The profile of maternal deaths in a district hospital: a five-year review of maternal deaths from 2006-2010

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Abstract

Objectives: The objectives were to determine the clinical and demographic profile of maternal deaths, determine the most common primary causes of maternal deaths at district hospital level, compare the causes of deaths at district hospital, provincial and national level, and to investigate the quality of care that was provided to maternal deaths patients and to make recommendations.

Design: The design was a cross-sectional retrospective chart review.

Setting and subjects: Subjects were all reported maternal deaths between January 2006 and December 2010 at Northdale Hospital, KwaZulu-Natal.

Outcome measures: Outcome measures were the common characteristics and causes of maternal deaths, avoidable maternal deaths and quality of care.

Results: The mean age of the 61 maternal deaths was 28 years. Thirty-three patients attended antenatal clinics. Of these, 57.6% booked at ≤ 20th week. Of the 28 (45.9%) who died in the postpartum period, seven delivered at home and three died of anaesthetic complications. Thirty-nine patients (63.9%) tested positive for human immunodeficiency virus. Only 10 were on highly active antiretroviral therapy. The five leading causes of deaths were non-pregnancy-related sepsis, miscarriage, acute collapse, pregnancy-related sepsis and anaesthetic complications. Thirty patients (49.3%) received substandard care.

Conclusion: The profile of maternal deaths at this district hospital differs from the national profile published in *2005-2007 Saving Mothers Report.* While there was an increase in maternal deaths at national level, maternal death numbers decreased at this district hospital. Non-pregnancy-related sepsis remained the leading cause of deaths at national and facility level, but the other four major causes at the hospital level differed from those at the national level.

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Introduction

Millennium Development Goal (MDG) target 5A calls for a reduction in the maternal mortality ratio of 75% between 1990 and 2015.[1] In order to reach the target, the global maternal mortality ratio would have to be reduced by an average of 5.5% a year between 1990 and 2015. The current average rate of reduction is < 2.3% a year.[2] Of the 536 000 reported maternal deaths worldwide in 2005, approximately half occurred in sub-Saharan Africa.[3] In 2008, the estimated number of maternal deaths globally decreased to 358 000. Sub-Saharan Africa accounted for 204 000 deaths (57%).[4] The top 12 countries with the highest number of maternal deaths also had the highest number of stillbirth and neonatal deaths in 2008.[5]

In the *2005-2007 Saving Mothers Report (SMR),* 3 959 institutional maternal deaths were reported in South Africa. This was an increase from the 3 296 deaths reported for the 2002-2004 period.[6] KwaZulu-Natal had the highest number of notified maternal deaths.[7] Various data sources indicate that South Africa is not on track to achieve its MDG 5 (target 5A) of a maternal mortality ratio of 38 deaths per 100 000 live births. The South African maternal mortality ratio was estimated to be 230 in 1990, 440 in 2005 and 410 in 2008.[4]

Globally, obstetrical haemorrhage and hypertensive disorders are leading causes of maternal deaths.[8] The major causes of maternal deaths in Africa between 1997 and 2002 were haemorrhage, sepsis and infections, hypertensive disorders, human immunodeficiency virus (HIV)/acquired immune deficiency syndrome (AIDS) and obstructed labour.[9,10] In South Africa, the five leading causes of maternal deaths from 2005-2007 were non-pregnancy-related infections (43.7%), hypertensive disorders of

pregnancy (15.7%), obstetrical haemorrhage (12.4%), pre-existing maternal diseases (6%) and pregnancy-related sepsis (5.6%).[6]

Although estimating the number of maternal deaths helps to understand the magnitude of the problem, it is more important to establish the quality of the care that is provided so that interventions can be instituted to reduce mortality. The quality of care received by patients is the most influential determinant of maternal deaths.[4,8] Ramos et al found that the larger the hospital size, the lower the risk of maternal deaths, because in larger hospitals, comprehensive obstetric care and specialist staff are available.[11] Other determinants of maternal mortality include socio-economic circumstances and demographic attributes, such as poverty, lack of empowerment of women, restrictive abortion legislation, inadequate health services and systems, and race.[12-17]

The aims of the study were to determine the clinical and demographic profile of maternal deaths at a district hospital, to determine the most common primary causes of maternal deaths at district hospital level, to compare the causes of deaths at district hospital, provincial and national level, to investigate the quality of care provided by healthcare workers and to make recommendations to the hospital management.

This study is relevant because most district hospitals are staffed by full- or part-time medical officers and family physicians. Lessons that are learnt from a maternal death review could lead to changes in clinical guidelines and health system policies.

Method

For the purpose of this study, a maternal death was defined as the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes. Maternal mortality ratio, an impact indicator that assesses the obstetrical risk of a woman dying from a given pregnancy, is the number of maternal deaths per 100 000 live births. In this study, the quality of care that is referred to is the standard of clinical management based on clinical guidelines and referral criteria.

This retrospective cross-sectional study was carried out at Northdale Hospital, the only district hospital in the Msunduzi subdistrict in KwaZulu-Natal. In 2010, it had a catchment population of 707 758 inhabitants. Medical records for all 61 maternal deaths that occurred from 2006-2010 were included. Two different methodologies were used to address the study objectives.

Profiling patients

Data were collected using a structured data collection sheet, which was developed by combining and adapting elements from the Tracing Adverse and Favourable Events in pregnancy care (TRACE) tool from Aberdeen University in Scotland and the South African maternal deaths notification form.[18,19] Clinical and demographic data that were collected and included on this sheet were analysed using IBM SPSS® (version 19) software. Frequency tables with percentages and a trend chart were generated from demographic and clinical data.

Quality of care and cause of deaths

A panel of three assessors, namely an experienced obstetrician specialist in maternal health and chairperson of the South African National Committee on Confidential Enquires into Maternal Deaths; an experienced obstetrician specialist in maternal health, provincial maternal death assessor and the head of a tertiary department of obstetrics

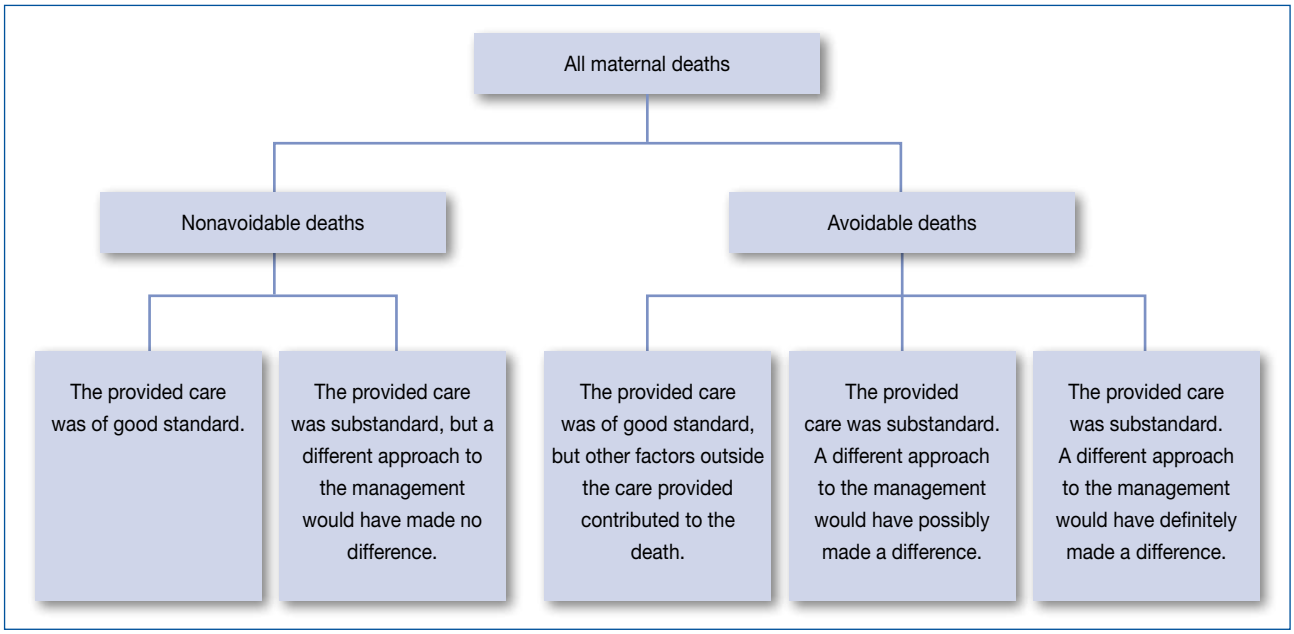

Figure 1: Categorisation of quality of care

and gynaecology; and a clinical manager who is head of obstetrics and gynaecology at Northdale Hospital and who has been working in obstetrics for eight years, determined the cause of deaths and evaluated the quality of care. This evaluation, carried out between January and June 2011, was based on clinical and nursing management received by the patients.

Each member of the panel worked independently, with no undue influence from the other two assessors. In cases where two or more assessors agreed on causes of deaths or quality of care, their assessment was considered to be final. In cases where all disagreed, a meeting of the three assessors was convened to reassess the cases to reach consensus. Causes of deaths were categorised using the headings used by the *SMR*. The quality of care was grouped into five categories (Figure 1). Quantitative methods were used to determine the proportion of deaths that matched a particular category of cause of death or quality of care.

The study received academic institutional ethics and provincial health authority approval.

Results

Clinical and demographic characteristics

There were 29 883 live births and 61 maternal deaths during the study period. The average maternal mortality ratio was 204 deaths per 100 000 live births. The number of maternal deaths and the maternal mortality ratio for each year are shown in Figure 2.

The mean age was 28 years [standard deviation (SD) = 6.4]. Only 54.1% attended an antenatal clinic. Of the 28 patients who died in the postpartum period, seven delivered at home and six delivered by Caesarean section. The number of antenatal visits per patient varied from one to 10. The prevalence of anaemia (haemoglobin < 10 g/dl) on admission was 59%. Table I summarises the demographic and clinical characteristics of the study population.

Of the 33 patients who attended antenatal care, 31 (93.9%) were tested for HIV and 20 (60.6%) were tested for syphilis. The prevalence of HIV and syphilis among antenatal care attendees was 78.8% and 3% respectively. The prevalence

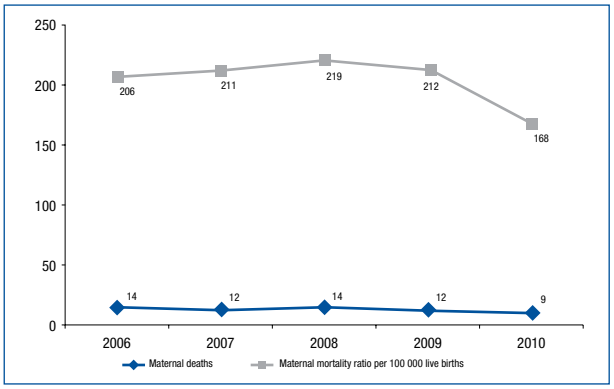

Figure 2: Maternal deaths and maternal mortality ratio from 2006-2010

Table I: Clinical and demographic characteristics of the study population

Variables	n	%	Mean (SD)	Median (IQR)
Age category (years)			28 years (6.4)	
< 20	7	11.5		
20-24	11	18.0		
25-29	18	29.5		
30-34	14	23.0		
> 34	11	18.0		
Gestational age at death				
Trimester 1	3	4.9		
Trimester 2	16	26.2		
Trimester 3	41	67.2		
Unknown	1	1.6		
Race group				
African	59	97.7		
Indian	2	3.3		
Antenatal care				
Never attended	21	34.4		
Booked ≤ 20 weeks	19	31.1		
Booked > 20 weeks	14	23.0		
Undocumented	7	11.5		
Number of antenatal visits			4.24 (2.6)	4 (6.5-2)
Gravidity			2.35 (0.95)	2 (3-2)
Gravida 1	12	19.7		
Gravida 2	20	32.8		
Gravida 3	18	29.5		
Gravida 4	7	11.5		
Unknown	4	6.6		
Current pregnancy outcome				
Undelivered	17	27.9		
Delivered	28	45.9		
Presumed spontaneous miscarriage	15	24.6		
Illegal miscarriage	1	1.6		
Place of delivery (n = 28)				
Health facility	21	75.0		
Home	7	25.5		
Mode of delivery (n = 28)				
Vaginal delivery	22	78.6		
Caesarean section	6	21.4		
HIV status of antenatal care attendees (n = 33)				
HIV-positive	26	78.8		
HIV-negative	5	15.6		
HIV status unknown	2	6.1		
Syphilis test of antenatal care attendees (n = 33)				
RPR reactive	1	3.0		
RPR nonreactive	19	57.6		
Syphilis status unknown	13	39.4		

IQR: interquartile range, RPR: rapid plasma reagin (syphilis test), SD: standard deviation

Table II: HIV and syphilis tests among participants

Year	Among all maternal deaths			Among those who attended antenatal care		
	Number of deaths	Tested*	%	Number of deaths	Tested*	%
HIV test coverage						
2006	14	10	71.4	9	8	88.9
2007	12	9	75.0	9	8	88.9
2008	14	11	78.6	5	5	100
2009	12	9	75.0	7	7	100
2010	9	6	66.7	3	3	100
Total	61	45	73.8	33	31	93.9
Syphilis test coverage						
2006	14	7	50.0	9	7	77.8
2007	12	1	8.3	9	1	11.1
2008	14	5	35.7	5	5	100
2009	12	5	41.7	7	5	71.4
2010	9	2	22.2	3	2	66.7
Total	61	20	32.8	33	20	60.6

* Two patients whose results for syphilis tests were not available were classified as not tested for syphilis.

of HIV and syphilis for each year is shown in Table II. The HIV test coverage of those who attended antenatal care ranged from 88.9-100%. The length of hospital stay varied widely from 0 minute (dead on arrival) to 497 hours, with a median of 41 hours.

Of the 45 patients who tested for HIV, 39 (63.9%) tested positive. CD4 cell count results were available for 17 (43.6%) of these. Fourteen (82.4%) had a CD4 cell count ≤ 200. Only 10 patients were on highly active antiretroviral therapy (HAART) and three were on antiretroviral drugs dual therapy. The median CD4 cell count was 140.

Primary causes of deaths

The five leading causes of maternal deaths were non-pregnancy-related sepsis (54.1%), miscarriage (14.8%), acute collapse (8.2%), pregnancy-related sepsis (6.6%), and anaesthetic complications (4.9%).

Table III compares the causes of deaths at district hospital, provincial and national levels.[6]

Quality of care

Thirty patients (49.3%) received substandard health care. A different approach in the management of these patients would have made no difference for 8 patients (13.1%), possibly made a difference for 15 (24.6%), and definitely made a difference for 7 (11.5%). There was evidence of inadequate resuscitation of patients in haemorrhagic shock and delays with physicians attending to consultation requests from the obstetrics and gynaecology department.

Discussion

The number of maternal deaths and the maternal mortality ratio at the hospital showed a decline in 2010. This finding contrasts with figures at national level, where the number of reported maternal deaths in South Africa increased from 3 296 for the triennium, 2002-2004, to 3 959 for the

Table III: Primary causes of deaths at facility, provincial and national levels

Primary cause of deaths	District hospital 2006-2010		KwaZulu-Natal* 2005-2007		South Africa* 2005-2007	
	n	%	n	%	n	%
Direct causes	25	41.0	361	38.6	1 819	45.9
Hypertension	1	1.6	113	12.1	622	15.7
Postpartum haemorrhage	1	1.6	68	7.3	383	9.7
Antepartum haemorrhage	1	1.6	13	1.4	108	2.7
Ectopic pregnancy	0	0	12	1.3	55	1.4
Miscarriage	9	14.8	34	3.6	136	3.4
Pregnancy related sepsis	4	6.6	66	7.1	223	5.6
Anaesthetic related	3	4.9	21	2.2	107	2.7
Embolism	1	1.6	5	0.5	57	1.4
Acute collapse	5	8.2	29	3.1	128	3.2
Indirect causes	35	57.4	508	54.3	1 966	49.7
Non-pregnancy-related infections	33	54.1	474	50.7	1729	43.7
(AIDS included)**	(32)	(52.5)	(185)	(19.1)	(915)	(23.1)
Pre-existing maternal diseases	2	3.3	34	3.6	237	6.0
Unknown cause	1	1.6	66	7.1	174	4.4
Total*	61	100	935	100%	3 959	100%

* Data for KwaZulu-Natal and South Africa, taken from page 229 of the *2005-2007 Saving Mothers Report*, excludes coincidental deaths.
** The figures refer to patients who had an AIDS-defining condition, a subgroup of non-pregnancy-related infections. They should not be double-counted.

triennium, 2005-2007.[6] Our average maternal mortality ratio of 204 is slightly higher than the KwaZulu-Natal provincial maternal mortality ratio of 188 and 182 for 2006 and 2007, respectively,[7] but much lower than that observed in the Nigerian towns of Sagamu from 2000-2005 (maternal mortality ratio of 2 989), and Benin City from 1994- 2003 (maternal mortality ratio of 518).[20,21]

The estimated South African maternal mortality ratio varied from 237-410 in 2008, depending on various data sources.[4,22,23] Brazil and Argentina, two countries with similar levels of development as South Africa, had much lower estimates of maternal mortality ratios in 2008, namely 58 and 70 respectively.[24,25] This difference in maternal mortality ratio is attributed to HIV/AIDS-related deaths. In 2009, the prevalence of HIV/AIDS in the adult population aged 15-49 years in Argentina and South Africa was 0.5% and 17.8%, respectively.[8,25-27] The proportion of maternal deaths due to HIV/AIDS alone in South Africa is estimated to be 42.5%.[4] The policy of treating all women with a CD4 count of ≤ 350 cells/ml was only implemented in April 2010. It is likely that falls in maternal mortality over the next few years will be witnessed.

The mean age of maternal death cases of 28 ± 6.4 years is in keeping with other facility-based studies in Argentina, a multi-centred study conducted in 2002 (29.1 ± 8 years);[11] Malawi, a nine-hospital study in 2007 (25.0 ± 6.8 years);[10] and in a university teaching hospital in Sagamu, Nigeria, between 2000 and 2005 (28.9 ± 6.2 years).[20] Most maternal deaths (70.5%) in this study were in the age range of 20-34 years. This age group was the most affected in studies carried out in Argentina and Uruguay (69.2%),[26] Nigeria (> 70%)[20,21] and Mozambique (> 50%).[16] Most patients who died were gravida 2. These findings are similar to those of a study in Afghanistan in 2008.[27] Less gravida 4 patients died as a result of childbirth in the study population. Low figures in this gravidity category indicate that most women completed their family when they had their third child, probably because of current socio-economic conditions.

The median and the mode of number of antenatal visits were four and three visits, respectively. This finding is similar to that of Karolinski et al in Argentina and Uruguay.[26] Only 54.1% of maternal death patients received antenatal care. Of these, only 57.6% booked at ≤ 20 weeks. This discouraging finding, in a country where antenatal care in the public sector is free, contrasts with the antenatal care attendance in the general South African population. Shisana et al[28] found that antenatal care attendance was 97.1%. Of these patients, 46.5% booked at ≤ 20 weeks. It is likely that poor help-seeking behaviour, including not attending antenatal care, contributed to the deaths of some of these patients. Further studies are needed to explore the determinants of poor antenatal care attendance in this community. Low antenatal care attendance among maternal death patients was also reported in Afghanistan in 2005,[27] a country that has been in a war situation since 2001. It is possible that women attended antenatal care infrequently, or delayed attending due to lack of transport. Improvements in transport or the use of waiting areas for mothers in appropriate settings may be a solution to poor access to health care in geographical areas in which transport difficulties exist.

The majority of deaths occurred during the third trimester of pregnancy (67.2%) or in the postpartum period (45.9%). The likelihood of dying in the third trimester might be linked to deteriorating physiological changes and immune systems as the pregnancy advances. These findings are supported by studies by Romans et al and Hurt et al.[29,30] Therefore, clinicians should be careful when treating very ill pregnant patients who are in their third trimester. Of the 28 patients (45.9%) who died in the postpartum period, seven (25%) delivered at home. This figure is high for a country in which healthcare and ambulance services are provided free to pregnant women. Further studies are needed to explore the determinants of place of delivery in this community. A study in Nigeria found that the woman's education level and her husband's employment status were determinants for a hospital delivery.[31]

Of the 36 patients who had low haemoglobin (< 10 g/dl), one patient died of antepartum haemorrhage. Of these patients who had low haemoglobin, 21 (58.3%) attended antenatal care. Ideally, anaemia should be corrected during antenatal care in order to prevent the morbidity and mortality that are associated with obstetrical haemorrhage.

There were three deaths for 7 719 Caesarean sections (equivalent to 39 deaths per 100 000 Caesarean sections) during the study period, which is 27 times lower than the 85 deaths for 8 070 Caesarean sections (equivalent to 1 053 deaths per 100 000 Caesarean sections) observed in Malawi between 1998 and 2000.[32] However, this is 40 times higher than the four deaths for 425 000 Caesarean sections (equivalent to one death per 100 000 Caesarean sections) observed in the UK between 2000 and 2002.[33] After adjustment for potential confounders, the risk of dying after having a Caesarean section was 3.6 times higher than after having vaginal delivery (odds ratio = 3.64; 95% CI: 2.15-6.19).[34] Decision-making with regard to Caesarean sections must take place timeously. The 2005-2007 *SMR* indicated that a Caesarean section performed after prolonged labour was more likely to be associated with postpartum haemorrhage and death.[6]

Of the 31 patients who were tested, 26 (83.9%) tested positive for HIV. The HIV prevalence rate in the study population was higher than the prevalence rates observed in 2009 in antenatal clinic attendees who were surveyed at national (29.4%) and provincial (39.5%) levels respectively, and the 47.3% HIV prevalence rate reported nationally in the fourth *SMR*.[6] The introduction of provider-initiated HIV counselling and testing is expected to improve the test coverage to above 95%. Screening for syphilis is one of the most effective ways to prevent congenital syphilis. Only 32.8% of all maternal death patients, or 60.6% of patients who attended antenatal care, were tested for syphilis. The introduction of on-site rapid syphilis screening test kits

at the beginning of 2011 is expected to eliminate result turnaround time and improve test coverage.

The median length of hospital stay of only 41 hours suggests that most patients were acutely ill or presented late. Patients should present at the hospital early and healthcare workers should improve their skills when dealing with emergencies and acutely ill patients. Ensuring that patients survive the first two days of hospitalisation might improve the survival rate.

The leading cause of death at hospital and national level was non-pregnancy-related sepsis, but the other four major causes at hospital level differ from those at national level. Effort should be generated in fighting the leading cause of maternal deaths, namely HIV/AIDS, if maternal death numbers are to be reduced. Sepsis, haemorrhage and hypertensive disorders are the leading causes of maternal deaths in Nigerian health facilities,[20,21] as are haemorrhage, sepsis and HIV/AIDS in Malawi,[10,35] and miscarriage in Argentina.[11] Globally, haemorrhage remains the leading cause.[29,35]

The importance of CD4 cell count results can never be sufficiently emphasised, especially as the cut-off point for eligibility for treatment was moved from ≤ 200 to ≤ 350 cells/ml on 1 April 2010. Patients who are eligible for HAART on the basis of their CD4 cell count (≤ 350) might not show signs of overt AIDS. Lack of CD4 cell count for such patients could considerably delay the initiation of HAART. Of the 39 patients who tested positive for HIV, 27 were not on HAART, despite some of them having a CD4 cell count ≤ 200.

In comparison with the results obtained at national level, at the district hospital that was studied, there was an overrepresentation of deaths due to miscarriage, acute collapse and anaesthetic complications (Table III). Some miscarriages that were classified as "spontaneous" might have been illegal termination of pregnancy (TOP). Access to TOP services is hindered by the limited number of healthcare facilities providing these services, their geographic location and the attitudes of staff members. There are only two public sector and one private sector TOP clinics in uMgungundlovu health district which has a catchment population of approximately 800 000. Contributing factors to miscarriage-related deaths include late presentation at the hospital and the inability of medical staff to manage these cases appropriately. Initial resuscitation in casualty is crucial for patients in septic or haemorrhagic shock. Current efforts, that include the timely referral of all septic miscarriage cases to the regional hospital, are expected to pay dividends. Guidelines on the resuscitation of patients in casualty should be drafted, disseminated and their implementation monitored closely.

By contrast, obstetrical haemorrhages, hypertensive disorders and ectopic pregnancy were under-represented in the study. Factors that might explain the under-representation of deaths due to obstetrical haemorrhages and ectopic pregnancy include the availability of blood and blood products, a high suspicion index for the diagnosis of these conditions and their early and appropriate management, and emphasis on the active management of the third stage of labour. Most patients with hypertensive disorders who present early are referred to the regional hospital. Current literature suggests that clinicians should be equally attentive to systolic blood pressure as they are to diastolic blood pressure.[36]

Thirty (49.2%) patients received substandard care. Further research is needed to determine factors that contribute to substandard care. The assessors thought that a different management approach would definitely have made a difference for seven patients. Three of these patients died of HIV/AIDS, and the others died from abortion, embolism, acute collapse and postpartum haemorrhage. The assessors thought that a different management approach could have possibly made a difference to 15 (24.5%) patients who died of non-pregnancy-related sepsis, pregnancy-related sepsis, anaesthetic complications, abortion and acute collapse. These are treatable obstetrical emergencies that need to be taught to medical and nursing staff. Even when treating patients with HIV/AIDS, clinicians should not give up.

Conclusion

This facility-based study confirmed our prior suspicion that the profile of maternal deaths at facility level was different to that at national level. It was relevant to conduct a maternal mortality audit at facility level in order to improve care. While there is an increase in the number of maternal deaths and the maternal mortality ratio at national level, these reflected a decrease at this district hospital. Non-pregnancy-related sepsis was the leading cause of maternal deaths at both national and district hospital level, but the other four major causes of maternal deaths at this facility from 2006-2010 differed from the other four major causes at national level between 2005 and 2007. The incidence of substandard care is too high and requires urgent attention.

Recommendations

All pregnant women who are eligible for antiretroviral therapy should be fast-tracked on HAART, not only for the prevention of mother-to-child transmission of HIV (PMTCT), but for their own well-being too. Integrating the initiation of HAART within general antenatal care might help to fast-track these patients. This recommendation is supported by the fact that HIV/AIDS remains the leading cause of deaths (52.5%).

Medical staff should be trained to recognise and appropriately manage septic miscarriages and anaesthetic complications. Referral criteria for septic miscarriage should be adhered to. Protocols for the resuscitation of these cases in casualty should be drafted and disseminated. This recommendation is supported by the fact that there was an over-representation of miscarriage and anaesthetic-related deaths at the hospital, namely 14.8% vs. 3.4%

for miscarriage, and 4.9% vs. 2.7% for anaesthetic complications.

The community should be educated about help-seeking behaviour, as demonstrated by poor antenatal care attendance, late antenatal booking, the high number of home deliveries and late presentation to the hospital.

The establishment of a waiting area for mothers might reduce the number of home deliveries and late presentation at the hospital when in labour. This recommendation is supported by the fact that 25.7% of those who died in the postpartum period delivered at home, and a number of patients in labour presented when they were already fully dilated.

Limitations of the study

There was missing information in some of the records. This is expected in any retrospective chart review. The records of all deaths of female of reproductive age were not checked to exclude the misclassification of maternal deaths. Under-reporting, due to misclassification or otherwise, might vary from 9.5-40%.[11,37-40] At times, the outcome of care rendered at the hospital was confounded by the care rendered at the referring facility. The study did not report on patients who died at the regional hospital after probably being mismanaged and referred from this facility to the regional hospital. The study covered five years, and some practices might have changed over time. Therefore, some of the findings from earlier years (2006 and 2007) might no longer be relevant, while those from 2009 and 2010 might be more so.

Conflict of interest

There was no conflict of interest that might have inappropriately influenced us in writing this paper.

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