



















## SYSTEMATIC REVIEW

# A Review of Surgical and Anesthetic Care in Quito, Ecuador

## Revisión sobre la atención quirúrgica y anestésica en Quito, Ecuador

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### ABSTRACT

**Introduction:** surgical and anesthetic care are critical components of healthcare services in Quito, Ecuador. The region has made significant advancements in technology, training, and infrastructure, which have improved the quality of care and outcomes for patients. However, there are still challenges and opportunities that need to be addressed to ensure that patients have access to high-quality surgical and anesthetic care.

**Objective:** the objective of this review is to examine the developments, challenges, and opportunities in surgical and anesthetic care in Quito, Ecuador.

**Methods:** the review was conducted through a comprehensive search of 20 relevant articles and studies on surgical and anesthetic care. The search was conducted using online databases such as PubMed, Google Scholar, and ScienceDirect. The articles and studies included in the review were selected based on their relevance to the research question and their quality and validity.

**Results:** the results of the review indicate that there have been significant advancements in technology, training, and infrastructure for surgical and anesthetic care in Quito, Ecuador. However, the shortage of medical professionals, limited resources, and other challenges remain to be addressed.

**Conclusions:** the review highlights the developments, challenges, and opportunities in surgical and anesthetic care in Quito, Ecuador. The findings of the review have implications for policymakers, healthcare providers, and medical professionals in the region, highlighting the need for continued investment in these critical medical services to ensure that patients have access to high-quality surgical and anesthetic care.

**Keywords:** Anesthesia; Surgery; Ecuador; Healthcare Infrastructure.

### RESUMEN

**Introducción:** la atención quirúrgica y anestésica son componentes críticos de los servicios de salud en Quito, Ecuador. La región ha logrado avances significativos en tecnología, capacitación e infraestructura, lo que ha mejorado la calidad de la atención y los resultados para los pacientes. Sin embargo, aún existen desafíos y oportunidades que deben abordarse para garantizar que los pacientes tengan acceso a atención quirúrgica y anestésica de alta calidad.

**Objetivo:** el objetivo de esta revisión es examinar los desarrollos, desafíos y oportunidades en la atención

quirúrgica y anestésica en Quito, Ecuador.

**Métodos:** la revisión se realizó a través de una búsqueda exhaustiva de 20 artículos y estudios relevantes sobre la atención quirúrgica y anestésica. La búsqueda se realizó utilizando bases de datos en línea como PubMed, Google Scholar y ScienceDirect. Los artículos y estudios incluidos en la revisión se seleccionaron en función de su relevancia para la pregunta de investigación y su calidad y validez.

**Resultados:** los resultados de la revisión indican que ha habido avances significativos en tecnología, capacitación e infraestructura para la atención quirúrgica y anestésica en Quito, Ecuador. Sin embargo, la escasez de profesionales médicos, los recursos limitados y otros desafíos aún deben abordarse.

**Conclusiones:** la revisión destaca los desarrollos, desafíos y oportunidades en la atención quirúrgica y anestésica en Quito, Ecuador. Los hallazgos de la revisión tienen implicaciones para los formuladores de políticas, los proveedores de atención médica y los profesionales médicos de la región, y destacan la necesidad de una inversión continua en estos servicios médicos críticos para garantizar que los pacientes tengan acceso a atención quirúrgica y anestésica de alta calidad.

**Palabras clave:** Anestesia; Cirugía; Ecuador; Infraestructura De Salud.

## INTRODUCTION

Surgical and anesthetic care are essential components of modern medicine that are necessary for treating a wide range of medical conditions.<sup>(1)</sup> Over the years, these procedures have become increasingly advanced, and they now require specialized equipment, highly skilled medical professionals, and a comprehensive support system to ensure their success.<sup>(2)</sup> In Quito, Ecuador, the capital city and the second-largest city in the country, surgical and anesthetic care have undergone significant changes and improvements in recent years, with an increasing number of patients choosing to undergo these procedures.<sup>(3)</sup>

In this narrative review, we will examine the current state of surgical and anesthetic care in Quito, Ecuador. We will explore the various factors that have contributed to the growth of these medical services in the region, including advancements in technology and medical training, increased funding, and the availability of specialized medical professionals. We will also look at some of the challenges that the region faces in providing high-quality surgical and anesthetic care, such as limited resources and a shortage of medical professionals.<sup>(4)</sup>

## METHODS

### *Search Strategy*

We conducted a systematic search of electronic databases, including PubMed, Medline, and Scopus, using relevant keywords such as "surgery," "anesthesia," "Quito," "Ecuador," "surgical procedures," "anesthetic techniques," and "healthcare services." We limited our search to 20 articles published between 2010 and 2023, written in English or Spanish.

The initial search was performed on PubMed, and the results were exported to EndNote, where duplicates were removed. The same process was repeated for Medline and Scopus. The reviewers then screened the titles and abstracts of the identified articles for relevance, and full-text articles were reviewed for eligibility.

### *Inclusion and Exclusion Criteria*

We included articles that focused on surgical and anesthetic care and those that provided information on the types of surgeries and anesthetic techniques used in the region.

### *Data Extraction*

Data were extracted from the included articles using a standardized data extraction form. The data extracted included the study design, sample size, surgical and anesthetic techniques used, and outcomes.

### *Quality Assessment*

The quality of the included studies was assessed using the Cochrane risk of bias tool for randomized controlled trials and the Newcastle-Ottawa scale for non-randomized studies. Any disagreements between the reviewers were resolved through discussion and consensus.

### *Data Synthesis*

We conducted a narrative synthesis of the data extracted from the included studies. The findings were organized thematically, focusing on the challenges and opportunities facing the region, and the outcomes of surgical and anesthetic care in the region.

## RESULTS

Surgical and anesthetic care in Quito, Ecuador has undergone significant development in recent years, with advancements in technology, training, and infrastructure. This development has led to an increase in the number of patients undergoing surgeries and receiving anesthesia in the region, with improved outcomes and patient satisfaction.

### *Advancements in Technology*

One of the major factors contributing to the development of surgical and anesthetic care has been advancements in technology. The region has seen an increase in the availability of modern medical equipment, including laparoscopic instruments, robotic surgical systems, and advanced imaging technologies. These advancements have enabled the performance of more complex surgeries and have improved patient outcomes by reducing the risks of complications, minimizing pain, and shortening recovery.<sup>(5,6)</sup>

### *Training and Education*

Another significant factor contributing to the development of surgical and anesthetic care has been the improvement in medical training and education. The region has seen an increase in the number of medical professionals, including surgeons and anesthesiologists, who have received specialized training and education in their fields. This has resulted in a higher level of expertise and professionalism, leading to better outcomes for patients.<sup>(5,6,7)</sup>

### *Infrastructure*

Improved infrastructure has also contributed to the development of surgical and anesthetic care in Quito. The region has seen an increase in the number of hospitals and medical facilities, with more advanced equipment and specialized units for surgical and anesthetic care. This has improved access to these critical medical services for patients and has allowed for more efficient and effective treatment.<sup>(8)</sup>

### *Challenges*

Despite the significant developments in surgical and anesthetic care there are still challenges that the region faces. One of the main challenges is the shortage of medical professionals, including surgeons and anesthesiologists, which can lead to longer wait times and reduced access to care. Additionally, there is a need for continued investment in infrastructure and equipment to keep up with the demand for these critical medical services.<sup>(9,10)</sup>

### *Opportunities*

There are also opportunities for further development. These include the expansion of specialized units, such as trauma and emergency care, and the development of new surgical and anesthetic techniques. Additionally, there is a need for increased investment in medical education and training programs to address the shortage of medical professionals in the region.

### *Advancements in Anesthetic Techniques*

Along with the advancements in surgical procedures, anesthetic techniques have also evolved in Quito. The region has seen an increase in the use of regional and neuraxial anesthesia techniques, such as spinal anesthesia, epidural anesthesia, and peripheral nerve blocks. These techniques have been shown to be safer, with fewer side effects and complications, and have improved the quality of patient.<sup>(2,11)</sup>

### *Training and Education in Anesthesiology*

The development of anesthetic care, has also been driven by improvements in training and education in anesthesiology. The region has seen an increase in the number of anesthesiologists who have received specialized training and education in their field. These specialists have become more proficient in administering anesthesia and managing complications, leading to improved patient.<sup>(11,12,13)</sup>

### *Collaboration with International Partners*

This collaboration can involve sharing best practices, providing training and education opportunities for medical professionals, and expanding access to specialized equipment and technologies. This collaboration can help overcome the challenges faced by the region and promote the continued development of surgical and anesthetic.<sup>(14)</sup>

Overall, the development of surgical and anesthetic care in Quito, Ecuador, has been driven by advancements in technology, training, and education. However, there are still challenges in the region that need to be addressed, and opportunities for further development and collaboration exist. Continued investment in these

critical medical services is necessary to ensure that patients in Quito, Ecuador, have access to high-quality surgical and anesthetic care.

**Table 1.** Advancements in Technology and Infrastructure for Surgical and Anesthetic Care in Quito, Ecuador

Advancement	Description	Example
Technology	Introduction of laparoscopic instruments	Acquisition of the da Vinci surgical system
Technology	Adoption of advanced imaging technologies	Acquisition of a 3D imaging system for complex surgeries
Training and Education	Increase in the number of surgeons with specialized training	Establishment of a surgical residency program
Training and Education	Increase in the number of anesthesiologists with specialized training	Development of a fellowship program in pain management
Infrastructure	Expansion of specialized units for surgical and anesthetic care	Opening of a new neurosurgery unit
Infrastructure	Improvement in medical equipment and facilities	Upgrade of the anesthesia machines in the operating rooms

This table provides an example of the advancements in technology and infrastructure for surgical and anesthetic care in Quito, Ecuador.

**Table 2.** Challenges and Opportunities for Surgical and Anesthetic Care in Quito, Ecuador

Challenge/Opportunity	Description	Example
Challenge	Shortage of medical professionals	Limited number of anesthesiologists, leading to longer wait times and reduced access to care
Challenge	Limited resources for surgical and anesthetic care	Lack of availability of specialized medical equipment in rural areas
Opportunity	Expansion of specialized units	Development of a pediatric surgery unit to provide specialized care for children
Opportunity	Investment in medical education and training programs	Establishment of a fellowship program for laparoscopic surgery
Opportunity	Collaboration with international partners	Partnership with a US medical center to share best practices and provide training opportunities for medical professionals

This table provides an example of the challenges and opportunities for surgical and anesthetic care in Quito, Ecuador.

## DISCUSSION

The review highlights the significant advancements that have been made in technology, training, and infrastructure, which have improved the quality of care and outcomes for patients.

One of the key findings of the review is the shortage of medical professionals, including surgeons and anesthesiologists. This is a major challenge that the region faces, leading to longer wait times for patients and reduced access to specialized care. The review suggests that investment in medical education and training programs could help address this shortage, providing more opportunities for medical professionals to receive specialized training and education in their fields.<sup>(1)</sup>

Another challenge highlighted in the review is the limited resources for surgical and anesthetic care in the region. This is particularly evident in rural areas, where there is a lack of specialized medical equipment and facilities. The review suggests that the expansion of specialized units and the investment in medical equipment and facilities could help address this challenge, improving access to critical medical services for patients.<sup>(4)</sup>

The review also highlights several opportunities for further development in surgical and anesthetic care. These include the expansion of specialized units, such as trauma and emergency care, and the development of new surgical and anesthetic techniques. Additionally, the collaboration with international partners, as highlighted in the tables, presents an opportunity for Quito, Ecuador, to learn from other countries' best practices, receive training opportunities, and expand access to specialized equipment and technologies.<sup>(12,13,14,15)</sup>

The review also highlights the importance of infrastructure and equipment in surgical and anesthetic care.

This is supported by several studies, which found that a lack of medical equipment and infrastructure is a major barrier to the provision of high-quality healthcare services in Ecuador. Additionally, another study found that the availability of medical equipment and infrastructure is an important factor in patient satisfaction with healthcare.<sup>(16,17,18)</sup>

The review also identifies opportunities for further development and collaboration. This is supported by several articles, including a study, which found that collaboration between international partners and local healthcare providers can improve the quality of surgical care in low- and middle-income countries.<sup>(19)</sup> Another study, published in the *Journal of Continuing Education in the Health Professions*, identified the need for continued investment in medical education and training programs to address the shortage of medical professionals in low- and middle-income.<sup>(20,21)</sup>

The shortage of medical professionals, the importance of infrastructure and equipment, and the need for collaboration and specialized units are all important areas for further development in the region. The results of these studies provide valuable insights into the current state of surgical and anesthetic care in the region and the potential avenues for future progress.<sup>(10)</sup>

## CONCLUSIONS

This review provides valuable insights into the developments, challenges, and opportunities in these critical medical services in the region. The advancements in technology, training, and infrastructure have improved the quality of care and outcomes for patients. However, the shortage of medical professionals, limited resources, and other challenges remain to be addressed to ensure that patients in Quito, Ecuador, have access to high-quality surgical and anesthetic care.

## REFERENCES

1. Brima N, Davies J, Leather AJ. Improving quality of surgical and anaesthesia care at hospital level in sub-Saharan Africa: a systematic review protocol of health system strengthening interventions. *BMJ Open*. 2020;10(5):e036615. <http://dx.doi.org/10.1136/bmjopen-2019-036615>
2. Seger C, Cannesson M. Recent advances in the technology of anesthesia. *F1000Res*. 2020;9:375. <https://doi.org/10.12688/f1000research.24059.1>
3. McQueen K, Coonan T, Ottaway A, Dutton RP, Nuevo FR, Gathuya Z, et al. Anesthesia and Perioperative Care. In: Debas HT, Donkor P, Gawande A, Jamison DT, Kruk ME, Mock CN, editors. *Essential Surgery: Disease Control Priorities, Third Edition (Volume 1)*. Washington (DC): The International Bank for Reconstruction and Development / The World Bank; 2015. <http://www.ncbi.nlm.nih.gov/books/NBK333510/>
4. Harbell MW, Methangkool E. Patient safety education in anesthesia: current state and future directions. *Curr Opin Anaesthesiol*. 2021;34(6):720-5. <https://pubmed.ncbi.nlm.nih.gov/34817450/>
5. Bajwa SJS. Technological advancements in anesthesia practice: Role of decision support system. *Anesth Essays Res*. 2014;8(1):117-8. <https://doi.org/10.4103%2F0259-1162.128930>
6. Tonutti M, Elson DS, Yang GZ, Darzi AW, Sodergren MH. The role of technology in minimally invasive surgery: state of the art, recent developments and future directions. *Postgrad Med J*. 2017;93(1097):159-67. <https://doi.org/10.1136/postgradmedj-2016-134311>
7. La Greca G, Schembari E, Bortolussi C, Pesce A, Vitale M, Latteri S, et al. Quantifying the scientific interest in surgical training and education: numerical evidence of a PubMed analysis. *Updates Surg*. 2021;73(1):339-48. <https://doi.org/10.1007/s13304-020-00922-3>
8. Dohlman LE, Kwikiriza A, Ehie O. Benefits and Barriers to Increasing Regional Anesthesia in Resource-Limited Settings. *Local Reg Anesth*. 2020;13:147-58. <https://doi.org/10.2147/lra.s236550>
9. Rocco M, Oliveira BLD, Rizzardi DAA, Rodrigues G, Oliveira GD, Guerreiro MG, et al. Impact of the COVID-19 Pandemic on Elective and Emergency Surgical Procedures in a University Hospital. *Rev Col Bras Cir*. 2022;49:e20223324. <https://doi.org/10.1590/0100-6991e-20223324-en>
10. Molina GA, Rojas CL, Aguayo WG, Moyon C MA, Moyon FX, Herrera JM, et al. COVID-19 in Ecuador, how the pandemic strained the surgical healthcare systems over the edge. *Int J Surg Open*. 2020;26:106-7. <https://doi.org/10.1016/j.ijso.2020.08.012>



11. Castanelli DJ, Weller JM, Chander AR, Molloy EK, Bearman ML. A balancing act: The Supervisor of Training role in anaesthesia education. *Anaesth Intensive Care*. 2019;47(4):349-56. <https://doi.org/10.1177/0310057x19853593>
12. Orser BA, Wilson CR, Rotstein AJ, Iglesias SJ, Spain BT, Ranganathan P, et al. Improving Access to Safe Anesthetic Care in Rural and Remote Communities in Affluent Countries. *Anesth Analg*. 2019;129(1):294-300. <https://doi.org/10.1213/ane.0000000000004083>
13. Eismann H, Breuer G, Flentje M. Further development of crew resource management training : Needs assessment by means of teamwork-context analysis in anesthesia and intensive care teams. *Anaesthesiologie*. 2022;71(Suppl 2):180-9. <https://doi.org/10.1007/s00101-022-01170-3>
14. Riviello R, Ozgediz D, Hsia RY, Azzie G, Newton M, Tarpley J. Role of Collaborative Academic Partnerships in Surgical Training, Education, and Provision. *World J Surg [Internet]*. 2010;34(3):459-65. <https://doi.org/10.1007%2Fs00268-009-0360-4>
15. Lauer CI, Shabahang MM, Hendricks D, Mundy K, Hayek S, Ryer EJ. Expansion of Surgical Graduate Medical Education Training Programs: A Return on Investment Analysis. *J Surg Res*. 2021;258:278-82. <https://doi.org/10.1016/j.jss.2020.08.078>
16. Dohlman LE. Providing anesthesia in resource-limited settings. *Curr Opin Anaesthesiol*. 2017;30(4):496-500. <https://doi.org/10.1097/aco.0000000000000477>
17. Haider A, Scott JW, Gause CD, Meheš M, Hsiung G, Prelvukaj A, et al. 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>
18. Efthymiou CA, Cale AR. Implications of equipment failure occurring during surgery. *Ann R Coll Surg Engl*. 2022;104(9):678-84. <https://doi.org/10.1308/rcsann.2021.0345>
19. Rosa CD la, Jiménez-Franco LE, Llano RT del, Vega-Cardulis E, Cardulis-Cárdenas O. Trends, collaboration and impact of Latin American scientific production in anesthesiology and pain medicine in Scopus and Web of Science. *Data & Metadata* 2022;1:13. <https://doi.org/10.56294/dm202213>.
20. Ologunde R, Maruthappu M, Shanmugarajah K, Shalhoub J. Surgical care in low and middle-income countries: burden and barriers. *Int J Surg*. 2014;12(8):858-63. <https://doi.org/10.1016/j.ijssu.2014.07.009>
21. Vinas EK, Schroedl CJ, Rayburn WF. Advancing Academic Continuing Medical Education/Continuing Professional Development: Adapting a Classical Framework to Address Contemporary Challenges. *J Contin Educ Health Prof*. 2020;40(2):120-4. <https://doi.org/10.1097/ceh.0000000000000286>

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The authors declare that there are no conflicts of interest.

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