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## Quality-of-care audit and perinatal mortality in South Africa

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### Abstract

**Problem** Suboptimal care contributes to perinatal mortality rates. Quality-of-care audit can be used to identify and change suboptimal care, but it is not known if such audits have reduced perinatal mortality in South Africa.

**Approach** We investigated perinatal mortality trends in health facilities that had completed at least five years of quality-of-care audit. In a subset of facilities that began audits from 2006, we analysed modifiable factors that may have contributed to perinatal deaths.

**Local setting** Since the 1990s, the perinatal problem identification programme has performed quality-of-care audits in South Africa to record perinatal deaths, identify modifiable factors and motivate change.

**Relevant changes** Five years of continuous audit were available for 163 facilities. Perinatal mortality rates decreased in 48 facilities (29%) and increased in 52 (32%). Among the subset of facilities that began audit in 2006, there was a decrease in perinatal mortality in 30% (16/54) but an increase in 35% (19/54). Facilities with increasing perinatal mortality were more likely to identify the following contributing factors: patient delay in seeking help when a baby was ill (odds ratio, OR: 4.67; 95% confidence interval, CI: 1.99–10.97); lack of use of antenatal steroids (OR: 9.57; 95% CI: 2.97–30.81); lack of nursing personnel (OR: 2.67; 95% CI: 1.34–5.33); fetal distress not detected antepartum when the fetus is monitored (OR: 2.92; 95% CI: 1.47–5.8) and poor progress in labour with incorrect interpretation of the partogram (OR: 2.77; 95% CI: 1.43–5.34).

**Lessons learnt** Quality-of-care audit was not shown to improve perinatal mortality in this study.

## Introduction

Perinatal mortality in South Africa remains high, with 33.4 deaths per 1000 live births in 2013.<sup>1-3</sup> Quality-of-care audit has been shown in non-randomized trials to reduce perinatal mortality by up to 30%.<sup>4-6</sup> The audit includes classifying avoidable deaths, changing service delivery and addressing health system problems.

The South African Medical Research Council introduced the perinatal problem identification programme in the 1990s to capture perinatal mortality, identify modifiable factors and motivate change.<sup>7</sup> This programme is a part of a quality-of-care audit cycle and until 2012, participation was voluntary. The programme is used at all levels of care, and captured 94% of hospitals (238/252) and 73% of births (1 330 869/1 820 664).<sup>8</sup> We wanted to determine how perinatal mortality rates had changed in health care facilities participating in the perinatal problem identification programme.

## Approach

We used data from the programme to explore the impact of onsite quality-of-care audit on the perinatal mortality rate, which is defined as fetal and early neonatal deaths (0–7 days) per 1000 births. We analysed perinatal mortality rates of babies weighing more than 1000 g from 163 facilities with at least five years of continuous audit between 1990 and 2013. There were 3 406 347 births and 85 728 deaths from 29 community health centres, 105 district hospitals, 4 national central hospitals, 22 regional hospitals and three provincial tertiary hospitals.

Data were smoothed using 12 month moving averages; trends in mortality were analysed using Epi Info version 7 (Centers of Disease Control and Prevention, Atlanta, United States of America). SPSS version 22 (IBM Corp., Armonk, USA) was used for all other analyses. For each site, we tested for temporal trend in perinatal mortality rates using the extended Mantel-Haenszel  $M^2$  statistic with one degree of freedom. The trend was assumed to be monotonic (i.e. continuously increasing or decreasing, compared to the initial value of the perinatal mortality rate). A *P*-value of less than 0.05 was considered significant.

Next, we tested the effect of the programme on a subgroup of 54 facilities that began auditing from 2006 onwards. We analysed two of the specific indicators of quality-of-care audit: the identification of modifiable factors in a death and the final obstetric cause of death. We compared facilities with increasing mortality and facilities with decreasing mortality.

The programme defines 69 modifiable factors which are an incident related to the actions of the mother or health care personnel, or the health care system, which may have altered the outcome of the specific case had it been managed differently.<sup>9</sup> Clinical staff identify potentially modifiable factors in the immediate period after the death. We estimated the crude odds ratios (OR) for a modifiable factor being implicated in a death in facilities with increasing mortality compared with facilities with decreasing mortality. To account for multiple testing (since more than one modifiable factor may be identified per death), a *P*-value of less than 0.01 was considered significant.

We calculated the average number of modifiable factors per death and the rates of obstetric causes of death (per 1000 total deaths) in the first and fifth year of audit. Changes in these values over time were assessed using a *t*-test for independent samples.

The perinatal problem identification programme has ethical approval from the University of Pretoria. Data were collected with permission from the South African Department of Health. This secondary analysis was approved by the technical task team, Medical Research Council of South Africa.

## Relevant changes

Of the 163 facilities, 29% (48) had a decreasing perinatal mortality rate, 32% (52) increasing and 39% (63) had no significant change. Included in these facilities were 29 community health centres (11 increasing, five decreasing and 13 no change), 105 district hospitals (32 increasing, 37 decreasing and 36 no change), 22 regional hospitals (seven increasing, five decreasing and 10 no change), four national central hospitals (one increasing, one decreasing and two no change) and three provincial tertiary hospitals (one increasing, two no change).

Fig. 1 shows the trend in perinatal mortality rates for facilities with a significant increase or decrease in mortality. One district hospital reduced its mortality rate from 100 deaths per 1000 live births at the beginning of audit to 12 deaths per 1000 live births at the end of five years (smoothed data). As the site had only 2438 births (0.07% of total births) and 130 deaths (0.15% of total deaths) over the whole period, we did not remove these cases from subsequent analyses, however this site is omitted from Fig. 1.

In the 54 facilities that began audit after 2006, 19 facilities (35%) had increasing mortality and 16 facilities (30%) had decreasing mortality. Facilities with increasing mortality were more likely to identify the following modifiable factors: patient delay in seeking help when a baby was ill (OR: 4.67; 95% confidence interval, CI: 1.99–10.97); lack

of use of antenatal steroids (OR: 9.57; 95% CI: 2.97–30.81); lack of nursing personnel (OR: 2.67; 95% CI: 1.34–5.33); fetal distress not detected antepartum when the fetus is monitored (OR: 2.92; 95% CI: 1.47–5.8) and poor progress in labour with incorrect interpretation of the partogram (OR: 2.77; 95% CI: 1.43–5.34). These same facilities were also significantly less likely to identify alcohol abuse, women who attended antenatal care late in pregnancy, inappropriate response to antepartum haemorrhage, inappropriate response to poor fetal movements, inappropriate response to rupture of membranes, infrequent visits to antenatal clinic, smoking, inadequate facilities in the nursery, inadequate resuscitation equipment, lack of transport, fetal distress not detected intrapartum when the fetus is not monitored, inadequate monitoring of the neonate, inadequate neonatal management plan and no response to positive syphilis serology test.

Facilities with increasing mortality identified 1.28 modifiable factors per death in their first year of audit and 1.49 factors in their fifth year ( $P = 0.431$ ). Facilities with decreasing mortality identified 1.53 modifiable factors per death in the first year and 1.66 in the fifth year ( $P = 0.73$ ). The rate of obstetric cause of death in the first year of audit was not significantly different between the two groups. In the fifth year of audit, facilities with decreasing mortality had significantly lower rates of spontaneous preterm labour and unexplained intrauterine death (Table 1).

## Lessons learnt

Audit is critical to the identification of potential problems; focused audits within a wider system can identify contextually specific service deficiencies and provide the impetus for change.<sup>10–12</sup> The variation in mortality rates in the facilities with five years of continuous quality-of-care audit suggests that this process does not necessarily reduce mortality. Facilities with increasing perinatal mortality identify some modifiable factors which should be easily remediable once identified (e.g. using antenatal corticosteroids).

That the facilities with increasing mortality rates were less likely to identify several of the modifiable factors is difficult to explain. There are no obvious differences between the groups in terms of level of health care, numbers of births and the obstetric causes of death at the beginning of audit. There were three community health centres with 39 151 births in sites with increasing mortality and community health centres with 11 168 births in sites with decreasing mortality ( $P = 0.137$ ) and 16 district hospitals with 112 754 births in sites with

increasing mortality and 12 district hospitals with 90 747 births in sites with decreasing mortality ( $P = 0.837$ ).

We know from qualitative research that there are factors that make audit successful – team drivers, institutional review, feedback and communication within the system.<sup>13</sup> We hypothesize that it is the quality of the process (the detailed death review and the response to modifiable factors) that is the vital component that changes perinatal mortality. This is supported by the significant reduction in the unexplained stillbirth category indicating a more thorough search for the cause of death.

The study has some limitations. Data were retrospective and so it was not possible to assess data accuracy or completeness of the review of perinatal deaths at each site. We did not adjust for temporal trends in maternal risk factors affecting perinatal mortality. Therefore, we cannot exclude the possibility that the observed changes in mortality were unrelated to clinical management.

In conclusion, we were unable to demonstrate an effect of quality-of-care audit on perinatal mortality. Further investigation of site response to audit and the effectiveness of mortality review needs to be undertaken to identify how best to use this tool, particularly in low- and middle-income settings with high perinatal mortality (Box 1).

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### **Competing interests:**

None declared.

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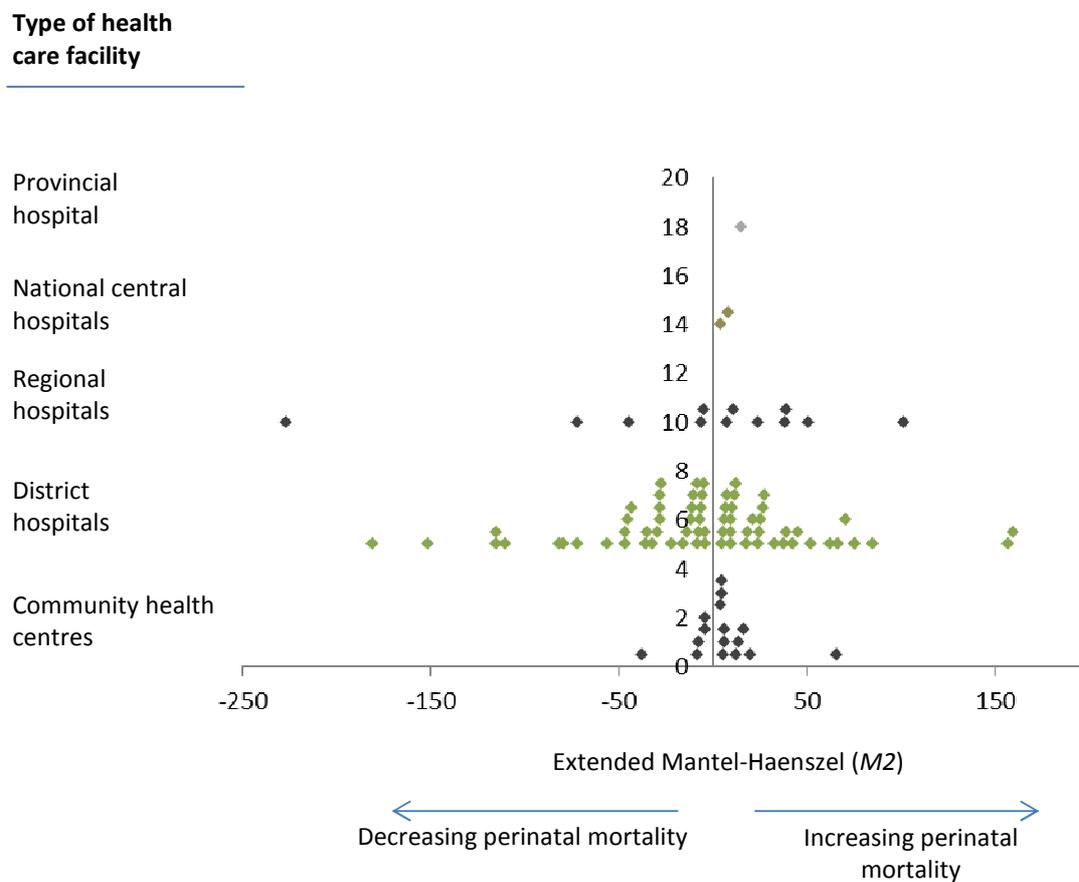
**Box 1. Summary of main lessons learnt**

- We were unable to demonstrate an effect of quality-of-care audit on perinatal mortality.
- Facility specific response to the audit process, including the response to identified modifiable factors may be the critical step in reducing perinatal mortality
- Further investigation is needed on how best to optimise quality-of-care audit as a tool in a low and middle income setting for reducing perinatal mortality

Table 1. **Obstetric causes of death in quality-of-care audits for health care facilities with increasing and decreasing perinatal mortality, South Africa**

Cause	Perinatal mortality per 1000 births					
	First year audit			Fifth year audit		
	Facilities with decreasing mortality	Facilities with increasing mortality	<i>P</i>	Facilities with decreasing mortality	Facilities with increasing mortality	<i>P</i>
Spontaneous preterm labour	5.0	3.0	0.150	3.0	5.8	0.038
Unexplained intrauterine death	5.5	4.1	0.487	3.3	6.9	0.011
Intrapartum asphyxia	3.1	3.5	0.713	3.1	5.8	0.07
Hypertension	3.3	0.9	0.090	1.1	2.1	0.106
Infections	1.4	1.6	0.785	0.4	0.8	0.250
Intrauterine growth restriction	0.3	0.1	0.311	0.1	0.1	0.582
Antepartum haemorrhage	1.2	0.8	0.535	1.1	1.8	0.210
Maternal disease	1.2	0.1	0.076	0.4	0.8	0.474
Fetal abnormality	0.7	0.2	0.209	0.9	0.6	0.550

Fig. 1. Trends in perinatal mortality for the first five years of quality-of-care audit in health care facilities, South Africa



Note: Each dot represents one health care facility.