RESEARCH

Does completion of the Essential Steps in Managing Obstetric Emergencies (ESMOE) training package result in improved knowledge and skills in managing obstetric emergencies?

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For the ESMOE Group

Objective. To assess the effect of the Essential Steps in Managing Obstetric Emergencies (ESMOE) training programme on improving knowledge and skills of interns.

Method. Interns starting their internship in Obstetrics and Gynaecology in May 2008 were asked to participate in the ESMOE training programme at all the sites where facilitators had been trained in ESMOE. At these sites, interns completing their obstetric and gynaecology rotations were asked to undergo an evaluation at the end of April; this group acted as a control group. Interns participating in the ESMOE training had the same evaluation before starting the course in May and at the end of August.

Outcomes. Scores obtained in knowledge testing by multiple choice questions (MCQ) and skills testing by objective structured clinical examination (OSCE).

Results. A total of 68 interns completing their O&G rotation in April wrote the MCQ paper from 8 hospitals. Twenty of them were randomly chosen to do the skills test. This group served as the control for the study group that underwent the training. Seventy-eight of the new group of O&G interns starting in May wrote the MCQ paper as a pre-test, and 21 were randomly chosen to do the skills test. The ESMOE training was then conducted. In August, this group re-wrote the MCQ paper as a post-test, and 24 were randomly selected to do the skills test. The post-test MCQ scores of the study group were significantly higher than their pre-test scores and those of the control group of interns (79 (58 - 93), 75 (48 - 91) and 77 (57 - 86) respectively). Similarly, the post-test OSCE scores of the post-test study group were significantly higher than their pre-test scores and those of the control group of interns (30.75 (25 - 38), 19.75 (8.5 - 27.5) and 24.5 (14.4 - 31) respectively).

Conclusion. Completion of the ESMOE training package resulted in a significant improvement of interns' knowledge and skills compared with that before the course or with other interns who had already completed their O&G rotation.

During the 2005 - 2007 triennium, 3 959 maternal deaths were reported in South Africa. A total of 1 519 deaths (38.4%) were thought by the assessors to be clearly avoidable within the health system. More than 80% of the clearly avoidable deaths were related to the emergency management of complications of hypertension, postpartum haemorrhage, puerperal sepsis, anaesthetic complications and the management of AIDS. Most of these deaths occurred in level 1 and 2 hospitals.[1] These hospitals are staffed mainly by junior doctors who recently completed their internships

and are performing their community service.

The sixth Saving Babies report[2] found that perinatal deaths from intrapartum asphyxia and birth trauma (IPA&T) were the most common probable health care provider-avoidable deaths (43%), that most probable avoidable deaths related to health care providers occur in district hospitals (57%), and most of the latter were the result of intrapartum asphyxia and birth trauma (47% of 57%). The rate of avoidable deaths related to health care providers was highest in district hospitals (7.04/1 000 births), and intrapartum asphyxia and birth trauma were the most common causes. Regional hospitals were second-worst regarding quality of care, and the pattern of disease was similar to that in district hospitals. The large number of avoidable deaths from intrapartum hypoxia indicates the need to focus training and skills on the management of labour.

From the *Saving Mothers*[1] and *Saving Babies*[2] reports, it is clear that:

- poor management of obstetric emergencies is a major contributor to maternal and perinatal deaths
- level 1 and 2 hospitals are major areas of increasing maternal and perinatal deaths
- community service doctors contribute a significant proportion of the human resources at these hospitals.

Obstetric emergencies (e.g. shoulder dystocia and acute collapses) are high-risk, infrequently witnessed events.[3,4] A simulated scenario comprises a setting in which mannequins and/or a living person and props are used to construct a real-life situation of a rare but medically risky occurrence. Simulation in training has been used to a large extent in the military and aviation industry.[4] Some researchers suggest that simulation in obstetrics and gynaecology has the potential to improve education, training and evaluation, and ensure competency.[4] It has also been extensively used in anaesthetic and trauma teaching.[5] A randomised controlled trial comparing students who performed the Advanced Trauma Life Support (ATLS) course (a well-known trauma training course conducted with simulated scenarios) compared with routine undergraduate training, and who underwent pre- and post-course testing, found that the ATLS group showed only a statistical improvement in the post-test score. This finding suggests that focused training improves knowledge.[7] An article by Weller in the *NZJM* in 2004 showed that medical interns had improved their ability in emergency care following a simulation-based workshop. The same article also stated that students found the method to be more effective than traditional educational means.[5] A study on the introduction of the MOET (Managing Obstetric Emergencies and Trauma) course to a group of Bangladeshi doctors showed a significant improvement in post-test, compared with pre-test, scores.[8]

While it is useful that information is acquired so easily and effectively in simulated teaching, the amount of time for which the information is retained has been queried. The authors of a study on 50 interns reported that knowledge acquired on airway management was retained for up to 9 months after simulation training.[3] Other than learning-specific skills, interns learnt how to become more systematic, to work together in teams and to communicate more effectively in a simulated setting.[9]

The pro-active real-time teaching session, often preceded by a short didactic lecture, reinforces theory, recruits most – if not all – the persons on the team to participate, and facilitates the facilitator to home in on weaknesses and deficiencies and rectify them immediately. The management of all emergencies begin with the same basic steps of ABC, and this repetitive training ensures that interns exposed to many different emergency scenarios will be fluent in cardiopulmonary resuscitation, at least till more definitive treatment is initiated.

In South Africa, the existence of the Academy of Advanced Life Support ensures proficiency in cardiac and paediatric life support. In addition, the Advanced Trauma Life Support training course offers training in trauma emergencies. The availability of this type of course is sorely missed for the training of South African doctors in the skills of emergency obstetrics within the country. The American Advanced Life Support in Obstetrics (ALSO) course and the Managing Obstetric Emergencies and Trauma (MOET) course offered in the UK are among the few teaching programmes specialising in obstetric and neonatal emergency care but also designed for circumstances in developed countries. The RCOG International Office developed a Life Saving Skills programme[10] aimed at improving emergency obstetric management in developing countries. The RCOG gave permission for this course to be adapted for South African circumstances. A team comprising representatives from the O&G departments of all medical schools in the country and a neonatologist was assembled, with support from the International Office of the RCOG and World Health Organization (WHO) internationally, the South African Society of Obstetricians and Gynaecologists (SASOG), the South African College of Obstetricians and Gynaecologists, the South African chapter of the RCOG, the national Department of Health and the National Committee for Confidential Enquiries into Maternal Deaths, and facilitated by the Medical Research Council (MRC) Maternal and Infant Health Care Strategies Research Unit. A training package for managing obstetric emergencies using simulation and mannequins and adapted for South African conditions was developed. The package was called Essential Steps in Managing Obstetric Emergencies (ESMOE), and the content is shown in Table I.

Prior to scaling-up any programme, its effectiveness needs to be demonstrated. The objective of this study was to ascertain whether the ESMOE training package resulted in (*i*) a change between pre-training and post-training theoretical and skills test scores, and (*ii*) an improved test score when compared with conventional intern training without the package.

Table I. Names and content of the 12 training modules in ESMOE

Module	Materials and methods
1. Maternal resuscitation	Powerpoint lecture, videos and training on mannequin
2. Care of the newborn	Powerpoint lecture and training on mannequin
3. Shock and the unconscious patient	Role plays, case studies, use of resuscitation equipment
4. Pre-eclampsia and eclampsia	Powerpoint lecture, case study
5. Obstetric haemorrhage	Powerpoint lecture, estimation of volume loss, clinical scenarios
6. Sepsis	Powerpoint lecture, clinical scenario and role play
7. Assisted delivery	Demonstration of the ventouse and forceps on mannequins
8. Obstructed labour	Powerpoint lecture, clinical scenarios requiring completion of partograms
9. Obstetric complications	Powerpoint lecture, video, demonstration of obstetric emergencies on mannequins
10. Surgical skills	Powerpoint lecture, videos
11. Complications of abortion	Powerpoint lecture, video, use of manual vacuum aspirator, clinical scenarios
12. HIV in pregnancy	Powerpoint lecture, clinical scenario

Materials and methods

Eight medical schools were invited to participate in the study (Universities of Cape Town, the Free State, KwaZulu-Natal, Limpopo, Pretoria, Stellenbosch and the Witwatersrand and Walter Sisulu University). Affiliated hospitals that participated were Chris Hani Baragwanath, Steve Biko Academic, Kalafong, Mowbray Maternity, Tygerberg, Bloemfontein Complex (Universitas and Pelonomi), and Mthatha. The study group comprised interns in their 4-month rotation in O&G from May to August 2008. At the beginning of their rotation, they were asked to participate in ESMOE training, a 12-module programme consisting of Powerpoint lectures, mannequin-based practical instruction, case scenarios and other training materials, as shown in Table I. An introductory lecture on maternal resuscitation (the ABCDs) and the systemic approach to the critically ill patient was also given. All facilitators who presented the programme were specialist obstetricians and gynaecologists trained at a national ESMOE workshop. They also participated in development of the programme, and each was the principal author of at least one of the training modules. To ensure standardisation of the content, an instructor's manual was produced and issued to all facilitators, and the Powerpoint lectures were made available on CD-ROM. All participating institutions were either already in possession of mannequins, or funding was provided by local funders to purchase them. These were used to demonstrate adult and neonatal endotracheal intubation, chest compressions and obstetric emergencies. Not all facilitators were necessarily certified or experienced in advanced airway support or neonatal resuscitation. To circumvent this limitation, help was obtained locally from anaesthetists and neonatologists. The frequency and duration of the training sessions depended on the availability of the facilitator and interns at each participating hospital. Most modules took about an hour to complete. In some institutions, the modules were taught on a once-weekly basis, and the programme took 12 weeks to complete. In other institutions, more than one module was covered per week.

Participating interns wrote a theoretical pre-test and a practical skills pre-test before starting the programme. The theoretical test took the form of MCQs covering aspects which had been discussed in each training module. The test consisted of 20 questions, each with 5 linked true-or-false statements. Marks were not deducted for wrong answers, meaning that, with zero knowledge, a mark of about 50% could be achieved. Therefore, the 'percentage' marks attained do not reflect a true knowledge percentage. After the training period, a post-test was administered which was identical to the pre-test. This was done in August 2008, at the end of the 4-month rotation in all participating institutions. The practical skills pre-test was done by 4 randomly chosen interns from the group at each institution before starting the programme, with a skills post-test done by 4 randomly chosen interns (not necessarily the same who wrote the skills pre-test) at the end. The skills test consisted of 4 questions, for 10 marks each, which evaluated practical skills in neonatal resuscitation, management of shoulder dystocia, emergency management of eclampsia and management of prolonged labour using a partogram. The skills tests were done with the facilitator in the form of a live objective-structured clinical examination (OSCE). Each of the 4 interns completed all 4 questions, for a total maximum mark of 40. At the end of the rotation, participating interns were also asked to evaluate the course by means of a questionnaire which posed questions about the general running of the course, and then on each module, rated on a scale as 1 (not useful) to 10 (extremely useful).

A control group of interns also wrote the MCQ theoretical test, and the skills test. This group comprised interns who were completing their 4-month tenure in O&G at their respective hospitals, just before the study group. At each

institution, 4 interns were chosen randomly to provide a control group to undergo the skills test as described above. This group did not receive any formal training in obstetric emergencies aside from skills acquired during their 4-month rotation. The control group was tested at the end of April 2008.

The results of the theoretical and practical skills post-tests were compared with those of the pre-tests. Also, the results of the post-tests were compared with those of the tests written by the control group of interns. Statistical analysis was done on Epi-Info statistical software using a non-parametric test (Kruskal-Wallis test for two groups). A p-value <0.05 was considered to represent statistical significance. For calculation of questionnaire scores, means were calculated.

Approval for the study was obtained from each of the departments running the project. All interns consented in writing to participate in the study and agreed to let their results be known for the study. However, individual marks and scores remained anonymous.

Results

Sixty-eight interns participated as controls and wrote the MCQ test. Seventy-eight interns who participated in ESMOE training wrote the pre-test and 72 wrote the post-test after completion of the course. The distribution of participating interns at the 7 hospitals is shown in Table II. Not all interns who wrote the pre-test subsequently wrote the post-test. Also, a small number of interns did not write pre-tests because they did not join the course at the first session. While the full complement did not attend each module because of emergency duties, sick leave and vacation leave, all training sessions were attended by the majority of interns.

The results of the MCQ test for controls and for ESMOE course attendees are shown in Table III. Controls scored a median mark of 77%, while the pre-test interns scored a median of 75%, and post-test interns a median mark of 79%. The differences between the control group and the post-test group, and between the pre-test and post-test groups, were statistically significant (p=0.006 and p=0.0004 respectively).

Skills test results for the controls, and for attendees who had pre-test and post-test skills evaluations, are shown in Table IV. Four interns at each of the 7 hospitals were tested. However, detailed results were not returned by the Bloemfontein Complex and Umtata Hospital for controls, by the Bloemfontein Complex and Kalafong Hospital for the skills pre-tests, and by the Bloemfontein Complex for the skills post-tests. The median control group mark, out of 40, was 24.5. The median marks for the pre-test and post-tests were 19.75 and 30.75 respectively. The differences between the control group and the post-test group, and the pre-test and the post-test group, were statistically significant (both p<0.0001).

Interns at 5 of the participating hospitals completed a questionnaire at the end of the ESMOE course (Chris Hani Baragwanath, N=15; Kalafong, N=7; Mowbray Maternity, N=8; Tygerberg, N=10; Mthatha, N=6). The mean scores for each of the 20 questions are shown in Table V. All questions resulted in mean scores of 8 or more, except for 3; these were: 'Was it easy to make the most of the

Table II. Numbers of participating interns at the 7 hospitals, divided into controls who wrote a MCQ theoretical test, and course attendees who wrote the same test as a pre- and post-test evaluation

Hospital	Control (N=68)	Pretest (N=78)	Post-test (N=72)
Chris Hani Baragwanath	16	22	19
Kalafong	6	7	7
Pretoria Academic	10	11	10
Mowbray Maternity	6	6	6
Tygerberg	10	10	10
Bloemfontein Complex	13	15	12
Mthatha	7	7	8

Table III. Percentage marks for the MCQ test for controls and for the pre- and post-tests of course attendees

	Control (N=68)	Pre-test (N=78)	Post-test (N=72)
Median (range)	77 (57 - 86)	75 (48 - 91)	79 (58 - 93)
Interquartile range	73 - 79	71 - 78	72 - 83

Post-test v. control: p=0.006; post-test v. pre-test: p=0.0004 (Kruskal-Wallis test for 2 groups).

Table IV. Marks for the skills test for controls and for the skills pre-tests and post-tests of course attendees (maximum mark = 40)

	Control (*N*=20)	Pre-test (*N*=20)	Post-test (*N*=24)
Median (range)	24.5 (14.5 - 31.0)	19.75 (8.5 - 27.5)	30.75 (25.0 - 38.0)
Interquartile range	22.0 - 26.75	14.0 - 23.5	29.25 - 35.5

Post-test v. control: $p<0.0001$; post-test v. pre-test: $p<0.0001$ (Kruskal-Wallis test for 2 groups).

course?' (mean score = 7.6), the obstructed labour module (mean score = 7.9), and the module on HIV and AIDS (mean score = 7.8).

Discussion

The vision of the ESMOE group is to effectively improve emergency obstetric care to minimise maternal and perinatal mortality. The group intends to achieve this by improving the emergency management of pregnant women and their infants by using a training package for emergency obstetric care that is:

- taught to undergraduate students, both medical and nursing
- taught to all interns who are:
  - signed off prior to registration as a doctor
  - trained by an accredited trainer
  - registered and certified by the Health Professions Council of South Africa (HPCSA)
- taught to all doctors involved in maternal and neonatal care
- a modified midwifery version taught to all advanced midwives involved in maternal and neonatal care
- that serves as a basis for emergency obstetric simulation training exercises for *all* health professionals in all institutions, public and private, offering maternity care where:
  - these training exercises are documented
  - they occur as part of the CEO of the institution's key performance areas.

To achieve this, an ESMOE Advisory Board has been set up, comprising representatives from the national Department of Health; the National Committee for the Confidential Enquiries into Maternal Deaths; the National Perinatal Morbidity and Mortality Committee; HPSCA; the Nursing Council; SASOG; RCOG (SA); South African Colleges of Obstetrics and Gynaecology, and Paediatrics and Anaesthetics; and the Midwifery Association of South Africa.

From the above study on the effectiveness of the ESMOE training package, a clear improvement in the knowledge and skills of those interns who participated in the trial

Table V. Evaluations on a scale of 1 - 10, for 20 questions that evaluated the ESMOE course, from participating interns at the end of the course (*N*=46)

	Mean score
General comments	
Was the course enjoyable?	8.4
Was it easy to make the most of the course?	7.6
Was it easy to join in the interactive sessions?	8.1
Did you feel comfortable and at ease during the course?	8.4
Was the course a good use of your time?	8.4
How good was the venue?	8.6
How good was the equipment provided for learning?	8.3
Evaluation on the modules	
Lecture on ABCDs and the systemic approach	8.3
Maternal resuscitation	8.3
Care of the newborn	8.2
Shock and the unconscious patient	8.1
Pre-eclampsia and eclampsia	8.3
Obstetric haemorrhage	8.4
Sepsis	8.2
Assisted delivery	8.2
Obstructed labour	7.9
Obstetric complications	8.3
Surgical skills	8.2
Complications of abortion	8.0
HIV in pregnancy	7.8

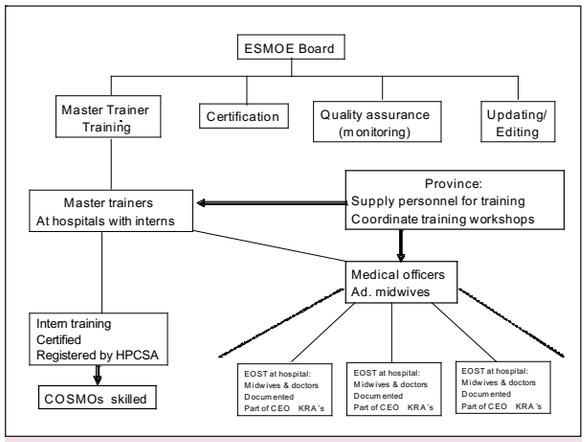

Fig. 1. Schematic diagram of scale-up process of ESMOE.

was evident when compared with those interns completing their O&G rotation but who did not participate in the course. It should be noted that the sites used to test the package were all university teaching hospitals; therefore, the interns would have normally been expected to have had training at their respective hospitals during their internship. Consequently, the results might be an underestimate of the ability of the training package to improve knowledge and skills of interns. The ESMOE Board therefore believes that it has a training package that meets its requirements.

The scaling-up of ESMOE training in conjunction with the development and introduction of emergency obstetric simulation training (EOST) exercises is progressing. Three priorities at present are training sufficient master trainers so that there are master trainers at all sites where interns are placed; training medical officers and advanced midwives in running EOST exercises in all 664 institutions that conduct births in South Africa; and modifying the ESMOE programme for advanced midwives by removing items not in their scope of practice. Fig. 1 illustrates the plans for the scale-up of the programme.

Plans are under way to monitor and evaluate the programme but, realistically, a significant fall in mortality rates owing to ESMOE training will only occur when EOST exercises are conducted in all sites conducting births. Only when all sites conducting births are running EOST exercises, can significant change be expected.[11]

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