

Maternity wards or emergency obstetric rooms? Incidence of near-miss events in African hospitals

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Background. This study examines near-miss obstetric events in African hospitals as to the frequency, nature, and ratio of near miss to death and considers whether these could become useful indicators for monitoring the performance of obstetric services in Africa.

Methods. Prospective or retrospective reviews of medical records were conducted in nine referral hospitals in three countries (Benin, Côte d'Ivoire, and Morocco). We calculated the incidence of near-miss obstetric events, near-miss cases, and maternal deaths related to hemorrhage, hypertensive diseases of pregnancy, dystocia, infections, and anemia and analyzed these according to hospital and timing relative to admission.

Results. The incidence of near-miss cases was varied, and in some hospitals extremely large: from 1% to almost a quarter of all deliveries were near misses. Near-miss cases were 15 times more common than deaths (ranging from a ratio of 9:1–108:1). Most of the women with near-miss events (NMEs) (83%) were already in a critical condition on arrival at the hospital (range 54–90%), and two in three were referred from another facility. The most frequent types of NMEs were hemorrhage and hypertensive diseases of pregnancy, but anemia was the leading cause in three first referral level hospitals in Benin and Côte d'Ivoire. Near-miss events due to infections were rare.

Conclusions. Near-miss events are extremely common in some African hospitals, with a high proportion arriving in critical conditions. Near-miss events must be estimated separately for those already in a critical condition on arrival and those developing after admission; the first as a good indicator of the effectiveness of emergency referrals and the second as a potential tool for monitoring the performance of obstetric services.

Key words: pregnancy complications; critical illness; morbidity; outcome assessment; epidemiology

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Obstetric complications are a leading cause of mortality and disability in women in developing countries. Countries use considerable resources in training midwives and obstetricians and in upgrading maternity services. Monitoring the quality of obstetric care is necessary to ensure that such investments lead to improvements in maternal health. To this end, the development

of indicators of obstetric performance has received a great deal of attention in the past 5 years (1–3). The analysis of sentinel events such as near-miss complications (women who nearly died) may be an important mechanism in the evaluation of the quality of maternity services (4).

Until recently, most studies of near miss or severe obstetric morbidity have been conducted

in developed countries, with notable exceptions in Francophonic Africa, South Africa, China, India, and Malaysia (5–9). Comparing results between studies are hampered by important differences in objectives and methodology, especially in regard to case definitions (10). No study has, so far, examined the variation in the frequency and nature of near-miss events (NMEs) between hospital settings in developing countries using standard case definitions. Although near miss morbidity has been suggested as a valuable indicator for monitoring the quality of hospital-based obstetric care (10), more empiric work is needed to establish the extent to which the incidence of near-miss cases or the ratio of near-miss cases to maternal death can inform the quality of obstetric care at the hospital level.

Our study examines the frequency of near-miss cases, the nature of NMEs, and the ratio of death to near miss in nine hospitals at different levels of the health system pyramids in Benin, Côte d'Ivoire, and Morocco. We consider whether they could become useful indicators of the performance of obstetric services in Africa, by examining the extent of their variation according to hospital and whether the women arrived as a near miss or not.

Materials and methods

Hospital and country settings

Our study was part of a larger project that documented the near-miss caseload in African hospitals and the feasibility of conducting multi-professional in-depth case reviews on a subset of these cases. The hospitals were chosen to create variety in settings. In Benin, hospitals included a teaching hospital [Clinique Universitaire de Gynécologie et d'Obstétrique (CUGO)], two regional hospitals [Center Hospitalier Départemental de l'Ouémé (CHDO) and Lagune], a rural sub district hospital (Aplahoué), and a private (not for profit) facility (St Luc). In Côte d'Ivoire, we included two hospitals in the capital Abidjan, a teaching hospital [Center Hospitalier Universitaire de Cocody (CHU Cocody)] and an urban district hospital [Formation Sanitaire d'Abobo Sud (FS Abobo)]. In Morocco, there were two district hospitals (Sidi Kacem and Tetouan). The maternal mortality ratio in these hospitals varies from below 100 (St Luc, FS Abobo, and Sidi Kacem) to above 3000 maternal deaths per 100 000 live births (CHDO and CHU Cocody). Most hospitals provide emergency obstetric surgery 24 hr a day, except for St Luc and Aplahoué in Benin, FS Abobo in Côte d'Ivoire, and Sidi Kacem in Morocco, in which case, women need to be referred to other hospitals for higher levels of care.

Case definitions

We distinguish an NME, which is a condition, from a near-miss case, which is a woman with at least one NME. Detailed definitions of NMEs used in this study are presented elsewhere (4,11), but, in short, we defined NMEs as complications that immediately threaten the woman's survival but do not lead to her death and considered five main diagnostic groups, hemorrhage (leading to shock, emergency

hysterectomy, and blood transfusion), hypertensive diseases of pregnancy (eclampsia and severe preeclampsia), dystocia (uterine rupture and impending rupture), infections (hyperthermia or hypothermia or a clear source of infection and clinical signs of shock), and anemia (low hemoglobin level (<6 g/dl) or clinical signs of severe anemia in women without hemorrhage). In Morocco, all cases of coma, cardiac arrest, and pulmonary edema also qualified as NME, independent of their cause. Maternal deaths were only included for the conditions listed above.

Case finding

The study was conducted from October 10, 1999 to October 10, 2000 in Benin, June 1, 2000 to May 31, 2001 in Côte d'Ivoire, and January 1, 1999 to December 31, 1999 in Morocco. In Benin and Côte d'Ivoire, maternity staff first identified women suspected to have an NME prospectively by attaching a label to their medical records. Medically-qualified researchers or trained midwives later confirmed whether the cases agreed with the pre-defined criteria. In Morocco, research staff identified cases retrospectively through a manual review of all case notes. All countries collected data on signs and symptoms or discharge diagnoses for all deaths and NMEs, the timing of events, and the outcome of the pregnancy. Data on deliveries were obtained from hospital registers for the same period as near-miss cases.

Analysis

We reported the number of NMEs and the number of near-miss cases broken down by their cause, whether they were near miss on arrival, referred from a health facility, or resulted in a stillbirth. We also presented the incidence of near-miss cases defined as the number of near-miss cases divided by the number of deliveries in the hospital (except for Côte d'Ivoire where the denominator is live births) and the ratio of deaths to near-miss cases.

Results

Nature and frequency of near miss

The number of NMEs per hospital ranged from 72 in the district hospital in Tetouan to 1098 in the teaching hospital in Cocody, Abidjan (Table I). The most common types of NMEs were hemorrhage and hypertensive diseases of pregnancy (averaging about one-third of all cases of near misses) in all hospitals, whereas in two hospitals in Benin and one hospital in Côte d'Ivoire, anemia was the leading cause (39.3% in St Luc and 46.4% in Aplahoué, and 30.2% in FS Abobo) (Table I). Early pregnancy losses with hemorrhage due to ectopic pregnancy or abortion represented between 8.2 and 20.5% of NMEs. A total of 495 dystocia cases (15% of NMEs) were also identified, among which 134 (27%) were cases of uterine rupture. NMEs related to infections were uncommon, ranging from no case to 8%.

There were 47 477 deliveries, 2864 near-miss cases, and 197 deaths in the nine hospitals

Table I. Diagnosis distribution for near-miss events in Benin, Cote d'Ivoire, and Morocco

	Benin* CUGO	Lagune	St Luc	CHDO	Aplahoué	Cote d'Ivoire* Abobo	Cocody	Sidi Kacem	Morocco* Tetouan
Hemorrhage	196 (37.5)	148 (29.0)	24 (27.0)	256 (35.8)	22 (22.7)	33 (28.4)	401 (40.4)	30 (35.3) [†]	38 (52.8) [†]
Early pregnancy [‡]	107 (20.5)	47 (9.2)	18 (20.2)	82 (11.5)	8 (8.2)	10 (8.6)	137 (12.5)	10 (11.8)	8 (11.1)
Ectopic pregnancy	78	38	11	42	3	9	126	1	7
Abortion	29	9	7	40	5	1	11	9	1
Late pregnancy [‡]	100 (19.1)	103 (20.2)	6 (6.7)	179 (25.0)	14 (14.4)	15 (12.9)	153 (13.9)	19 (22.4)	29 (40.3)
Placenta praevia	15	27	2	55	3	0	36	3	5
Abruptio placentae	11	16	0	13	1	1	31	5	17
Postpartum hemorrhage	49	38	3	61	4	14	86	7	4
Other	26	24	1	50	6	0	0	4	3
Hypertension	137 (26.2)	189 (35.1)	24 (27.0)	180 (25.1)	9 (9.3)	33 (28.4)	243 (22.1)	41 (48.2)	26 (36.1)
Eclampsia	72	84	13	70	5	11	121	13	14
Preeclampsia	65	105	11	110	4	22	122	28	12
Anemia	98 (18.7)	84 (16.5)	35 (39.3)	122 (17.0)	45 (46.4)	35 (30.2)	186 (16.9)	–	–
Dystocia	56 (10.7)	84 (16.5)	1 (1.1)	127 (17.7)	15 (15.5)	10 (8.6)	185 (16.8)	9 (10.6)	8 (11.1)
Uterine rupture	16	25	1	39	7	2	32	6	6
Pending rupture	40	59	0	88	8	8	153	3	2
Infection	36 (6.9)	5 (1.0)	5 (5.6)	31 (4.3)	6 (6.2)	5 (4.3)	83 (7.6)	1 (1.2)	0 (0.0)
All near-miss events [§]	523	510	89	716	97	116	1098	85	72

*Data are from October 1999 to October 2000 in Benin, June 2000 to May 2001 in Cote d'Ivoire, and January 2001 to December 2001 in Morocco.

[†]There is one missing medical diagnosis for hemorrhage in Sidi Kacem and Tetouan.

[‡]Some women have more than one near-miss hemorrhage diagnoses.

[§]All near-miss events for hemorrhage, hypertension, anemia, dystocia, and infection. Morocco data also include four other events for Sidi Kacem (coma, acute pulmonary edema).

CUGO, Clinique Universitaire de Gynécologie et d'Obstétrique; CHDO, Center Hospitalier Départemental de l'Ouémé.

combined (Table II). Some women received several near-miss diagnoses, with an average of 1.2 NMEs per case. Most of the near-miss cases (83%) were in a critical condition on arrival at the hospital (range 54–90%) and had been referred from another facility (69%) (range 19–81%). Those referred from a facility were more likely to be near miss on arrival (88% versus 77%) (p value < 0.0001). Between 10–47% of near-miss cases who went into labor lost their babies (27% in all near-miss cases) (table not shown). The proportion of near miss after admission was similar between diagnostic categories

(hemorrhage 17%, hypertension 10%, infections 16%, and anemia 13%), except for dystocia, 40% of which occurred after the woman had been admitted to hospital.

Hospital-based near-miss incidence and death to near miss ratio

The incidence of near-miss cases in hospitals ranged from 11.7 to 237.5 cases per 1000 deliveries (Table II) (Fig. 1). The highest incidence was found in the two teaching hospitals (109.1 and 224.5 per 1000 in CUGO and CHU Cocody,

Table II. Frequency, characteristics, and deaths to near miss ratio of near-miss cases in Benin, Cote d'Ivoire, and Morocco

	Benin CUGO	Lagune	St Luc	CHDO	Aplahoué	Cote d'Ivoire Abobo	Cocody	Morocco Sidi Kacem	Tetouan
Deliveries (n)	4068	5764	827	2602	1061	9187*	4111	2262	3596
Near-miss events (n)	523	510	89	716	97	116	1098	85	72
Near-miss cases (n)	444	464	78	618	88	108	923	73	68
On arrival [n (%)] [†]	385 (86.9)	347 (75.4)	60 (76.9)	551 (89.2)	78 (88.6)	58 (53.7)	766 (83.2)	64 (90.1)	48 (71.6)
Referred from other health facility [n (%)] [†]	301 (70.0)	297 (64.6)	15 (19.2)	491 (81.0)	58 (65.9)	NA	NA	31 (43.1)	NA
Deaths (n)	20	31	1	67	5	1	65	2	5
Near-miss cases per 1000 deliveries	109.1	80.5	94.3	237.5	82.9	11.7	224.5	32.3	18.9
On arrival	94.6	60.2	72.6	211.8	73.5	6.3	186.3	28.3	13.3
After admission	14.5	20.2	21.8	25.7	9.4	5.4	38.2	4.0	5.6
Death to near miss ratio	1:22	1:15	1:78	1:9	1:18	1:108	1:14	1:36	1:14

*Live births.

[†]Excluding missing values.

CUGO, Clinique Universitaire de Gynécologie et d'Obstétrique; CHDO, Center Hospitalier Départemental de l'Ouémé.

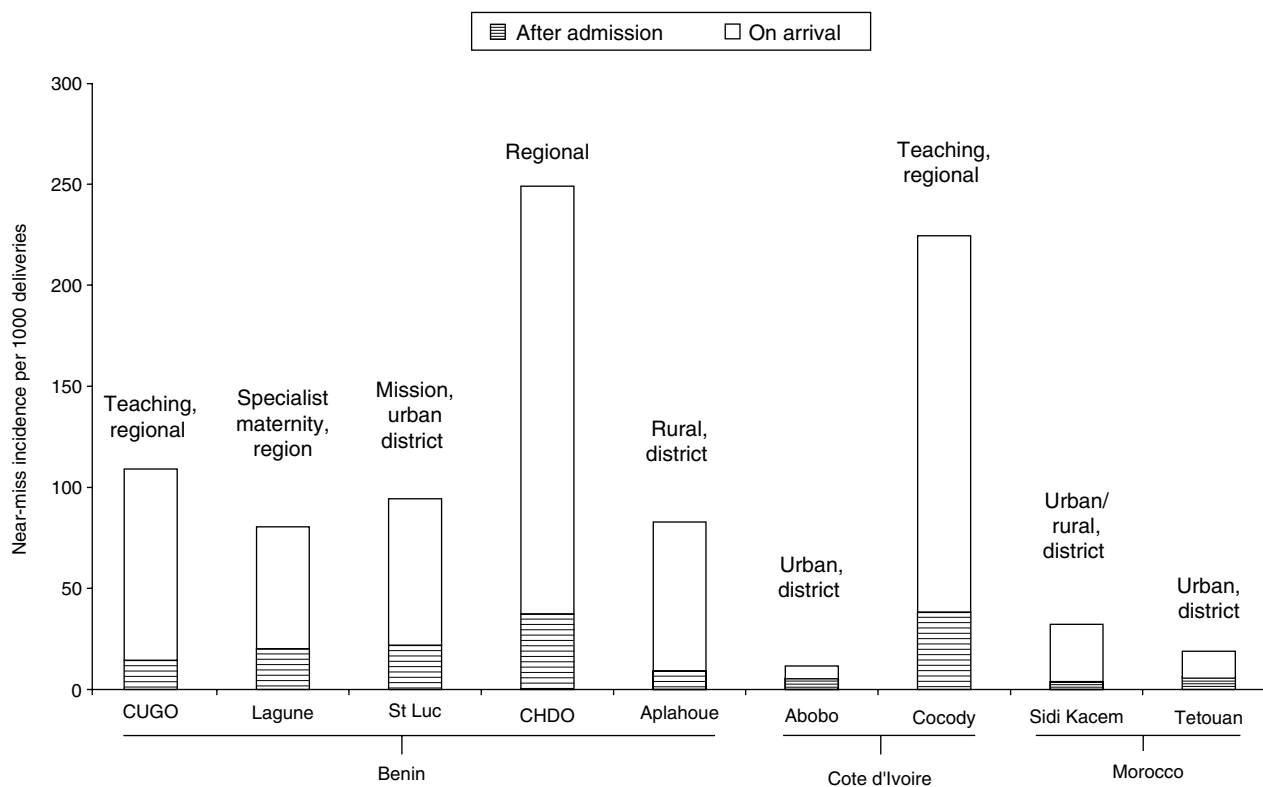


Fig. 1. Near-miss incidence in nine African hospitals.

respectively) and in the regional hospital in Benin (237.5 per 1000 in CHDO). The lowest incidence was found in the two Moroccan district hospitals (32.3 and 18.9 per 1000 in Sidi Kacem and Tetouan, respectively) and in the district hospital in Côte d'Ivoire (11.7 per 1000 in FS Abobo). The large variation in the incidence of near miss between hospitals was largely due to the variation in the incidence of near miss on arrival (range 6.3–211.8 per 1000). The incidence of near-miss cases that developed during the woman's stay in the hospital was much lower, ranging from 4.0 in Sidi Kacem, Morocco to 38.2 per 1000 in Cocody, Côte d'Ivoire. Overall, near-miss cases were 15 times more common than deaths, but there were large differences between hospitals. The death to near miss ratio ranged from one death for nine near-miss cases in CHDO, Benin, to one death for 108 near-miss cases in Abobo, Côte d'Ivoire.

Discussion

Women with NMEs make up a very large proportion of deliveries in some African hospitals, with near-miss cases representing nearly a quarter of admissions in two of the large referral hospitals in Benin and Côte d'Ivoire. Previous studies have typically established a much smaller hospital-

based incidence of severe life-threatening complications (range 0.5–82 per 1000 births) (4). If true, this illustrates the context of permanent emergency in which staff in some of these maternity units work, leaving staff little time to assist women in normal labour. Yet, hospitals in Benin, Côte d'Ivoire, and Morocco do not always have the resources to manage emergencies.

Could differences in case definition explain the higher incidence found compared to other hospital-based studies? Studies in industrialized countries have typically used admission to intensive care units as their main identification criteria (12), while others have either used criteria based on organ failure or dysfunction (6) or on different combinations of signs, symptoms, and treatment options (5). However, it is unlikely that we underestimated the true magnitude of NMEs because we only investigated a subset of obstetric complications.

Hemorrhage and hypertension were the main causes of NME, as in most previous studies (12–14). They are also the main causes of maternal deaths worldwide (15). However, the causes of complications do not always reflect the causes of death in hospital settings (12,16), and anemia as a leading cause of critical illness in pregnancy is relatively less documented. Severe anemia was a very important near-miss cause in first referral

level hospitals in Benin and Côte d'Ivoire, while acute obstetric problems requiring specialist care were seen in tertiary level hospitals. Both Benin and Côte d'Ivoire have a high prevalence of malaria, iron deficiency, and hookworm. Malaria is not present in Morocco, nutritional deficiencies are uncommon, and severe anemia unrelated to blood loss is, therefore, rarely seen in hospitals.

Few women had an NME related to infections. A previous study in Benin has found a high-case fatality among women with severe puerperal infections, suggesting that relatively few survive to become near miss (17). Alternative explanations include a relatively low incidence in the community or good access to antibiotics with early and effective treatment. Women may also have left the participating hospitals by the time symptoms started and not returned for treatment there.

Near-miss incidence varies considerably between hospitals, and it is difficult to discern a clear pattern at first. We used strict criteria to identify NMEs, and differing case definitions are unlikely to explain the variation. Correct interpretation requires a separation of near misses that are in a critical state on arrival to the hospital, and those who become critically ill during hospitalization. Interpretation also requires information on the type of admitting hospital and its role in the health system pyramid.

Near misses upon arrival, evidently, cannot be used to assess the quality of care in the admitting facility. They indicate delays in reaching the hospital, either because the referral chain is failing or because women and their caretakers are late in deciding to seek care. In Abidjan, for example, two thirds of women arrive at the health facility within less than 1 hr of delivery (18). Reasons for this include delayed referral from health centers to tertiary hospitals, the high cost of emergency obstetric care, and poor access to public transport (18). A high incidence of near miss upon arrival is indicative of a failure of the system to ensure prompt access to care for women in need of such care. A hospital with a high proportion of deliveries arriving as near miss also requires adequate resources and organization to manage such emergencies. For example, none of the three hospitals with the highest incidence of NMEs have emergency drugs immediately available in the services, and families must obtain these from pharmacies sometimes outside the hospital compounds.

The incidence of near miss developing during hospitalization may be a good indicator of quality of care within facilities, and the large number of cases of ruptured uterus and impending rup-

ture that developed in the study hospitals raise questions about the care provided during labor. However, caution is still required in the interpretation of near miss after admission as a sole indicator of the quality of obstetric care, because a low incidence of near miss after admission may result from severe cases being immediately transferred to higher levels of care, without being admitted. Understanding near-miss incidence both on arrival and after, requires a good understanding of the health system context within which the hospital functions, including proportion referred without admission. At present, indicators using NME will be most useful if presented separately for before and after arrival and complemented by other indicators monitoring the performance of the health system and obstetric services. In-depth case reviews of near-miss cases may also be useful, not only to assess the multiple dimensions of the quality of obstetric care but also to increase the systems' responsiveness to the problems identified (4).

Conclusion

The sheer number of maternal deaths and near misses in some of the hospitals should serve as a unequivocal advocacy tool for more resources to ensure that facilities can adequately respond to such emergencies. In developing countries, NMEs must be estimated separately for those on arrival and those developing after admission; the first is a good indicator of the effectiveness of emergency referrals and the second as a potential tool for monitoring the performance of obstetric services, in the context of other local data.

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Contributors

VF and CR were the study coordinators; they designed the study and coordinated the collection and analysis of incidence data across countries. VF wrote the first draft of the article with CR. SG and VDB took part in designing the study; with VG, ML, AS, and JS, they supervised the collection of the incidence data and analyzed the findings at national level for Benin, Cote d'Ivoire, and Morocco. All authors contributed to the revisions of the first draft and the preparation of the final version of the article. VF will act as a guarantor of the article.

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