



Murdoch
UNIVERSITY

MURDOCH RESEARCH REPOSITORY

*This is the author's final version of the work, as accepted for publication following peer review but without the publisher's layout or pagination.
The definitive version is available at :*

<http://dx.doi.org/10.1111/ajo.12110>

Walker, L.J.M., Fetherston, C.M. and McMurray, A. (2013) Perceived changes in the knowledge and confidence of doctors and midwives to manage obstetric emergencies following completion of an Advanced Life Support in Obstetrics course in Australia. *Australian and New Zealand Journal of Obstetrics and Gynaecology*, 53 (6). pp. 525-531.

<http://researchrepository.murdoch.edu.au/16296/>

Copyright: © 2013 The Royal Australian and New Zealand College of Obstetricians and Gynaecologists

It is posted here for your personal use. No further distribution is permitted.

workforce in Australia can also benefit from centralised courses like ALSO, which promote internationally recognised, evidence-based obstetric emergency skills that are transferable to any workplace. Although the effectiveness of the ALSO course has been evaluated several times in the United States of America (USA)¹²⁻¹⁵ and ALSO outcomes have been measured in a hospital in Tanzania,¹⁶ no other published research evaluating the ALSO course was identified. To this end, the aims of this study were to measure changes in participants' confidence and perceived knowledge to manage specific obstetric situations immediately after completion of an ALSO course in Australia and to reassess six weeks later to determine retention of confidence and perceived knowledge.

Materials and Methods

A prospective repeated-measures survey design was undertaken over three time periods: precourse, postcourse and six weeks postcourse, using a questionnaire adapted, with permission, from an instrument used to investigate ALSO courses in the USA.¹⁴ The revised survey consisted of five-point rank-ordered responses Likert scale questions that measured perceptions of knowledge and confidence to manage the obstetric emergency situations covered in the ALSO curriculum, detailed in Table 1.

In each questionnaire, participants were asked to rate their current knowledge about the recommended management of specified obstetric situations and then to rate their level of confidence to clinically manage the same situations. The rating scale responses on the 1 to 5 scale for level of knowledge were 1 = poor to 5 = excellent. Responses on the 1 to 5 rating scale for level of confidence were 1 = not confident to 5 = extremely confident. Sociodemographic variables included participants' gender, profession, job title, years of clinical practice and current working area. The six weeks postcourse questionnaire also included several open-ended questions about various aspects of the course, including whether or not participants had had any obstetric

Table 1 Situations taught in the ALSO course

Interpreting cardiocograph (CTG) traces
Forceps-assisted births
Vacuum-assisted births
Shoulder dystocia
Postpartum haemorrhage (PPH)
Umbilical cord prolapse
Pre-eclampsia/eclampsia
Vaginal breech births
Preterm labour (PTL)
Antepartum haemorrhage (APH)
Labour dystocia
Maternal resuscitation
Neonatal resuscitation (NNR)
Maternal venous thrombosis
First-trimester bleeding
Perinatal loss

situations at work in which they had used the knowledge or skills learnt during their recent ALSO course. Following permission to conduct the study by the Australian ALSO Executive Board and ethics approval by Murdoch University Human Research Ethics Committee, all participants attending one of four consecutive ALSO courses in Western Australia, New South Wales, Victoria and Queensland from June to December 2010 were invited by email to participate. At the course registration, those attendees who consented were given an envelope containing a coded consent form and coded precourse questionnaire. Completed questionnaires were returned to the envelope, sealed and 'posted' into a survey submission box. This process was repeated on completion of the course, and a third questionnaire was posted to the participants six weeks after completion of the course. One of the objectives in choosing the six-week time frame was to examine whether there was any decline in confidence and/or perceived knowledge before participants were exposed to intervening variables, such as other courses or training, which could potentially confound the outcomes. Each questionnaire asked the same questions about the obstetric situations taught in the course and intended to establish the participant's perceived knowledge and confidence about each obstetric situation at that particular time, thereby allowing comparisons across the three time periods.

Prior to the evaluation, a pilot study ($n = 29$) was undertaken to establish reliability and face and content validity of the questionnaires, resulting in a Cronbach's alpha of 0.92 and 0.97 for the pre- and postcourse questionnaires, respectively. As no changes to the questionnaires were deemed necessary, the data from the pilot study were included in the main study.

Analysis was conducted using SPSS 17[®] for Windows (2008) with descriptive data reporting frequencies, percentages, median and interquartile range (IQR) or mean and standard deviation according to normality. A Friedman two-way repeated-measures analysis of variance for related samples was used to investigate the impact of the ALSO course on the participants' confidence in their knowledge and ability to manage the different obstetric emergency situations. Follow-up pairwise comparisons (precourse to immediately postcourse; precourse to six weeks postcourse; and immediately postcourse to six weeks postcourse) using the Wilcoxon signed rank test with a Bonferroni correction were subsequently performed. After analysing the results for all categories of participants, the sample was then split to investigate differences in the findings for the doctors and midwives.

Effect size (r) was calculated,¹⁷ and the size of the effect was described as small ($r = 0.1$), medium ($r = 0.3$) or large ($r = 0.5$).¹⁸ All P levels lower than 0.05 were considered significant.

Results

The sampling frame consisted of 242 course attendees (98 doctors and 144 midwives), of whom 170 agreed to

Table 2 Professional positions held by study medical participants

Occupation of doctors	Pre- and postcourse Participants <i>n</i> = 62 (%)	6/52 postcourse Participants <i>n</i> = 35 (%)
O&G Consultant	1 (2)	1 (3)
GP Obstetrician	8 (13)	5 (14)
O&G Registrar	2 (3)	2 (6)
O&G Resident	21 (34)	7 (20)
Flight Doctor	3 (5)	2 (6)
District Medical Officer/Medical Officer	17 (27)	15 (43)
GP/GP trainee	5 (8)	3 (8)
Consultant/Senior Registrar (non O&G)	4 (6)	0
Other	1 (2)	0

participate in the study, although five were subsequently excluded due to incomplete data. This resulted in an adequate sample size¹⁹ of 165 (68%), including 62 doctors (37.6%) and 102 midwives (61.8%). One participant's profession was unknown.

One hundred and one participants (61% of the original 165 participants) completed the six weeks postcourse questionnaire, including 65 (65%) midwives and 35 (35%) doctors. All midwives were female, with 14 male and 21 female doctors. Although the midwives did not generally specify their professional status, Table 2 illustrates the doctors' professional positions at the different data collection times.

Sociodemographic data

Precourse data were unavailable for ALSO course attendees who chose not to participate in the study, and therefore, no demographic comparisons can be made between survey responders and nonresponders. However, sampling bias was minimised by the relatively high response rate where 63.3% of doctors and 70.8% of midwives in the sampling frame responded to the pre- and postcourse survey. Amongst the study participants, years of experience for doctors ranged from 1 to 32 with a median of 4 (IQR: 2, 10), whereas midwives generally had more experience with a range of 1–38 years, median 15 (IQR: 5.75, 25). The majority of study participants indicated their work involved some aspects of maternity care, with only 13% having no direct involvement in the clinical care of maternity patients. However, a larger proportion of the doctors were not involved in the clinical care of maternity patients both in the initial sample (28%) and in the six-week sample (29%) compared with midwives (4% of both samples).

Perceptions of knowledge

Perceptions of knowledge related to the recommended management of all of the obstetric situations measured increased significantly from precourse to six weeks postcourse, $X^2 = 1452.25$ (corrected for ties), $df = 50$, $N - \text{ties} = 88$, $P < 0.001$. These findings are presented in Table 3.

Follow-up pairwise comparisons at the three time periods showed a significant increase in perceptions of knowledge related to all the obstetric situations from precourse to immediately postcourse for both professional groups ($P < 0.001$, $r = 0.64$ – 0.91), which was sustained at six weeks postcourse ($P < 0.001$, $r = 0.76$ – 0.92).

Perceptions of confidence

Participants' confidence to clinically manage all of the obstetric situations measured increased significantly from precourse to six weeks postcourse, $X^2 = 2088.42$ (corrected for ties), $df = 53$, $N - \text{ties} = 93$, $P < 0.001$. These findings are presented in Table 4.

Follow-up pairwise comparisons showed a significant increase in the confidence of both professional groups to clinically manage all the obstetric situations from precourse to immediately postcourse ($P < 0.001$, $r = 0.79$ – 0.93), which was sustained for six weeks following the course ($P < 0.001$, $r = 0.74$ – 0.95).

Retention of knowledge and confidence

Although both professional groups experienced overall significantly increased levels of perceived knowledge and confidence for up to six weeks following the ALSO course, there were significant decreases in both groups, to varying degrees, in the perceived knowledge and/or confidence for many of the obstetric situations measured during the period from immediately postcourse to six weeks postcourse. The six weeks postcourse question as to whether participants had had any obstetric situations at work in which they had used the knowledge or skills learnt during their recent ALSO course revealed that 54% of doctors and 34% of midwives had not. Several participants added explanations which included:

Have been on holidays but know I will use them extensively on my return

Working in medical wards since

Not often

Not yet thankfully

Only because I have now rotated onto a different unit. I will be undertaking GP obstetrician work next year and I have no doubt that ALSO skills/knowledge will be invaluable

Table 3 Changes in perceived knowledge about the management of obstetric situations from precourse to six weeks post-course

Obstetric situation	Participants	Precourse Median (IQR)	Six weeks postcourse Median (IQR)	Significance (two-tailed)	Effect size
Interpreting intrapartum CTG traces	Midwives	4 (3,4)	4 (4,4)	<0.001	0.82
	Doctors	3 (3,4)	4 (3,4)	<0.001	0.79
Forceps-assisted births	Midwives	3 (2,3)	4 (3,4)	<0.001	0.80
	Doctors	2 (2,3)	3 (3,4)	<0.001	0.82
Maternal venous thrombosis	Midwives	3 (3,3)	4 (3,4)	<0.001	0.91
	Doctors	3 (3,4)	4 (4,4)	<0.001	0.93
Postpartum haemorrhage	Midwives	4 (3,4)	4 (4,5)	<0.001	0.89
	Doctors	4 (3,4)	4 (4,5)	<0.001	0.90
Maternal resuscitation	Midwives	3 (3,4)	4 (4,4)	<0.001	0.83
	Doctors	3 (3,4)	4 (4,5)	<0.001	0.87
Pre-eclampsia	Midwives	3 (3,4)	4 (4,4)	<0.001	0.84
	Doctors	3 (3,4)	4 (4,5)	<0.001	0.85
Eclampsia	Midwives	3 (3,4)	4 (4,4)	<0.001	0.94
	Doctors	3 (3,4)	4 (3,4)	0.002	0.58
Umbilical cord prolapse	Midwives	3 (3,4)	4 (4,4.5)	<0.001	0.87
	Doctors	3 (2,3.5)	4 (3,4)	<0.001	0.91
Vaginal breech births	Midwives	3 (2,3)	4 (3,4)	<0.001	0.84
	Doctors	2 (2,3)	3 (3,4)	<0.001	0.86
Neonatal resuscitation	Midwives	4 (3,4)	4 (4,5)	<0.001	0.82
	Doctors	3 (2.5,4)	4 (3,4.25)	<0.001	0.81
Vacuum-assisted births	Midwives	3 (3,3)	4 (4,4)	<0.001	0.86
	Doctors	3 (2,4)	4 (3,4)	<0.001	0.77
Shoulder dystocia	Midwives	3 (3,4)	4 (4,5)	<0.001	0.91
	Doctors	3 (2.5,3.5)	4 (4,5)	<0.001	0.96
Antepartum haemorrhage	Midwives	3 (3,4)	4 (4,4)	<0.001	0.89
	Doctors	4 (3,4)	4 (3,4)	<0.001	0.79
Preterm labour	Midwives	3 (3,4)	4 (4,4.5)	<0.001	0.86
	Doctors	3 (3,4)	4 (3,4)	<0.001	0.88
First-trimester bleeding	Midwives	3 (3,3.5)	4 (3.25,4)	<0.001	0.82
	Doctors	4 (3,4)	4 (4,5)	0.012	0.59
Labour dystocia	Midwives	3 (3,4)	4 (4,4)	<0.001	0.85
	Doctors	3 (2,4)	4 (3,4)	<0.001	0.86
Families experiencing perinatal loss	Midwives	3 (3,4)	4 (4,4)	<0.001	0.76
	Doctors	3 (2,4)	4 (3,4)	<0.001	0.90

The areas where a decrease in knowledge and/or confidence occurred for each professional group in the six weeks following successful completion of the course are outlined in Table 5.

Discussion

This study's findings support those from other ALSO course evaluations conducted in the USA that found the course increased participants' levels of comfort or confidence.¹²⁻¹⁴ Although this study did not measure changes in knowledge, it is reassuring to note the increase in perceptions of knowledge following the Australian ALSO course. This study extended previous findings in that the USA studies focussed largely on medical practitioners, whereas this study has contributed knowledge related to both doctors and midwives. Adding strength to the findings was the recruitment of participants from different states around Australia over several courses,

which resulted in a representative study sample of typical ALSO course attendees. Interestingly, many of the doctors reported lower levels of experience than the midwives, which suggests that they may have been either recent graduates or not directly involved in day-to-day obstetric care.

Despite the overall increase in confidence and knowledge at both the completion of the course and at six weeks, as can be seen in Table 5, analysis of specific emergency situations revealed a decrease in knowledge and/or confidence from immediately postcourse to six weeks postcourse for many of the emergency situations measured. This observed variation may be explained by either the complicated nature of these procedures or the rarity with which some of them are practised, either because the procedures themselves are uncommon or because these doctors and midwives were not currently exposed to the particular practice issue that would help them consolidate their learning. For instance, in Australia,

Table 4 Changes in confidence to clinically manage obstetric situations from precourse to six weeks post-course

Obstetric situation	Participants	Precourse Median (IQR)	Six-weeks postcourse Median (IQR)	Significance (two-tailed)	Effect size
Interpreting intrapartum CTG traces	Midwives	4 (3,4)	4 (4,4)	<0.001	0.97
	Doctors	3 (2.5,4)	4 (3,4)	<0.001	0.94
Forceps-assisted births	Midwives	2 (2,3)	3 (3,4)	<0.001	0.85
	Doctors	2 (2,3)	3 (3,4)	<0.001	0.90
Maternal venous thrombosis	Midwives	3 (2.3,3)	4 (3,4)	<0.001	0.81
	Doctors	3 (3,4)	4 (4,4.25)	<0.001	0.81
Postpartum haemorrhage	Midwives	4 (3,4)	4 (4,5)	<0.001	0.93
	Doctors	4 (3,4)	4 (4,5)	<0.001	0.86
Maternal Maternal resuscitation	Midwives	3 (3,4)	4 (4,4)	<0.001	0.90
	Doctors	3 (3,4)	4 (4,5)	<0.001	0.94
Pre-eclampsia	Midwives	3 (3,4)	4 (4,4)	<0.001	0.88
	Doctors	3 (3,4)	4 (4,5)	<0.001	0.87
Eclampsia	Midwives	3 (3,4)	4 (4,4)	<0.001	0.93
	Doctors	3 (2,3)	4 (3,4)	<0.001	0.82
Umbilical cord prolapse	Midwives	3 (3,4)	4 (4,4)	<0.001	0.89
	Doctors	2 (2,3)	4 (3,4)	<0.001	0.91
Breech: Lovsett manoeuvre	Midwives	2 (2,3)	4 (3,4)	<0.001	0.87
	Doctors	2 (1,3)	3 (3,4)	<0.001	0.90
Breech: Mauriceau Smellie Veit manoeuvre	Midwives	2 (2,3)	4 (3,4)	<0.001	0.87
	Doctors	2 (1.5,3)	3 (3,4)	<0.001	0.90
Neonatal resuscitation	Midwives	4 (3,4)	4 (4,5)	<0.001	0.83
	Doctors	3 (3,4)	4 (3.75,4.25)	<0.001	0.85
Vacuum-assisted births	Midwives	3 (2,3)	4 (3,4)	<0.001	0.84
	Doctors	3 (2,3)	4 (3,4)	<0.001	0.90
Shoulder dystocia: HELPER manoeuvres	Midwives	3 (3,4)	4 (4,5)	<0.001	0.91
	Doctors	3 (2,3)	4 (4,5)	<0.001	0.89
Antepartum haemorrhage	Midwives	3 (3,4)	4 (4,4)	<0.001	0.92
	Doctors	3 (3,4)	4 (3.75,5)	<0.001	0.89
Preterm labour	Midwives	3 (3,4)	4 (4,4)	<0.001	0.90
	Doctors	3 (3,4)	4 (4,4)	<0.001	0.86
First trimester bleeding	Midwives	3 (3,3)	4 (3,4)	<0.001	0.89
	Doctors	4 (3,4)	4 (4,5)	<0.001	0.85
Labour dystocia	Midwives	3 (3,4)	4 (4,4)	<0.001	0.85
	Doctors	3 (2,4)	4 (3,4)	<0.001	0.90
Families experiencing perinatal loss	Midwives	3 (3,4)	4 (3.5,4)	<0.001	0.66
	Doctors	3 (2,4)	4 (3,4)	<0.001	0.88

almost all breech babies are born by Caesarean section,²⁰ so although it is essential that doctors and midwives have a working knowledge of how to safely assist a vaginal breech birth, in reality, this rarely happens.

In regard to caring for families experiencing a perinatal loss, although babies of 'low-risk' women can unexpectedly die at birth, it is generally babies of 'high-risk' women who are more likely to become sick or die.²¹ Such 'high-risk' women are usually booked to birth at a tertiary unit with specialist obstetric, midwifery and neonatal teams to provide the expert care they require. Consequently, many midwives and doctors do not have the opportunity to care for these families.

The decline in confidence regarding neonatal resuscitation (NNR) may have been due to aspects of training such as the need to demonstrate intermittent positive pressure ventilation and concurrent cardiac compressions, which occurs infrequently.²¹ This finding is supported by

Sørensen *et al.*²² who also found a significant decrease in confidence with NNR nine months after an obstetric skills' training course, explaining it on the basis that NNR is managed less frequently than the other skills covered in their training programme.

The use of cardiotocographs (CTGs) intrapartum is fairly widespread throughout Australia, yet both doctors and midwives also reported a significant decrease in confidence in this area six weeks after the course. These findings are likely to be related to levels of precourse knowledge and expertise,²³ but support similar findings of a previous Australian study²⁴ which found that completion of an intrapartum fetal surveillance programme did not necessarily increase confidence to interpret CTG traces.

Unexpectedly, there were additional obstetric situations where only the doctors and not the midwives reported a decline in their confidence and/or perceived knowledge at the six-week follow-up. Table 2 indicates that only 29% of

Table 5 Decreases in confidence and perceptions of knowledge about specific obstetric emergencies from immediately postcourse to six weeks postcourse

Obstetric situation	Perceptions of knowledge					Confidence to manage				
	Participants	Postcourse Median (IQR)	Six weeks postcourse Median (IQR)	Significance (two-tailed)	Effect size	Participants	Postcourse Median (IQR)	Six weeks postcourse Median (IQR)	Significance (two-tailed)	Effect size
Interpreting intrapartum CTG traces	Doctors	4 (4,5)	4 (3,4)	0.02	0.67	Doctors Midwives	4 (4,5) 4 (4,5)	4 (3,4) 4 (4,4)	0.046 0.041	0.55 0.42
Forceps assisted births	Doctors	4 (4,5)	3 (3,4)	<0.001	0.94	Doctors	4 (4,5)	4 (3,4)	0.007	0.62
Postpartum haemorrhage	Doctors	5 (4,5)	4 (4,5)	0.02	0.6	Doctors	4 (3,4)	4 (3,4)		
Eclampsia	Doctors	4 (4,5)	4 (3,4)	0.032	0.59	Doctors	4 (4,5)	4 (3,4)		
Umbilical cord prolapse	Doctors	4 (4,5)	4 (3,4)	0.013	0.69	Doctors	4 (3,5)	4 (3,4)	0.018	0.61
Vaginal breech births	Doctors Midwives	4 (3,5) 4 (4,4)	3 (3,4) 4 (3,4)	0.002 0.043	0.7 0.37	Doctors Midwives	4 (3,4) 4 (3,4)	4 (3,4) 3 (3,4)		
Vaginal breech: Lovsett manoeuvre	Doctors	4 (4,5)	4 (3,4,25)	0.003	0.82	Doctors Midwives	4 (4,5) 4 (3,4)	4 (3,4) 4 (3,4)	0.01 0.035	0.71 0.40
Vaginal breech: Mauriceau Smellie Veit manoeuvre	Doctors	4 (4,5)	4 (3,4)	0.001	0.84	Doctors	4 (4,5)	4 (3,4)	0.04	0.53
Neonatal resuscitation	Doctors	5 (4,5)	4 (4,5)	0.011	0.64	Midwives	4 (4,5)	4 (3,4)	0.028	0.48
Vacuum assisted births	Doctors	4 (4,5)	4 (3,5,4)	0.007	0.42	All participants	4 (4,5)	4 (4,4,75)	0.043	0.30
Shoulder dystocia	All participants	4 (4,5)				All participants	4 (4,5)			
Families experiencing perinatal loss	All participants	4 (4,5)				Midwives	4 (4,5)	4 (3,5,4)	0.013	0.45

these doctors were working exclusively in obstetrics, so many of the situations would be relatively uncommon for the clinicians who were not regularly providing intra-partum care. The six-week time frame between completion of the course and collection of data also limits the chances for exposure to these events as indicated by responses to the question related to opportunities to practise skills learnt during the course.

Most studies investigating knowledge and skill retention find variable levels of decline over different time frames, which is often explained by the inability to control relevant variables that could impact on the longer term results, such as levels of prior knowledge, proficiency of precourse skills, clinical experience and encountering relevant situations in the workplace.²⁵⁻²⁷ Again, it is crucial to reinforce the benefits of short courses through continuing clinical experience²⁸ as repetition promotes skill retention,²⁹ and where opportunities to manage rare clinical situations are limited, access to in-house training should be mandatory to maintain skills.

By measuring confidence and perceived knowledge just six weeks after training, we have been able to show that for some participants, even after this short period of time, there is loss of confidence and perceived knowledge. The corollary of this relatively short retention in certain areas appears to support the old adage 'use it or lose it'. Nonetheless, despite this decline, when compared to precourse levels, participants still retained a significantly increased amount of confidence and perceived knowledge as a result of completing the Australian ALSO course, thereby providing evidence that the course exerted a positive effect on confidence and theoretical knowledge to manage obstetric emergencies in the short term. However, as assessment of actual knowledge retention, or its clinical impact, was a limitation of this study, whether participants' enhanced confidence and knowledge translates to the workplace resulting in improved clinical outcomes for mothers and babies is unknown.

Ideally, a course evaluation would measure outcomes in practice.³⁰ Although ALSO outcomes have successfully been measured in a hospital in Tanzania,¹⁶ the geographical diversity of participants' workplaces in Australia and the differences in opportunities for participants to use skills learned during a course (entirely dependent on the type of institution where they practise and the level of maternity care it provides) make a more objective evaluation of learning outcomes from the Australian ALSO course complicated. Whilst recognising the difficulty of this endeavour, nonetheless it should be considered as an important direction for establishing the substantive efficacy of the course.

These research findings contribute valuable information to the merits and usefulness of the ALSO course both nationally and internationally and will hopefully encourage further research in measuring outcomes related to both knowledge and competence following participation in obstetric emergency courses, along with strategies to improve retention of knowledge and skills.

Acknowledgements

We are grateful to the Australian ALSO Executive Board for their support of the study, and special thanks go to the participants and the ALSO administrators and Advisory Faculty at targeted courses for their invaluable assistance with participant recruitment and data collection.

Conflict of interest

Laura Walker is an instructor and Advisory Faculty member for the Australian ALSO course. Although she was Advisory Faculty on the pilot course of this study, she did not teach at the course and was not in attendance at any of the courses during the main study.

References

- 1 Sullivan E, Hall B, King J. Maternal Deaths in Australia 2003–2005. Canberra: Australian Institute of Health and Welfare, 2008.
- 2 Catling-Paull C, McDonnell N, Moores A, Homer CSE. Maternal mortality in Australia: learning from maternal cardiac arrest. *Nurs Health Sci* 2011; **13**: 10–15.
- 3 Kildea S, Pollock WE, Barclay L. Making pregnancy safer in Australia: the importance of maternal death review. *Aust N Z J Obstet Gynaecol* 2008; **48**: 130–136.
- 4 Upadhyay K, Scholefield H. Risk management and medicolegal issues related to postpartum haemorrhage. *Best Pract Res Clin Obstet Gynaecol* 2008; **22**: 1149–1169.
- 5 Centre for Maternal and Child Enquiries (CMACE). The eighth report of the confidential enquiries into maternal deaths in the United Kingdom. *Br J Obstet Gynaecol* 2011; **118**: 1–203.
- 6 Johanson R, Cox C, O'Donnell E *et al.* Managing obstetric emergencies and trauma (MOET). *TOG* 1999; **1**: 46–52.
- 7 Cooke H, Foureur M, Kinnear A *et al.* The development and initiation of the NSW Department of Health interprofessional Fetal welfare Obstetric emergency Neonatal resuscitation Training project (FONT). *Aust N Z J Obstet Gynaecol* 2010; **50**: 334–339.
- 8 Maouris P, Jennings B, Ford J *et al.* Outreach obstetrics training in Western Australia improves neonatal outcome and decreases caesarean sections. *J Obstet Gynaecol* 2010; **30**: 6–9.
- 9 Black RS, Brocklehurst P. A systematic review of training in acute obstetric emergencies. *Br J Obstet Gynaecol* 2003; **110**: 837–841.
- 10 Nielsen PE, Goldman MB, Mann S *et al.* Effects of teamwork training on adverse outcomes and process of care in labor and delivery: a randomized controlled trial. *Obstet Gynecol* 2007; **109**: 48–55.
- 11 Siasssakos D, Crofts JF, Winter C *et al.* The active components of effective training in obstetric emergencies. *Br J Obstet Gynaecol* 2009; **116**: 1028–1032.
- 12 Beasley JW, Damos JR, Roberts RG, Nesbitt TS. The advanced life support in obstetrics course: a national program to enhance obstetric emergency skills and to support maternity care practice. *Arch Fam Med* 1994; **3**: 1037–1041.
- 13 Bower DJ, Wolkomir MS, Schubot DB. The effects of the ALSO course as an educational intervention for residents. *Fam Med* 1997; **29**: 187–193.
- 14 Taylor HA, Kiser WR. Reported comfort with obstetrical emergencies before and after participation in the Advance Life Support in Obstetrics course. *Fam Med* 1998; **30**: 103–107.
- 15 Dauphin-McKenzie N, Celestin MJ, Brown D, González-Quintero VH. The advanced life support in obstetrics course as an orientation tool for obstetrics and gynaecology residents. *Am J Obstet Gynecol* 2007; **196**: 27–28.
- 16 Sorensen BL, Rasch V, Massawe S *et al.* Advanced life support in obstetrics (ALSO) and post-partum hemorrhage: a prospective intervention study in Tanzania. *Acta Obstet Gynecol Scand* 2011; **90**: 609–614.
- 17 Clark-Carter D. Quantitative Psychological Research: The Complete Student's Companion, 3rd edn. New York: Psychology Press, 2009.
- 18 Cohen J. Statistical Power Analysis for the Behavioural Sciences, 2nd edn. Hillsdale, NJ: Erlbaum, 1988.
- 19 Bartlett JE, Kotrlik JW, Higgins C. Organizational research: determining appropriate sample size in survey research. *ITLPP* 2001; **19**: 43–50.
- 20 Sullivan EA, Moran K, Chapman M. Term breech singletons and caesarean section: a population study, Australia 1991–2005. *Aust N Z J Obstet Gynaecol* 2009; **49**: 456–460.
- 21 Australian Resuscitation Council. Guideline 13.1: Introduction to Resuscitation of the Newborn Infant. Australian Resuscitation Council, 2010. **4**
- 22 Sørensen JL, Løkkegaard E, Johansen M *et al.* The implementation and evaluation of a mandatory multi-professional obstetric skills training program. *Acta Obstet Gynecol* 2009; **88**: 1107–1117.
- 23 Shapiro AM. How including prior knowledge as a subject variable may change outcomes of learning research. *Am Educ Res J* 2004; **41**: 159–189.
- 24 Kroushev A, Beaves M, Jenkins V, Wallace EM. Participant evaluation of the RANZCOG fetal surveillance education program. *Aust N Z J Obstet Gynaecol* 2009; **49**: 268–273.
- 25 Gass DA, Curry L. Physicians' and nurses' retention of knowledge and skill in cardiopulmonary resuscitation. *Can Med Assoc J* 1983; **128**: 550–551.
- 26 Crofts JF, Ellis D, Draycott TJ *et al.* Change in knowledge of midwives and obstetricians following obstetric emergency training: a randomised controlled trial of local hospital, simulation centre and teamwork training. *Br J Obstet Gynaecol* 2007; **114**: 1534–1541.
- 27 Govender K, Rangiah C, Ross A, Campbell L. Retention of knowledge of and skills in cardiopulmonary resuscitation among healthcare providers after training. *S Afr Fam Pract* 2010; **52**: 459–462.
- 28 Patel M, Oosthuizen G, Child S, Windsor JA. Training effect of skills courses on confidence of junior doctors performing clinical procedures. *N Z Med J* 2008; **121**: 1275.
- 29 Riegel B, Birnbaum A, Aufderheide TP *et al.* Predictors of cardiopulmonary resuscitation and automated external defibrillator skill retention. *Am Heart J* 2005; **150**: 927–932.
- 30 Kirkpatrick D. Great ideas revisited: techniques for evaluating training programs: revisiting Kirkpatrick's four-level model. *Training Dev* 1996; **????**: ???–???. **5**