Quality-of-care audits and perinatal mortality in South Africa
Emma R Allanson & Robert C Pattinson

Introduction
Perinatal mortality in South Africa remains high, with 33.4 deaths per 1000 live births in 2013. 1-3 Quality-of-care audits have been shown in non-randomized trials to reduce perinatal mortality by up to 30%. 4-6 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 Program in the 1990s to capture perinatal mortality, identify modifiable factors and motivate change. 7 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). 8 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 audits 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 audits 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 for 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 trends in perinatal mortality rates using the extended Mantel-Haenszel P² 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 audits: 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. 9 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 Program 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 of the South African Medical Research Council.
Lessons from the field
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Relevant changes

Of the 163 facilities, 29% (48) had a decreasing perinatal mortality rate, 32% (52) had an increasing rate 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 the audits 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 auditing 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...

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

Box 1. Summary of main lessons learnt

- We were unable to demonstrate an effect of quality-of-care audits 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 optimize quality-of-care audits as a tool in a low- and middle-income setting for reducing perinatal mortality.

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

M2

Decreasing perinatal mortality
Increasing perinatal mortality

Extended Mantel-Haenszel

Note: Each diamond represents one health-care facility.
alcohol abuse, women who attended antenatal care late in pregnancy, inappropriate response to ante partum 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
Audits are 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.\(^{10,12}\) The variation in mortality rates in the facilities with five years of continuous quality-of-care audits suggests that this process does not necessarily reduce mortality. Facilities with increasing perinatal mortality identified 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 the audits. 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 audits successful – team drivers, institutional review, feedback and communication within the system.\(^ {13}\) 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 audits on perinatal mortality. Further investigation of site response to audits 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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Contrôle de la qualité des soins et mortalité périnatale en Afrique du Sud

Problème Des soins sous-optimaux contribuent à des taux élevés de mortalité périnatale. Les contrôles de la qualité des soins peuvent permettre de déterminer si des soins sont sous-optimaux et de les modifier, mais il reste à savoir si ce type de contrôle a permis de réduire la mortalité périnatale en Afrique du Sud.

Approche Nous avons examiné les tendances en termes de mortalité périnatale dans des établissements de santé qui avaient réalisé des contrôles de la qualité des soins sur au moins cinq ans. Dans un sous-groupe d’établissements ayant commencé ces contrôles dès 2006, nous avons analysé les facteurs modifiables qui pourraient avoir eu un effet sur la mortalité périnatale.

Environnement local Depuis les années 1990, dans le cadre du programme d’identification des problèmes périnataux (PPIP), des contrôles de la qualité des soins ont été réalisés en Afrique du Sud afin d’enregistrer les décès périnataux, de déterminer les facteurs modifiables et de favoriser des changements.

Changements significatifs Des contrôles en continu sur cinq ans avaient été réalisés dans 163 établissements. Le taux de mortalité périnatale avait diminué dans 48 établissements (29 %) et augmenté dans 52 (32 %). Concernant le sous-groupe des établissements qui avaient commencé le contrôle en 2006, on a observé une diminution de la mortalité périnatale dans 30 % d’entre eux (16/54) mais une augmentation dans 35 % de ces établissements (19/54). Dans les établissements qui affichaient une augmentation du taux de mortalité périnatale, les facteurs suivants étaient plus fréquemment identifiés : consultation tardive des patients lorsqu’un enfant était malade (rapport de cotes, RC : 4,67 ; intervalle de confiance de 95 %, IC : 1,99–10,97) ; non-administration prénatale de stéroïdes (RC : 9,57 ; IC de 95 % : 2,97–30,81) ; manque de personnel infirmier (RC : 2,67 ; IC de 95 % : 1,34–5,33) ; soiffure fœtale non détectée ante partum lors de la surveillance du fœtus (RC : 2,92 ; IC de 95 % : 1,47–5,8) et mauvaise progression du travail, avec une interprétation incorrecte du partogramme (RC : 2,77 ; IC de 95 % : 1,43–5,34).

Leçons tirées Cette étude n’a pas montré que le contrôle de la qualité des soins permettait de réduire la mortalité périnatale.
Resumen

Verificación de la calidad de la asistencia y mortalidad perinatal en Sudáfrica

Situación
El cuidado por debajo del nivel óptimo contribuye a las tasas de mortalidad perinatal. Las verificaciones de la calidad de la asistencia se pueden utilizar para identificar y cambiar el cuidado por debajo del nivel óptimo, pero no se sabe si tales verificaciones han reducido la mortalidad perinatal en Sudáfrica.

Enfoque
Se investigaron las tendencias de mortalidad perinatal en centros de salud que habían completado por lo menos cinco años de verificaciones de la calidad de la asistencia. En un subgrupo de centros que empezaron las verificaciones en 2006, se analizaron los factores modificables que podrían haber contribuido a las muertes perinatales.

Marco regional
Desde la década de 1990, el programa de identificación del problema perinatal ha realizado verificaciones de la calidad de la asistencia en Sudáfrica para registrar las muertes perinatales, identificar los factores modificables y estimular el cambio.

Cambios importantes
Cincos años de verificaciones continuas estuvieron disponibles para 163 centros. Las tasas de mortalidad perinatal disminuyeron en 48 centros (28%) y aumentaron en 52 (32%).

En el subgrupo de centros que empezó la verificación en 2005, hubo una disminución en la mortalidad perinatal del 30% (16/54), pero un aumento del 35% (19/54). Los centros con una mortalidad perinatal en aumento tenían una mayor probabilidad de identificar los siguientes factores: retraso de los pacientes en la búsqueda de ayuda cuando un niño enfermaba (cociente de posibilidades, CP: 4,67; intervalo de confianza, IC del 95%: 1,99–9,07), falta de uso de asteroides prenatales (CP: 9,57 (IC del 95%: 2,97–30,81); falta de personal de enfermería (CP: 2,67 (IC del 95%: 1,34–5,33); septicemia neonatal no identificada antes del parto durante el control del feto (CP: 2,92 (IC del 95%: 1,47–5,8) y escasos progresos en el parto con una interpretación incorrecta del partograma (CP: 2,77 (IC del 95%: 1,43–5,34).

Lecciones aprendidas
Las verificaciones de la calidad de la asistencia no ha mostrado mejoras en la mortalidad perinatal en este estudio.

Referencias
1. Bradshaw D, Chopra M, Kerber K, Lawn JE, Bamford L, Moodley J, et al; South Africa Every Death Counts Writing Group. Every death counts: use of mortality audit data for decision making to save the lives of mothers, babies, and children in South Africa. Lancet. 2008 Aug 9;371(9620):1294–304. doi: http://dx.doi.org/10.1016/S0140-6736(08)60564-4 PMID: 18406864
2. Osrin D, Prost A. Perinatal interventions and survival in resource-poor settings: which work, which don’t, which have the jury out? Arch Dis Child. 2010 Dec;95(12):1039–46. doi: http://dx.doi.org/10.1136/adc.2009.179366 PMID: 20980274
3. Pattinson RC, Rhoda N. Saving babies 2012-2013: Ninth report on perinatal care in South Africa. Pretoria: Tshepesa Press; 2014. Available from: http://www.ppip.co.za/wp-content/uploads/Saving-Babies-2012-2013.pdf [cited 2015 Mar 31]
4. Wilkinson D. Reducing perinatal mortality in developing countries. Health Policy Plan. 1997 Jun;12(2):161–5. doi: http://dx.doi.org/10.1093/heapoli/12.2.161 PMID: 10168198
5. Drife JO. Perinatal audit in low- and high-income countries. Semin Fetal Neonatal Med. 2006 Feb;11(1):29–36. doi: http://dx.doi.org/10.1016/j.siny.2005.10.003 PMID: 16364705
6. Pattinson R, Kerber K, Waswa P, Day LT, Muxsell F, Asiruddin SK, et al. Perinatal mortality audit: counting, accountability, and overcoming challenges in scaling up in low- and middle-income countries. Int J Gynaecol Obstet. 2009 Oct;107 Suppl 1:S113–21, S121–2. doi: http://dx.doi.org/10.1016/j.ijgo.2009.07.011 PMID: 19815206
7. Pattinson R, Woods D, Greenfield D, Velaphi S. Improving survival rates of newborn infants in South Africa. Reprod Health. 2005;2(4): doi: http://dx.doi.org/10.1186/1472-6963-2-4 PMID: 16095525
8. Pattinson RC. Saving babies 2010-2011: Eighth report on perinatal care in South Africa. Pretoria: Tshepesa Press, 2013. Available from: http://www.ppip.co.za/wp-content/uploads/Saving-Babies-2010-2011.pdf [cited 2015 Mar 31]
9. Perinatal problem identification program [Internet]. Pretoria: Simply Software; 2014. Available from: http://www.ppip.co.za/about-ppip/ [cited 2015 Mar 31]
10. Lindmark G, Langhoff-Roos J. Regional quality assessment in perinatal care. Semin Neonatol. 2004 Apr;9(2):145–53. doi: http://dx.doi.org/10.1016/j.siny.2003.08.013 PMID: 16256718
11. Manco-Jones M, Brugha RF. Using perinatal audit to promote change: a review. Health Policy Plan. 1997 Sep;12(3):183–92. doi: http://dx.doi.org/10.1093/heapoli/12.3.183 PMID: 10173999
12. Nakibuka VK, Okong P, Waswa P, Baryangah RN. Perinatal death audits in a peri-urban hospital in Kampala, Uganda. Afr Health Sci. 2012 Dec;12(4):43–42. PMID: 23515457
13. Belizán M, Bergh AM, Cilliers C, Pattinson RC, Voce A; Synergy Group. Stages of change: A qualitative study on the implementation of a perinatal audit programme in South Africa. BMC Health Serv Res. 2011 Mar;11(243):243. doi: http://dx.doi.org/10.1186/1472-6963-11-243 PMID: 21958353