



## Severe acute maternal morbidity and maternal death audit — a rapid diagnostic tool for evaluating maternal care

L Cochet, R C Pattinson, A P Macdonald

**Objective.** To analyse severe acute maternal morbidity (SAMM) and maternal mortality in the Pretoria region over a 2-year period (2000 - 2001).

**Setting.** Public hospitals in the Pretoria region, South Africa, serving a mainly indigent urban population.

**Methods.** A descriptive study was performed whereby women with SAMM and maternal deaths were identified at daily audit meetings and an audit form was completed for all cases fulfilling the definition of SAMM ('near miss') and for all maternal deaths.

**Results.** The number of maternal deaths declined slightly but not significantly from 18 deaths in 2000 to 16 in 2001. This represents a change in the maternal mortality ratio (MMR) from 130/100 000 live births in 2000 to a MMR of 100/100 000 live births in 2001. However, when data for women with SAMM and maternal deaths were combined, there was a

significant increase in major maternal morbidity from 90 cases (SAMM and maternal death rate 649/100 000 live births) in 2000 to 142 cases (SAMM and maternal death rate 889/100 000 live births) in 2001 ( $p = 0.006$ ). This increase was due to a significant increase in severe maternal morbidity related to abortions and obstetric haemorrhages.

**Conclusion.** Analysis of maternal deaths only in the Pretoria region failed to identify abortions and haemorrhages as major maternal care problems. When data for women with SAMM were combined with data for maternal deaths, however, these problems were clearly identified, and remedial action could be taken. Including SAMM in maternal death audits increases the rapidity with which health system problems can be identified.

*S Afr Med J* 2003; 93: 700-702.

Traditionally maternal mortality audits have served as the standard audit system of maternal care. Large-scale systems such as the confidential enquiries into maternal mortality<sup>1</sup> have been put in place to identify problems in maternal health care. These systems have the advantage of collecting a large sample over a relatively short period of time. This allows for in-depth analysis of certain conditions so that changes in practice can be effected in a relatively short period of time. However, for a given area the problems identified in the general survey might not be valid either because of local circumstances or an insufficient number of cases from which to draw valid conclusions. Alternatively the area can wait until a large enough sample has been collected, but the time taken to achieve this might invalidate the conclusions as circumstances may have changed during the collection period.

Severe acute maternal morbidity (SAMM), also known as 'near miss', has been defined by Mantel *et al.*<sup>2</sup> If a woman has severe organ dysfunction or organ failure in pregnancy, during labour or in the puerperium that could result in maternal death, but she survives, she is described as having SAMM. A woman with SAMM is one who survives due either to good

care, or good luck. SAMM occurs approximately five times more frequently than maternal death.<sup>2</sup> Identifying women with SAMM allows for the gathering of more information on the disease profile for major complications in a population. By definition, the woman survives and the case can be assessed, allowing clear identification of problems in the health system. Therefore auditing women with SAMM and maternal deaths allows rapid collection of data and this may create a rapid diagnostic tool for evaluating the current standard of maternal care in an area.

The aim of this study was to describe the pattern of SAMM and maternal deaths in the Pretoria region for the years 2000 and 2001, and thereby to determine whether collection and analysis of data for women with SAMM and for maternal deaths was beneficial in determining problems in the maternal health service of Pretoria.

### Methods

Women with SAMM and maternal deaths were identified at daily audit meetings in the hospitals of the Pretoria Academic Complex, namely Kalafong Hospital and Pretoria Academic Hospital. All cases referred from outside the Pretoria region were excluded from the study. A SAMM audit form was completed for all cases fulfilling the criteria (Table I) and for all maternal deaths. The audit was performed from 1 January 2000 to 31 December 2001. The data obtained in 2001 were



**Table I. Definitions of severe acute maternal morbidity**

Organ system dysfunction	Criteria
Cardiac	Pulmonary oedema, cardiac arrest
Circulatory	Hypovolaemia requiring $\geq 5$ units red cell transfusion
Immunological	Sepsis resulting in a hysterectomy or ICU admission
Respiratory	Intubation and ventilation for $\geq 60$ minutes, oxygen saturation $< 90\%$ for $\geq 60$ minutes
Renal	Oliguria ( $< 400$ ml/24 h) that does not respond to fluids or diuretics, serum urea $\geq 15$ mmol/l, creatinine $\geq 400$ $\mu$ mol/l, or need for dialysis
Hepatic	Jaundice in the presence of pre-eclampsia
Metabolic	Diabetic ketoacidosis, hypoglycaemic coma, thyroid crisis
Coagulation	Acute thrombocytopenia requiring a platelet transfusion
Cerebral	Coma lasting $\geq 12$ hours, or intracerebral or subarachnoid haemorrhage
Management-based	
Intensive care admission	For any reason
Emergency hysterectomy	For any reason
Anaesthetic accidents	Severe hypotension associated with regional anaesthesia: a systolic BP $< 90$ mmHg for $\geq 60$ minutes, a high spinal requiring intubation, or failed intubation requiring anaesthetic reversal

compared with the data for the year 2000.

The definitions for primary obstetric causes of SAMM and maternal death are the same as those used in Confidential Enquiry into Maternal Deaths in South Africa.<sup>1</sup> The mortality index was introduced by Vandecruys *et al.*<sup>3</sup> It is defined as the number of maternal deaths divided by the combined number of women with SAMM and maternal deaths, expressed as a percentage. It reflects the proportion of women presenting with SAMM who subsequently die. The mortality index gives a measure of how good the health service is with regard to managing a specific disease process and also allows comparison between areas. The lower the mortality index, the better the care. In this study only standard statistical techniques were used.

The study was approved by the current Ethics Committee of the Faculty of Health Sciences at the University of Pretoria.

## Results

The total number of births within the Pretoria region served by the Pretoria Academic Complex was 13 854 in 2000 and 15 978 in 2001. In 2000 the combined number of women with SAMM and maternal deaths was 94 (76 women with SAMM and 18 maternal deaths), giving a SAMM and maternal death rate of 649/100 000 live births. In 2001 the number was 147 (131 women with SAMM and 16 maternal deaths), resulting in a rate of 889/100 000 live births. There was a significant increase in the number of women with SAMM during 2001 ( $p = 0.006$ ), but there was no difference in the maternal mortality ratio during the 2 years.

Table II gives the primary obstetric causes of maternal death in the Pretoria region for 2000 and 2001 expressed as rates per 100 000 live births. There was a non-significant decrease in

maternal deaths from 2000 to 2001. Table III details the primary obstetric causes of SAMM and maternal deaths. There was a significant increase in the number of women with SAMM and the number of maternal deaths related to abortions, ante- and postpartum haemorrhage in 2001 compared with 2000.

Fig. 1 shows the mortality index for the different primary obstetric causes of SAMM and maternal death in the Pretoria region for 2000 and 2001. The mortality index in 2001 improved for all primary obstetric causes except obstetric haemorrhage and hypertension.

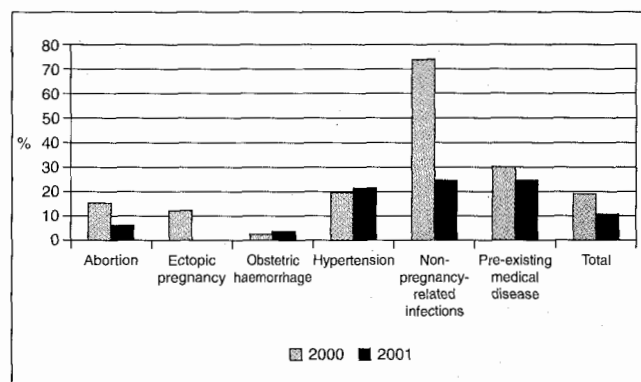


Fig. 1. Comparison of the mortality indexes in the Pretoria region, 2000 - 2001.

## Discussion

During 2001 there was an increased number of women with SAMM, but a decreased number of maternal deaths compared with the previous year. The general mortality index decreased from 19.1% in 2000 to 10.9% in 2001. This implies that the care of severely ill pregnant women improved in the Pretoria



Table II. A comparison of the primary obstetric causes of maternal death in the Pretoria region, 2000 - 2001

Primary obstetric cause	Maternal death				p-value
	2000		2001		
	Number	Rate*	Number	Rate*	
Abortion	2	14	2	13	NS
Ectopic pregnancy	1	7	0	0	NS
Antepartum haemorrhage	0	0	1	6	NS
Postpartum haemorrhage	1	7	2	13	NS
Hypertension	3	22	5	31	NS
Pregnancy-related sepsis	0	0	0	0	NS
Embolism	1	7	1	6	NS
Anaesthetic complication	1	7	0	0	NS
Acute collapse, cause unknown	0	0	1	6	NS
Non-pregnancy-related infection	6	43	1	6	NS
Pre-existing maternal disease	3	22	2	13	NS
Unknown	0	0	0	0	NS

\* Rate expressed per 100 000 live births.  
NS = not significant.

Table III. A comparison of the primary obstetric causes of SAMM and maternal death in the Pretoria region, 2000 - 2001

Primary obstetric cause	SAMM + maternal death				p-value
	2000		2001		
	Number	Rate*	Number	Rate*	
Abortion	12	87	27	169	0.03
Ectopic pregnancy	7	51	4	25	NS
Antepartum haemorrhage	6	43	20	125	0.01
Postpartum haemorrhage	19	137	38	238	0.03
Hypertension	15	108	22	138	NS
Pregnancy-related sepsis	6	43	12	75	NS
Embolism	1	7	2	13	NS
Anaesthetic complication	5	36	2	13	NS
Acute collapse, cause unknown	1	7	1	6	NS
Non-pregnancy-related infection	8	58	4	25	NS
Pre-existing maternal disease	10	72	8	50	NS
Unknown	0	0	2	13	NS

\* Rate expressed per 100 000 live births.  
SAMM = severe acute maternal morbidity; NS = not significant.

Academic Complex during 2001. However, it is of concern that there has been a significant rise in the number of women with SAMM in the Pretoria region. This may be due to the pregnant population being less healthy, or failure of the primary health care system to detect and refer these problems. Further investigation is needed to define and address these deficiencies.

There was no increase in maternal deaths related to abortions, ante- or postpartum haemorrhage, but there was a significant increase in these problems when women with SAMM were included. Analysis of maternal deaths in the Pretoria region only would have failed to detect the increasing health care problems related to abortion and obstetric haemorrhage. The clinical definitions of what constitutes severe maternal morbidity were simple to use. Including

women with SAMM in maternal death audits increases the speed with which problems in the health care system can be identified. The authors believe that this practice should constitute an integral part of any audit system evaluating maternal health care.

We would like to thank all the registrars in the Department of Obstetrics and Gynaecology for filling in the relevant forms. The Medical Research Council supported the study.

#### References

1. National Committee for Confidential Enquiries into Maternal Deaths. *Saving Mothers: Report on Confidential Enquiries into Maternal Deaths in South Africa, 1998*. Pretoria: Government Printer, 1999.
2. Mantel GD, Buchmann E, Rees H, Pattinson RC. Severe acute maternal morbidity: a pilot study of a definition for a near-miss. *Br J Obstet Gynaecol* 1998; **105**: 985-990.
3. Vandecruys H, Pattinson RC, Macdonald AP, Mantel GD. Severe acute maternal morbidity and mortality in the Pretoria Academic Complex: changing patterns over 4 years. *Eur J Obstet Gynecol Reprod Biol* 2002; **102**: 6-10.