



Teaching and Learning Obstetric Anaesthesia in Low- and Middle-Income Countries: Current Situation and Perspectives

Emilia Guasch^{1,4} · Nicolas Brogly² · Fernando Gilsanz³

Accepted: 17 March 2023 / Published online: 19 April 2023

© The Author(s), under exclusive licence to Springer Science+Business Media, LLC, part of Springer Nature 2023

Abstract

Purpose of Review Our goal in this review is to describe the current context and peculiarities of obstetric anaesthesia in low- and middle-income countries (LMIC) and the ongoing actions and perspectives in terms of teaching and learning, focusing on improving maternal outcomes.

Recent Findings Correct identification of barriers and lack of infrastructures and anaesthesia providers are still major problems despite efforts of different stakeholders. International consensus and commitment for 2030 goals are trying to be achieved.

Summary Structured training courses look a good option as short- and long-term evaluations show a positive impact. Future efforts will have to be also focused on indicators that may help to decrease the high mortality and morbidity ratios in LMIC

Keywords Obstetric anaesthesia · Anesthesia in LMIC · Teaching obstetric anaesthesia · Anaesthesia related mortality · Patient safety

Introduction

Aproximately 250,000 women die every year during pregnancy or soon after. Ninety-nine percent of these maternal deaths occur in low- and middle-income countries (LMIC) [1]. The maternal mortality ratio (maternal deaths per 100,000 live births) in these LMIC is as high as 14 times than that in high-income countries (HIC) [2]. Many cases of maternal mortality in LMIC and even in HIC are preventable.

Anaesthetic care is essential worldwide and, of course, for maternal survival, but there is a lack of physician and non physician anaesthetists in these areas. The exact statistics differ, depending on the LMIC region considered, but the estimated ratio is one physician anaesthetist per million women, what means that physician anaesthetists are scarce [3, 4].

Manpower is not the only existing problem; lack of infrastructure, drugs and anaesthesia equipment, and monitoring are also important limitations.

The contribution of anaesthesia-related causes to maternal mortality in LMIC is not known but is undoubtedly higher than that in HIC. The precise contribution is worthy of investment. To date, many efforts have been done to improve obstetric and anaesthesia services, mainly focusing on improving operating room functionality and anaesthesia skills [5•]. The causes of maternal death are 3:1 when comparing general anaesthesia to regional anaesthesia. Airway management events were the most frequent causes associated to anaesthesia-related mortality [6•].

Not many interventions have shown evidence that they improve maternal anaesthesia outcomes in the LMIC. For example, simply attending didactic lectures or having an expert anaesthesiologist visit to demonstrate skills (practical or not) has not demonstrated any significant change in

✉ Emilia Guasch
emiguasch@hotmail.com

¹ Anaesthesia and Reanimation Department, Hospital Universitario La Paz, Servicio Anestesia Y Reanimación, Paseo Castellana, 261, 28046 Madrid, Spain

² Anesthesia and Reanimation Department, European Society of Anaesthesia and Intensive Care (ESAIC), Hospital Universitario La Paz, Madrid, Spain

³ European Society of Anaesthesia and Intensive Care (ESAIC), Spanish Royal Academy of Medicine (RANME), Universidad Autónoma de Madrid, Madrid, Spain

⁴ WFSA Obstetric Anaesthesia Committee and WFSA Council Member, London, UK

any anaesthetic technique or practice improvement in LMIC anesthesiologists.

Our goal in this review is to describe the current context of obstetric anaesthesia in LMIC and the ongoing educational initiatives in low-resource areas, focusing on improving maternal outcomes.

The Obstetric Patient and Anaesthesia-Related Mortality

In HIC, anaesthesia contribution as a cause of maternal death is very low [6•]. Although very few data are available on the same topic in LMIC, some data suggest that it may be much higher.

In a systematic review [6•], the aim was to get data of anaesthesia-attributed deaths in pregnant women exposed to anaesthesia and to identify the factors linked to adverse outcomes in pregnant women exposed to anaesthesia in LMIC. The authors included 44 studies (> 600,000 pregnancies) that reported anaesthesia risks of death in women under obstetric surgery and 95 (32 million pregnancies and 36,144 deaths) that gave rates of anaesthesia-attributed deaths as a proportion of maternal deaths. Two-thirds (68) of the 95 included studies had a low risk of bias. About half had a high risk of bias for representativeness of the population and setting, and 90% had adequate sample selection, and a quarter had a high risk of bias for outcome reporting. Three-quarters of all studies had adequate sample size, and about two-thirds adequately accounted for maternal deaths [6•].

Anaesthesia was identified as the main cause of mortality in 2.8% of the total amount of maternal deaths (direct and indirect). Highest rates were reported in East and North Africa (6.2%) and the lowest in East Asia and Pacific (1.5%). Anaesthesia was documented as cause of death in 3.5% of all direct maternal deaths and 13.8% of all deaths related to a caesarean section (during or after). General anaesthesia (GA) had 3 times the rate of maternal death, when compared to regional techniques (neuraxial), with mortality rates of 5.9 per 1000 (GA) and 1.2 per 1000 respectively. GA also has twice the perinatal mortality rate when compared with neuraxial techniques. Other complications also appeared more often when GA is used (postpartum haemorrhage, low Apgar score 1 and 5 min), with no differences in cardiac arrest rate. Rural areas reported an association with a higher maternal mortality [6•].

During or after a caesarean delivery, there is a 1:7 relation on maternal deaths related to anaesthesia in LMIC, which is much higher than mortality during or after caesarean delivery in HIC [7, 8].

In 2020, in the USA, maternal mortality is still considered a major problem, and some inequities have been described [9•].

The disparities in maternal mortality rates comparing HIC and LMIC, and between different regions in LMIC, need to be investigated. Training of anaesthesia providers would probably improve maternal outcomes, despite other needs, such as infrastructures and many other deficiencies that have been previously described.

Given the current situation, highlighting the current and future efforts to improve education and training in LMIC can play an important role for its potential translation to improved maternal mortality and morbidity rates [10].

Why Obstetric Anaesthesia is Different from Other Scenarios

Obstetric patients' care can be challenging and really complex. Real emergencies can appear at any moment. Clarity of diagnosis of these situations and coordinated team responses are essential for a correct decision-making in the emergency moment [11••]. Individual decision-making may be influenced by many sources, including external. These main influences can be classified and studied and include [11••].

- Cognitive biases: in recognition of vulnerability to biased thinking, assumptions can be checked during decision making to reveal gaps or inaccuracies. Being explicit in one's decision-making allows the review of thinking, allowing errors to be caught immediately. An independent observer during any obstetric emergency can do this task and will have the capacity to examine these circumstances despite of the emergency.
- Emotions: emotions come in 2 distinct categories in the context of decision making: integral and incidental. Integral emotions are directly attributable to the decision making (anxiety or fear during high-risk situations). Incidental emotions are unrelated to the decisions at hand but may still influence decision making.
- Individual situation awareness

There are also other factors that may influence the team for obstetric decision-making such as psychological safety or the effects of team diversity on speaking up.

Several strategies have been developed, mainly by Edmonson et al. to try to decrease these biases. Particularly interesting are those focused on team decision-making, speaking up, collaboration, experimentation, and reflexion [12, 13].

These strategies look simple, effective, and inexpensive but require some specific knowledge and training in every institution, including in LMIC learning programs.

The mnemonic Name/Claim/Aim has been proposed as a tool for rapid team organization [11••]. Teams are taught to explicitly diagnose and designate roles aloud (claim) and then share which steps the team should enact

in a coordinated manner (aim). This technique can be really helpful in high-stress situations with its focus on identifying only need-to-know information and sharing it. It needs the training of the entire team to be a really useful tool.

Additional strategies that can be implemented in HIC or LMIC and included in the formal training in obstetric anaesthesia include.

- Look for individual and team decision-making, emphasising on vulnerable areas of the specific team and on team growth
- Review of high-risk situations with all the obstetric team members to increase their awareness
- Evaluation of the obstetric team’s capacity for the new team training strategies (metacognition) and the use of all the cognitive aids and other organization frameworks (such as Name/Claim/Aim)

The impact of the described strategies, tools, and cognitive aids need to be evaluated.

Challenges in Obstetrics in LMIC

Caesarean delivery is an essential surgical service. However, this service is sometimes not available or safe in LMICs [14, 15••].

One of the most important challenges is to fight against the “3 delays”:

- First delay: the decision to seek health care is made late. It happens probably because of lack of knowledge, gender inequity, past negative experiences with the health-care system, and lack of financial resources for those seeking that treatment.
- Second delay: it means the delay to reach a health-care facility. An important segment of population in LMICs lives far from any health-care facility, and the transport logistics may be very difficult, especially when sick patients need care.
- Third delay: once the patient is in a health-care facility, it means getting appropriate care. This may be limited by infrastructural or staffing reasons, lack of disposables or blood supplies, or need to transfer the patient to a higher level facility because of severity of medical condition [16]. This may cause an important delay to treat life-threatening emergencies. It is not easy to measure the impact of these delays, as recording systems may be very poor or may not even exist [2].

Important and severe obstetrical emergencies happen quite often in LMIC, and a quick response is needed. Most of maternal deaths take place during intrapartum or in early

postpartum period. Daily practice differs a lot from LMIC to HIC. In LMIC, once a basic framework has been developed and established, a good dose of flexibility and resourcefulness is required [2, 17•].

Staff training and education are particularly vital to try to avoid or decrease the third delay.

The anaesthesia provider’s early involvement, as a member of the obstetric team, may also be helpful to reduce the third delay [2]. Involvement in decision-making regarding specific interventions, transfers, and referral to appropriate levels of care should be taught to the whole team as it will also improve communication among members and provide more effective care of the obstetric patient.

Another challenge in LMIC is to provide safe anaesthesia. The quality of anaesthesia care varies even in different regions of the same country. Electricity, water, and medical gases supply can be scarce or even not available. Anaesthesia ventilators and even other monitors can be absent or broken, while disposables and drugs may be also scarce. Nurses’ lack of training, if they are even available, is also a problem. In some cases, the only anaesthesia provider is a nurse or even a non health care technician. In some facilities, there is no anaesthesia provider at all [2].

Given all these considerations, neuraxial anaesthesia may put the obstetric patient under an additional risk, especially if a caesarean delivery is needed. Arterial hypotension and other complications or side effects of spinal anaesthesia can be worse and more dangerous than a GA without the necessary vasopressors and monitors. Haemodynamic stability and airway reflexes are a priority in these difficult contexts [2, 16].

Postpartum haemorrhage (PPH) is the main cause of maternal mortality in LMIC. Blood resources may be absent or very scarce. Team bidirectional communication between the surgical and anaesthesia providers is vital. When blood is not available, basic measures, such as normothermia maintenance and the use of crystalloids and vasopressors, may be life-saving in some cases. Epinephrine may be the only vasopressor available. Misoprostol is a good option for uterine atony, as it does not need a freezer for its conservation [18].

Although access to pain management is considered “a human right” in many countries, it is just unaffordable, because of lack of technical and human resources [19]. When there is certain availability of resources, spinal analgesia for the second stage of labour may be an option that also helps in case of an operative delivery, as the need of forceps delivery or any instrumental delivery or other painful manoeuvres. Complications are rare, because of low dose used, so it is a relatively safe procedure and technique. Nursing staff must be properly trained for surveillance of the mother and foetus.

The COVID-19 pandemic has added additional challenges to the obstetric patient population. Despite any

other concerns, it seems that spinal anaesthesia, if feasible, remains the gold standard for CS, even for COVID-19 patients, as the results have shown no differences neither in maternal nor in neonatal outcomes [20, 21].

Real Scenarios in LMIC

Minimal standards of care are highly recommended, including in surgery and anaesthesia. WFSA recommends the use of international standards for safe practice for anaesthesia professionals throughout the world [22•]. In resource-limited settings, minimum, recommended standards are often difficult to meet, particularly in East Africa.

Routine cases, not just vital emergencies, are performed every day under such circumstances [23]. A fully trained anaesthetist throughout surgery is a basic requirement in the WFSA standards, but 93% of the anaesthetists identified as the major challenge, the shortage of trained anaesthesia personnel at the national referral hospitals in a survey performed in East Africa [23].

In Kenya, for example, for a population of 40 million people, there are 300 anaesthesia providers (120 physician anaesthetists), mainly in urban areas. In Rwanda, there are only 13 trained physician anaesthetists, and in 6 of 44 hospitals, there is no any anaesthesia provider available. Non physician anaesthesia providers work in rural areas, where non supervised work and lack of training may be responsible of high mortality and morbidity rates. Focus on training may be a life-saving strategy.

Effective Training Programs in LMIC

Despite all this challenging landscape, there are several programs to train anaesthesia providers in LMIC, and most of them are really good initiatives.

Kybele and Cooperative for Assistance and Relief Everywhere (CARE), humanitarian organizations groups, provide successful programs that start with the provision of infrastructure, staffing, and equipment, including consumables [5•].

The Kybele report [24] describes some changes from which we can learn, that include the following:

1. Technical in situ training, following by repeated evaluation of learning, leadership development, and improvement of recorded and collected data
2. Carefully planned implementation with the involvement of stakeholders, administrators, and clinicians
3. Sustained efforts over the time to overcome difficulties and developing a group of trained anaesthesia and other health care providers that is large enough to implement this change

The Kybele group that works extensively in Eastern Europe, the Baltic countries, and Africa has a wide experience identifying obstacles and key areas in obstetric anaesthesia and in analgesia change management. This group observes and promotes group discussions to better identify the needs, in terms of equipment, skills, or any other priority. They repeat the visit-assessment cycle and believe that is the key of success.

The impact of a Kybele program, focused on regional anaesthesia and analgesia techniques for obstetric patients, has been analysed in Croatia. This initial evaluation showed that the short-term impact was high, increasing the percentages of women who were under these techniques for caesarean delivery or labour analgesia [25]. Further evaluation is to follow.

CARE is a nongovernmental organization that is devoted to the reduction of poverty in 87 countries that focuses on improving the quality of operating room services and improving mothers' access to these services [16, 26, 27].

They increase clinical knowledge, but they also build a network of "local champions". For example, they highlight the importance of implementing local policy changes, to ensure that local authorities support infrastructure and staff needs. CARE identifies a "functional operating room" as a key element for improvement, as they also consider the availability of surgeons and anaesthetists for obstetric patients [27].

CARE also is committed on protocol development (based on evidence, outline the step-by-step approach to obstetric problems and contemplating the competencies required by staff in each facility) [5•].

This is similar to a South African initiative "Essential Steps in the Management of Obstetric Emergencies", which focused on decreasing preventable causes of maternal mortality that includes 13 clinical modules with details of clinical management, with one of them dedicated to obstetric anaesthesia [28].

The Safer Anaesthesia from Education Obstetric Anaesthesia (SAFE-OB) program is mainly devoted to an educational course designed for its use in LMIC and developed in partnership with the "Association of Anaesthetists of Great Britain and Ireland" (AAGBI) and "World Federation of Societies of Anaesthesiologists" (WFSA) [29, 30•]. The standard courses have been adapted to the different levels of anaesthesia providers.

SAFE-OB's objective is "to improve the quality of obstetric anaesthesia care" developing a 3-day course for trained anaesthesia providers (physician and non physician) to address essential obstetric anaesthesia and the most common causes of maternal death" [31]. It can be a part of continuous medical education, which many times do not exist formally in LMIC. The SAFE-OB course is currently highly interactive, very practical, and uses many teaching

and learning tools not based on lectures (direct teaching scenarios, specific skills sessions, plus small-group discussion). The course is designed for 32 participants plus 6–8 faculty instructors in order to have the faculty/participant ratio low to enhance learning and interaction [32].

Since the first course in 2011, 104 SAFE-OB courses have taken place in 40 countries, and nearly 3244 anaesthesia providers and 581 trainers have been trained [33].

Short- and long-term outcomes have already been published [31, 34, 35]. Course attendants showed positive responses in 4 levels:

- “Reaction and learning”, immediately, at 4, 12, and 18 months after the end of the course
- “Change in personal practice”, also with positive long term evaluation, and
- “Organizational cultural change”, showing better teamwork, communication, and preparation for future scenarios with improved knowledge skills and skills retention. In Congo and Madagascar, there were described self-reported changes in personal practice and organizational culture maintained over time [35]

Similar results of SAFE courses have been published from two different regions of Ethiopia [33]. As the SAFE initiative expands, other models of training and are being developed. SAFE-OB refreshers have recently been done in Tanzania [33].

SAFE-OB courses plans to expand in the near future, despite barriers, which are mainly related to limited resources.

Evaluation and Future Plans

The Lancet Commission on Global Surgery suggested in 2015 to evaluate progress focusing on timely access to safe surgical, anaesthesia, and obstetric care [15••]. The aim was “to capture access to surgery, surgical workforce, surgical volume, perioperative mortality rate, and catastrophic and impoverishing financial consequences of surgery”. Six indicators were proposed, although they were heterogeneous and not well defined. Data obtained from them were scarce or perhaps not valid for comparisons or follow up.

In 2019 and 2020, a group reviewed these 6 indicators applying Utstein methodology [36].

Participants in this group were experts in surgery, anaesthesia, and obstetric care; data science; and health indicators from HIC and LMIC. After consensus was reached, one indicator was removed, and 5 were redefined. Only 21% of participants were from LMIC, but in contrast, an important number of global institutes and multilateral agencies were involved in this process [37••]. Accurate indicators

are extremely important, including the field of education and training on maternal and neonatal outcomes, especially if we plan for long term. Having correct feedback is vital for progress.

In 2017, a document was published with 15 key indicators for surgery, obstetrics, and trauma patients (G4 Alliance). The objective is to have a target and consensus indicators for “Global Surgical Systems Strengthening” from 2015.

These indicators are divided in.

- “Access”, in obstetrics: the caesarean delivery rate
- “Quality”, in obstetrics: the maternal mortality ratio (proportion due to postpartum haemorrhage, obstructed labour), and
- “Financial risk protection”, for the global surgery system

The G4 Alliance defined its global target as “Safe Surgical and Anaesthesia Care for 80% of the World by 2030”. It is recognized that an immediate action is required to transfer the efforts in academic, political, and advocacy fields into an effective delivery of surgical care [38•].

This provides an additional incentive to focus on education and training to reach these 2030 goals, as soon as possible.

In Nigeria, an important effort has been made applying the Lancet Global Surgery indicators and the 2030 objectives, to the current reality. Nigeria’s national surgical, obstetric, and anaesthesia plan for 2019–2023 is a phased, organized platform to improve surgical care in LMIC. Getting financial resources is the main challenge for its implementation. Nigeria’s strategic priorities for surgical care need the commitment and contribution of all stakeholders. Government and other development partners are needed to overcome the main challenges of LMIC [39].

The aim of this plan was to foster actions to prioritize surgical care for the achievement of universal health coverage in addition to creating a costed strategy to strengthen surgical care. Pilot implementation of the plan began in 2020, supported by a nongovernmental organization with experience in surgical care in the region. Specific entry points have been created to facilitate the pilot implementation. In this pilot, an electronic surgery registry was created. Personnel are trained in life support, and nurses are trained in safe perioperative care. Also, biomedical technicians and sterile supply nurses are being trained in surgical instrument repair and maintenance. Research capacity was strengthened. In addition, the mainstream media are being mobilised to improve awareness about the plan among policy-makers and the general population. Money is a key challenge to full implementation, so innovative domestic funding strategies are needed to support and sustain its implementation.

In summary, there appear to be three key components to successful programs for obstetric anaesthesia care in LMIC:

- 1) establishing that safe access to obstetric anaesthesia and analgesia is a human right
- 2) avoiding patient delay in care at all junctures, using clear indicators, for an objective evaluation of improvement
- 3) establishing and educating teams of sufficient size and structure to provide the necessary care.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they do not have existing conflict of interest.

References

Papers of particular interest, published recently, have been highlighted as:

- Of importance
- Of major importance

1. Say L, Chou D, Gemmill A, Tunçalp Ö, Moller AB, Daniels J, Gülmezoglu AM, Temmerman M, Alkema L. Global causes of maternal death: a WHO systematic analysis. *Lancet Glob Health*. 2014;2(6):e323–33. [https://doi.org/10.1016/S2214-109X\(14\)70227-X](https://doi.org/10.1016/S2214-109X(14)70227-X).
2. Pelland A. MD, RB George MD FRCPC. Safe obstetric anaesthesia in low- and middle-income countries. *BJA Educ*. 2017;17(6):194–7. <https://doi.org/10.1093/bjaed/mkw073>.
3. Clyburn P, Morris S, Hall J. Anaesthesia and safe motherhood. *Anaesthesia*. 2007;62(Suppl 1):21–5. <https://doi.org/10.1111/j.1365-2044.2007.05293.x>.
4. Hoyler M, Finlayson SR, McClain CD, Meara JG, Hagander L. Shortage of doctors, shortage of data: a review of the global surgery, obstetrics, and anaesthesia workforce literature. *World J Surg*. 2014;38(2):269–80. <https://doi.org/10.1007/s00268-013-2324-y>.
- 5.● Reed A, Mumba JM, Dyer R. A spotlight on obstetric anaesthesia in the developing world: finally getting the attention it deserves. *Anesth Analg*. 2015;120(6):1179–81. <https://doi.org/10.1213/ANE.0000000000000722>. **It highlights the importance and specific problems in the field of obstetric anaesthesia.**
- 6.● Sobhy S, Zamora J, Dharmarajah K, Arroyo-Manzano D, Wilson M, Navaratnarajah R, Coomarasamy A, Khan KS, Thangaratnam S. Anaesthesia-related maternal mortality in low-income and middle-income countries: a systematic review and meta-analysis. *Lancet Glob Health*. 2016;4(5):e320–7. [https://doi.org/10.1016/S2214-109X\(16\)30003-1](https://doi.org/10.1016/S2214-109X(16)30003-1). **Focused meta-analysis on anaesthesia-related maternal mortality.**
7. McClure JH, Cooper GM, Clutton-Brock TH. Saving mothers' lives: reviewing maternal deaths to make motherhood safer: 2006–8: a review. *Br J Anaesth*. 2011;107(2):127–32. <https://doi.org/10.1093/bja/aer192>.
8. Knight M, Bunch K, Tuffnell D, Patel R, Shakespeare J, Kotnis R, Kenyon S, Kurinczuk JJ (Eds.) on behalf of MBRRACE-UK. Saving Lives, Improving mothers' care - lessons learned to inform maternity care from the UK and Ireland Confidential Enquiries into Maternal Deaths and Morbidity 2017–19. Oxford: National Perinatal Epidemiology Unit, University of Oxford 2021.
- 9.● Lim G. What is new in obstetric anaesthesia in 2020: a focus on research priorities for maternal morbidity, mortality, and postpartum health. *Int J Obst Anesth*. 2022;51:103568. <https://doi.org/10.1016/j.ijoa.2022.103568>. **Very recent paper that highlights recent facts related to inequity in maternal care.**
10. Kitila SB, Feyissa GT, Olika AK, Wordofa MA. Maternal healthcare in low- and middle-income countries: a scoping review. *Health Serv Insights*. 2022;21(15):11786329221100310. <https://doi.org/10.1177/11786329221100310>.
- 11.●● Minehart RD, Katz D. Decision making in obstetric anaesthesia. *Anesthesiol Clin*. 2021;39:793–809. <https://doi.org/10.1016/j.anclin.2021.08.013>. **It is focused on decision making, trying to highlight non-technical skills.**
12. Edmondson A. Psychological safety and learning behavior in work teams. *Adm Sci Q*. 1999;44(2):350–83. <https://doi.org/10.2307/2666999>.
13. Edmondson AC. Speaking up in the operating room: how team leaders promote learning in interdisciplinary action teams. *J Manage Stud*. 2003;40:1419–52. <https://doi.org/10.1111/1467-6486.00386>.
14. Ronsmans C, Graham WJ. Lancet maternal survival series steering group. Maternal mortality: who, when, where, and why. *Lancet*. 2006;368(9542):1189–200. [https://doi.org/10.1016/S0140-6736\(06\)69380-X](https://doi.org/10.1016/S0140-6736(06)69380-X).
- 15.●● Meara JG, Leather AJ, Hagander L, Alkire BC, Alonso N, Ameh EA, Bickler SW, Conteh L, Dare AJ, Davies J, Mésieris ED, El-Halabi S, Farmer PE, Gawande A, Gillies R, Greenberg SL, Grimes CE, Gruen RL, Ismail EA, Kamara TB, Lavy C, Lundeg G, Mkandawire NC, Raykar NP, Riesel JN, Rodas E, Rose J, Roy N, Shrimme MG, Sullivan R, Verguet S, Watters D, Weiser TG, Wilson IH, Yamey G, Yip W. Global surgery 2030: evidence and solutions for achieving health, welfare, and economic development. *Lancet*. 2015;386(9993):569–624. [https://doi.org/10.1016/S0140-6736\(15\)60160-X](https://doi.org/10.1016/S0140-6736(15)60160-X). **Political picture trying to focus on achievable goals for the next future.**
16. Cavallaro FL, Marchant TJ. Responsiveness of emergency obstetric care systems in low- and middle-income countries: a critical review of the “hird delay.” *Acta Obstet Gynecol Scand*. 2013;92(5):496–507. <https://doi.org/10.1111/aogs.12071>.
- 17.● van Dyk D, Dyer RA, Bishop DG. Spinal hypotension in obstetrics: context-sensitive prevention and management. *Best Pract Res Clin Anaesthesiol*. 2022;1:69–82. <https://doi.org/10.1016/j.bpa.2022.04.001>. **It highlights the differences in the problems because of a common problem in LMIC and HIC, providing different solutions.**
18. Weeks A, Faúndes A. Misoprostol in obstetrics and gynecology. *Int J Gynaecol Obstet*. 2007;99(Suppl 2):S156–9. <https://doi.org/10.1016/j.ijgo.2007.09.003>.
19. Schnittger T. Regional anaesthesia in developing countries. *Anaesthesia*. 2007;62(Suppl 1):44–7. <https://doi.org/10.1111/j.1365-2044.2007.05297.x>.
20. Ababneh O, Alrabayah M, El-Share AI, Bsisu I, Bahar Y, Dabousi B, Sandoqa A, AlWreikat D, Qatawneh A. Perioperative outcomes in COVID-19 obstetric patients undergoing spinal anaesthesia for cesarean section: a prospective observational study. *Healthcare*. 2022;10(1):23. <https://doi.org/10.3390/healthcare10010023>.
21. Ioscovich A, Guasch E, Brogly N, Shatalin D, Manrique-Muñoz S, Sánchez Royo ME, Zimro S, Ginosar Y, Lages N, Weinstein J, Berkenstadt H, Greenberger C, Lazutkin A, Izakson A, Ioscovich D, Orbach-Zinger S, Weiniger CF. Peripartum anesthetic management of women with SARS-CoV-2 infection in eight medical centers across three European countries: prospective cohort observation study. *J Matern Fetal Neonatal Med*. 2021;9:1–8. <https://doi.org/10.1080/14767058.2021.1937105>.

22. ● Merry AF, Cooper JB, Soyannwo O, Wilson IH, Eichhorn JH. International standards for a safe practice of anaesthesia 2010. *Can J Anaesth.* 2010;57(11):1027–34. <https://doi.org/10.1007/s12630-010-9381-6>. **Last version available of standards of practice in anaesthesia by WFSA. Standardization is vital for success in LMIC.**
23. Epiu I, Tindimwebwa JV, Mijumbi C, Chokwe TM, Lugazia E, Ndarugirire F, Twagirumugabe T, Dubowitz G. Challenges of anaesthesia in low- and middle-income countries: a cross-sectional survey of access to safe obstetric anaesthesia in East Africa. *Anesth Analg.* 2017;124(1):290–9. <https://doi.org/10.1213/ANE.0000000000001690>.
24. Olufolabi AJ, Atito-Narh E, Eshun M, Ross VH, Muir HA, Owen MD. Teaching neuraxial anaesthesia techniques for obstetric care in a Ghanaian referral hospital: achievements and obstacles. *Anesth Analg.* 2015;120(6):1317–22. <https://doi.org/10.1213/ANE.0000000000000464>.
25. Kopic D, Sedensky A, Owen M. The impact of a teaching program on obstetric anaesthesia practices in Croatia. *Int J Obstet Anesth.* 2009;18:4–9. <https://doi.org/10.1016/j.ijoa.2008.04.007>.
26. Kayongo M, Rubardt M, Butera J, Abdullah M, Mboninyibuka D, Madili M. Making EmOC a reality—CARE’s experiences in areas of high maternal mortality in Africa. *Int J Gynaecol Obstet.* 2006;92(3):308–19. <https://doi.org/10.1016/j.ijgo.2005.12.003>.
27. Kayongo M, Esquiche E, Luna MR, Frias G, Vega-Centeno L, Bailey P. Strengthening emergency obstetric care in Ayacucho. *Peru Int J Gynaecol Obstet.* 2006;92(3):299–307. <https://doi.org/10.1016/j.ijgo.2005.12.005>.
28. Dyer RA, Reed AR, James MF. Obstetric anaesthesia in low-resource settings. *Best Pract Res Clin Obstet Gynaecol.* 2010;24(3):401–12. <https://doi.org/10.1016/j.bpobgyn.2009.11.005>.
29. Evans FM, Duarte JC, Haylock Loor C, Morriss W. Are short subspecialty courses the educational answer? *Anesth Analg.* 2018;126(4):1305–11. <https://doi.org/10.1213/ANE.0000000000002664>.
30. ● <https://wfsahq.org/our-work/education-training/safe-training/> (accessed October 20th, 2022). **Recently updated document of WFSA on training in LMIC using SAFE courses.**
31. Enright A, Grady K, Evans F. A new approach to teaching obstetric anaesthesia in low-resource areas. *J Obstet Gynaecol Can.* 2015;37(10):880–4. [https://doi.org/10.1016/s1701-2163\(16\)30021-4](https://doi.org/10.1016/s1701-2163(16)30021-4).
32. White MC, Rakotoarisoa T, Cox NH, Close KL, Kotze J, Watrous A. A mixed-method design evaluation of the SAFE obstetric anaesthesia course at 4 and 12–18 months after training in the Republic of Congo and Madagascar. *Anesth Analg.* 2019;129(6):1707–14. <https://doi.org/10.1213/ANE.0000000000004329>.
33. Moore JN, Morriss WW, Asfaw G, Tesfaye G, Ahmed AR, Walker IA. The impact of the Safer Anaesthesia from Education (SAFE) Obstetric Anaesthesia training course in Ethiopia: A mixed methods longitudinal cohort study. *Anaesth Intensive Care.* 2020;48(4):297–305. <https://doi.org/10.1177/0310057X20940330>.
34. Livingston P, Evans F, Nsereko E, Nyirigira G, Ruhato P, Sargeant J, Chipp M, Enright A. Safer obstetric anaesthesia through education and mentorship: a model for knowledge translation in Rwanda. *Can J Anaesth.* 2014;61(11):1028–39. <https://doi.org/10.1007/s12630-014-0224-8>.
35. White MC, Rakotoarisoa T, Cox NH, Close KL, Kotze J, Watrous A. A mixed-method design evaluation of the SAFE Obstetric Anaesthesia Course at 4 and 12–18 Months after training in the Republic of Congo and Madagascar. *Anesth Analg.* 2019;129(6):1707–14. <https://doi.org/10.1213/ANE.0000000000004329>.
36. Peberdy MA, Cretikos M, Abella BS, DeVita M, Goldhill D, Kloeck W, et al. Recommended guidelines for monitoring, reporting, and conducting research on medical emergency team, outreach, and rapid response systems: an Utstein-style scientific statement: a scientific statement from the International Liaison Committee on Resuscitation (American Heart Association, Australian Resuscitation Council, European Resuscitation Council, Heart and Stroke Foundation of Canada, Inter American Heart Foundation, Resuscitation Council of Southern Africa, and the New Zealand Resuscitation Council); the American Heart Association Emergency Cardiovascular Care Committee; the Council on Cardiopulmonary, Perioperative, and Critical Care; and the Interdisciplinary Working Group on Quality of Care and Outcomes Research. *Circ.* 2007;116(21):2481–500. <https://doi.org/10.1161/CIRCULATIONAHA.107.186227>.
37. ● Davies JI, Gelb AW, Gore-Booth J, Martin J, Mellin-Olsen J, Åkerman C, et al. Global surgery, obstetric, and anaesthesia indicator definitions and reporting: an Utstein consensus report. *PLoS Med.* 2021;18(8):e1003749. <https://doi.org/10.1371/journal.pmed.1003749>. **Important political paper dedicated to an objective evaluation of actions and programs.**
38. ● Haider A, Scott JW, Gause CD, Meheš M, Hsiung G, Prelvukaj A, Yanocha D, Baumann LM, Ahmed F, Ahmed N, Anderson S, Angate H, Arfaa L, Asbun H, Ashengo T, Asuman K, Ayala R, Bickler S, Billingsley S, Bird P, Botman M, Butler M, Buyske J, Capozzi A, Casey K, Clayton C, Cobey J, Cotton M, Deckelbaum D, Derbew M, deVries C, Dillner J, Downham M, Draisin N, Echinard D, Elneil S, ElSayed A, Estelle A, Finley A, Frenkel E, Frykman PK, Gheorghie F, Gore-Booth J, Henker R, Henry J, Henry O, Hoemeke L, Hoffman D, Ibanga I, Jackson EV Jr, Jani P, Johnson W, Jones A, Kassem Z, Kisebo A, Kocan A, Krishnaswami S, Lane R, Latif A, Levy B, Linos D, Linz P, Listwa LA, Magee D, Makasa E, Marin ML, Martin C, McQueen K, Morgan J, Moser R, Neighbor R, Novick WM, Ogendo S, Omigbodun A, Onajin-Obembe B, Parsan N, Philip BK, Price R, Rasheed S, Ratel M, Reynolds C, Roser SM, Rowles J, Samad L, Sampson J, Sanghvi H, Sellers ML, Sigalet D, Steffes BC, Stieber E, Swaroop M, Tarpley J, Varghese A, Varughese J, Wagner R, Warf B, Wetzig N, Williamson S, Wood J, Zeidan A, Zirkle L, Allen B, Abdullah F. Development of a unifying target and consensus indicators for global surgical systems strengthening: proposed by the global alliance for surgery, obstetric, trauma, and anaesthesia care (The G4 Alliance). *World J Surg.* 2017;41(10):2426–34. <https://doi.org/10.1007/s00268-017-4028-1>. **Objective evaluation of actions, programs, etc.**
39. Seyi-Olajide JO, Anderson JE, Williams OM, Faboya O, Amedu JO, Anyanwu SNC, et al. National surgical, obstetric, anaesthesia and nursing plan. *Nigeria Bull World Health Organ.* 2021;99:883–91. <https://doi.org/10.2471/BLT.20.280297>.

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Springer Nature or its licensor (e.g. a society or other partner) holds exclusive rights to this article under a publishing agreement with the author(s) or other rightsholder(s); author self-archiving of the accepted manuscript version of this article is solely governed by the terms of such publishing agreement and applicable law.