

Maternal mortality in hospitals in Zululand, July 1993 - June 1994

J. V. Larsen, K. A. Janowski, A. Krolikowski

Objective. This study reports on maternal mortality in Zululand, a region in north-eastern KwaZulu-Natal served by 4 urban and 10 rural hospitals.

Context. The Zululand obstetric service is organised around district hospitals with peripheral clinics. Further organisation around three regional referral units is still incomplete. A risk approach to obstetric care has been employed, using regional protocols. Midwives with advanced diplomas and village health workers are important members of the service.

Results. The reported maternal mortality rate was 10.77/10 000 for 41 779 deliveries. Thirty-three of the 45 deaths were potentially avoidable, 28 of them with avoidable factors in the health service. The important avoidable factors were staff shortages (6), staff errors (21), transport difficulties (1) and unfortunate patient behaviour (5). Nine deaths (20%) were related to anaesthesia for caesarean section, and its complications.

Conclusions. The high incidence of deaths from avoidable factors in the health service in this survey is a cause for concern. Urgent steps are required to provide appropriate obstetric and anaesthetic orientation programmes in regional and teaching hospitals for new medical staff preparing to work in rural hospitals. It is equally urgent that regionalisation of rural obstetric services be completed, and that effective attention be given to staff levels and working environments in rural obstetric services. A regular confidential maternal mortality survey is a necessary tool for the improvement of obstetric services. Abortion was an insignificant cause of death in this survey.

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This paper reports the findings of a confidential maternal mortality survey undertaken in the state hospitals of the Zululand coastal and inland regions during the period 1 July 1993 to 30 June 1994. Previous reports on perinatal mortality rates in part of the region have been published.^{1,2}

Eshowe Hospital, Eshowe, KwaZulu-Natal

J. V. Larsen, M.B. CH.B., FR.C.O.G.

K. A. Janowski, M.D.

A. Krolikowski, M.D., PH.D.

Context of survey

The maternal health services in Zululand have been organised according to a district hospital model for over 15 years. Each district hospital has its own peripheral clinics, most of which offer a 24-hour delivery service. The clinic network is extensive, but still has areas which are underserved. Mobile units offer antenatal care in most areas where there is no clinic. Many districts also have village health care workers who are effective in motivating women to make proper use of antenatal care. There are 3 regional hospitals with a total of 5 consultant obstetric staff between them. Only 1 regional hospital has an intensive care unit. The other 2 have high-care areas. There has been limited success in organising the district hospitals into regions around these 3 regional hospitals.

Fourteen of the 16 state hospitals in the region (11 district hospitals and the 3 regional hospitals) participated in the survey. One regional hospital is situated in a large urban complex and 3 hospitals are situated in small towns. The remaining 10 can be classified as rural units. Most of these rural units are short-staffed and all 3 regional hospitals have inadequate staff complements. All are surrounded by areas with poor communications, and most have waiting mothers' areas to help address this problem.

The antenatal clinic staff at the clinics and the hospitals have been using a risk approach based on protocols outlined in a handbook we developed in the region. These protocols recommend the delivery of high-risk mothers in the hospitals and low-risk women in the clinics. This approach has been used by other authors to reduce the maternal mortality rate in Third-World situations.³ We have also made extensive use of midwives with the advanced diploma in midwifery in an extended role to help compensate for the lack of medical personnel.

A survey in 1994 showed that 95.7% of black women in KwaZulu-Natal used antenatal care and that 80.8% attended more than twice. Fifteen per cent of women delivered outside the health system (at home or in transit), but we believe that the incidence of home delivery varies widely in the region and is more common in more remote areas.⁴ Of the obstetric population, 7.7% are grand multiparas and 9.0% teenagers.

The black adult female literacy rate for the 20 census districts affected by this study was 46.13%. Two districts have literacy rates of under 30%.⁵

Materials and methods

A prospective study was undertaken, starting on 1 July 1993. Every unit in the region was approached with the request that they fill in a questionnaire for every maternal death and send photocopies of all relevant parts of the mothers' charts. The definition of maternal death we used for this study was that adopted by the International Federation of Gynaecology and Obstetrics (FIGO) and recommended in the 9th revision of the *International Statistical Classification of Diseases, Injuries and Causes of Death*:⁶ 'The death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and the site of the pregnancy, from any cause

related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes.'

Results

There were 41 779 deliveries in these hospitals during the study period. Forty-five maternal deaths were reported, giving a maternal mortality rate of 10.77/10 000 deliveries.

Two mothers were 16 years of age, 3 were 17 - 19 years old, 24 were in the 20 - 35-year group and 10 were over 36 years old. Ages were not given for 6 mothers.

Fourteen women were primigravidas, 18 were gravida 2 - 5 and 6 were gravida 6 or more. Parity was not recorded for 7.

All the charts were analysed to identify important obstetric risk factors and the final cause of death. The results of this analysis are set out in Tables I and II.

Table I. Obstetric risk factors associated with maternal death

Obstetric complications	No.	%
Hypertensive disorders	12	26.7
Eclampsia	8	17.8
Proteinuric hypertension	4	8.9
Protracted labour	10	22.2
Other unspecified obstetric complications	8	17.8
No obstetric complication	6	13.3
Antepartum haemorrhage	5	11.1
Abruptio placentae	4	8.9
Placenta praevia	1	2.2
Infections	4	8.9
Amniotic fluid infection	4	8.9

Table II. Final causes of maternal death

Final cause of death	No.	%
Haemorrhage	15	33.3
Rupture of the uterus	6	13.3
Postpartum haemorrhage	5	11.1
Abruptio placentae	3	6.7
Haemorrhage associated with abortion	1	2.3
Anaesthetic complications	9	20.0
Complications of general anaesthesia	5	11.1
Complications of spinal block	3	6.7
Complications of epidural block	1	2.3
Infection	8	17.8
Puerperal sepsis following normal delivery	3	6.7
Puerperal sepsis following caesarean section	2	4.4
Unspecified incidental maternal infection	2	4.4
Sepsis associated with abortion	1	2.3
Hypertensive disorders	7	15.5
Intracranial complications with eclampsia	5	11.1
Pulmonary oedema with hypertension	2	4.4
Pulmonary embolism	4	8.9
Thrombotic pulmonary embolism	2	4.4
Amniotic pulmonary embolism	2	4.4
Other unspecified causes	2	4.4

The important obstetric risk factors were hypertensive disorders in 12 women (26.7%), protracted labour (usually considered to be due to cephalopelvic disproportion) in 10 (22.2%) and antepartum haemorrhage in 5 (11.1%). The danger of eclampsia is underlined by the fact that it was an associated condition in 8 (17.8%) of the deaths. Abruptio placentae was an associated condition in 4 (8.9%) deaths. The other obstetric risk factors were previous lower segment caesarean section (1), twins (2), preterm labour (1), fetal distress (1), grand multiparity alone (1), gestational diabetes (1) and abortion without excessive haemorrhage (1).

The important final causes of death were haemorrhage, including rupture of the uterus, in 15 women (33.3%), anaesthetic complications in 9 (20%), infection in 8 (17.8%) and hypertensive disorders in 7 (15.6%).

The 4 deaths in hypertensive women without eclampsia were due to pulmonary oedema (2), postpartum haemorrhage (1) and haemorrhage following abruptio placentae (1). Five eclamptics died of cerebral complications, 2 died during anaesthesia for caesarean section and 1 died of pulmonary embolism 7 days after vaginal delivery. The causes of death in the 10 women with protracted labour were ruptured uterus (3), postpartum haemorrhage (1), postpartum sepsis (2), amniotic fluid embolism (1) and anaesthetic accidents (3). Two of the 4 women with abruptio placentae died of massive postpartum haemorrhage, 1 of a massive retroperitoneal haematoma, and 1 because of failed intubation during anaesthesia for caesarean section for fetal distress. The causes of death among the 4 women with amniotic fluid infection were amniotic fluid embolism (1) and septicaemia with its complications (3). The causes of death among the 6 women with no identified obstetric risk factor were post-abortion haemorrhage due to placenta percreta in a 20-year-old primigravida (1), ruptured liver haemangioma (1), puerperal sepsis (2), and *Escherichia coli* ventriculitis in a mother with a treated cerebral astrocytoma.

Five deaths were associated with general anaesthesia and 3 with spinal anaesthesia. There was 1 death associated with epidural anaesthesia. This mother collapsed quite suddenly and died in spite of energetic efforts at resuscitation 5 hours after caesarean section for premature labour with intra-uterine infection and twins. It is not certain whether this death was anaesthesia-related, but it has been included under anaesthetic deaths because it occurred within 12 hours of anaesthesia.

The absence of trophoblastic disease from this list is a result of our policy of referring these women to the nearest gynaecological oncology service at King Edward VIII Hospital, which is outside this region.

Avoidable deaths

We consider 33 deaths to have been potentially avoidable, 28 with avoidable factors in the health service. **Staff shortages** contributed directly to 6 deaths. One was due to eclampsia and 5 due to haemorrhage. **Transport difficulties** led to the death of an eclamptic.

Staff errors led to 21 deaths. **Protocols were not implemented** in 5 patients. As a result, 3 women ruptured their uteri, and 2 women died of overwhelming sepsis when they were not given prophylactic antibiotics following emergency caesarean sections. **Poorly organised theatre**

routines led to 6 deaths. Three women died in the recovery room, and 3 women died because the drill for coping with a failed intubation was not adequate. **Errors resulting from staff inexperience** led to 10 deaths. These deaths were related to the management of severe proteinuric hypertension, abruptio placentae, postpartum haemorrhage and placenta praevia.

Unfortunate patient behaviour led to 5 deaths. Three hypertensive women refused admission. One of these died of abruptio placentae and massive retroperitoneal haemorrhage due to a disseminated intravascular coagulopathy. The second died of congestive cardiac failure leading to cardiac arrest. The third attempted home delivery and died of a postpartum haemorrhage. A 24-year-old gravida 2 (previous normal vaginal delivery) attempted home delivery and died of a ruptured uterus in the ambulance. A booked mother who attended the antenatal clinic very irregularly died of eclampsia.

Discussion

The maternal mortality rate in this study was 10.77/10 000 deliveries. Comparative figures for other surveys are:

- (i) Harare Maternity Service: 1983 — 12/10 000, 1993 — 26/10 000 (V. F. Iliff — personal communication);
- (ii) King Edward VIII Hospital 1975 - 1982 — 19 - 24/10 000;⁷
- (iii) Africa in general — 64/10 000.⁸

We have a long way to go to reach the maternal mortality rate of 1 - 3/10 000 reported in Europe and North America.⁸

Recommendations for the organisation of rural maternal and anaesthetic services

This is one of very few published studies of maternal deaths in rural hospitals in South Africa. The high incidence of anaesthetic-related maternal deaths is its most notable finding relative to other published South African studies.

The other notable finding is that 28 of 33 deaths were judged to have avoidable factors in the health system. These included staff errors (including some of the anaesthetic deaths), staff shortages and transport difficulties. The high number of deaths due to staff errors is a function of the inexperience of many medical staff and the lack of supervision to enforce the use of management protocols. This lack of supervision is a result of low staffing levels and low standards of discipline in some units where morale is low because of difficult working environments.

A particular problem has been that many expatriate medical staff have been obliged to provide anaesthetic and obstetric care for high-risk mothers in an African environment, without any appropriate orientation programme. This is also a consequence of inadequate staffing levels and inadequate regionalisation. One regional obstetrician cannot provide adequate support for the medical and midwifery staff of 16 hospitals. There is presently no full-time anaesthetist in the region.

We believe that it is essential for norms to be developed for the postgraduate preparation of medical personnel to equip them to work in the periphery. We also feel that every small hospital should have a clear link with a regional hospital that is adequately staffed with anaesthetic, obstetric

and paediatric consultant personnel and therefore able to provide the training to meet those norms. These specialist staff should also have the task of developing management protocols for medical and nursing staff in all three disciplines, and of providing ongoing in-service education. The basic concept of regionalisation with a risk approach remains sound, and is that advocated by Keeling *et al.* in their attempts to reduce maternal mortality in Jamaica.⁵ In Zululand, it is essential that the regions served by each regional specialist be small enough to make adequate supervision and training possible.

This study also highlights the need to ensure adequate staffing levels in peripheral hospitals. It must be accepted that labour wards are intensive care nursing areas, and that most peripheral hospitals are obliged to care for mothers who are at high risk. Urgent attention is needed to improve the quality of the working environment in many rural hospitals.

We believe that the fact that the maternal mortality rate in this study was not as high as in other series reporting on maternal deaths in similar Third-World situations^{10,11} is probably a result of relatively easy access to antenatal care and the risk approach taken in the organisation of care. We consider this to be in line with the observations of other authors that a risk approach has value.^{3,9} Our experience also supports the value of the decision to train a large number of midwives to advanced diploma level for the region. They have often been the people who maintained continuity and the correct application of protocols in hospitals where there were no medical staff to do so.

The impact of low literacy on maternal mortality

The other important part of the equation which needs attention if we are to reduce the maternal mortality rate further is the low literacy rate of 46.13% among adult black women in this region. The issue is that appropriate education empowers women to make better health-related choices. "To reduce deaths and improve maternal health, the sub-Saharan woman must be helped to enhance her own self-esteem and the worth she places on her life. At the same time, we need to create an enabling environment where access to functional and basic, but professional, medical care is readily available. There is now overwhelming evidence that in the long term, no approach will be as successful as universal formal educational."¹⁸ We have gone some way toward providing ready access to functional and basic, but professional, maternity care. It is gratifying that the issues of education and the status of women are also being addressed.

Patterns of maternal death

The main causes of maternal death in this series are not very different from those reported from Guinea by Toure *et al.*,¹⁰ with the exception of abortion-related and anaesthetic-related deaths, but there are considerable differences from those reported by Melrose⁷ at King Edward VIII Hospital in Durban (Table III). The fact that our smaller rural units have limited access to blood for cross-matching is probably one factor in the high incidence of deaths due to haemorrhage in this series.

Hypertensive disease affects about 11% of pregnant Zulu women. The task of providing optimal management of eclampsia in a remote hospital without an intensive care unit continues to offer a difficult challenge. Five eclamptic women in this survey died of cerebral complications followed by cardiorespiratory arrest. Two hypertensive mothers died quite unexpectedly of pulmonary oedema followed by cardiac arrest. Neither was receiving an intravenous infusion at the time of the onset of pulmonary oedema.

Table III. A comparison of final causes of maternal death (%)

	Zululand	Conakry ¹⁰	Durban ⁷
Haemorrhage*	33.3	35.0	9.6
Anaesthetic complications	20.0	-	-
Infection	17.8	12.0	11.6
Hypertensive disease	15.6	20.0	18.9
Abortion	2.2	17.0	18.6

* Includes abruptio placentae.

One issue is that we need easier access to intensive care ambulance transport so that eclamptics and women with abruptio placentae with serious complications can be stabilised and moved more safely and more rapidly to regional obstetric units. It is also essential that every regional referral hospital have a fully equipped and fully staffed intensive care unit.

An interesting finding of this study is that there was only 1 death due to infection after abortion, and that it was AIDS-related. This confirms our impression that induced abortion is unusual in our rural population, among whom there is a high regard for fetal life.

HIV infection was a proven factor in only 2 deaths. One was a death due to sepsis following vaginal delivery and the other was one of the abortions. However, HIV infection may have been a factor in other deaths due to sepsis and intercurrent infections. We do not yet have a policy of routine HIV testing in pregnancy, although the incidence of infection is over 12%.

The comparatively high number of deaths of women under 20 years of age is not an uncommon finding in Africa. Toure *et al.*¹⁰ reported that 25% of maternal deaths in Conakry, Guinea, were women under 20 years old.

The limitations of this study

This study has two important limitations. One is that very few postmortem examinations were performed, partly because there is no pathologist in Zululand and medical staff find it difficult to find the time to do postmortems, and partly because there is considerable reluctance among rural people to give permission for postmortem examinations. The only exception to this rule is in cases where the mother has died undelivered and a postmortem caesarean section is requested. A low incidence of postmortem examinations is a common limitation of maternal mortality studies in developing countries. In the King Edward VIII Hospital study, postmortem examinations were undertaken in less than 50% of maternal deaths.⁷

The second limitation of the study is that we have no information about any maternal deaths which may have

occurred at home. A previous study suggests that the maternal mortality rate of these women may be about 55/10 000.¹²

Finally, it is desirable that we implement a regular national confidential inquiry into maternal deaths. British experience suggests that such inquiries have been an important factor in the drop in the maternal mortality rate in England and Wales from 5 in 1950 to 1/10 000 in 1978.¹³

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