

Curriculum Development for the South African Essential Steps in Managing Obstetric Emergencies (ESMOE) Anesthesiology Training Module: A Delphi Study

Kuün, Engela FCA(SA)¹; Spijkerman, Sandra FCA(SA)¹

¹ From the Department of Anaesthesiology, University of Pretoria, Pretoria, Gauteng, South Africa.

Address correspondence to Engela Kuün, FCA(SA), Department of Anaesthesiology, University of Pretoria, Private Bag x 20, Hatfield, Pretoria, Gauteng, South Africa, 0028 Address e-mail to engela.kuun@gmail.com.

Abstract

BACKGROUND: The United Nations Sustainable Development Goal 3 (SDG3) for 2030 aims at <70 maternal deaths per 100,000 live births. South Africa (SA) falls short of this goal and most deaths occur in district and regional hospitals. Due to low anesthesiologist (specialist anesthetist) numbers in the public sector, the anesthetic workforce in these hospitals consists mainly of nonspecialist (general practitioner) junior doctors with limited supervision. The Essential Steps in Managing Obstetric Emergencies (ESMOE) training program for interns was introduced in 2008 to reduce maternal deaths in SA. Training is not consistently offered at all intern-training institutions and it has not been recently revised. This study sought expert suggestions to guide a revision of the regulation, pedagogy, and content of the ESMOE anesthetic module.

METHODS: A 3-round consensus-seeking modified Delphi technique was used whereby experts rated current and suggested learning outcomes as well as pedagogical- and regulatory aspects of the ESMOE anesthetic module in an anonymous, online, Likert-scale questionnaire. Consensus was defined as $\geq 70\%$ agreement. Open-ended questions sought motivations for decisions and further suggestions for program improvement.

RESULTS: Between March 4, 2021 and August 18, 2021, a total of 17/24 (71%), 16/17 (94%), and 15/16 (94%) consenting experts completed the first, second, and third rounds, respectively. During the 3 rounds, the panel achieved consensus on all but 2 questionnaire items. The panel agreed that ESMOE anesthesia training should be mandatory and that it should be offered through a blended learning model. They further concurred that the current learning outcomes should be retained, and suggested additional outcomes based on the most common causes of maternal mortality in SA.

CONCLUSIONS: Attendance of the ESMOE anesthesia module should be mandatory. Its pedagogy should be updated to a blended learning style to benefit the current digital native intern generation. The content should be updated to address the main causes of maternal mortality in SA in line with SDG3. A national obstetric anesthesia guideline should be considered, and leadership and collaboration are required to improve the alignment of undergraduate, internship, and junior doctor anesthesia training in SA. The content, process, and stakeholder engagement suggestions in this study can assist short-course-based anesthesia workforce training in similar global contexts.

Clinical trial number: N/A (not a clinical trial) [National Health Research Database (NHRD) registration number: GP_202010_085]

KEY POINTS

- **Question:** How can the Anesthesia module of the South African Essential Steps in Managing Obstetric Emergencies (ESMOE) Intern program be improved and updated?
- **Findings:** ESMOE training should be compulsory for all interns in South Africa and the Anesthetic module should be taught through a blended learning program that includes a set of learning outcomes revised by the expert Delphi panel in this study.
- **Meanings:** Updated outcomes and pedagogical strategies were recommended for the anesthetic module of the ESMOE intern-training program to improve intern obstetric anesthesia competence with the aim of reducing maternal mortality in line with the Sustainable Development Goal 3 (SDG3) for 2030.

“Every woman, every newborn, everywhere has the right to good quality care.”¹ Reducing maternal mortality has been a global priority for the past quarter-century. The United Nations Sustainable Development Goal 3 (SDG3) for 2030 aims at <70 maternal deaths per 100,000 live births.²

SA does not use nonphysician anesthesia providers (NPAPs) in the delivery of anesthesia services. Physician anesthesia provider (PAP) training in South Africa (SA) begins at the undergraduate level, with training mandated by the Health Professions Council of South Africa (HPCSA). Training programs are autonomously determined at each medical school, and there are no standardized national curriculum outcomes for undergraduates. Consequently, graduates enter internship with different levels of competence.^{3,4} After medical school, individuals complete a 2-year internship in a supervised workplace setting. This internship includes a mandatory 2-month anesthesia rotation, which is a workplace-based clerkship with broad HPCSA-defined outcomes and some skills requirements, monitored through a logbook.⁵ The internship is conducted at accredited, mostly nonuniversity-affiliated hospitals, and training is not standardized. Interns participate in cases at these hospitals, with no guarantee that they will see specific types of cases. Varied internship experiences were reported, with >50% of interns performing general anesthesia (GA) for 3 or fewer cesarean deliveries (CDs).⁶ After completing the internship, newly qualified doctors serve the community for 1 year in rural hospitals as community service medical officers (COSMOs), which may involve providing unsupervised anesthesia. Thereafter, they register as independent medical practitioners with the HPCSA and can then work as medical officers (MOs) in anesthesia, with the opportunity to pursue further training toward a diploma and/or specialization.

The majority of specialist anesthesiologists in SA work in the private sector. The public sector’s approximate ratio of 0.5 specialist anesthesiologists per 100,000 population falls significantly below the recommended minimum of 5 per 100,000.³ Consequently, the anesthetic workforce in regional and district hospitals largely comprises nonspecialist (general practitioners) COSMOs and MOs who often work without supervision.⁷ In tertiary and university-affiliated hospitals, anesthesia is primarily provided by MOs and registrars (specializing doctors) under specialist supervision.

CD is the most commonly performed surgical procedure in Sub-Saharan Africa.⁸ The in-facility maternal mortality ratio (iMMR) in SA for 2017 to 2019 was 113 per 100,000 live births, with 2.39% attributed to anesthesia (2.72/113), surpassing the SDG3 goal. Notably, the majority of

these fatalities transpired in regional and district hospitals.^{2,9} Of anesthetic-related deaths, approximately 93% were avoidable and 78% were spinal anesthesia-related, mostly due to insufficient skills and knowledge about the management of complications.⁹⁻¹¹ Most anesthetic deaths were due to hypotension/total spinal block, pulmonary aspiration, or failed intubation.¹²

Internship training reveals significant gaps, particularly in obstetric and anesthetic rotations, warranting immediate attention and intervention. Notably, there may be inadequacies, especially in GA for CD and the handling of complications related to spinal anesthesia.^{13,14}

National initiatives to upskill junior doctors in the performance of obstetric anesthesia include the anesthetic module of The Essential Steps in Managing Obstetric Emergencies (ESMOE) training program¹⁵ for interns and the Safer Anaesthesia From Education – Obstetrics (SAFE-Obstetrics) course for MO.¹⁶ ESMOE is focused on emergencies and is mainly an Obstetrics training program with 1 obstetric anesthesia module. It was introduced in 2008 to address maternal mortality in SA. Although meant to be compulsory, it is not consistently taught.^{6,15} In a survey that explored SA graduates' experiences of internship obstetrics and obstetric anesthesia training, the majority of surveyed doctors attended the ESMOE course during their internship. ESMOE anesthesia module attendance was however as low as 38%.⁶ At the time of writing, neither the content nor the pedagogy of the program has been revised in more than a decade. The current content might be outdated and the face-to-face offering might not align with the learning preferences of the digitally native current intern generation.^{17,18} In a systematic review comparing blended learning with nonblended learning for health professionals, blended learning was more effective than exclusively face-to-face learning.¹⁹ The objective of this study was to obtain SA expert input on the appropriateness and potential areas for improvement of the current ESMOE anesthetic training module. The results may inform an ESMOE anesthetic module revision as well as the development of training programs for entry-level obstetric PAPs in similar health care contexts globally.

METHODS

Research Ethics approval for the study was obtained from The University of Pretoria, Faculty of Health Sciences Research Ethics Committee (696/2020), and the study was registered with the National Health Research Database (GP_202010_085). A study information leaflet was emailed to prospective participants, who were enrolled in the study on receipt of a return email expressing consent and willingness to participate. An iterative, mixed-method, descriptive study was undertaken between March 2021 and August 2021. This comprised a 3-round modified Delphi consensus-seeking technique among expert anesthesiologists in SA. As per the modified Delphi literature guidelines, this study was confined to 3 rounds due to practical constraints related to time, resources, cost, and the consideration of minimizing the burden on participants.²⁰

The research team created the round-one modified Delphi questionnaire based on the current ESMOE anesthetic training module objectives,²¹ the HPCSA internship learning outcomes,⁵ the South African “Saving Mothers” reports of the last decade,⁹⁻¹¹ and the SAFE-Obstetrics course objectives,²² keeping in mind that the ESMOE course is aimed at the treatment of emergencies. The current program encompasses the following subjects.²¹

- - Preanesthetic checklist
- - Essential equipment list for anesthesia
- - Drugs required for anesthesia for CD

- - Airway evaluation
- - Spinal anesthesia—innervations and dermatomes
- - Protocol for CD under spinal anesthesia
- - Protocol for CD under GA
- - Failed intubation and failed ventilation drill
- - Guidelines for appropriate level of care
- - Blood loss estimation training (color images depicting different volumes of blood loss)

Multiple topics, not included in the current ESMOE guideline, have emerged from our review of other documents^{5,9,11–22}.

The first-round questionnaire (Supplemental Digital Content 1, Supplemental Questionnaire 1, <https://links.lww.com/AA/E822>) consisted of 43 5-point Likert-scale items with an open-ended comment section, inviting participants to give literature-based opinions on the current anesthetic module and suggestions for revision, including suggestions for further learning outcomes to be included in a revised ESMOE program. Six specialist Anesthesiologists with an interest in obstetric anesthesia from the authors' institution validated the round-one questionnaire, assessing usability, validity, and reliability. These specialists were not invited to participate in the Delphi study.

The second- and third-round questionnaires (Supplemental Digital Content 2 and 3, Supplemental Questionnaires 2 and 3, <https://links.lww.com/AA/E823>, <https://links.lww.com/AA/E824>) consisted of items that did not reach consensus in the preceding round, as well as an open-ended section for suggestions. Deidentified feedback reports were compiled from the first- and second-round open-ended responses and the feedback report from each round was circulated to participants along with the questionnaire for the subsequent round.

A paucity of specialist anesthesiologists with additional obstetric anesthesia qualifications in SA precluded an additional qualification as a requirement to serve on the Delphi panel. The Heads of Anesthesiology Departments at the established South African medical schools were tasked with identifying anesthetic specialists with expertise in obstetric anesthesia within their referral systems (clusters) in the public sector. These are the highest qualified obstetric anesthesiologists in SA, as no fellowship/superspecialization is offered. Private-sector specialists were excluded because internship training and community service occur in public sector hospitals with very different resources from private practice. There are no definitive guidelines on the number of participants that should be included in a Delphi study. The literature supports a minimum of 8 participants as an acceptable panel.²³ We aimed to include at least 10 participants.

REDCap (Research Electronic Data Capture),²⁴ a secure web application, managed by Safe Surgery SA in our study,²⁵ was used to distribute the informed consent documents and questionnaires and to capture data. Participants received a unique participation number by which their results were recorded and analyzed. Participants received weekly email reminders to complete the questionnaires in each of the 3 rounds.

Statistical Methods

The quantitative Likert-scale data were captured in Microsoft Excel (Microsoft Corp) whereafter the statistical analysis was performed by a statistician. As per protocol and the literature, an agreement among 70% of experts was construed as consensus.²⁶ The Likert-scale results were consolidated for each statement by calculating the number (percentage) of responses that disagreed (Likert scores 1 and 2) and agreed (Likert scores 4 and 5) with the statements, while the “neither agree nor disagree” responses were excluded from the calculations. Descriptive statistics median and interquartile range were used to describe quantitative Likert data from the questionnaires. All analyses were done using STATA16 (StataCorp). The qualitative comments were grouped into categories and incorporated into a deidentified feedback report to participants in each round.

The study was reported in line with the appropriate Equator Network (Conducting and REporting DELphi Studies [CREDES]) reporting guideline.²⁷

RESULTS

Data were collected between 4 March 2021 and 18 August 2021. The Figure shows the 3-round modified Delphi process that was followed.

Flow diagram illustrating the three-round modified Delphi study process

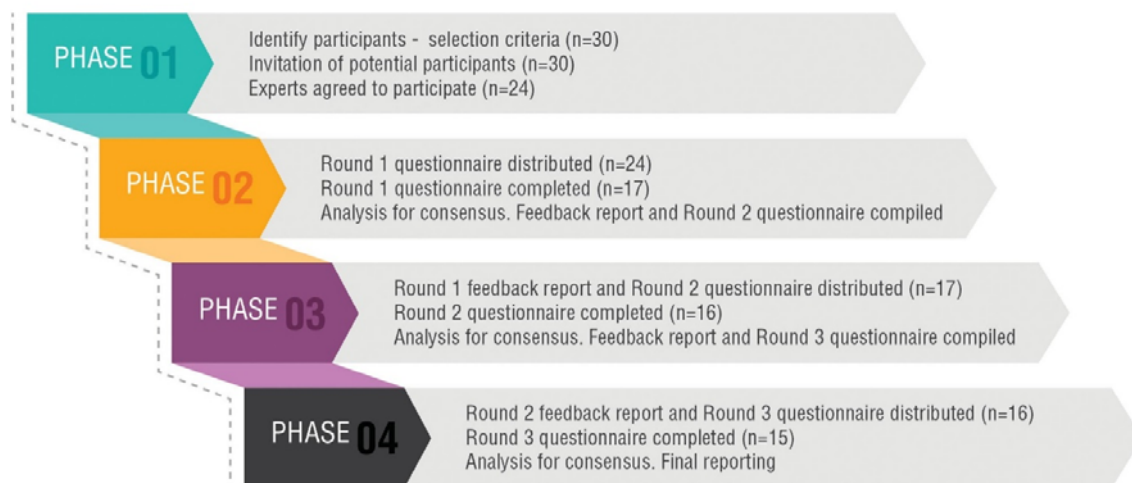


Figure : The 3-round modified Delphi study process.

A total of 30 experts who met the selection criteria were identified and invited to participate in the 3-round modified Delphi research study, of whom 24 agreed to participate (Supplemental Digital Content 4, <https://links.lww.com/AA/F129>). A REDCap link to the round 1 questionnaire was sent to the 24 Anesthesiologists and 17 completed the questionnaire between 4 March 2021 and 29 March 2021.

Table 1 shows the participants’ demographic details. More women than men (58.8% vs 41.2%) formed part of the study population. All participants had at least 5 years of anesthetic work

experience. The majority (65%) worked in tertiary and central (academic) public sector hospitals. The participants represented 6 of the 8 invited medical schools in SA, resulting in a good geographical spread of participants.

Table 1. - Demographic Details of Round 1 Delphi Participants

Variables	n (%)
Sex	
Male	7 (41.2%)
Female	10 (58.8%)
Age (in y)	
30–34	1 (5.9%)
35–39	2 (11.8%)
40–44	6 (35.3%)
45–49	3 (17.7%)
50–54	4 (23.5%)
Other	1 (5.9%)
Experience as anesthesiologist (y)	
0–4	0 (0%)
5–9	2 (11.8%)
10–14	8 (47.1%)
15–19	2 (11.8%)
20–24	2 (11.8%)
Other	3 (17.7%)
Primary area of work	
Public tertiary/central	11 (64.7%)
Public regional	2 (11.8%)
Public district	4 (23.5%)
Other	0 (0%)
University affiliation	
University of Cape Town	2 (11.8%)
Stellenbosch University	3 (17.7%)
University of the Free State	1 (5.9%)
University of the Witwatersrand	4 (23.5%)
University of Pretoria	3 (17.7%)
Sefako Makgatho University	0 (0%)
Nelson Mandela University	0 (0%)
University of KwaZulu-Natal	2 (11.8%)
None	2 (11.8%)

A total of 19 experts started the first-round questionnaire of which 17 completed it (70.8% response rate). Two accessed the link but did not start the questionnaire. There was no other missing data in this study. Agreement statements with consensus (at least 70% of the panel agreed or strongly agreed with the statement) during the 3 Delphi rounds are shown in Table 2.

Disagreement statements with consensus (at least 70% of the panel disagreed or strongly disagreed with the statement) during the 3 Delphi rounds are shown in Table 3.

Nonconsensus statements (not achieving 70% consensus) during the 3 Delphi rounds are shown in Table 4.

Table 2. - Delphi Agreement (Strongly Agree/Agree) Statements With Consensus

Statements—Round 1	% Consensus	Median	IQR
HPCSA must make the ESMOE anesthetic program compulsory for all medical interns during their 2-month anesthesiology rotation	100	5	5–5
ESMOE training adequately develops interns' knowledge and skills to manage anesthetic obstetric emergencies during their community service	75	4	3–4
Learning objectives of the current ESMOE anesthetic program should remain part of the revised program			
Preanesthetic checklist	100	5	5–5
Spinal anesthesia—innervations and dermatomes	100	5	5–5
Protocol for cesarean delivery under spinal anesthesia	100	5	5–5
Protocol for cesarean delivery under general anesthesia	100	5	5–5
Drugs required for anesthesia for cesarean delivery	100	5	5–5
Airway evaluation	100	5	5–5
Guidelines for appropriate level of care	100	5	4–5
Failed intubation and failed intubation drill	100	5	4–5
Essential equipment list for anesthesia	100	5	4–5
Colorful diagram for blood loss	93.3	5	4–5
In light of the saving mothers report and major anesthetic-related causes of maternal mortality, the following should be included in the ESMOE anesthetic program			
Maternal anatomical and physiological changes	92.9	5	4–5
Preanesthetic checklist—difficult airway equipment	100	5	4–5
Fasting period guidelines	100	5	4–5
Aspiration prophylaxis guidelines	100	5	4–5
Preeclampsia anesthetic management	88.2	5	4–5
Eclampsia anesthetic management	82.4	5	4–5
Placenta previa anesthetic management	76.5	5	4–5
Abruptio placenta anesthetic management	82.4	5	4–5
Contraindications to spinal anesthesia list	100	5	5–5
Local anesthetic maximal dosages	100	5	4–5
Potential complications of spinal anesthesia management	100	5	5–5
Hypotension algorithm	100	5	5–5
High/total spinal algorithm	100	5	5–5
Preoxygenation technique	100	5	5–5
Anticipated difficult airway management algorithm	93.8	5	4–5
Unanticipated difficult airway management algorithm	100	5	5–5
Difficult airway society guidelines obstetric algorithm	100	5	5–5
Surgical cricothyroidotomy	91.7	4	3–5
Aspiration management	100	5	4–5
Anaphylaxis management	86.7	5	4–5
Conversion of a neuraxial anesthetic to a general anesthetic	100	5	5–5
Uterine atony management	100	5	5–5
Maternal cardiac arrest algorithm	100	5	5–5
Perimortem cesarean delivery	88.2	5	4–5
Neonatal resuscitation algorithm	80	4	3–5
An ethics component must be added to the ESMOE anesthetic program	75	4	3–5
ESMOE training program must be updated to a blended learning style	94.1	5	4–5
Statements—Round 2			

In light of the saving mothers report and major anesthetic-related causes of maternal mortality. Anesthetic management of the following hypertensive disorders in pregnancy should be added to the ESMOE anesthetic program ^a			
Gestational hypertension	92.3	4.5	3.5–5
Preeclampsia	100	5	4.5–5
Severe preeclampsia	87.5	5	4–5
Eclampsia	93.8	5	4.5–5
HELLP syndrome	86.7	5	4–5
A referral system should be added to the ESMOE anesthetic program ^b	100	5	4–5
Statements—Round 3			
Surgical cricothyroidotomy should be included in the ESMOE training program ^a	75	4	3–5
Anesthetic management of chronic hypertension should be added to the ESMOE anesthetic program ^a	92.9	4	4–4

Abbreviations: ESMOE, Essential Steps in Managing Obstetric Emergencies; HELLP, hemolysis, elevated liver enzymes, low platelet count; HPCSA, Health Professions Council of South Africa; IQR, interquartile range.

^aNonconsensus from previous round(s).

^bNewly suggested item by expert(s).

Table 3. - Delphi Disagreement (Strongly Disagree/Disagree) Statements With Consensus

Statements—Round 1	% Con-sensus	Median	IQR
Currently, all intern-training institutions have adequate ESMOE training resources and ESMOE “master trainers” to train the ESMOE anesthesia module.	92.9	2	2–2
Statements—Round 2			
The current ESMOE anesthetic training program adequately develops interns’ knowledge and skills to manage anesthetic obstetric emergencies during their community service and in future practice.	80	2	2–2

Abbreviations: ESMOE, Essential Steps in Managing Obstetric Emergencies; IQR, interquartile range.

Table 4. - Delphi Nonconsensus Statements

Statements—Round 1
The “current” ESMOE anesthetic training program adequately develops interns’ knowledge and skills to manage anesthetic obstetric emergencies during their community service and in future practice
In light of the Saving Mothers report and major anesthetic-related causes of maternal mortality, the following should be included in the ESMOE anesthetic training program:
HELLP syndrome anesthetic management
LAST management
Needle cricothyroidotomy
Statements—Round 2
The “current” ESMOE anesthetic training program adequately develops interns’ knowledge and skills to manage anesthetic obstetric emergencies during their community service and in future practice
In light of the Saving Mothers report and major anesthetic-related causes of maternal mortality, the following should be included in the ESMOE anesthetic training program:
LAST management
Needle cricothyroidotomy

Abbreviations: ESMOE, Essential Steps in Managing Obstetric Emergencies; HELLP, hemolysis, elevated liver enzymes, low platelet count; LAST, Local Anesthetic Systemic Toxicity.

Consensus was obtained for 39 of 43 (90.7%) statements in Round 1, for 6 out of 9 (66.7%) in Round 2 and for 3 out of 5 statements (60%) in Round 3.

Of the experts in round 1, 94% agreed that the ESMOE Anesthetic training program should be updated to a blended learning style (online and face-to-face component). They felt that this would benefit the current interns’ learning preference, reduce the teaching workload, and standardize the teaching program across the country. Interns would also be able to access the program multiple times in current and future practice. Regarding potential challenges, they commented that the initial start-up cost might be high (building online material, training master trainers, purchasing simulation equipment) and that interns might have technical and connectivity challenges in accessing the blended learning online component.

Consensus was reached for the 3 hypertensive conditions listed in Round 1 (preeclampsia, HELLP syndrome, eclampsia) but the experts suggested the addition of chronic- and gestational hypertension and severe preeclampsia (as per the hypertension disorders in pregnancy classification). Therefore all 6 were included in the second Delphi round.

Consensus was reached in Round 1 for teaching surgical cricothyroidotomy, but not for needle cricothyroidotomy. In Round 2, experts however reopened the discussion by providing literature-based motivations for including surgical cricothyroidotomy as well as needle cricothyroidotomy. We therefore included both in Round 3.

The first-round feedback report and the second-round REDCap questionnaire link were sent to the 17 respondents of the first round. Sixteen of these experts completed the second-round questionnaire (94.1% response rate) between 7 June 2021 and 12 July 2021. The second-round feedback report and third-round REDCap questionnaire link were sent to the 16 respondents of the second round. Fifteen experts completed the third-round questionnaire (93.8% response rate) between 2 August 2021 and 18 August 2021.

Experts felt that the current ESMOE anesthetic training program did not adequately develop interns' knowledge and skills to manage anesthetic obstetric emergencies during their community service and beyond. Participants provided the following motivations:

“Internship training adequately prepares South African medical graduates for community service – with exceptions,” is a study by Nkabinde et al.¹⁴. It concluded that critical skills in anesthesiology need urgent attention.

A study by Kusel et al²⁸ “Practicing anesthesia as a community service doctor: a survey-based assessment” showed that community service doctors play a significant role in providing anesthesia, especially in rural areas. However, a large number feel uncomfortable in administering GA. Intern-training should be modified according to this study.

Simulation-based training may be valuable to improve intern-training as per a simulation-based study published by Kiwalabye et al.¹³ The study evaluated the readiness of interns' postanesthesia rotation management of a failed obstetric intubation scenario and concluded inadequate management, despite ESMOE airway module training.

Most participants expressed the opinion that the National Department of Health (NDoH) should bear the expenses of the ESMOE Anesthetic training program, as maternal health is a national health priority.

Two statements did not reach consensus within the 3 rounds (Table 5).

Table 5. - Delphi Statements That Did Not Reach Consensus After 3 Rounds

Statements	Median	IQR
Needle cricothyroidotomy should be included in the ESMOE anesthetic training program.	2	1–4
LAST should be included in the ESMOE anesthetic training program.	3	2–5

Abbreviations: ESMOE, Essential Steps in Managing Obstetric Emergencies; IQR, interquartile range; LAST, Local Anesthetic Systemic Toxicity.

The experts disagreed that needle cricothyroidotomy should be included in the ESMOE Anesthetic training program, stating that “The Difficult Airway Society (DAS) guidelines²⁹ recommend surgical cricothyroidotomy over needle cricothyroidotomy” and “NAP4 (4th National Audit Project)³⁰ highlighted the high failure rate for needle cricothyroidotomy.” They recommended “focus on core airway skills (bag-mask ventilation, supra-glottic airway placement and intubation)” and surgical cricothyrotomy, instead of needle cricothyrotomy.

Experts believed that Local Anesthetic Systemic Toxicity (LAST) was not a common complication in obstetric anesthesia and felt that it should not be a priority area in ESMOE training. “The National Committee on Confidential Enquiries into Maternal Deaths (NCCEMD)¹¹ reports do not list LAST as an important outcome measure. Rather focus on common complications.” Other experts felt that LAST was a “rare complication but it cannot be overlooked as local anesthetics are commonly used in obstetric anesthesia and drug errors do occur.”

DISCUSSION

Although its impact on morbidity and mortality is largely unknown, subspecialty short courses may enhance the knowledge and skills of the anesthetic workforce in low-resource environments.¹⁶ The ESMOE course was developed to upskill SA interns in the management of obstetric patients,^{15,31} but it is not offered consistently⁶ and was not recently updated. In this 3-round modified Delphi study, an expert panel of specialist anesthesiologists made regulatory, pedagogical, and content suggestions for a revised ESMOE anesthetic module.

The 2008 to 2010 Saving Mothers Report recommended that the HPCSA should mandate ESMOE training during internship and that successful completion should be a prerequisite for registration as a medical practitioner.³¹ The Obstetrics section of the current Internship training handbook stipulates that to “gain competence in ESMOE” is a training requirement. Although obstetric anesthesia outcomes are listed, there is no reference to ESMOE in the Anesthesiology section.⁵ Hence, successful completion of internship is possible without formal ESMOE course attendance. This is evidenced by reports of as little as 38% participation in the ESMOE anesthetic module.⁶ Nonspecialist anesthesiologists (with or without diplomas in Anesthesiology) provide most of the workplace-based intern supervision,⁶ likely because of limited specialist numbers at many government hospitals. Internship training varies across SA with some interns performing <3 GAs for CD, while others get significantly more experience in all aspects of obstetric anesthesia.⁶ Insufficient obstetric anesthetic competencies have been reported after internship.^{13,14} Our Delphi panel recommended (100% consensus) that ESMOE should be compulsory for interns. It will require a significant financial and human resources commitment from the NDoH to ensure ESMOE training for >2000³² interns per year.

A blended learning educational strategy improves the learning of postgraduate health care professionals.³³ SA interns preferred video tutorials to face-to-face anesthesia lectures.³⁴ Our Delphi panel recommended a blended learning approach for the ESMOE course. An asynchronous online theory and skills video component can reduce the service delivery impact which results from groups of interns from the same institution simultaneously attending lectures. It will further allow own pace learning and opportunity for revision, with training access extending beyond internship. Although most SA interns had Internet connectivity and devices to support blended learning, some reported hardware, software, or connectivity challenges, necessitating the distribution of training material on portable data storage devices.³⁴ Experts in our study concurred (94% consensus) that the program should be updated to a blended learning curriculum to adequately teach the current digital native generation of interns. Most panel members worked at tertiary or central training hospitals. These hospitals are typically associated with universities and most panel members would have been involved with undergraduate and postgraduate teaching. The coronavirus disease-2019 (COVID-19) pandemic accelerated a move to online teaching, rendering most lecturers proficient in the development and presentation of online material.³⁵ The initial start-up of an online component might require a cost and time investment, but there is sufficient expertise to support a digital transformation of the pedagogy of the ESMOE anesthesia module in SA.

The Delphi panel agreed that all current learning outcomes should be retained, and suggested additional outcomes, based on the common causes of maternal mortality in SA.^{8,9} Insufficient anesthetic provider knowledge and skills contribute to maternal mortality in SA. This is often spinal anesthesia-related.¹⁰ In line with this, the Delphi experts recommended the following additions to the program outcomes: contraindications for spinal anesthesia, local anesthetic

maximal dosages, the management of spinal anesthesia hypotension, high and total spinal anesthesia, and the conversion of a neuraxial technique to a GA.

Due to the high number of maternal deaths caused by cardio-respiratory failure,¹⁰ the Delphi panel recommended the following additions: preanesthetic checklists for difficult airway equipment, anticipated and unanticipated difficult airway management algorithms, the Difficult Airway Society (DAS) guidelines obstetric algorithm,²⁹ surgical cricothyroidotomy technique, aspiration management, anaphylaxis management, the maternal cardiac arrest algorithm, perimortem CD, and the neonatal resuscitation algorithm. Obstetric hemorrhage and hypertensive disorders are major causes of maternal mortality in SA.^{9,11} This was also reflected in the Delphi panel's recommendations (Table 2).

Two statements did not reach consensus. LAST management was deemed important but, given the short (2-month) internship anesthetic training duration, experts felt that priority should be given to maternal resuscitation and core airway skills (bag-mask ventilation, supraglottic airway placement, and intubation). The inclusion of surgical cricothyroidotomy was recommended. Expert opinions were divided on the inclusion of needle cricothyroidotomy, reflecting the controversy on its use in the literature.³⁰

Stakeholder engagement and collaboration will optimize the development and implementation of a revised ESMOE anesthesia module. HPCSA-mandated ESMOE anesthesia training, as recommended in this study, will likely improve attendance of the anesthetic module.

Panel members felt that the NDoH should fund ESMOE anesthetics training, as maternal health is a national health priority and a SDG for 2030.² The majority of specialist anesthesiologists work in the private sector in SA.³ Fewer anesthetic-related maternal deaths occur in these hospitals compared to the public sector,¹¹ possibly in part due to the predominantly specialist workforce. Public-private partnerships could provide funding and human resource support for ESMOE training.

There is insufficient alignment between the various junior doctor anesthesia training phases in SA.^{4,28} Undergraduate anesthesia training at medical schools in SA differs in duration (2–7 weeks), and there are no standardized national outcomes. ESMOE training was meant to enhance interns' obstetric anesthesia competence, but attendance of the anesthetic module is suboptimal.⁶ The SAFE-Obstetrics course is an international essential obstetric anesthesia refresher course for resource-limited regions. It is more comprehensive than the ESMOE anesthesia module, and is offered as voluntary training to COSMO and MO in SA. There are however some discrepancies between the recommendations in the ESMOE and SAFE-Obstetrics guidelines. One example is the oxytocin dose. This is likely due to the different origins of the 2 guidelines, as dose recommendations differ between countries.³⁶ A national obstetric anesthesia guideline for junior doctors in SA could improve the alignment of anesthesia training between the different training phases. Improved alignment would require leadership and collaboration between undergraduate, intern (ESMOE), and postintern junior doctor (SAFE-Obstetrics) trainers and other stakeholders such as the HPCSA, South African Society of Anaesthesiologists (SASA), Obstetric Anaesthesia Special Interest Society (OASIS), the NDoH and, once established, a National Surgical, Obstetric and Anesthesia Plan (NSOAP)³⁷ group. While education lays the groundwork, it alone might not be sufficient for achieving improved patient outcomes. Success demands a synergy of factors, encompassing access, policies, protocol implementation, and resources.

Study Strengths

Experts from around the country were included, resulting in a representative opinion. A Delphi consensus technique considers different views. Other than gaining consensus on outcomes, panel experts made valuable suggestions to improve the program and justified their responses with literature-based explanations.

Study Limitations

Most of the participants worked in tertiary or central (academic) hospitals but many interns are trained in primary and secondary hospitals. This study did not include experts from these hospitals. Interns' opinions were not considered. The study did not aim to define specific learning objectives, but rather highlighted broader outcomes deemed important by experts. The study aims did not include the relative importance of the various outcomes.

Future Research

The opinions of other stakeholders should be sought. This includes previous and current interns and community service doctors to explore the content and pedagogy that would benefit them. The literature indicates that improved patient outcomes are not necessarily guaranteed by an educational intervention.¹⁶ After the development of the revised ESMOE module, the educational and patient care impact of the new module should be assessed.

CONCLUSIONS

Due to the varied internship training in SA, experts in this study recommended that ESMOE anesthesia training be continued, and its scope expanded. The content and pedagogy should be revised, and the course made compulsory for interns. Stakeholder engagement and collaboration are required to standardize and align the different anesthetic training phases of junior doctors in SA. The content, process, and stakeholder engagement suggestions in this study can assist curriculum development for short-course-based anesthetic workforce training globally in similar contexts. It could, in addition, initiate discourse around training phase alignment in these spaces.

ACKNOWLEDGMENTS

We would like to thank the participants in this study for their time and valuable input. We also thank the following people for their contributions: Mr. Charl Janse van Rensburg for statistical support, Ms Duvenage and Ms Fihla from Safe Surgery South Africa for the distribution of the questionnaires, and Ms Marizanne Booyens from Creative Studios.

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