

Title:

Outreach obstetrics training in Western Australia improves neonatal outcome and decreases cesarean sections.

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Summary:

The objective was to determine the effect of a multi-professional outreach obstetric training program on perinatal and neonatal outcomes. This was a retrospective comparison of 5-minute low Apgar scores, stillbirth, perinatal death and moderate/severe hypoxic ischemic encephalopathy rates in 127,753 infants born in Western Australia before and after the introduction of training in rural & remote areas. Following the introduction of the training program, there was a highly significant ($p=0.003$) decrease in the rate of infants born with low 5-minute Apgar scores (from 20.4 to 15.4 per thousand live births). Whilst the changes in the other three outcomes were not significant, all three demonstrated a trend for improvement in the intervention area. This is the second study of an educational intervention in obstetrics to demonstrate improvement in neonatal outcome and the first to be associated with a decrease in cesarean sections.

Introduction

There are approximately 26,000 births per year in Western Australia (WA), one fifth occurring in rural and remote (R&R) areas. Two-thirds of Aboriginal pregnant women (with perinatal mortality rates approximately double those of non-Aboriginal women), reside and give birth in R&R areas. Australian specialist obstetricians practice mainly in metropolitan areas with only 15% located in R&R areas where 28.5% of the female population lives (Australian Medical Workforce Advisory Committee, 1998). There are fewer obstetric specialists in rural/remote WA than in rural/remote Australia overall (6.9 compared with 12.7 per 100,000 females aged 15-49 years). The provision of maternity services in R&R areas depends largely on midwives working with General Practitioner (GP) obstetricians with regional and metropolitan specialist obstetrician support.

The United Kingdom Confidential Enquiry into Stillbirths and Deaths in Infancy has identified deficiencies in the management of conditions such as shoulder dystocia (Maternal and Child Health Research Consortium, 1998), breech presentation and cardiotocograph interpretation (Maternal and Child Health Research Consortium, 2000). A similar audit in WA (Perinatal and Infant Mortality Committee Report, 2005) has reported that over a third of perinatal deaths had at least one preventable factor and recommended support of health professionals in the maintenance of necessary knowledge and skills to care for mothers and babies.

In 2002, at the request of Rural Health West, a group of specialist obstetricians and midwifery educators from King Edward Memorial Hospital (KEMH) developed an outreach, multi-professional, one-day training program in obstetrics for R&R areas. The goal was to provide up-to-date training in all aspects of obstetrics to rural GP obstetricians and midwives in their local setting, aiming for improvements in maternity care.

A recent report from Bristol (Draycott et al., 2006), demonstrated an improvement in neonatal outcomes following the introduction of an obstetric emergencies training program.

The aim of this study was to determine whether the introduction of this educational intervention in R&R areas of WA had a similar effect on perinatal outcomes.

Methods

This was a retrospective comparison of the pre-training (1999-2001), with the post-training period (2004-2005), for the R&R areas. The years 2002-2003 were excluded as the first cycle of training was not completed until September 2003. The course content was based on an initial needs-analysis with subsequent modifications in response to course evaluations. The aim was to provide an

evidence-based refresher to all rural GP obstetricians and midwives of all aspects of obstetric care with particular emphasis on obstetric emergencies. The training program includes sessions in teamwork, antenatal care, intrapartum fetal heart rate monitoring, obstetric emergencies, postpartum care, neonatal resuscitation, local birth statistics review and case presentations. The training involves midwives and doctors working together in teams of 4-8 persons encouraging interactive, hands-on participation via workshops and practice drills. A small team (2-4) of obstetricians and midwife educators from KEMH travel to each of 14 R&R hospitals 100 to 3,200 kilometres away from Perth once every 12-18 months to deliver the training program which continues to evolve in response to course evaluations. By the end of the study period, each site had received at least two training visits.

Approval for the study was obtained from the KEMH Ethics Committee. The Australian government provided funding under the medical specialist outreach assistance program. The annual cost was \$25,000 Australian dollars initially, rising to \$36,000 for the current funding cycle (approximately \$360 per trainee) and includes travel, accommodation and KEMH staff salaries.

The outcome criteria were: five-minute Apgar score less than 7, stillbirth, perinatal mortality and moderate/severe Hypoxic Ischemic Encephalopathy (HIE) rates. The stillbirth rate was defined as the number of fetal deaths per thousand total births, where the gestation was at least 20 weeks or 400 grams birth weight.

Apgar scores, stillbirth and perinatal mortality rates were obtained from the WA Midwives' Notification System (Gee et al., 2005). HIE cases were identified using the Sarnat criteria (Sarnat & Sarnat, 1976) from the prospective electronic databases and the admission registers of both tertiary Neonatal Intensive Care Units.

The incidence rates of the outcome criteria pre and post-training were compared using Fisher's exact test. The level of significance was set at 0.05. The study had 80% power to detect a 25% difference between the two study periods for low Apgar scores, but could detect significance in the stillbirth or perinatal death rates only if there were 40% difference and had even less power for HIE.

Results

During the three years prior to the introduction of the training program, there were 16,883 hospital births in the R&R areas out of a total of 75,543 in WA (22.3%). In the two years post-training, there were 10,521 births in the R&R areas out of a total of 52,210 (20.2%). During this time there was also a decrease in the proportion of births to women who were resident in R&R areas from 27.3% of the total pre-training to 25.3% post-training. There was a small but significant increase in the proportion of women residing in R&R areas who gave birth in the metropolitan area from 17.5% to 19.6%.

The proportion of older and nulliparous women increased significantly during the second epoch (Table 1). The proportion of infants less than 33 weeks gestation born in the R&R areas did not change over the two epochs. The proportion of vaginal breech births and the cesarean section rate decreased significantly (Table 1).

Following the introduction of training to R&R areas, there was a highly significant 25% reduction in the rate of infants born with low 5-minute Apgar scores.

At the same time, there was a non-significant 21% decrease in the stillbirth rate and a non-significant 22% improvement in the perinatal death rate .

The moderate/severe HIE rates showed a similar trend of non-significant 10% improvement in the R&R areas.

Discussion

A systematic review of training programmes in acute obstetric emergencies (Black & Brocklehurst, 2003) highlighted that all the previously published studies relied on the use of questionnaires to course participants instead of using objective outcomes-based evaluations. In 2001, Young et al. (Young et al., 2001) reported that despite demonstrating a dramatic improvement in the proportion of cases associated with suboptimal care, they were unable to show an

improvement in low Apgar scores or low cord pH after their cardiotocograph training and regular audit interventions.

A major criticism of any study showing an improvement in perinatal outcomes after an intervention is that this improvement may be due to a variety of other factors which occurred during that time. Recent reports from Edinburgh (Becher et al., 2007) and Dublin (Walsh et al., 2008) have confirmed reductions in asphyxia related mortality and morbidity over time which may be due to a number of changes in obstetric management. In order to confound the effect of changes over time, we have compared the changes in the outcome criteria in the intervention area to the metropolitan area which did not receive this specific intervention. During the same time period, there was a similar increase in the rate of older and nulliparous mothers in the metropolitan area and a decrease in vaginal breech births. The caesarean section rate, however, had increased significantly in the metropolitan area. There were no significant changes in any of the outcome criteria in the metropolitan area.

During the study period there were major changes in antenatal and intrapartum management in the metropolitan area as a result of the inquiry into obstetric and gynaecological services at KEMH 1990-2000 (Western Australian Department of Health, 2001), leading to significant improvements in all areas of intrapartum management (McLean & Walsh, 2003) in the only tertiary referral hospital in WA after its release in November 2001. At the same time there have been increasing

workforce problems with shortage of obstetricians, GP obstetricians, midwives and neonatal nurses across the state but especially in the R&R areas (Perinatal & Infant Mortality Committee Report, 2007). Both of these factors would be expected to make it more difficult to demonstrate improvements in the R&R areas compared to the metropolitan area.

Another difficulty lies in the very low prevalence of perinatal outcome criteria so that in order to show a statistically significant improvement in any of them, a very large sample size is needed. Our study was underpowered to show clinically important improvements in all outcome criteria except the low Apgar score.

The main finding of this study is a highly significant improvement in the low 5-minute Apgar score in the R&R areas following this educational intervention. Whilst the changes in the other three outcomes of stillbirth, perinatal death and HIE rates were not statistically significant, all three demonstrated a trend for improvement in the R&R areas. The lack of statistical significance may be attributed to the lack of power of this study for these criteria.

As low Apgar scores and moderate/severe HIE rates correlate well with intrapartum asphyxia (Hogan et al., 2007), this study provides evidence for improvement in intrapartum care in R&R areas.

One explanation for the improvement trend in stillbirth and perinatal mortality rates in the R&R areas may be an increase in the number of high risk transfers

from R&R to the metropolitan area. There was a small (12%) increase in the proportion of women resident in R&R areas giving birth in the metropolitan area and better selection of high risk cases transferred is also possible, as per the training program's objectives. Approximately two thirds of all perinatal deaths in WA occur in gestations less than 33 weeks (Perinatal & Infant Mortality Committee Report, 2007). The proportion of such births in the R&R area, however, did not change over the two epochs. Furthermore, analysing the data by the mother's residence as opposed to birth location did not change the findings in any of the outcome criteria. This suggests that there was a real improvement in both antenatal and intrapartum care of women residing in R&R areas after the introduction of the training program.

This improvement was associated with a significant decrease in the cesarean section rate in the R&R areas in contrast to an increase in the metropolitan area. This may be attributed to increased utilisation of intrapartum fetal scalp stimulation tests for non-reassuring fetal heart as a result of our teaching and is in line with recent data reporting a lack of correlation of neonatal seizures and peripartum deaths with a rising cesarean section rate (Foley et al., 2005). The other changes in the baseline characteristics of the two groups over the study period (higher proportion of older and primiparous women), would be expected to lead to an increase in poor neonatal outcomes, making it more difficult to demonstrate any improvements.

The expected decrease in the vaginal breech delivery rates following the publication of the Term Breech Trial (Hannah et al., 2000) indicates that the training program was effective in achieving evidence-based practice. The relative contribution of this to the improvement in neonatal outcomes would, however, be expected to be small as the difference represented only 0.4% of vaginal births.

Draycott et al. (2006) were the first to report an educational intervention in obstetric emergencies which was associated with a significant improvement in low 5-minute Apgar scores and all degrees of HIE. As only moderate and severe grades of HIE are predictive of cerebral palsy, mild HIE was excluded from the outcome criteria in the present study to make them more clinically relevant.

Draycott et al. (2006) were also unable to show a statistically significant improvement in moderate/severe HIE or in stillbirth rates but unlike the present study they reported an increase in emergency cesarean sections.

Both the WA and the Bristol (Draycott et al., 2006) training courses are multi-professional, utilising small group teaching, with theoretical, skill and drill components. They both cover teamwork, intrapartum fetal heart monitoring and obstetric emergencies in one day. Our training course also aims to improve knowledge in other aspects of obstetric care and is able to adapt to the local needs of the various locations through a process of pre-visit needs analysis and course evaluations. It could easily be adapted to other rural and remote and also metropolitan areas in Australia and other countries with similar health care settings. The Bristol study assessed one tertiary level unit and a total of 19,460

births whereas in the present study we reviewed data from 127,753 births and encompassed all the hospitals in WA.

It is difficult to know which particular aspect of this training program is most important in its success. The combination of multi-professional involvement, almost full participation of staff, evidence-based content, the adaptability to local needs and being run in the local hospitals are all important factors in the program's success. A recent randomised trial of teamwork training failed to demonstrate a beneficial impact on maternal and neonatal adverse outcomes (Nielsen et al., 2007). However, it was noticeable during the current program that the hospitals with the lowest perinatal mortality rates (Perinatal and Infant Mortality Committee Report, 2007) were the ones with the best working relationships between midwives and doctors. The authors believe that the quality of obstetric care depends primarily on how well midwives and doctors function together as a team and involving them in drills is the best way to improve teamwork. Ellis et al. (2008) have recently demonstrated that drills training for eclampsia management improved performance and teamwork behaviour but specific theoretical instruction on teamwork did not have any additional benefit, suggesting that improved teamwork is a general effect of drills rehearsal.

Conclusion

The introduction of an outreach, multi-professional, one-day training program in obstetrics to R&R areas was associated with a highly significant reduction in low 5-minute Apgar scores and a trend for improvement in all the other outcome criteria. This is only the second study of an educational intervention in obstetrics demonstrating an improvement in neonatal outcomes and the first associated with a decrease in the caesarean section rate . This study is important not only because it provides additional weight to the previous scanty evidence that multi-professional training in obstetrics may improve neonatal outcome but also because it demonstrates for the first time that this can be achieved on an outreach basis, over a vast geographical area, at a relatively low cost and a decrease in cesarean sections.

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