

Safety in Non-Operating Room Anaesthesia in Low-and Middle-Income Countries: Challenges and Opportunities

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Abstract

Given the increase of minimally invasive procedures in many medical specialties, non-operating room anaesthesia (NORA) is a fast-growing field that presents both challenges and opportunities, particularly in low- and middle-income countries (LMICs). We aim to explore the technical, organisational, economic, and educational dimensions of NORA in LMICs, highlighting the unique hurdles faced and potential avenues for improvement. The challenges NORA faces in LMICs offer opportunities for innovation and improvement. By addressing equipment shortages, strengthening training programmes, optimising workflows, fostering interprofessional collaboration, and exploring funding mechanisms, LMICs can enhance NORA practices and improve patient outcomes.

Key words: low and middle income countries, non-operating room anaesthesia, staffing, education, health-care economics

INTRODUCTION

Non-operating room anaesthesia (NORA) refers to the administration of anaesthesia outside traditional operating room settings.^{1,2} According to some authors, about 25%³ or 35,9%⁴ of the procedures involving anaesthesia provider's care are performed outside the operating room, and this number is likely to increase.⁵ Although anaesthesiologists are located primarily in operating theatres or intensive care units, NORA is becoming progressively more popular, both because of the increase in the number of procedures and because of the improved patient comfort that is now being achieved in procedures that used to be performed without anaesthesia. Due to this fact, the American Society of Anaesthesiology has published a guidance document describing the minimal standards to administer anaesthesia in NORA locations.⁶

Anesthesiologists, who are in a position of leadership in perioperative medicine, are responsible for providing patient care during all NORA procedures. Although anaesthesiology has been regarded as a less competitive speciality to get into, particularly in LMICs, it is primarily as a result of the work of the anaesthesiologist and technological advances that surgery is increasingly able to offer a wider range of services and that patient safety has improved exponentially.⁷

The NORA environment entails a completely different approach from the Operating Room Anaesthesia (ORA) location since mortality has been reported to be twice the mortality described in the ORA setting.⁸ Also, NORA is associated with higher morbidity, a higher rate of claims attributable to inadequate oxygenation, and a higher proportion of side effects related to substandard care.⁹

Healthcare systems in low- and middle-income countries (LMICs) face a unique set of challenges in implementing and optimizing NORA practices due to resource constraints, infrastructure limitations, and socioeconomic factors.¹⁰ Other huge challenges are the often lacking human resources to administer anaesthesia and/or inadequate education and training of the anaesthesia providers at hand.¹¹ However, these settings may also present opportunities for innovative solutions to improve patient care and healthcare delivery.^{12,13}

The anaesthesiologist therefore has a global role and must ensure the same standards of the best medical treatment and maximum safety in any location where a technique or procedure is performed under anaesthesia. However, these proceedings represent a paradigm shift in view of the fact that they involve

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a set of variables that need to be considered in addition to those included in the ORA setting. We aim to explore the challenges and opportunities associated with NORA in LMICs, focusing on the technical, organisational, economic and educational dimensions (Figure 1) to provide recommendations for enhancing anaesthesia care outside the operating room, ultimately contributing to improved healthcare outcomes for patients in LMICs.¹⁴

Technical challenges:

LMICs often face shortages of essential anaesthesia equipment and supplies, including monitoring devices, airway management tools, and drugs.^{15,16} Limited availability and inadequate maintenance of equipment may hinder the safe administration of anaesthesia in NORA settings.¹⁷ Innovative approaches, such as portable and low-cost equipment solutions, can address these challenges.^{2,12}

The availability of basic requirements such as running water, constant electricity and an adequate supply of oxygen can be highly variable in LMICs.¹⁸ In addition to infrastructural needs, basic monitoring, such as a pulse oximeter, is also necessary. A 2007 survey in Uganda

found that 74% of anaesthesia was performed without a pulse oximeter¹⁹ and that almost 35% of healthcare facilities have no access to oxygen.²⁰ Other Asian countries described a similar situation with lack of resources and trustworthy equipment to perform anaesthesia safely.²¹

NORA environments introduce additional complexity in patient assessment and selection.²² The absence of sterile conditions, unpredictable patient acuity, and varying procedure types pose challenges for anaesthesia providers. Developing standardised protocols for patient assessment and selection, including risk stratification tools, can enhance patient safety and optimize outcomes.^{1,10,23}

Certain anaesthetic techniques, such as regional anaesthesia and sedation, are well-suited for NORA.²⁴ However, skill gaps and limited training opportunities in these techniques may pose a significant challenge.²⁵ Strengthening training programmes, promoting knowledge exchange through partnerships, and utilizing simulation-based education can enhance anaesthesia providers' skills and increase the adoption of appropriate techniques.²⁴

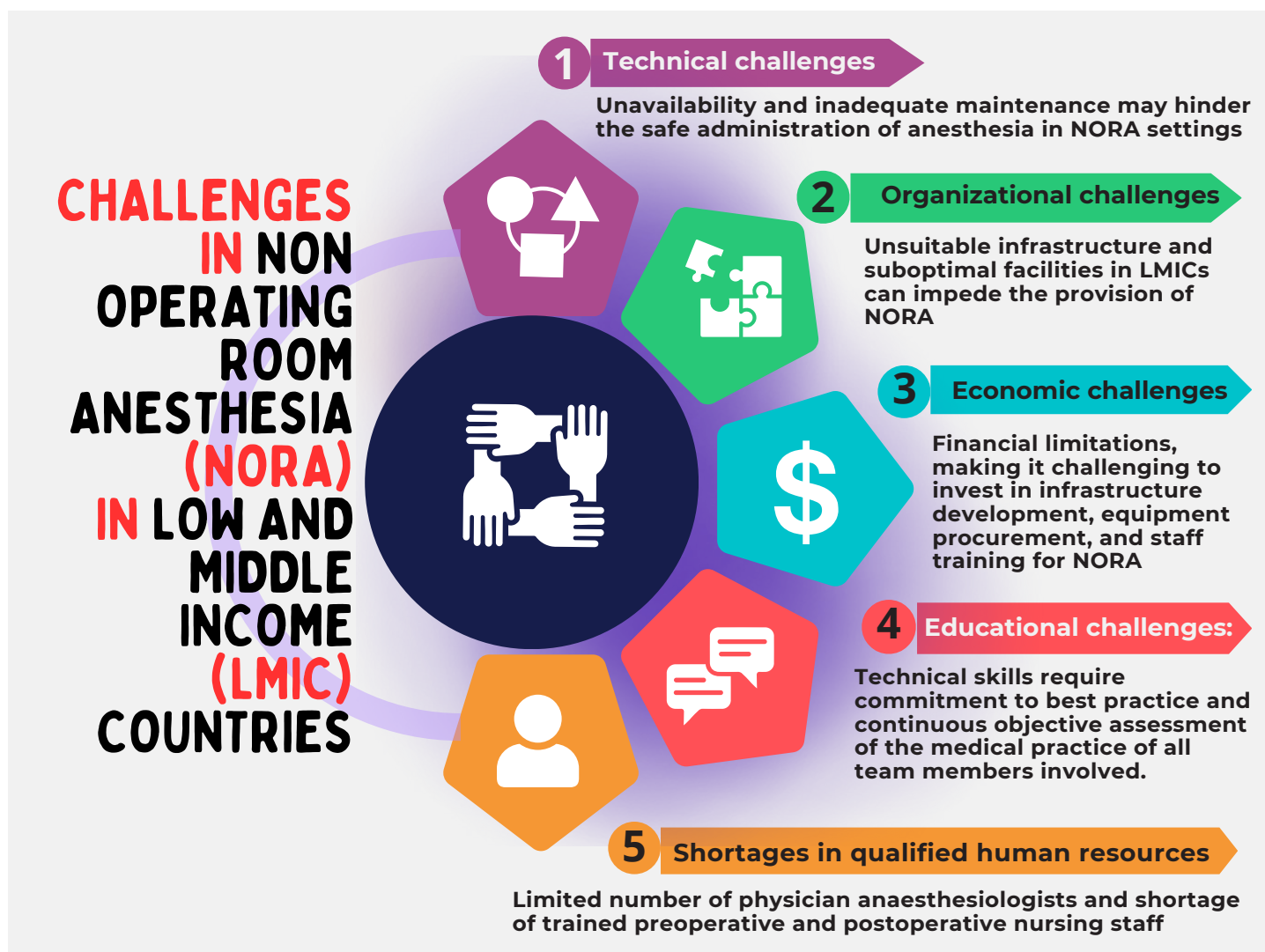


Figure 1– Critical dimensions to address safety in Non-Operating Room Anesthesia (NORA) in Low-and Middle-Income Countries (LMICs).

Organisational challenges:

Limited availability of suitable infrastructure and suboptimal facilities in LMICs can impede the provision of NORA.^{26,27} Inadequate recovery areas, absence of appropriate monitoring systems, and lack of infection control measures are significant concerns.¹⁰ Collaborative efforts involving policymakers, healthcare administrators, and anaesthesia societies are necessary to improve infrastructure and establish minimum standards for NORA settings.^{22,26}

Collaboration among healthcare professionals, including anaesthesiologists, surgeons, nurses, and technicians, is crucial for the success of NORA.^{1,2} However, poor interdisciplinary communication, hierarchical barriers, and limited teamwork hinder effective collaboration.²⁸ In addition, NORA environments often lack efficient workflow systems, leading to delays, overcrowding, and suboptimal resource utilization. Additionally, integrating NORA services within existing healthcare structures can facilitate better coordination and resource allocation.²⁹ These situations are critical in some LMIC where there is significant shortage of anaesthesiologists and the majority of NORA procedures are performed by nurses or by clinical assistants.²⁰ It is important to urgently address the need for supporting local residency and fellowship programmes in LMICs to promote the continuous growth of local and adequately trained anaesthesia workforce.

Economic challenges:

LMICs face financial limitations, making it challenging to invest in infrastructure development, equipment procurement, and staff training for NORA.¹⁰ Exploring innovative funding mechanisms, such as public-private partnerships, international collaborations, and grants, can help overcome financial barriers and sustain NORA initiatives.^{10,22,26} Therefore demonstrating the cost-effectiveness and value of NORA is essential to secure funding and support from policymakers and healthcare institutions. Conducting health economic evaluations, generating local evidence, and highlighting the long-term benefits of NORA, including reduced surgical complications and improved patient outcomes, can strengthen the case for investment.²²

One of the biggest issues for LMICs is precisely not having adequate data collecting systems or effective incident notification protocols to properly create sufficient and adequate statistical information with enough economic impact. A very important international collaboration or grant would be sharing adequate data collecting platforms or donation of computer-based programmes that may help gather these important findings.

Last but not least, the exact cost of services provided during NORA has not been widely studied. While a cost of approximately \$35 United States Dollars (USD) per minute of NORA has been mentioned, other groups have underpinned the cost to be as high as almost \$300 USD.³⁰ Undoubtedly, the economic impact will be one of the limiting factors in whether or not the use of NORA will increase in LMICs.

Educational challenges:

General anaesthesia together with monitored anaesthetic care are the most frequently used techniques in the context of NORA.

However, regional anaesthesia may also have a wide applicability in this setting.³¹ Regional anaesthesia has clear benefits in the sense that the patient may not require any sedation thereby reducing airway risks.³² However, regional anaesthesia requires well-trained anaesthesiologists and an organisational system that supports the longer pre-intervention times that are required for the performance of these techniques. This is particularly the case while using regional anaesthesia in children,^{30,33} a situation that has not yet been extensively evaluated.

Technical skills require commitment to best practice and continuous objective assessment of the medical practice of all team members involved.³⁴ It has been found that the percentage of patient complaints was higher in NORA procedures than in conventional operating room procedures.³⁵ Adherence to clinical practice guidelines and the highest quality standards should be applied without exception, as the unique characteristics of NORA procedures can compromise patient safety, either immediately during the procedure, or in the short term after the intervention.

Free online educational courses, safety and quality workshops, short term anaesthesia training programmes, teacher-mentoring collaborations and anaesthesia residency programmes should be promoted, advertised, and strengthened worldwide.

NORA procedures tend to be shorter so that large numbers of patients with diverse co-morbidities and a variety of clinical presentations, can be treated during a working day. In LMICs, specially in public hospital settings, the number of daily procedures is usually quite large and to avoid cancellations many children and adults are left with long hours of fasting. Many patients travel from long and difficult to access communities, making same day preanesthetic evaluation an unavoidable practice, they are usually placed in distressing or crowded waiting rooms and are occasionally discharged late. Due to the enormous workload, several times, patients feel avoided, ignored or underinformed.

Cultural beliefs make them prone to herbal medications that may be of therapeutical concern, non-compliant to fasting instructions and uncomfortable with same day discharging.

Native languages may cause communication barriers and poor educational background bring about deficient comprehension of the clinical situation and NORA pre and post procedural instructions.

Economic factors make patients from LMICs prone to malnutrition and untreated or undiagnosed illness.

The integration of NORA assessment clinics at all community health centres may help detect several weeks prior to procedure, all possible health derangements that may cause patient discomfort or avoidable surgical-anaesthesia cancellations.

Shortages in qualified human resources:

In addition to the challenges described earlier, LMICs also face a critical shortage of manpower trained in providing safe and robust perioperative care. Limited numbers of physician anaesthesiologists, increased reliance on non-physician anaesthesia providers, and shortage of trained preoperative and postoperative nursing staff

have been described in the literature from LMICs.^{36,37} With such constraints of trained human resources affecting capacity and patient flow in the operating theatres, the same is likely to hold true for operating sustainable NORA services in LMICs as well. Continued education and training opportunities for healthcare workers is largely non-existent. High rates of staff attrition due to migrations, redeployment of hospital staff and burnout syndrome are some of the many burdens anaesthesiologists in LMICs must endure.^{38,39}

Hospital administrators and managers would need to first address these human resource issues to ensure that NORA services are provided in a manner that it safe and sustainable. Understanding the importance of addressing this issue as soon as possible is the basis of anaesthesia procedural quality and safety improvement and NORA successful implementation in LMICs.

Opportunities for improvement:

Advances in technology, such as portable monitoring devices, telemedicine, and mobile applications, offer opportunities to enhance NORA practices in LMICs.¹⁰ Leveraging these technologies can improve patient monitoring, facilitate remote consultation, and enable real-time data collection for research and quality improvement initiatives.^{40,41} Investing in anaesthesia training programmes, workshops, and simulation centres can enhance the skills and knowledge of anaesthesia providers.^{1,10} Collaborative partnerships between high-income countries and LMICs, as well as regional knowledge-sharing networks, can contribute to capacity building and knowledge dissemination.⁴² Other initiatives already on the agenda propose further research in relation to the discovery of new sedative and analgesic drugs that are safe and allow anaesthesia to be performed outside the operating theatre with fewer adverse events.⁴³

Patient selection is another cornerstone of the NORA framework³⁰ combined with strong policy including guidelines, regulations, and quality assurance mechanisms, are vital for promoting and sustaining NORA practices.²² Engaging policymakers and advocating for the integration of NORA in national surgical and anaesthesia plans can facilitate the development of supportive policies.^{22,44}

CONCLUSION

Non-Operating Room Anaesthesia (NORA) in low- and middle-income countries presents numerous challenges in technical, organisational, workforce and economic dimensions. However, these challenges also offer opportunities for innovation and improvement. By addressing equipment shortages, strengthening training programmes, optimizing workflows, fostering interprofessional collaboration, and exploring funding mechanisms, healthcare systems in LMICs can enhance NORA practices and improve patient outcomes. Continued research, investment, and collaboration are necessary to overcome barriers and unlock the full potential of NORA in LMICs.

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