Analysis of peer-reviewed articles reporting on emergency obstetric care skill training programs

KEY:

Scope of training:

G	General training in at least 3 emergency types
Sp	Training for a specific type of emergency as part of a more comprehensive training programme/trial
CI	Training part of a complex intervention
PS	Patient safety focus
NMP	Not multiprofessional
A	Abstract only

Training modalities and approaches (delivery method):

D	Didactic (lecture based)
DE	Classroom teaching enhanced with other interactive activities (e.g. demonstration & skills practice)
S	Simulation
ST	Simulation with teamwork mentioned/implied
HF	High fidelity
LF	Low fidelity
PA	Patient actor
T	Team

Off	Offsite
On	Onsite / in situ
Y	Yes
-	Not specified/described in sufficient detail
**********	
KPs	Kirkpatrick levels
signif	significant

ACRONYMS:

AGOTA	Association of Gynaecologists and Obstetricians of Tanzania
AIP	ALARM International Program
ALARM	Advances in Labor and Risk Management
AMTSL	Active management of the third stage of labour
ACNM	American College of Nurse-Midwives
ALSO	Advanced Life Support in Obstetrics
AOI	Adverse Outcomes Index
BeMONC	Basic emergency obstetric and neonatal care
c/s	Caesarean section
CEmOC	Comprehensive emergency obstetric care
CRM	Crew resource management
CSiM	Clinical simulation in maternity (CSiM): interprofessional learning through simulation
CTS	Clinical Teamwork Scale
EmONC	Emergency obstetric and neonatal care
EOC	Emergency obstetric care
ESMOE	Essential Steps in the Management of Obstetric Emergencies
HIE	Hypoxic–ischaemic encephalopathy
KSA	Knowledge, skills, attitudes
LSS	Life saving skills
LSTM-RCOG LSS-EOC and NC	Liverpool School of Tropical Medicine – Royal College of Obstetrics and Gynaecology Life Saving Skills – Essential Obstetric and Newborn Care Training
MAR	Magnesium Administration Rank
MAOI	Modified Adverse Outcomes Index
MOET	Managing Obstetric Emergencies and Trauma
NVOG	Dutch Society of Obstetrics and Gynaecology
OBCTT	Obstetric Crisis Team Training Program
PNMR	Perinatal mortality rate
PPH	Postpartum haemorrhage
PROMPT	Practical Obstetric Multi-professional Training
PRONTO	Programa de Rescate Obstétrico y Neonatal: Tratamiento Óptimo y Oportuno (Mexico)
QUARITE	Quality of care, risk management, and technology in obstetrics
RCOG	Royal College of Obstetrics and Gynaecology
RCT	Randomised controlled trial
SaFE	Simulation and Fire-drill Evaluation
SB	Stillbirth
SD	Shoulder dystocia
TeamSTEPPS	Team Strategies and Tools to Enhance Performance & Patient Safety
TOSTI	Training Obstetrische Spoed Teams Interventie (Netherlands)
TOT	Training the trainers
UK	United Kingdom
US	United States

	Studies excluded		Only abstracts of full papers could be accessed		Specific training curriculum or approach
		XXXXX	No positive result		Training programme or study with outcomes reported in more than one article

	Scope of training	Authors (Year) Program / Study	Country / Countries	Research design (Outcomes)	Description of training	Delivery method							Results/Effect	Remarks	KPs
						Method	Simulation type	Place	Refreshers/ repeats	Team training	Follow up	Communi-cation			
		PROMPT													
	G	Siassakos et al[1] (2013) Summary outcomes Bristol & SaFE studies	UK	General description of the findings from different studies and also using data from the SaFE study (Effect of training on teamwork)	Studies referred to: 1. Management umbilical cord prolapse[2] 2. Staff attitudes survey for safety culture & teamwork climate[3] 3. Knowledge, skills and attitudes (KSA)[4] 4. Generic teamwork[5] 5. Specific teamwork behaviour[6, 7] 6. Interaction with patient actors[7] 7. Focus groups frontline staff[8]								Results: 1. Improved compliance with key clinical action 2. Positive safety culture & teamwork climate after introduction of training[3] 3. No relation between conventional KSA measures of individual ability and variation in team efficiency 4. Strong correlation between generic team-work scores and clinical efficiency of teams 5. Better teams likely to have stated emergency earlier & more likely to have used closed-loop communication to allocate critical tasks 6. Significant correlation between PA perceptions & team behaviours – better perceptions leader with directive communi-cation style & if communication includes certain information items 7. Need for teamwork training, rank of leader not that important, certain behaviours improve team performance or patient perception of care 8. Integrated list of team-work behaviours for teaching provided in this study		4b 3a&c

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		BRISTOL training programme (Southmead Hospital)			• Infrastructural changes (protocols, props to help adherence to guidelines, practical solutions) • Regular in-house clinical drills for all staff[9]										
1.	G	Draycott et al[10] (2006) PROMPT	UK	Pre-post: retrospective cohort observational study (5 min Apgar score; **HIE**)	• 1-day obstetric emergency course • Format of course: - CTG interpretation – workbook, lectures, small group care discussions, documentation - 6 scenarios for obstetric emergency drills – also use of PAs - Course materials: developed 'in house'	DE + ST	LF + PA	On	*	T	**	Y	• 5-minute Apgar ≤6: 51% reduction (signif) • HIE: 50% reduction (signif) • SB rates: unchanged	*1 day/2 months ** Mandatory annual attend-ance	4c
2.	G (Sp)	Draycott et al[11] (2008) PROMPT	UK	Pre-post (**SD** complications)	• See above • 30-min practical session on SD management • Content: risk factor, recognition, demonstration resolution manoeuvres, documentation, simulated scenario	DE + S	HF	On	*	T	**	Y	Review of intrapartum & postpartum records: • SD management after training: different (signif) • Clinical outcome: 75% reduction babies with brachial plexus injury (Erb's palsy) (signif)	*1 day/2 months ** Mandatory annual attend-ance	4c 3c
3.	G (Sp)	Siassakos et al[2] (2009) PROMPT	UK	Pre-post: retrospective cohort observational study (**Cord prolapse** diagnosis-delivery interval; compli-ance other key recommendations; neonatal outcome)	• See above • Feedback on drill: Content: risk factor, recognition, demonstration resolution manoeuvres, documentation, simulated scenario	DE + S	LF	On	*	T	**	Y	• Diagnosis-delivery interval: median = 40% reduction from 25 to 14.5 minutes (signif) • Use of recommended actions: increase (signif) • Neonatal outcome: reduction low Apgar scores & rate of admission to NICU • C/s post-training: increase (signif) • Also observed: increased use of spinal rather than general anaesthesia after training (maternal benefit)	*1 day/2 months ** Mandatory annual attend-ance	4c 3c

	Scope of training	Authors (Year) Program / Study	Country / Countries	Research design (Outcomes)	Description of training	Delivery method							Results/Effect	Remarks	KPs
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		SaFE trial PROMPT (based on the Bristol/ Southmead model)	**UK**	RCT (Multifaceted – 2x2 factorial design)	• 4 multi-professional groups • Training sites: - Hospital – 1 day without team without teamwork theory & 2 days with teamwork - Simulation centre (1 or 2days with/without team theory) • All trainers: - Attended TOT course & session on teamwork training - Received trainer's manual with slide presentations & lecture notes • All participants: manual on management of obstetric emergencies • All groups: - Lectures plus - Simulated drills (scenarios): eclampsia, PPH, cord shoulder dystocia, cord prolapse etc, with feedback • Baseline assessment 1-3 weeks before & post-training assessment 1-3 weeks: - MCQs to test knowledge - Drills video-recorded – reviewed by 2 assessors – teamwork also assessed - PAs scored respect, safety, communication	D + ST	HF *or* LF + PA	Off *or* On	*	T**	Y	Y		* Annual training for proficient performers * Additional training after 3 weeks for non-performers & more frequent rehearsals ** Team training for 2 groups	2b&c
4.	G	Crofts et al[12] (2007) PROMPT SaFE study	UK	• See above • Pre-post (Knowledge change)	• See above • Baseline assessment 1-3 weeks before & post-training assessment 1-3 weeks: MCQs: knowledge								• Knowledge: increase (signif) • Means knowledge score not related to location of training or inclusion of additional teamwork training		2b

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5.	G	Crofts et al[13] (2013) PROMPT SaFE study	UK	• See above • Pre-post (Knowledge – long-term retention)	• See above • Post-assessment at 3 weeks, 6 and 12 months								• Factual knowledge: greater after 1 year (signif) • Means knowledge score not related to location of training or inclusion of additional teamwork training		2b
6.	G	Crofts et al[14] (2008) PROMPT SaFE study	UK	• See above • Pre-post (Perception of care – **PPH, eclampsia & SD** scenarios)	• See above • PA assessment of drills pre- & post-training								• Training with PAs: - PPH: improved perception of care (safety & communi-cation scores) (signif) – trend towards higher scores for respect - Eclampsia: trend towards higher scores for communication in eclampsia • Groups with additional teamwork theory training: no additional effect • Training with PA may be better than training with HF simulator	*Annual updating supported and recommended by study	2b&c
7.	G	Siassakos et al[7] (2011) PROMPT SaFE study	UK	• See above • Secondary analysis (**Eclampsia** scenarios –	• See above • Assessment of scenarios: - PA evaluation immediately after drill - Blind assessment of video-recordings by: * External team of 2 assessors * Blinded language & communication expert								Correlation between PA perception of • communication & number & duration of communication episodes (signif) • safety and teamwork skills score (signif) • respect an teamwork behaviour and number & total duration of communication episodes (signif)		2c

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	Surrogate measures for team efficiency and patient outcome														
8.	G (Sp)	Ellis et al[15] (2008) PROMPT SaFE study	UK	• See above (**Eclampsia** - team task completion)	• See above • 4 groups - multi-professional • Training sites – hospital (1 or 2 days) or simulation centre (1 or 2 days) • All groups: lecture (20 min) plus drill with feedback (40 min) on eclampsia management • Baseline assessment 1-3 weeks before & post-training assessment 1-3 weeks: - MCQs: knowledge - Scenarios: eclampsia - PAs scored respect, safety, communication	D + ST	HF *or* LF + PA	Off *or* On	-	T*	-	Y	• All groups – no difference between types of training: - Knowledge: improved (signif) - Time taken to complete 5 basic tasks: improved (signif) - Lower number of protocol violations - Teamwork scores (clinical skills & teamwork behaviour): improved (signif) • No advantage: - Training at HF simulation centre - Teamwork theory	* Team training for 2 groups	2b&c
9.	G (Sp)	Siassakos et al[6] (2011) PROMPT SaFE study	UK	• See above (**Eclampsia** – relationship teamwork and tie to administration magnesium sulphate)	• See above								• More efficient teams more likely to: - Have stated emergency earlier (signif) - Have managed critical task using closed-loop communication (signif) • Teams that administered magnesium sulphate within allocated time: fewer exists from labour room (signif)	**Administration of drug as valid surrogate of team efficiency and patient outcome**	2c

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10.	G (Sp)	Crofts et al[16] (2006) PROMPT SaFE study	UK	• See above (**SD** – delivery performance)	• See above • All groups: started with discussion of SD and demonstration of manoeuvres • High- and low-fidelity models • Pre- and post-assessment: - Participant in a delivery room with standardised scenario - Force applied measured during delivery - Immediately after simulation, PA scored quality of communication during delivery - Two trained assessors scored video-recordings with checklist								• All groups – no difference between types of training: - Successful SD deliveries: increase (signif) - Performance of all basic actions: increase (signif) - Communication: increased (signif) • HF mannequin training: - Successful delivery: greater likelihood (signif) - Head-to-body delivery interval: shorter (signif) - Delivering posterior arm: higher chance - Call for paediatric support: less likely (signif) • Maternal or neonatal outcome: currently no evidence		2c
11.	G (Sp)	Crofts et al[17] (2007) PROMPT SaFE study	UK	• See above • Pre-post (**SD** – long-term retention of delivery skills)	• See above • 40 min practical workshop • Post-assessment at 3 weeks, 6 and 12 months				*				SD delivery: • Pre-training: 49% • Post-training: - 3 weeks: 82% - 6 months: 84% - 12 months: 85%	* Annual training for proficient performers * Additional training after 3 weeks for non-performers & more frequent rehearsals	3b 2c
12.	G (Sp)	Crofts et al[18] (2007) PROMPT SaFE study	UK	• See above • Post? (**SD** – force applied)	• See above								• Wide range for all force variables – some signif; others not		2c

	Scope of training	Authors (Year) Program / Study	Country / Countries	Research design (Outcomes)	Description of training	Delivery method							Results/Effect	Remarks	KPs
						Method	Simulation type	Place	Refreshers/ repeats	Team training	Follow up	Communi-cation			
13.	G	Siassakos et al[5] (2011) PROMPT SaFE study	UK	• See above (Correlation between team performance and generic teamwork scores)	• See above • Team performance (clinical efficiency score) measurement based on time to administra-tion of magnesium sulphate – used to rank teams • Finding active ingredients of effective teams regardless of their training status								• Better teams administered magnesium more quickly (signif) • Correlation between clinical efficiency score & generic teamwork score on all 3 dimensions (team skills, behaviour, overall teamwork) (highly signif)		2c
		PROMPT Liverpool													
14.	CI	Scholefield et al[19] (2007) Siassakos et al (2009)[9] Liverpool	UK	• Pre-post • Quality improvement initiative	• Mandatory multidisciplinary training following the Southmead (Bristol) model • Other components: - Integrated risk management - Patient involvement - Regular team briefings - Regular fire-drills - Infrastructural improvements	ST (CI)	LF	On	*	T	*	Y	Delivery outcomes: • Adverse events with identified suboptimal care: 11% reduction • Failed vacuum extractions → forceps delivery: reduction 36% • Failed instrumental deliveries → c/s: reduction 32% Neonatal outcomes • 5-minute Apgar <4: 50% reduction • Cord pH <7: 50% reduction • Incidence of Erb's palsy: 86% reduction	* Annual updating required	4b&c

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		PROMPT - Australia													
15.	G	Shoushtarian et al[20] (2014) PROMPT	Australia	Pre-post (pilot) (Organisational & clinical changes)	• TOT model (4 participants/hospital) • Lectures & scenario-based drills	D + S	-	(Off +) On)	*	T	-	-	• Training Evaluation Questionnaire: positive response • Safety Attitude Questionnaire: teamwork, safety, perceptions of management = higher (signif) • Clinical changes: - Apgar < 7 at 1 minute: reduction (signif) - Apgar < 7 at 5 minutes: no change - Cord lactates: improved (signif) - Length of baby's stay in hospital: reduction (signif)	* Trainer to repeat training in individual hospitals	4b&c 2a 1

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		PRONTO													
16.	G (CI)	Walker et al[21] (2012) PRONTO	Mexico	Pre-post (pilot) (Acceptability, feasibility & rating PRONTO training; institutional goal achievement; teamwork; knowledge & self-efficacy/skills)	• Two-step training with 3-month each (5 community hospitals): - Module I (16 hours) (obstetric haemorrhage, neonatal resuscitation, teamwork) - Module II (8 hours) (pre-eclampsia/eclampsia & dystocia) • Training activities: - Skills stations & other activities - 8 simulations with PartoPants simulator - Immediate guided debriefing after each scenario - Team-training activities with TeamSTEPPS curriculum - Outcomes measured at Module II?	ST	HF	Off	-	T	-	Y	• Reaction to training: positive • Knowledge: improved for obstetric haemorrhage & neonatal resuscitation • Self-efficacy improved for obstetric haemor-rhage, basic delivery care, EOC • Teamwork: improved • Changes in practices and resource management individualised per site, e.g. - introduction AMTSL - diffusion algorithms - improvement connec-tions & referral network - blood bank management - installation alarm system - movement equipment - training & equipment needs identified	Time of outcome measurement < 6 months after training	2a&b 1
17.	G (CI)	Walker et al[22] (2014) PRONTO	Mexico	RCT (cluster) (Knowledge & self-efficacy; teamwork; institutional goal achievement – training, teamwork or system change goals)	• See above • 24 hospitals included – 10 received intervention	ST	HF	Off	-	T	*	Y	• Reaction to training: positive • Knowledge: improved for all emergencies (signif) • Self-efficacy improved for all emergencies (signif) • Teamwork: improved between 2 modules (some aspects signif) • Goals: 2-6 goals per hospital achieved after 3 months	Time of outcome measurement < 6 months after training * 3 months period between Modules I and II	2a&b

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		AIP													
18.	CI	Dumont et al[23] (2013) AIP QUARITE	Senegal Mali	RCT (cluster) (Primary outcome: hospital-based maternal death; secondary outcomes: resource availability, medical practice for EOC, perinatal mortality)	• 46 hospitals randomised to control (n=23) and intervention (n=23) groups • Initial 6-day interactive workshop (1 nurse & 1 doctor/hospital) - Best practices EOC (3 days) - Maternal death review (1 day) - Awareness training (1 day) - Adult education (1 day) • Quarterly outreach visits (focus maternal death reviews and best practice implementation) • 4-8 on-site training sessions in intervention period	-	-	Off (+ On)	*	-	**	-	• Mortality reduction of 15% = higher (signif) only in capital & district hospitals = not in regional hospitals ↓ deaths from haemor-rhage, (pre-) eclampsia, puerperal infection in intervention group • ↑ probability transfusions • ↑ probability antepartum c/s (signif) • ↓ frequency intrapartum c/s (signif) • Mean score protocol & training = greater in intervention group (signif) • SBs: no effect • Neonatal mortality: only decrease (signif) in capital hospitals	* Recertification once / year ** 2 year follow-up – regular outreach visits	4b&c

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19.	G	Spitzer et al[24] (2014) AIP	Kenya	Pre-post (Primary outcome: direct obstetric fatality rate; secondary: maternal & neonatal morbidity)	• 5-day multiprofessional course • Topics: - Main causes of maternal death (obstructed labour, haemorrhage, sepsis, hypertensive disorders, complications unsafe abortion) - Neonatal resuscitation & care - Sensitisation social, economic, cultural, and legal factors impeding access RH services & social justice. • M&E methodologies • Framework = sexual & reproductive rights	-	-	-	-	-	-	-	Chart review: • Administering oxytocin: increased (signif) • PPH: decreased (signif) • Case fatality rate: not signif • Apgar scores <5 at 5 min: reduced (signif)	Training approach & methods not discussed	4c 3c
		ALSO	(American Academy of Family Physicians)												
20.	G	Sorensen et al[25] (2011) ALSO	Tanzania	Pre-post (prospective intervention study) (Staff performance [observation scheme] & incidences PPH)	• 2-day provider course (1 hospital) • Hands-on and teamwork training • Mannequins in simulated emergency situations • Lectures, workshops, case discussions • Data sources for assessment: - measured post-partum blood loss - observations on management - case reports - structured interviews	DE + ST	LF	Off	-	T	*	-	PPH indicators: • Better identification of PPH (signif) • More women received ergometrine early after delivery (signif) • Lower mean blood loss (signif) • Incidence of PPH almost halved (32.9 → 18.2%) (signif)	* One-year follow-up data collection abandoned	4b&c

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		LSTM-RCOG LSS-EOC and NC													
21.	G	Van Lonkhuijzen et al[26] (2008) LSS-EOC and NC	Tanzania (AGOTA-NVOG partnership)	Pre- and post- (Course satisfaction, Knowledge)	• Short classes, alternating between theoretical and practical sessions / simulation of obstetric emergency	D + S	LF	Off	-	-	-	-	• Participant response: enthusiastic; confidence in application of skills • Knowledge: improved (signif)		2b 1
22.	G	Grady et al[27] (2011) LSS-EOC and NC	• Somaliland • Kenya • Malawi • Swaziland • Zimbabwe • Tanzania • Sierra Leone	Pre- post (Course satisfaction, knowledge, skills)	Mixture of methods including: • Lectures • Scenario teaching • Skills teaching • Demonstration • Workshops/Breakout sessions	DE + S	LF	Off	-	-	-	-	• Reaction to training: positive • Knowledge: improved (signif) • Skills: improved (signif)		2b&c 1
23.	G	Ameh et al[28] (2012) LSS-EOC and NC	• Somali-land, Somalia	Pre-post (Course satisfaction, knowledge, skills, behaviour, EOC signal functions)	• Short classes, alternating between theoretical and practical sessions / simulation of obstetric emergency • Post-training assessment - Immediately after: knowledge & skills (quant) - 3 and 6 months after: change in behaviour (qual) & signal functions (quant)	D + S	LF	Off	-	-	*	Y	• Reaction to training: positive • Knowledge: improved in 50% of trainees (signif) • Skills: improved in 100% of trainees (signif) • Confidence with response to an emergency: improved preparedness, but limitations for midwives • Signal functions: all available after 6 months	* Facility visits before training and 3 and 6 months post-training	4b 3a 2b&c 1
24.	G	Raven et al[29] (2011) LSS-EOC and NC Making It Happen	• Bangladesh • India	Pre- post (Course satisfaction, knowledge, skills)	• Content of training based on main causes of maternal deaths and EOC&NC signal functions	D + S	LF	Off	-	-	-	-	• Participant response: enthusiastic • Knowledge: improved (signif) • Skills: improved (signif) • India: confidence improved • Bangladesh: mixed results in increase of signal functions (<6 months)	Also reported in Grady et al	2a-c 1

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		LSS - ACNM													
25.	G (CI)	Sloan et al[30] (2005) LSS - ACNM	Vietnam	Quasi-experimental with control group (Recognition and management of life-threatening obstetric conditions)	• 3 groups (hospital only, hospitals & clinics, comparison group) • Competency-based training • Accompanied by improvement of facility readiness	-	-	Off	-	-	-	-	• Recognition of life-threatening conditions: more identified • Essential management of obstetric conditions: improved in intervention hospitals, but still at a low level (<60%)	Compare with Riley et al's RCT	3c
		CRM-based training programs (some combined with TeamSTEPPS)													
26.	PS	Nielsen et al[31] (2007) CRM (National study)	US	RCT (cluster) (Reduction in overall frequency of adverse outcomes)	National study: • Intervention group = 7 hospitals; control group = 8 hospitals • Standardised teamwork training (CRM): - Didactic lessons (4 hrs) - Video scenarios - Interactive training (team structure & processes, planning & problem solving; communication, workload management, team skills, implementation)	DE + ST	LF?	On	-	T	-	Y	• Adverse Outcome Index[1] (AOI) (maternal & neonatal outcomes): no difference between 2 groups	*Assumption emergency obstetric skills are in place (good track record of clinical perfor-mance) – not clear how much obstetric content*	4c

[1] Adverse Outcomes Index: weighted outcomes: maternal death; intrapartum or neonatal death; uterine rupture; maternal admission to ICU; birth trauma (Erb's palsy, vacuum or forceps injury); return to operating room or labour and delivery unit; admission to NICU; Apgar score <7 at 5 min; blood transfusion; 3rd/4th-degree perineal tear

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27.	PS	Pratt et al[32] (2007) CRM	US	Pre-post (Impact teamwork training on frequency adverse outcomes)	One hospital not included in national study reported in Nielsen et al[31] • 4 teamwork modules for all staff (communication, situation monitoring, mutual support, leadership) (4 hrs) • Timeline for introduction of one CRM concept every 1-2 weeks • Debriefings, improved handover • Protocol development • Selected clinical drills	DE + ST	LF?	On	-	T	-	Y	• Staff attitudes to safety: labour staff more positive attitudes than rest of hospital • AOI: 23% reduction in adverse obstetric events (decreased from 5.9% to 4.6% = 1.4% absolute drop) • Weighted Adverse Outcome Score (WAOS): decreased by 33% • Severity Index (SI); decreased by 13% • Malpractice claims: high-severity rate reduced by 62% (from 13 to 5)	*Assumption emergency obstetric skills are in place (good track record of clinical perfor-mance) – not clear how much obstetric content*	4b&c 2a

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28.	PS (CI)	Wagner et al (2011)[33] CRM & Team-STEPPS	US	• Pre-post • Comparison: - across different time points - with benchmark data from literature (Reduction adverse obstetrical outcomes)	• Incremental introduction of a comprehensive perinatal safety initiative (PSI) over 2 years • Components: - Team STEPPS - Electronic foetal monitoring (EFM) course and exam (online) - Multidisciplinary teaching rounds daily - Obstetrical emergency simulation – multidisciplinary drills - Introduction evidence-based protocols • Assessment: modified AOI (MAOI) [2]	ST	-	On	Y	T	Y	Y	• MAOI : - Year 1: decrease from 2% to 0.8% (signif) - Year 2: MAOI maintained • Rates of return to operating room: decrease over time (signif) • Birth trauma: decrease over time (signif) • Staff perceptions of safety: improved (signif) • In-patient perceptions of staff team work: improved (signif) • Abnormal foetal heart rate tracings: - Management improved (signif) - Documentation improved (signif) • Documentation of obstetric haemorrhage (signif)		4b&c 3a
29.	PS	Phipps et al[34] (2012) CRM	US	Pre-post (Adverse outcomes)	• Didactic portion (4 hrs) • 3-7 days later: 4-hour high-fidelity simulation (video-taped) • Debriefing session • Assessment: data 6 quarters post-CRM	D + ST	HF	On	-	T	-	Y	• Patient satisfaction: high levels of satisfaction pre-CRM – could not measure difference • AOI: decrease (signif)		4b&c

[2] Modified Adverse Outcomes Index: Maternal indicators: maternal death; admitted to higher level of care; uterine rupture; peripartum hysterectomy; return to operating room (OR). Neonatal indicators: stillbirth; neonatal death; 5 min APGAR <7; iatrogenic prematurity; birth trauma HIE

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						Method	Simulation type	Place	Refreshers/ repeats	Team training	Follow up	Communi-cation			
30.	PS	Haller et al[35, 36] (2008) CRM Ensemble	Switzerland	Pre-post cross-sectional (Satisfaction, learning, change in behaviour / attitude to safety)	• 2-day CRM-based training programme /seminar designed to improve teamwork & communication skills • Film, discussions, interactive sessions, role plays, work-shops • Assessment: - Course evaluation (satisfaction, learning before & after, safety attitude) - Over a period of 1 year later: repeat patient safety questionnaire	DE	-	Off	-	T	Y	Y	• Participant reaction: experience valued highly • Knowledge on teamwork building, shared decision making, other methods of improving patient safety: improved (signif) • Team and safety climate after 1 year: positive change (signif for majority of items)	*Assumption emergency obstetric skills are in place (good track record of clinical perfor-mance) – not clear how much obstetric content*	3a 2a 1
31.	PS	Riley et al[37] (2011) CRM & Team-STEPPS	US	RCT (cluster)	• 3 hospitals: TeamSTEPPS didactic training programme, TeamSTEPPS plus in situ simulation training exercises, control hospital	D vs. ST	HF	On?	-	T	-	-	• Safety Attitudes Questionnaire: high at baseline – no change • Perinatal morbidity: in simulation hospital ↓ 37% (signif) – no difference other two groups	Compare with Sloan et al's quasi-experi-mental study Must still receive full text	4c 2a
32.	G	Robertson et al[38] (2009) CRM OBCTT	US	Quasi-experimental pre-post test (10 variables: knowledge, confidence, competence, attitudes, etc)	• Online module to study before attendance • 4-hour training session: - Brief didactic slide presentation - 4 standardised simulated crisis scenarios (video recorded) - Debriefings after each simulation • Variety assessment tools	D + ST	HF	Off	-	T	-	Y	• Recommend training to others: high score • Perceptions individual & team performance & competence to respond to emergency: positive shift (signif) • Confidence and various attitudes: no change • Knowledge: high pre-scores – could not assess • Task team completion: from 1st to last simulation: improved (signif)		2a-c 1
		OTHER													

	Scope of training	Authors (Year) Program / Study	Country / Countries	Research design (Outcomes)	Description of training	Delivery method							Results/Effect	Remarks	KPs
						Method	Simulation type	Place	Refreshers/ repeats	Team training	Follow up	Communi-cation			
33.	G (CI)	Makuwani et al[39] 2010	Tanzania	Pre-post (Reduce referrals to Dar es Salaam and delays in receiving CEmOC)	• District hospital without CEmOC skilled personnel • Local manpower and resources • Hospital staff trained on CEmOC – included = use of partograph and management common obstetric emergencies • Essential equipment purchased via district management • Monitoring: weekly visit by project manager	-	-	-	-	-	-	-	• 3-4 fold increase in monthly number of deliveries in hospital • Almost all major obstetric interventions performed in hospital • Referrals decreased sharply - only 20% of patients	Must still receive full text	3c
34.	G	Sørensen et al[40] (2009)	Denmark	Pre-post (Outcome measures for the 4 Kirkpatrick levels)	• Mandatory for all staff - multiprofessional • Own training material developed • 2 (?) training sessions (2½ hours each) over a 3-year period [2-step training] • 12 participants per session • Each session with lectures followed by training workshop	D + S	LF	On	*	-	-	-	• Reaction on training: positive • Confidence scores 9-15 months post-training: varied for different conditions • SD & PPH: positive self-reports • ↑ frequency of use of ICD-code for PPH (signif) • ↑ use of uterotonics (signif) • 45% drop in midwives' sick leave (signif) • Several organisational changes: guidelines; algorithms; checklists; forms; PPH & pre-eclampsia boxes; neonatal resuscitation equipment, etc	*Catch-up training sessions for new staff	4b 3a 2a&b 1

	Scope of training	Authors (Year) Program / Study	Country / Countries	Research design (Outcomes)	Description of training	Delivery method							Results/Effect	Remarks	KPs
						Method	Simulation type	Place	Refreshers/ repeats	Team training	Follow up	Communi-cation			
35.	G	Reynolds et al[41] (2011)	Portugal	Post 1 year after training	• Simulation-based team training course (4 hours) • Management of 4 emergencies (acute foetal hypoxia; SD; PPH; eclampsia) • Scenarios done 2x – debriefing after 2nd resolution • Assessment: 1 year after training (statements to indicate improvement)	ST	HF + PA	On	-	-	-	-	• Usefulness of course: 80% agreed totally • Improvement knowledge of management guidelines : 57% agreed totally • Ability of diagnose or be aware of emergency situations: 52% agreed totally • Rest of items (technical skills, teamwork, communication skills, support, sharing): between 15% and 43% agreed totally		3a 2b 1
		TO BE EXCLUDED:													
		ONLY TWO EMERGENCY TYPES													
	Sp	Daniels et al[42] (2010)	US	RCT	2 groups, each with 3 hours' training: 1. simulation laboratory 2. didactic lectures/video and hands-on demonstration Assessment: • Pre-training: cognitive testing (MCQs) • One-months post-training: - Repeat pre-training MCQs - Performance drills: checklist for scoring procedures and team performance	DE or ST	HF	Off	-	T	-	-	• Knowledge: improved in both groups (not signif) • Performance: simulation trained teams scored higher than didactic trained teams (signif)	Only 2 types of emergencies (shoulder dystocia & eclampsia)	2b&c

	Scope of training	Authors (Year) Program / Study	Country / Countries	Research design (Outcomes)	Description of training	Delivery method							Results/Effect	Remarks	KPs
						Method	Simulation type	Place	Refreshers/ repeats	Team training	Follow up	Communi-cation			
	PS	Fransen et al[43] (2012) CRM TOSTI study	Netherlands	RCT (cluster) (Team performance, medical skills)	• Multiprofessional team training in a medical simulation centre (1 day training) vs. no training • CRM = 80% of time; skills = 20% • Scenarios based on NVOG, RCOG & MOET • Assessment: 6 months after training – 2 unannounced simulated scenarios (SD, amniotic fluid emoblis)	DE + ST	HF	Off	-	T	-	Y	• Team performance (CTS): improved (signif) • Use of new technical skills: improved (signif) (better adherence to protocols)	Only 2 types of emergencies (SD, amniotic fluid emoblis)	3b&c
		BRISTOL (Southmead Hospital)													
	PS	Siassakos et al[3] (2011) Bristol PROMPT	UK	Post (Determine remaining challenges after training regarding improved quality and safety)	• Standard hospital training								• Positive safety culture, teamwork and job satisfaction • Negative observations: high workload and insufficient staffing levels • Prerequisites for further improvement: 24-hour consultant presence & better management support		2a
		SaFE study													
		Team performance													
	G	Siassakos et al[4] (2010) PROMPT SaFE study	UK	• See above (Correlation between team performance and various aspects of individual's knowledge, attitudes and skills)	• See above • Team magnesium administration rank (MAR) used as measure for team performance: increased after training (signif) (validation) • Knowledge MCQs • Individual skills measure: SD • Teamwork / safety attitude questionnaire								• No relationship between team performance and cumulative individual MCQs, skill or teamwork/safety attitude scores • No correlation between team MAR and team average, team maximum or senior doctors' manual skill scores		2a-c

	Scope of training	Authors (Year) Program / Study	Country / Countries	Research design (Outcomes)	Description of training	Delivery method							Results/Effect	Remarks	KPs
						Method	Simulation type	Place	Refreshers/ repeats	Team training	Follow up	Communi-cation			
		PROMPT US													
	A	Weiner et al[44] (2014) PROMPT	US	Pre-post (Perinatal outcomes)	• Americanisation of PROMPT	-	-	On	*	-	-	-	• Brachial plexus injury - ↓ SD (signif) - ↓ vaginal delivery (signif) • ↓ C/s rate (signif) • ↓ perinatal HIE	Abstract only * Mandatory annual attend-ance	4c
		PRONTO													
	A	Walker et al[45] (2010) PRONTO	See above	• See above (Contraception outcomes)	• See above								Outcomes related to contraception	• Abstract only • Outomes not relevant	
	A	Walker et al[46] (2014) PRONTO	Mexico	• See above (PNMR, eclampsia, AMTSL, postpartum uterine sweeping)	• See above • Data collection: baseline, 4, 8, 12 months				*				• PNMR: ↓ 44% (8 months) (signif) • Eclampsia: ↓ 68% (12 months) • AMTSL: ↑23% 1st step AMTSL (8 months) • Postpartum uterine sweeping: ↓ 31% (8 months) (signif)	Abstract only * Refresher training recommended to maintain effect	4b&c
	A	Walker et al[47] (2014) PRONTO	Mexico	• See above (Non-primary outcome: C/s rate)	• See above • Data collection: baseline, 4, 8, 12 months								C/s delivery rate Baseline: 33% 4 months: ↓ 17% (signif) 8 months: ↓ 24% (signif) 12 months: ↓ 21% (signif)	Abstract only	4b (&c)
		ALSO													

	Scope of training	Authors (Year) Program / Study	Country / Countries	Research design (Outcomes)	Description of training	Delivery method							Results/Effect	Remarks	KPs
						Method	Simulation type	Place	Refreshers/ repeats	Team training	Follow up	Communi-cation			
	NMP	Beasley et al[48] (1994) ALSO	US	End-of-course evaluation	• Syllabi for instructor and provider • Lecture series with a standardized slide set • Hands-on skill-building emergency procedure workshops (with custom-designed maternal-fetal mannequins) • Assessment: - Workshop supervision - Objective test, - "Mega-delivery" testing station	D + S	LF	Off	-	-	-	-	• Comfort level with obstetric emergencies: increased • Likelihood to continue providing obstetric services: increased	Predominantly family physicians and residents. Only 50/1012 (4%) nurses.	2a
	LSTM-RCOG LSS-EOC and NC														
	NMP	Frank et al[49] (2009) LSS-EOC and NC ESMOE	South Africa	Pre-post (Knowledge & skills)	• Theory on EOC followed by: • Skills training (videos, case studies, clinical scenarios, demonstrations and practice on mannequins) • Post-training assessment	DE + S	LF	Off	-	-	-	-	Interns who have completed the ESMOE training package: • Knowledge: improved (signif) • Skills: improved (signif) *compared to* knowledge and skills of interns before ESMOE course and of interns who had already completed their O&G rotation	Medical interns only	2b&c 1
	MOET														
	NMP	Johanson et al[50] (1999)	UK	Pre-post (Satisfaction; self-report in change of behaviour)	• 13 participants • Structured skills training using models & 25 reality-based scenarios • Each topic introduced by short summary lecture followed by skills practice • Post-training assessment: "moulage performance"	D + S	LF	Off	-	-	-	-	• Lectures and skills stations: positively evaluated post-training and after 4 or 10 months • Condition managed better: minority of responded participants = highest: 6/19	• Doctors only • MOET data-base, Man-chester: positive feedback from partici-pants[51]	3a 1

	Scope of training	Authors (Year) Program / Study	Country / Countries	Research design (Outcomes)	Description of training	Delivery method							Results/Effect	Remarks	KPs
						Method	Simulation type	Place	Refreshers/ repeats	Team training	Follow up	Communi-cation			
	NMP	Johanson et al[51] (2002)	Bangladesh	Pre-post (Validation of course: knowledge & skills)	• 9 doctors • Structured skills training using models & 25 reality-based scenarios • Each topic introduced by short summary lecture followed by skills practice • Post-training assessment: "moulage performance"	D + S	LF	Off	*	-	-	-	• Overall rating of course: good • Knowledge: improved (signif) • Skills: improved (signif)	Doctors only * Not clear if planned follow up did take place	2&c 1
	NMP	Johanson et al.[52] (2002)	Armenia	Pre-post (Validation of course: knowledge & skills)	• 8 doctors • Structured skills training using models & 24 reality-based scenarios • Each topic introduced by short summary lecture followed by skills practice • Focus on 'problem solving' (patient needs) • Post-training assessment: 'moulage performance'	D + S	LF	Off	-	-	-	Y	• Overall rating of course: good • Knowledge: improved (signif) • Skills: improved (signif)	• Doctors only • Part of 'Family Care' in Nagomo Karabach (8 years' experience)	2b&c 1
	OTHER														
	NMP	Mirkhuzie et al[53] (2014)	Ethiopia	Pre-post (Project objective: improve quality of basic EmONC)	• 10 health centres Addis Ababa • Standard BeMONC in-service curriculum of 18 days: - 8 days: classroom theoretical sessions with demonstration, video, case studies & role plays - 10 days: skills training demonstration and clinical practice	DE + S	LF	Off	-	-	*	-	Reaction training: positive Knowledge: 40% not mastery in immediate post-test score	• Only mid-wives & nurses • Course exceeds 2 weeks' length * Further follow-up still underway	2b 1

	Scope of training	Authors (Year) Program / Study	Country / Countries	Research design (Outcomes)	Description of training	Delivery method							Results/Effect	Remarks	KPs
						Method	Simulation type	Place	Refreshers/ repeats	Team training	Follow up	Communi-cation			
	NMP	Vadnais et al[54] (2012)	US	Pre-post (continued for 12 months) (Short- & long-term improvement knowledge & comfort level)	• 1-day intensive, multiple-task simulation training • Didactic session (1 hour) • 4clinical scenarios (60-90 min) (some with high and some with low fidelity models) • Assessment: residents 4 & 12 months and physicians 12 months post-training • Workshop repeated after 1 year •	D + S	HF + LF	Off	Y	-	-	-	• Knowledge and comfort levels: residents' improved more and retained better than attending physicians • Repeat of simulation after 1 year: additional improvement	• Doctors only • Residents were still in training when monitored over a year – other factors could have contributed to results	2a&b 3c
	NMP	Pliego et al[55] (2008) Ob/Gyn "Boot Camp"	US	Pre-post – pilot (perceptions of technical confidence, leadership role, stress hardiness)	• In 1st 3 months of academic year • 4 scenarios (SD, neonatal resuscitation, PPH, ruptured ectopic pregnancy) – immediate debriefing	S	HF	Off	-	T	-	Y	• Experience: positive • Learning interest: stimulated • Self-reported competency & stress hardiness scores improved: - Technical competency SD (signif) - Ruptured ectopic pregnancy (singif) - Neonatal resuscitation (singif) -	• Doctors only • Resident training	2a 1
	G	Gum et al[56] (2010) (CSiM)	Australia	Qualitative study post intervention (semi-structured interviews 1-2 weeks post-training and again 3-6 months later)	• Workshops for rural clinicians: - Simulation & CRM learning principles, obstetric education, skill trainer stations, simulation scenarios - Debriefing with video playback – focus on process	D + S	-	Off	-	T	-	Y	Three themes (only 1st one covered): • Collaboration in teambuilding (persona role awareness, interpositional knowledge. mutuality, leadership) • Clinical practice outcomes • Clinical simulation as earning tool	Another paper on perceptions of clinical practice	2a

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