Title: Impact of Introducing Practical Obstetric Multi-Professional Training (PROMPT) into Maternity Units in Victoria, Australia

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Running title: Introduction of PROMPT training into Maternity Units in Victoria, Australia

Abstract

Objective To assess the introduction of PROMPT training into maternity units and evaluate effects on organisational culture and perinatal outcomes.

Design A retrospective cohort study.

Setting Maternity units in eight public hospitals in metropolitan and regional Victoria, Australia.

Population or Sample Staff in eight maternity units and a total of 43408 babies born between July 2008 and December 2011.

Methods Representatives from eight Victorian hospitals underwent a single day of training (Train the Trainer), to conduct PROMPT. Organisational culture was compared prior to and following PROMPT. Clinical outcomes were evaluated prior to, during and after PROMPT training.

Main Outcome Measures The number of courses run and the proportion of staff trained were determined. Organisational culture was measured using the Safety Attitude Questionnaire (SAQ). Clinical measures included Apgar scores at 1 and 5 minutes (Apgar 1 and Apgar 5), cord lactate, blood loss and babies' length of stay in hospital.

Results Seven of the eight hospitals conducted PROMPT training. Overall about 50% of staff was trained in each year of the study. Significant increases were found in SAQ scores representing domains of teamwork (Hedges' g 0.27, 95%CI 0.13-0.41), safety (Hedges' g 0.28, 95%CI 0.15-0.42) and perception of management (Hedges' g 0.17, 95%CI 0.04-0.31). There were significant improvements in Apgar 1 (OR 0.84, 95% CI 0.77-0.91), cord lactates

(OR 0.92, 95% CI 0.85-0.99) and average length of stay of babies (Hedges' g 0.03, 95% CI 0.01-0.05) during or post training, but no change in Apgar 5 scores or proportion of cases with high blood loss.

Conclusion PROMPT can be introduced using the Train the Trainer model. Improvements in organisational culture and some clinical measures were observed following PROMPT.

Keywords PROMPT, multi-professional training, pregnancy, maternity

Introduction

Practical Obstetric Multi-professional Training (PROMPT) is one of a number of training programs developed to reduce adverse neonatal and perinatal outcomes through multi-professional training aimed at improving communication and teamwork.[1] Implementation of the program in the UK has resulted in significant improvements across a range of outcomes.[1-3] Typically the program involves a full day of hospital-based training comprising short lectures and scenario-based simulation training in obstetric emergencies, by trainers drawn from the hospital's staff. The program has been introduced in many hospitals in the UK and in other countries (such as the USA), in most cases using a 'Train the Trainer' model.[4] Under this model a small group of trainers from each hospital is given one day of training and teaching materials and then expected to conduct training in their own hospitals.

PROMPT was selected to address a gap in the training available in maternity units in Victoria. It was selected as there was sufficient evidence, at least in South-West England, to show its cost effectiveness and sustainability by delivering training in the maternity unit by staff from within a maternity unit.

A number of reviews have highlighted the need for objective evaluation of obstetric emergency training courses.[5,6] The introduction of such courses and the training of maternity staff comes at a significant cost, and not all training has been associated with improvements in outcomes.[1] Despite the widespread introduction of PROMPT internationally, to the best of our knowledge there is no published evidence regarding its

effectiveness outside the UK, including both clinical outcomes and improvements in organisational culture.

The aim of this paper was to investigate overall changes in organisational and clinical outcomes across all sites prior to and following PROMPT training in Victoria.

Methods

Ethics approval for the project was obtained through the Eastern Health Ethics Committee in February 2010.

Eight Hospitals were chosen to participate in a pilot project to introduce PROMPT training into Victorian hospitals. Hospitals are referred to as Site 1 to Site 8. The sites were specifically selected to ensure representation of rural, regional and metropolitan hospitals. A one-day training course ('Train the Trainer') was conducted by an experienced faculty in early 2010. It was attended by representatives from each of the eight participating hospitals. Each hospital was invited to send four clinical teachers, an anaesthetist, an obstetrician and two midwives. These participants were trained to run the PROMPT course. They were then provided with teaching materials with which to conduct courses within their own hospitals. The teaching materials supplied included prepared presentations and material for conducting scenario based simulation training. Each site was expected to train all their maternity unit staff once in each of the two years of the project (until the end of 2011). The CEO at each health service signed a Memorandum of Understanding agreeing to establish and run PROMPT courses for the two years of the study. The project manager and a management committee provided support and encouragement to the hospitals and staff

from the co-sponsor of the project, Victorian Managed Insurance Authority (VMIA) the hospital insurer, also provided encouragement to individual hospitals.

PROMPT lectures and scenario based drills covered teamwork, maternal collapse including basic life support, maternal cardiac arrest and advanced life support, breech presentation, eclampsia, postpartum haemorrhage and shoulder dystocia. As hospitals taking part in this project varied in size, location (regional versus metropolitan) and maternity tasks handled, training modules were slightly modified at each hospital to cover specific requirements.

Rollout of the project was monitored by recording the time taken from the initial Train the Trainer course to conducting the first PROMPT course at each site, number of courses conducted and percentage of staff trained. Retention of staff trained at Train the Trainer courses was also monitored.

The Kirkpatrick model[7] was used to assess the effectiveness of PROMPT training. The four levels of Kirkpatrick's evaluation model essentially measure, Level 1: Reaction (to what degree participants react favourably to the training), Level 2: Learning (to what degree participants acquire the intended knowledge, skills, attitudes, confidence, and commitment based on their participation in a training event), Level 3: Behaviour (to what degree participants apply what they learned during training when they are back on the job) and, Level 4: Results (to what degree targeted outcomes occur as a result of the training event and subsequent reinforcement).

To assess the first level of the Kirkpatrick model (Reaction), staff satisfaction with local training was assessed using a Training Evaluation Questionnaire. Questionnaires were

distributed to participants at the end of each training session, structured around the obstetric emergency topics covered. The questionnaire included statements about each of the topics (e.g. 'the lecture was relevant to me' or 'the content was about right'). A five-point Likert Scale was used to ask participants about the extent to which they agreed or disagreed with the statements (strongly agree, agree, no opinion, disagree and strongly agree).

To address the second level of the Kirkpatrick model, a Safety Attitude Questionnaire (SAQ) was implemented, designed to assess whether training enhanced organisational culture through a positive effect on patient safety attitudes and staff morale.[8] The SAQ assessed staff attitudes through six climate scales (referred to here as 'scales'): teamwork; safety; job satisfaction; perceptions of management; working conditions; and stress recognition.[8] The SAQ also includes questions on the respondents' demographics.

The SAQ has demonstrated good psychometric properties and has been recommended as a tool to measure caregiver attitudes, to promote interventions to improve safety attitudes and to measure the effectiveness of these interventions.[8] Staff at hospitals participating in this project completed the Labour and Delivery version of the SAQ prior to and following training (in February 2010 and then 2011). Items in the SAQ use a five-point Likert scale (ranging from disagree strongly to agree strongly). For each of the six scales, a 100 point scale score is calculated.[8]

Levels three and four of the Kirkpatrick evaluation model focus on behaviour and results, and in this study were assessed by improvements in clinical outcomes.

Patient outcomes were evaluated by the following clinical measures:

- *One-minute Apgar Scores (Apgar 1):* Percentage of Apgar 1 scores less than 7.
- *Five-minute Apgar Scores (Apgar 5):* Percentage of Apgar 5 scores less than 7.
- *Postpartum haemorrhage:* Blood loss values above 1500 ml.
- *Baby length of stay in hospital following birth*
- *Cord Lactate:* Abnormal cord lactate defined as the percentage of cord lactate levels above 5.27 mmol/L, corresponding to the 75th percentile of the distribution of the aggregated data.

The clinical measures were compared in the following time periods:

- Pre-training: July 2008-Dec-2009
- Training period: Jan 2010 to Dec 2010
- Post training: Jan 2011 to Dec 2011

The clinical records were obtained from the electronic maternity data-base used in each maternity unit. The following exclusions were applied:[1] still births, babies born before arrival at the hospital, babies delivered by elective caesarean section, multiple pregnancies and preterm babies (gestation less than 37 weeks).

Data Analysis

To assess responses from the training evaluation questionnaires, distribution of responses (percentage of participants who agreed, disagreed, etc.) were calculated. For the SAQ, differences in scale scores were assessed using one-tailed t-tests to assess whether there were increases in scores following training. Further comparisons of SAQ scale scores prior to and following training were performed using 'percentage agreement' scores. [10] The 'percentage of respondents' with a scale score of 75 or higher constitute the 'percentage

agreement' (i.e. agree slightly or strongly agree). Respondent demographics were compared prior to and following PROMPT training using Wilcoxon rank-sum and chi-squared tests.

Ordinary least squares and logistic regression were used to test differences in clinical measures at the different time periods. Changes in clinical measures over time were also examined. To do this the data was aggregated to monthly summaries. These were modelled using standard ordinary least square regression, adjusting for birth months. To account for any within-hospital correlation all models were adjusted using robust standard errors (clustering on hospitals). Results were considered significant at $P < 0.05$. Measures of effect size (Hedges' g or odds ratios) and 95% confidence intervals were calculated for comparisons. Statistical analyses were performed using Stata version 12.1 (StataCorp, Texas, USA) and Matlab (Release 2012b; The MathWorks, Inc., Natick, MA, United States).

Results

Results presented indicate outcomes from data aggregated across all participating hospitals. One participating site (Site 5) completed the SAQ according to the study protocol at 2 time points but did not complete any training during the period specified. The clinical data from this site was therefore excluded from analysis and only SAQ data is presented.

Introduction of PROMPT Training

Time taken to conduct first PROMPT course: There was considerable variation in the time it took each hospital to run their first course following the Train the Trainer. As shown in Figure 1, the first course at Site 4 was conducted the day after the Train the Trainer course making use of assistance from the experienced staff who had conducted the Train the

Trainer. Other sites took up to 186 days before conducting their first course. One hospital (Site 5) did not conduct a course at all.

Courses conducted and staff trained: The number of courses conducted at each site is shown in Table 1. PROMPT training was conducted as a full day course at all sites, apart from Site 7 (a regional hospital), where it was conducted as two half days, to accommodate the staff from a very small maternity unit.

Overall 51% of all possible staff were trained in the first year of the program. As seen in Table 1, two hospitals trained over 85% of their staff, and a further three trained between 60% and 75% of their staff. Three hospitals trained less than 20% of their staff.

Retention of staff trained at the Train the Trainer course: At the start of the project, it was anticipated that training would be conducted by staff who attended a Train the Trainer course and others who did not. This was the case throughout the project, with the latter group comprised of clinicians who became involved with the project after the initial Train the Trainer course and were provided the trainer material but did not attend a course. This group comprised 44% of the trainers with 56% having attended a Train the Trainer day.

Table 1 shows the number of staff from each site that were trained in the original Train the Trainer day, the number of staff actually involved in facilitation of PROMPT training days at the end of 2010, and the number of staff who had been trained and were no longer involved with PROMPT training days. Overall the retention of staff trained at the Train the Trainer course was satisfactory and an increase in total number of trainers was seen throughout 2010.

The Training Evaluation Questionnaire

Results from the training evaluations demonstrated very high participant satisfaction with the training program. For each training topic (e.g. maternal cardiac arrest or advanced life support), similar response distributions for each of the statements were found. Results for the last item 'session should remain' are therefore presented to reflect overall feedback to that topic. Over 33 training days conducted across all sites, over 95% of participants strongly agreed or agreed that each session should remain.

The questionnaire contained an 'overall' section which included a statement on recommending the training to their colleagues ('I would recommend it to my colleagues'). At one site less than 1% of respondents disagreed that they would recommend the training. All other participants strongly agreed or agreed with the statement.

The Staff Attitude Questionnaire

Respondent Demographics: In total 933 staff completed the SAQ at the two time points. Prior to training, a total of 432 surveys were handed out across all sites with an average response rate of 47.6%. After training, 501 surveys were returned resulting in a response rate of 45.9%. Of the total returned surveys 10 pre-training and 18 post-training were excluded as respondents worked at multiple sites and it was not clear which site their responses referred to. It should be noted that respondents completing the survey at the two time points were not necessarily the same people.

Comparison of respondent demographics prior to and following training showed no significant difference in respondents' distribution of age, gender, usual shifts worked, job status or first language. Staff who completed the survey prior to training had more experience in their specialty than those who completed the survey after training was rolled

out (M (SD): 20.82 (13.03) versus 13.03 (10.88) years; $P < 0.001$). They had also worked at their current hospital for longer than those who completed the SAQ after PROMPT rollout (M (SD): 22.42(12.79) versus 8.69 (9.14) years; $P < 0.001$).

SAQ Scale Scores: Results from comparison of mean SAQ scale scores from seven sites are shown in Table2. Data from Site 5 is presented separately as it did not perform PROMPT training as planned and can be viewed as a control site. There was a significant increase in teamwork, safety and perception of management scores following training at the sites where PROMPT training was preformed but not at Site 5.

Further comparisons of SAQ scale scores prior to and following training were performed using 'percentage agreement' scores as these have been used in previous studies.[8] The percentages of respondents with a scale score of 75 or higher constitute the 'percentage agreement' (i.e. agree slightly or strongly agree). Similar to the results found above, post-training respondents were more likely to score above 75 in the teamwork ($\chi^2 = 12.481$, $P < 0.001$), safety ($\chi^2 = 15.998$, $P < 0.001$) and perception of management scales, than those who completed the survey prior to training ($\chi^2 = 7.962$, $P = 0.005$).

Clinical Outcomes

Results from clinical data aggregated across seven sites are presented. Data from Site 5 was not included as no training was performed during the period specified. A total of 50905 births were identified. Following the exclusions applied, a total of 18364 births in the pre-training period, 12586 during training and 12458 in the post-training period were identified.

Table 3 summarises the average measures during each evaluation period. The average monthly changes assessed using fitted regression lines, are shown in Table 4.

Apgar 1: Prior to PROMPT training 9.1% of cases had Apgar 1 scores less than 7. This was significantly reduced to 8.3% during the training period. Following training, a further reduction to 7.7% was seen, however this did not reach significance.

Prior to PROMPT the rate of reduction in low Apgar 1 scores was greater than the other two intervention periods (Figure 2a). Overall, differences between the slopes for the 3 evaluation periods were not significant.

Apgar 5: Prior to PROMPT training 1.5% of cases had Apgar 5 scores less than 7. This percentage remained unchanged during training but increased to 1.6% following training. Differences between evaluation periods were not significant. The rate of decrease in low Apgar 5 scores was similar in the three periods (Figure 2b).

Cord Lactate: Prior to PROMPT, 25% of cases had cord lactate values above 5.27mmol/L. This was significantly reduced to 24.7% during and 23.4% after training.

Prior to training, there was no discernible variation in the average monthly percentage of high cord lactate values (Figure 2c). This was significantly reduced during the training period.

Postpartum haemorrhage: As seen in Figure 2d, there was no significant change in percentage of cases with high blood loss in the three evaluation periods (1.2% prior to and during training and 1.3% after training).

In the periods before and during training there was a similar increase in the monthly changes (Figure 2d). Post-training however, this was reduced. Differences between the slopes in the three evaluation periods were not significant.

Baby Length of Stay: A significant reduction in length of stay was seen during training (M(SD): 2.79 (1.55) days) compared to pre-training (M(SD): 2.85 (1.55) days). Differences with the post training period were not significant (M(SD): 2.82(1.55) days) (Figure 2e). Post-training there was a steeper reduction in average monthly length of stay compared to the pre-training period as well as during training, however the difference did not reach significance.

Discussion

Main Findings

The multi-professional training program PROMPT has previously shown improvement in neonatal clinical outcomes.[1] This study supports previous findings and in addition shows improvements in staff culture as assessed by the SAQ. The incidence of infants born with Apgar 1 scores less than 7 significantly decreased during the year PROMPT training was rolled out. This was then further reduced in the year following training. The proportion of babies with high cord lactates were also significantly reduced in the post-training period. The length of stay of babies in hospital was significantly reduced during the training period. Results from the SAQ showed significant improvement in staff attitudes toward safety, teamwork and perception of management following PROMPT training.

Strengths and Limitations

It was anticipated that all staff in the participating hospitals would be trained in each of the two years of the project. However in practice about 50% of staff in the participating hospitals was trained. Nevertheless this study demonstrates significant improvements in safety culture and in some clinical outcomes. It appears that improvements can be seen even when a relatively small proportion of staff are trained.

It has previously been demonstrated that PROMPT training results in increased knowledge in managing maternity emergencies amongst participants.[11] Assessment of knowledge acquisition was excluded from this study, as it was felt that this would assist in defining PROMPT as a learning experience rather than an assessment process, and would in turn encourage participants' acceptance of the program. However this could potentially be included to complement evaluation of the course in a future study.

The effects of PROMPT on staff attitudes had not previously been investigated. A limitation however was that not all participants who completed the questionnaire in the post-training period had attended PROMPT training and they were a younger group with less experience compared to staff in the pre-training period. We chose to include data from these participants in the analyses as our aim was to investigate overall organisational outcomes following PROMPT training.

Limitations of the evaluation of clinical results are that comparisons were made between the time period prior to training and then during and after training with training occurring over the two years of the project and not at a particular single time point. Also changes may have been due to factors other than the training program which we were not aware of. Background secular trends may also have been present in the data although we believe the inclusion of data from all seven sites which conducted PROMPT would reduce

the likelihood of such an effect on the results. Data over longer periods before the training and interrupted times series methods would be required to investigate these affects more accurately.

Interpretation

Our results show significant improvements in staff attitudes toward safety, teamwork and perception of management. Although the effect sizes reported were small, for teamwork and safety these were interpreted as educationally significant.[12] We believe this is an indication of the effectiveness of PROMPT as these are two areas of focus within the course.

The safety score in the SAQ is an indication of perceptions of a strong and proactive organisational commitment to safety and has been associated with lower risk adjusted patient mortality[13] and fewer medication errors.[14] The teamwork score in the SAQ represents the perceived quality of collaboration between staff members. Deficiencies in teamwork have been reported as a factor in the mismanagement of obstetric emergencies[15] with increased knowledge shown to improve management of these cases.[11] The increase in teamwork scores observed here are therefore likely to result in improved clinical outcomes.

Perception of management represents overall staff attitudes toward managerial action. Although perception of management is influenced by a wide range of factors, rollout of a training course which the vast majority of staff were satisfied with and felt they needed (as indicated by the evaluation questionnaires) could strongly influence their perception of managerial action.

Scores for job satisfaction, stress recognition and working conditions did not show significant improvements when measured after training. As PROMPT training by nature did not specifically address these topics, we did not expect significant changes in staff attitudes on these scales.

SAQ scores from the hospital at which no training was organised, showed no significant changes in the second set of questionnaires completed. The similarity of the SAQ results prior to and following the rollout of PROMPT appeared to further emphasise the effectiveness of training on improvements in scale scores at the other sites.

The SAQ has previously been used to identify attitudes in a maternity team in the UK where PROMPT training had been in place for a number of years.[16] Although scores in teamwork and training in this study were lower (5% and 3.7% respectively), they were within 0.4 standard deviations of those that reported by Siassakos et.al.[16] In contrast, the score in perception of management after training was 8.3% higher and within 0.5 standard deviations of their score.

Clinical outcomes were also assessed as part of the evaluation model used.[7] Improvements in Apgar 1 scores, cord lactate values and length of stay of babies in hospital were found. In contrast to the reduction in Apgar 1 scores, the proportion of babies with low Apgar 5 scores remained constant throughout the evaluation periods. Apgar scores at 1 minute and 5 minutes after birth of a baby are believed to be predictors of subsequent neurological disability.[17, 18] This association is generally agreed to be stronger with Apgar 5 scores than with Apgar 1 scores. However it has been demonstrated that Apgar scores at 1 minute but not at 5 minutes were related to neurological evaluation at 24 hours.[19, 20] This indicates that infants with low Apgar 1 scores may recover at five minutes however this

does not improve neurological evaluation at 24 hours after birth. We would therefore contend that the improvement in Apgar 1 scores is clinically important.

Our results in relation to low Apgar 5 scores were in contrast to results previously reported by Draycott et al.[1] which showed a reduction in this proportion. One reason for this could be the initially smaller population of babies with low Apgar 5 scores (1.5%) compared to those with low Apgar 1 scores (8%) which already show improvements. We did observe that changes in clinical measures occurred at different times relative to the rollout of training (i.e. during or after training), so it is possible that with more time changes would be observed in Apgar 5. A review of the active components of effective obstetric emergency training programs has shown high participation rates with regular training to be important factors in improving outcomes.[21] Training a higher number of staff than the 50% achieved as well as more regular training days may therefore be needed in order to achieve a reduction in low Apgar 5 scores comparable to those previously reported.[1] Modified training modules may also have affected outcomes. The content used in this course was not identical to that used in the UK in that fetal surveillance education was not included, as this was delivered separately.

The slight increase in percentage of cases with high blood loss in the post-training period year of the introduction of the program could be explained by an increased awareness of blood loss and a greater acceptance of the value of accurate measurement of blood loss following training. It is well known that blood loss estimation following child birth is inaccurate and the amount often under-estimated.[22] These facts are taught in the training program and it is possible that the increased reported blood loss is due to better reporting rather than an actual increase. This is consistent with the observation that the rate of

increase appeared to slow in the period after training, with the trend in the fitted regression line reversed from a positive slope to a slight negative slope indicating a slow reduction in average monthly blood loss values.

Although positive, improvements in clinical outcomes are relatively modest compared to those previously published[1] and effect sizes for changes in staff attitudes are small.[23] This may be explained by the fact that only a proportion of staff were trained and it is possible that a stronger effect would be seen with ongoing training of a larger number of staff. We believe that this association as well as previous work showing the effectiveness of PROMPT,[1] provide some evidence of a likely causal relationship between training and improvements in safety culture and clinical outcomes according to Hill's criteria for causation.[24] We acknowledge that further work is required to better establish this causal association and its ongoing effectiveness. We believe for the program to be most efficacious, methods need to be identified that improve the uptake of training. Training is a significant expense and it is incumbent on health services to continue to evaluate its effectiveness.

Conclusion

The results presented here suggest that PROMPT training can be introduced using the 'Train the Trainer' model and, in addition to improving clinical outcomes, can also improve staff attitudes.

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Disclosure of Interests

All authors declare they have no conflict of interest related to this study.

Contribution to Authorship

MS was involved in the execution of the research project as well as the design and execution of the statistical analyses. She wrote the first draft of the manuscript and was involved in its review.

MB was involved in the conception, organisation and execution of this project. He was involved in the writing and review of the manuscript.

FM was involved in the organisation and execution of the research project. She also reviewed the manuscript.

JF was involved in the design, and execution of the statistical analyses and review of the manuscript.

Details of Ethics Approval

Ethics approval for the project was obtained through the Eastern Health Ethics Committee in February 2010 (reference LR48/0910). This approval was also processed through each of the participating hospitals' ethics committee.

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Figure Caption List

Figure 1 Days from training (Train the Trainer) until first in house PROMPT training day.

Figure 2 Average monthly values of clinical measures: (a) Percentage Apgar 1 scores below 7; (b) Percentage Apgar 5 scores below 7; (c) Percentage cord lactate values above 5.27 mmol/L (i.e. 75th percentile which is used as threshold); (d) Percentage blood loss greater than 1500 ml; (e) Babies' length of stay (days) in hospital.

Table Caption List

Table 1 Trained staff at Train the Trainer from each site at the beginning and end of 2010 and courses conducted and staff trained in 2010.

Table 2 Mean (SD) and effect size (Hedges' g) of SAQ scales prior to and following PROMPT training for seven participating sites and the site where no training was performed.

Table 3 Comparison of average clinical measures before, during and after training.

Table 4 Difference between coefficients of fitted regression lines (showing average monthly change in clinical measures) between evaluation periods. 95% CI of difference is also shown.

Table 1 Trained staff at Train the Trainers from each site at the beginning and end of 2010 and courses conducted and staff trained in 2010.

Train the Trainers				Courses and staff trained		
Site	**Number of staff in initial Train the Trainers**	**Number of staff involved in PROMPT at the end of 2010**	**Number of staff initially trained but no longer involved in PROMPT at the end of 2010**	**Training days planned**	**Actual training days**	**Percentage staff trained**
1	8	9	1	4	4	61
2	4	7	0	6	6	85
3	5	13	1	5	5	100
4	8	9	1	5	5	75
5	4	5	1	2	0	0
6	4	5	1	5	2	10
7	1	1	0	2x1/2	2x1/2	75
8	7	13	0	6	4	21

Table 2 Mean (SD) and effect size (Hedges' g) of SAQ scales prior to and following PROMPT training for seven participating sites and the site where no training was performed.

	7 Sites (PROMPT conducted)			**Site 5 (no PROMPT conducted)**		
Scale	Scores Pre-training mean (SD)	Scores Post-training mean (SD)	Hedges' g Effect size (95% CI)	Scores pre-training Mean (SD)	Scores post-training Mean (SD)	Hedges' g Effect size (95% CI)
Teamwork	67.1 (13.4)	71.1 (16.1)**	0.27 (0.13-0.41)	71.8 (12.5)	70 (15.9)	-0.12(-0.54-0.31)
Safety	66.2 (13.3)	70.3 (14.6)***	0.28 (0.15-0.42)	69.4 (14.4)	69.9 (13.7)	0.03(-0.40-0.45)
Stress recognition	71.4 (20.2)	70.8 (19.4)	-0.03 (-0.17-0.10)	71.6 (18.7)	66.6 (25.3)	-0.21(-0.64-0.22)
Working conditions	60.2 (20.5)	61.1 (21.8)	0.04 (-0.09-0.18)	69.2 (14.6)	63.9 (15.1)	-0.35(-0.77-0.08)
Job satisfaction	69.4 (17.5)	69.7 (18.7)	0.01 (-0.11-0.15)	77.8 (13.6)	71.5 (20.5)	-0.34(-0.77-0.09)
Perception of management	51.8 (19.4)	55.3 (21.1)*	0.17 (0.04-0.31)	64.8 (17.8)	61.8 (16.5)	-0.17(-0.60-0.25)

Differences assessed using one-tailed t-tests. * $P<0.05$; ** $P<0.01$; *** $P<0.001$

Table 3 Comparison of average clinical measures before, during and after training.

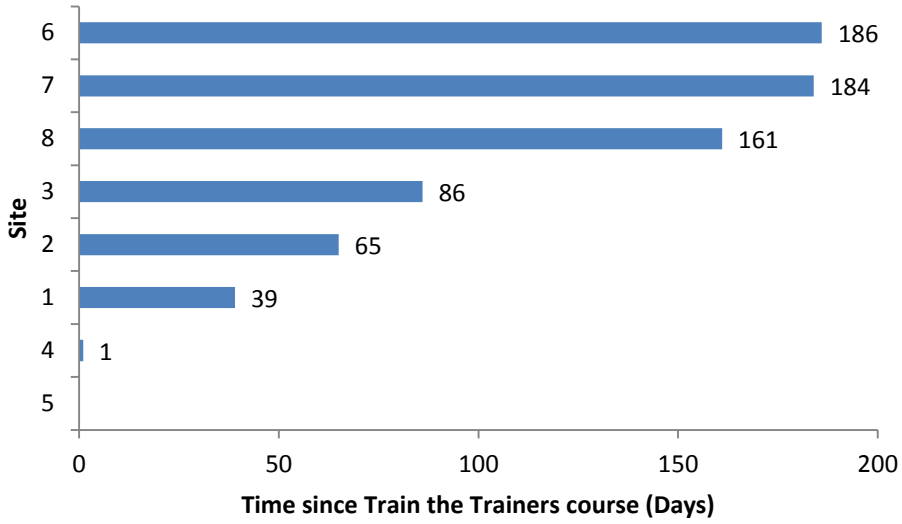
	Pre vs during		Pre vs post		During vs post	
	Odds ratio (95% CI)	P	Odds ratio (95% CI)	P	Odds ratio (95% CI)	P
% Apgar 1 <7	0.91 (0.83-0.98)	0.017*	0.84 (0.77-0.91)	<0.001**	0.92 (0.84-1.01)	0.087
% Apgar 5 <7	0.96 (0.8-1.16)	0.694	1.05 (0.88-1.26)	0.573	1.09 (0.89-1.34)	0.380
% Cord lactate >5.27	0.99 (0.92-1.06)	0.774	0.92 (0.85-0.99)	0.028*	0.93(0.86-1.01)	0.07
% Blood loss > 1500 mls	0.98 (0.79-1.2)	0.841	1.1 (0.89-1.35)	0.370	1.12 (0.9-1.4)	0.316
	Hedges' d effect size (95% CI)	P	Hedges' d effect size (95% CI)	P	Hedges' d effect size (95% CI)	P
Baby length of stay (days), mean(SD)	0.03(0.01-0.05)	0.006**	0.02(-0.01-0.04)	0.156	-0.01(-0.04-0.01)	0.250

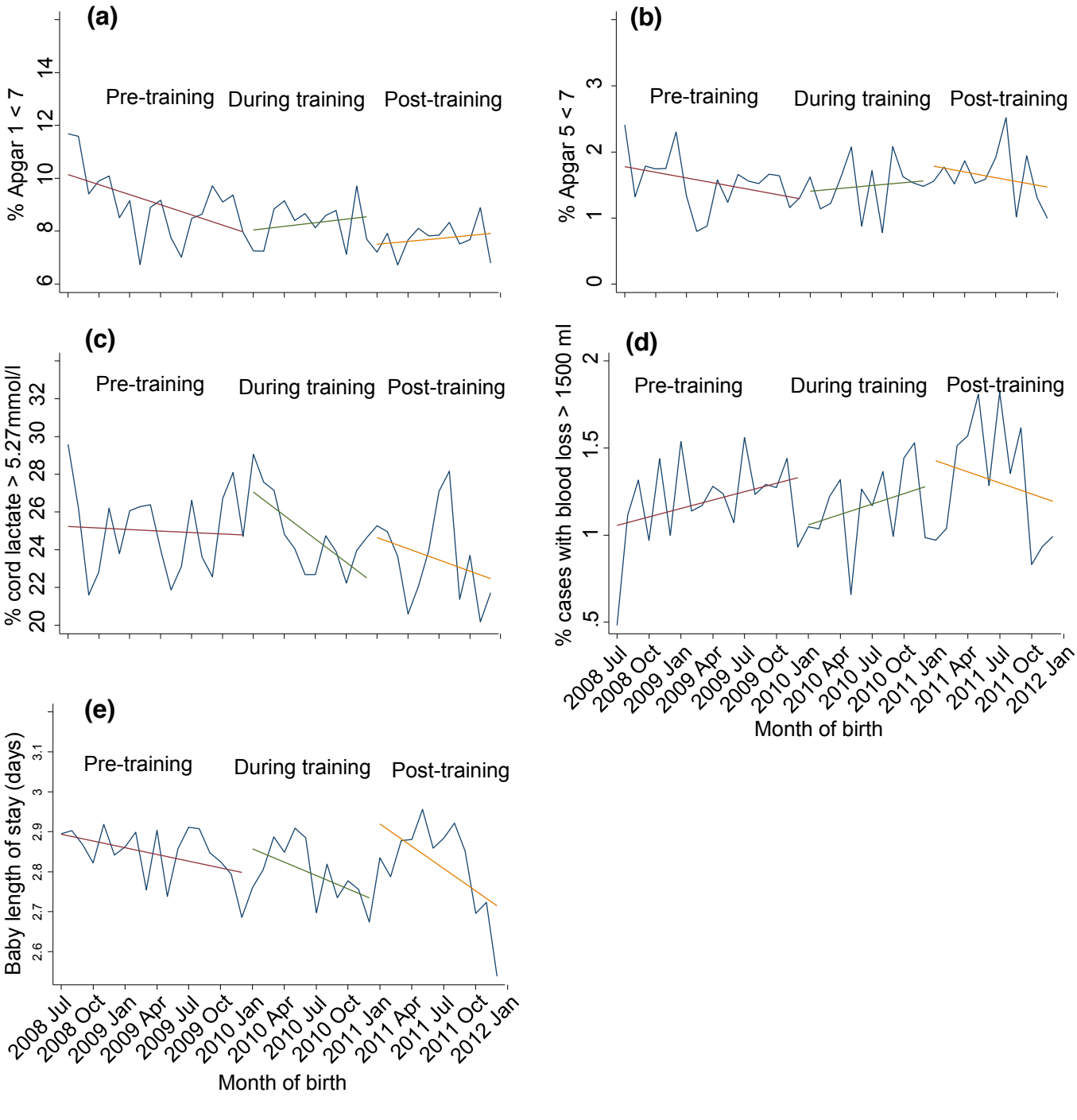
Logistic regression was used to test Apgar1, Apgar 5, cord lactate and blood loss. Ordinary least squares regression was used to test babies' length of stay. *P<0.05; **P<0.01

Table 4 Difference between coefficients of fitted regression lines (showing average monthly change in clinical measures) between evaluation periods. 95% CI of difference is also shown.

	Pre vs during		Pre vs post		During vs post	
	Difference between mean coefficients (95% CI)	P	Difference Between mean coefficients (95% CI)	P	Difference between mean coefficients (95% CI)	P
Apgar 1 <7 (percentage/month)	0.173 (-0.02-0.37)	0.086	0.16 (-0.01-.33)	0.058	-0.01 (-0.22-0.21)	0.93
Apgar 5 <7 (percentage/month)	0.04 (-0.12-0.10)	0.129	-0.00 (-0.06-0.07)	0.957	-0.04 (-0.11-0.03)	0.272
Cord lactate >5.27 (percentage/month)	-0.38 (-0.76-0.01)	0.044*	-0.17 (-0.55-0.21)	0.358	0.21 (-0.18-0.61)	0.134
Blood loss>1500 (percentage/month)	0.00 (-0.04-0.05)	0.857	-0.04 (-0.11-0.03)	0.273	-0.04 (-0.11-0.03)	0.481
Baby length of stay (hr/month)	-0.13 (-042-0.16)	0.361	-0.31 (-0.79-0.17)	0.186	-0.18 (-0.71-0.35)	0.324

Logistic regression was used to test Apgar1, Apgar 5, cord lactate and blood loss. Ordinary least squares regression was used to test babies' length of stay. *P<0.05; **P<0.01


6
7
8
3
2
1
4
5
Site
186
184
161
86
65
39
1
0
50
100
150
200
Time since Train the Trainers course (Days)


(a)
Pre-training
During training
Post-training
% Apgar 1 < 7
6
8
10
12
14
(b)
Pre-training
During training
Post-training
% Apgar 5 < 7
0
1
2
3
(c)
Pre-training
During training
Post-training
% cord lactate > 5.27mmol/l
20
22
24
26
28
30
32
(d)
Pre-training
During training
Post-training
% cases with blood loss > 1500 ml
.5
1
1.5
2
2008 Jul
2008 Oct
2009 Jan
2009 Apr
2009 Jul
2009 Oct
2010 Jan
2010 Apr
2010 Jul
2010 Oct
2011 Jan
2011 Apr
2011 Jul
2011 Oct
2012 Jan
Month of birth
(e)
Pre-training
During training
Post-training
Baby length of stay (days)
2.6
2.7
2.8
2.9
3
3.1
2008 Jul
2008 Oct
2009 Jan
2009 Apr
2009 Jul
2009 Oct
2010 Jan
2010 Apr
2010 Jul
2010 Oct
2011 Jan
2011 Apr
2011 Jul
2011 Oct
2012 Jan
Month of birth