and Reproductive Biology*, 1993, **48**: 15–18.
33. **Correa P et al.** [Maternal mortality by dystocia among African women of Dakar (Senegal)]. *African Journal of Medical Sciences*, 1983, **212**: 393–398 (in French).
34. **Leitch CR, Cameron AD, Walker JJ.** The changing pattern of eclampsia over a 60-year period. *British Journal of Obstetrics and Gynaecology*, 1997, **104**: 917–922.
35. WHO International collaborative study of hypertensive disorders of pregnancy. Geographic variation in the incidence of hypertension in pregnancy. *American Journal of Obstetrics and Gynecology*, 1988, **58**: 80–83.
36. **Douglas KA, Redman CWG.** Eclampsia in the United Kingdom. *British Medical Journal*, 1994, **309**: 1395–1400.
37. **De Brouwere V, Laabid A, Van Lerberghe W.** [Requirements for obstetric interventions in Morocco: an approach based on spatial analysis of deficits]. *Revue d'Epidémiologie et de Santé Publique*, 1996, **44**: 11–124 (in French).
38. **Pruai A, de Bernis L, Bouvier-Colle MH.** [Utilization of maternal health services in six large cities in West Africa]. Twenty-second Congress of Association des Epidémiologistes de Langue française (ADELF), Montpellier, 2–4 April 1997. *Revue d'Epidémiologie et de Santé Publique*, 1997, **45** (Suppl. 1): S8–S9 (in French).
39. **Jaffré Y, Pruai A.** Midwives in Niger: an uncomfortable position between social behavior and healthcare constraints. *Social Science and Medicine*, 1994, **38** (8): 1069–1073.