Anesthesia Patient Safety: Next Steps to Improve Worldwide Perioperative Safety by 2030

Article *in* Anesthesia and Analgesia · April 2022

DOI: 10.1213/ANE.0000000000006028

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SPECIAL ARTICLE

Anesthesia Patient Safety: Next Steps to Improve Worldwide Perioperative Safety by 2030

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Patient safety is a core principle of anesthesia care worldwide. The specialty of anesthesiology has been a leader in medicine for the past half century in pursuing patient safety research and implementing standards of care and systematic improvements in processes of care. Together, these efforts have dramatically reduced patient harm associated with anesthesia. However, improved anesthesia patient safety has not been uniformly obtained worldwide. There are unique differences in patient safety outcomes between countries and regions in the world. These differences are often related to factors such as availability, support, and use of health care resources, trained personnel, patient safety outcome data collection efforts, standards of care, and cultures of safety and teamwork in health care facilities. This article provides insights from national anesthesia society leaders from 13 countries around the world. The countries they represent are diverse geographically and in health care resources. The authors share their countries' current and future initiatives in anesthesia patient safety. Ten major patient safety issues are common to these countries, with several of these focused on the importance of extending initiatives into the full perioperative as well as intraoperative environments. These issues may be used by anesthesia leaders around the globe to direct collaborative efforts to improve the safety of patients undergoing surgery and anesthesia in the coming decade. (Anesth Analg 2022;00:00–00)

GLOSSARY

SBAR = Situation, Background, Assessment, and Recommendation; **SENSAR** = Spanish Anesthesia Incident Reporting System; **WFSA** = World Federation of Societies of Anaesthesiologists

One hundred years ago in its inaugural issue, *Current Researches in Anesthesia & Analgesia* (subsequently named *Anesthesia & Analgesia)* published an anesthesia patient safety article, "Morbidity and Mortality in Obstetrics as Influenced by Anesthesia."[1] In the past century, the Journal has continued to serve globally as an important source of novel anesthesia and perioperative patient safety reports.

Clearly, anesthesia patient safety has improved dramatically in the past century. This is particularly true since seminal reports on critical incidents in anesthesia care,[2–4] the promulgation of anesthesia standards of care,[5–7] and the modern evolution of the anesthesia patient safety movement in America and other countries in the late 1970s and throughout the 1980s.[8] However, the distribution of improvement has not been consistent globally, and low- and middle-income countries, as defined by the World Bank,[9] currently have much higher intraoperative and perioperative mortalities and complication rates than high-income countries.[10,11]

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DOI: 10.1213/ANE.0000000000006028

Accepted for publication March 2, 2022.

Funding: None.

The authors declare no conflicts of interest.

Reprints will not be available from the authors.

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Anesthesiologists, other anesthesia providers, surgeons and other proceduralists, health researchers, and patient safety scientists around the world have worked diligently in coordinated efforts over the past several decades to improve anesthesia patient safety, including in low- and middle-income countries. For example, the World Federation of Societies of Anaesthesiologists (WFSA) first endorsed standards of intraoperative anesthesia care in 1992.[12] These standards have since evolved,[13] and in 2018, the WFSA and the World Health Organization together developed international standards for the safe practice of anesthesia.[14]

In this article, the authors provide their perspectives on the current state of anesthesia patient safety in a diverse set of countries from around the world and issues that they hope to address in the coming decade. These countries are representative of the range of health care resources available in nations around the world. The resource levels of the countries represented by these authors are reflected in the World Bank classification system (Table 1).[9] Estimated populations for the countries in 2020 may be found in data from the United Nations' Population Division and are used in the World Bank estimates of gross national product per capita.[15] To approximate anesthesia care resources within nations, the WFSA's ratio of number of physician anesthesia providers per 100,000 population in 2016 is provided.[16,17]

The countries profiled in this article were randomly chosen to represent a range of health care resourcing. To provide an expansive representation, they come from each major region of the world as described by the World Bank.[9] The authors for the country sections in this article are physician anesthesia leaders in their national societies (Figure). Their perspectives are presented in the countries' alphabetical order.

COLOMBIA (PEDRO IBARRA, ACAD, MD, MSC)

Colombia had an estimated population of 50,833,000 in 2020 and is an upper middle-income country. It had a physician anesthesia provider ratio of 7.46 per 100,000 population in 2016.

Colombia's national standards[18] are consistent with the state-of-the-art anesthesia practices and international standards.

Table 1. World Bank Country Classifications by Income Level: 2021–2022[a]

Low income	Lower middle income	Upper middle income	High income
≤$1045	$1046–$4095	$4096–$12,695	>$12,695

[a]Classification by gross national income per capita using data estimated for the 2022 fiscal year and calculated in 2020 US dollars.[9]

Three important related priorities would improve anesthesia patient safety in Colombia in the coming decade. First, the country needs mandatory review of standards in anesthesia residency training programs. Second, inclusion of safety topics in the continuing education programs of our regional and national meetings and other academic activities would advance knowledge about these topics and emphasize their importance. These presentations should specifically address adherence to our national standards and the patient safety and medicolegal implications of noncompliance. Third, the introduction of a simplified "checklist" for adherence to the most critical elements of the standards in every anesthesia case could potentially improve safety. This checklist could be incorporated into anesthesia records and, more controversially, to billing records. For the latter, noncompliance with the standards might result in a negative impact on reimbursement after a number of transgressions.

Systematic violation of standards is a major health care issue in Colombia, which, particularly in anesthesia, periodically correlates with malpractice cases. Wachter and Pronovost[19] addressed violation of standards with a provocative editorial in 2009 in which they discussed the important issues of enforcement of safety standards and accountability of individual provider performance. We could improve anesthesia patient safety in Colombia by incorporating their recommendations.

In parallel to improving standards adherence, a movement toward expanding the role of anesthesiologists by adopting a perioperative care model, with the corresponding favorable impact on outcomes by decreasing preventable perioperative complications, has been adopted in the last decade, by at least 1 of the 23 residency training programs in Colombia.

HONDURAS (CAROLINA HAYLOCK-LOOR, MD)

Honduras had an estimated population of 9905,000 in 2020 and is a lower middle-income country. It had a physician anesthesia provider ratio of 2.23 per 100,000 population in 2016.

Latin America is considered the most inequitable region in the world.[20] Honduras shares this scourge as it encompasses political, economic, and social issues that impact health care and, ultimately, patients' outcomes.

In an effort to bring more equity, patient safety outreach has been 1 of the most relevant recent initiatives in our country's health care in general and a priority for the Honduran Society of Anesthesiology. The value of patient safety is reflected in all our society's projects and endeavors. It has been 1 decade since we implemented the World Health Organization's Surgical Safety Checklist into one of our main public hospitals.

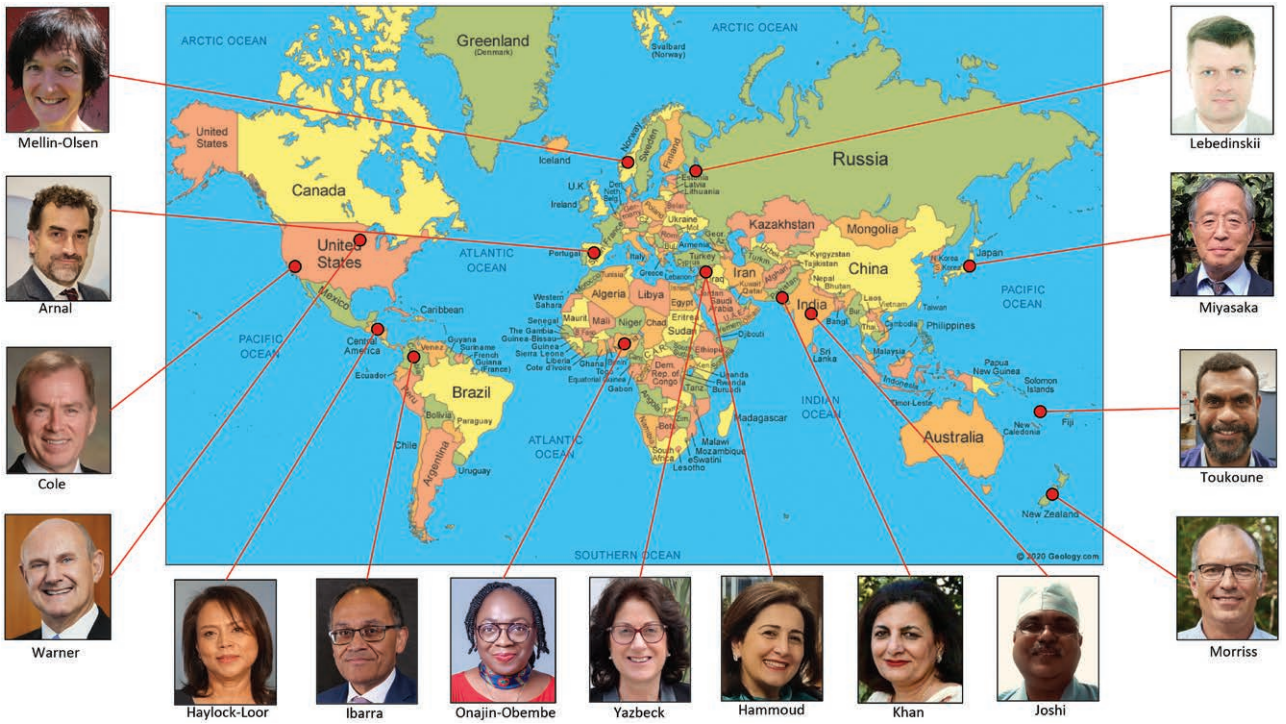

Figure. The authors and their countries. These countries represent all 4 gross national income per capita classifications and all global region categories of the World Bank.[9]

This inaugural project was reinforced through the achievement of closing the pulse oximetry gap present throughout our country in 2012 with support of our national society and with donations from the University of Florida. The society worked together with Lifebox Foundation and the WFSA to extend the Surgical Safety Checklist and pulse oximeter workshops nationwide.[21] Implementing the checklist for all procedures inside and outside the operating rooms was effective in our public hospitals, resulting in fewer preventable complications (eg, a 20% reduction in surgical infections), similar to reports from the same investigative team in Moldova.[22]

The Surgical Safety Checklist project and pulse oximeter campaign enhanced the patient safety cultures in our hospitals. The checklist process was augmented in 2013 when our government included the checklist as part of its health care regulations. We subsequently urged our private and Social Security health care systems to embrace it. For example, in 2019, we trained 32 checklist facilitators (ie, surgeons, anesthesiologists, and nurses) from 11 health care centers nationwide to continue checklist training locally.

The use of the checklist and a pulse oximeter in every surgical/anesthetic procedure is now part of our country's safety policy.[23] While we are pleased to have helped with the initial implementation of safety into our health care culture, the need to improve anesthesia patient safety and cultures of safety in health care continues. We are resolved to move forward with these efforts to promote safety everywhere and to everyone in the country.

INDIA (MURALIDHAR JOSHI, MBBS, MD)

India had an estimated population of 1380,004,000 in 2020 and is an upper middle-income country. It had a physician anesthesia provider ratio of 1.27 per 100,000 population in 2016.

The Indian Society of Anaesthesiologists has been working relentlessly to improve safety and quality of anesthesia practice in our country. The work has picked up pace over the last 2 decades. We reached a key milestone in 2021 with the introduction of our society's national registry. The registry is the first national initiative to collect standardized perioperative safety and quality data.

Our current 3 major safety initiatives are focused on improving the culture of safety and teamwork, detecting and preventing perioperative deterioration, and nonoperating room anesthesia. Even though we have a nascent national database, individual health care facilities have their own committees and teams to look into issues that impede safe practice. Training of health care professionals in relation to safe anesthesia and perioperative practices is an ongoing process. In most Indian facilities, regular audits document safety-related incidents, corrective measures, and activities to improve safety through specific training programs. These efforts are helping to create a culture of safety and teamwork.

As elsewhere, improving detection of perioperative deterioration and implementing appropriate interventions is crucial to improving anesthesia patient safety. Even minor misjudgments or miscommunications can lead to major patient safety catastrophes. Our goal as a national society is to ultimately ensure there will be enough appropriately trained health care personnel available throughout the perioperative phases of care to manage unexpected problems, anticipate and report incidents, and contribute to overall improved perioperative safety.

The nonoperating room procedural environment is a growing and challenging aspect of patient safety in anesthesia practice. Anesthesia in remote locations such as radiology, endoscopy, bronchoscopy, electroconvulsive therapy, and urodynamic procedural suites comes with their own challenges. Our national society is working to assist with initiatives to identify potentially missing resources and promote the use of checklists in these unique environments.

JAPAN (KATSUYUKI MIYASAKA, MD, PHD)

Japan had an estimated population of 126,476,000 in 2020 and is a high-income country. It had a physician anesthesia provider ratio of 9.64 per 100,000 population in 2016.

Japan faces an unprecedented superaging society, with 31.1% of the population estimated to be over age 65 by 2030.[24] Advances in less invasive surgery will decrease surgical risk, but their expanded use will likely increase the number of increasingly elderly patients who have high anesthesia risk.

Japan's health care system, paid for by the government and with guaranteed equal access, has resulted in long-life expectancies and low infant mortality. However, fundamental reform is needed as the shrinking workforce decreases tax revenue. That reform may impact anesthesia care and patient safety.

Anesthesia safety in the operating room has improved over the past decade.[25] We are concerned, however, that anesthesia and sedation are increasingly performed by nonanesthesiologists outside the operating room setting. Extending anesthesia patient safety to outside of traditional operating room environments is a high priority for us. For example, promotion of the monitoring of all spontaneously breathing sedated patients outside the operating rooms by capnometers or their equivalent is urgently needed.

To further improve anesthesia safety in and beyond the operating rooms, we are introducing the concept of perianesthesia care teams that prioritize patient safety. These teams consist of anesthesiologists, perianesthesia nurses,[26] operating room nurses, pharmacists, and other allied specialists. The perianesthesia teams focus on patient safety and communicate with surgical teams directly to improve safety at all stages of patient management.

In addition, the health care industry, including our anesthesia practices, accounts for almost 5% of global carbon dioxide emissions.[27] Dependence on single-use items, justified by the hygiene doctrine, must be minimized. We also are promoting careful integration of digital technology into electronic records. This integration will enable real-time digital surveillance of patient information and may reduce preventable errors.

LEBANON (PATRICIA YAZBECK, MD, AND ROLA HAMMOUD, MD)

Lebanon had an estimated population of 6825,000 in 2020 and is still classified as an upper middle-income country despite its current failing economy, which puts the country at risk of being downgraded by the World Bank. It had a physician anesthesia provider ratio of 9.57 per 100,000 population in 2016. This ratio may also be lower in 2022 as many physicians, including anesthesiologists, have left the country after its recent several years of civil unrest.

During the last decade, Lebanon has made important progress in terms of establishing accreditation standards. These focus on quality, health information systems, and patient safety. A study among Lebanese hospitals described staffing, punitive responses to error, and communication breakdown as major factors influencing patient safety.[28]

The operating room environment is a small sample of a health care organization in which humans, technology, biology, pharmacology, and physiology all interact together. Depending on the quality of these interactions, they can lead to persistent risk of adverse events. We find that addressing staffing issues, making improvements in communication and team building strategies, and establishing cultures of safety are very important to reducing preventable harm in the future. In a study conducted in Lebanon, 40% of participants noted a negative patient safety impact of staffing shortages, and 67% commented on the safety-related problems associated with long work hours.[28] As these elements are directly related to medical errors,[29,30] national recommendations on operating room staffing and working hours need to be implemented in Lebanon.

Two-thirds of surgical adverse events result from poor communication in the operating rooms and inadequate teamwork.[31] Approximately 40% of these errors are preventable. Effective communication with clear and accurate messages (verbal or nonverbal), a standardized communication process, and postoperative debriefings have proven effective in improving anesthesia and perioperative patient safety.[32] We plan as a society to reinforce the use of improved

communications with new tools such as the World Health Organization's Surgical Safety Checklist, Team Strategies and Tools to Enhance Performance and Patient Safety (TeamStepps), and communication techniques such as Situation, Background, Assessment, and Recommendation (SBAR).

Between 2010 and 2011, 6807 health care providers from different Lebanese hospitals were surveyed regarding the patient safety culture in their institution.[33] Eighty-two percent of participants believed that their mistakes, if reported, would affect them negatively professionally. Underreporting of errors due to a punitive environment creates fear and humiliation. Facilities with punitive environments often have a lack of strong leaders and leaders who do not promote patient safety cultures. We believe it is essential to create specific "no blame, no shame" environments that encourage error reporting of adverse events and processes to address them systematically.

NEW ZEALAND (WAYNE W. MORRISS, MB CHB)

New Zealand had an estimated population of 4822,000 in 2020 and is a high-income country. It had a physician anesthesia provider ratio of 21.71 per 100,000 population in 2016.

The vision of the New Zealand Health Quality and Safety Commission is quality health for all, or "hauora kounga mō te katoa" in the indigenous Maori language.[34] The commission provides an example of New Zealand's approach to health care that attempts to integrate community and hospital care across all sectors of society. The commission's programs include medication safety, primary care, safe surgery, reducing harm from falls, and a national trauma network.

The Postoperative Mortality Review Committee of the New Zealand Health Quality and Safety Commission is an independent committee that advises the commission.[35] The committee has produced regular reports since 2011. Recent reports have focused on trauma outcomes, surgical equity for Maori, and management of hip fractures.

Anesthesiologists are involved in initiatives addressing a range of quality and safety issues, including health care equity; teamwork, communication, and crisis management; and integrated perioperative care. Regarding the former, a 2019 report of the Postoperative Mortality Review Committee identified a lack of equity for Maori as a major factor affecting surgical outcomes.[36] The report recommended a range of improvements, including proactive management plans and collection of high-quality ethnicity data. The Australian and New Zealand College of Anaesthetists has also committed to improving equity in training and health care delivery.[37]

The use of surgical safety checklists and communication tools is now widespread in New Zealand.[38] The checklists and tools are designed to break down barriers and enhance interprofessional communication in the operating room. The Effective Management of Anesthetic Crises course, which emphasizes nontechnical skills and team dynamics, is a compulsory training requirement in Australia and New Zealand.[39]

Patient safety depends on not only what happens in the operating room but also integrated care before and after an operation. The Australian and New Zealand College of Anaesthetists is currently leading a multidisciplinary project to develop a formal perioperative medicine qualification.[40] This initiative aims to establish an effective, integrated, and collaborative perioperative care model.

NIGERIA (BISOLA ONAJIN-OBEMBE, FWACS, PHD)

Nigeria had an estimated population of 206,140,000 in 2020 and is a lower middle-income country. It had a physician anesthesia provider ratio of 0.58 per 100,000 population in 2016.

Improving patient safety in Nigeria is crucial.[41] While the motto of the Nigerian Society of Anaesthetists is "Safety First," the "high-touch, low-tech" monitoring by a vigilant physician anesthesia provider has been the country's dominant practice. Although multimodal monitors are available in most of the country's teaching hospitals and many of its private hospitals, many surgical patients in Nigeria are still monitored using only a precordial stethoscope to detect and assess heart rates and breath sounds. The availability of anesthesia and analgesic drugs is limited, and sophisticated or the state-of-the-art equipment is unavailable in many of our hospitals. Neuroaxial anesthesia, as a single-shot technique, is the only option for emergency cesarean sections in rural and peripheral hospitals.

Our most important next steps to making anesthesia safer involve improving or modernizing our anesthesia equipment, providing multimodal monitors, and making anesthesia drug readily available. Currently, outside of our teaching medical centers and best private hospitals, we do not have the equipment and drugs that would help improve anesthesia patient safety. We do not have the monitors to mandate international standards for monitoring during anesthesia in many of our smaller hospitals. In our rural and secondary hospitals, we often struggle with basics such as having reliable sources of oxygen and electricity. Our drug selection is limited in many hospitals. For example, our nondepolarizing muscle relaxants are often limited to pancuronium and atracurium, if available at all. Our next level of anesthesia patient safety will require having muscle relaxants that can provide adequate paralysis within clinically acceptable times of onset (eg, <3 minutes), capable of rapid pharmacological antagonism if required, have minimal side

effects, be noncumulative on repeated dosing, and have a short duration-of-action (15–20 minutes).

Regarding regional anesthesia, we believe we can improve patient safety and outcomes if we expand our ability to provide continuous epidural anesthesia and analgesia. We would love to advance from gravimetric infusion and intermittent bolus administration of propofol to the use of drug delivery systems such as target-controlled infusion pumps for the continuous administration of propofol. We hope that these systems and the drugs we need to administer are available and less expensive in the coming decade.

Currently, our physician anesthesia provider per 100,000 population is very low. As a national society, we must advocate for a deliberate and strategic increase in the anesthesia workforce by training more physician anesthesia providers. We believe that we will need a minimum of 4 physician anesthesia providers per 100,000 population in Nigeria to make a meaningful impact on patient safety.[42]

Specific to pediatric patients, our current practices do not support the anesthesia patient safety that we believe is needed. For example, age- and weight-specific equipment and monitoring are often not available for children. This includes pediatric-sized pulse oximeter probes and blood pressure cuffs and monitors and age-appropriate methods for warming fluids and small children.

NORWAY (JANNICKE MELLIN-OLSEN, MD, DPH)

Norway had an estimated population of 5421,000 in 2020 and is a high-income country. It had a physician anesthesia provider ratio of 25.50 per 100,000 population in 2016.

Norwegian patients are privileged as almost everyone has access to safer overall health services than most people worldwide, with these services funded by the government.[43] Specifically for anesthesia, services are organized according to the principle of flexible anesthesia teams, meaning that there should always be 2 competent anesthesia providers immediately available for every patient.[44] In our country, anesthesiology is considered to be among the most prestigious medical specialties. However, that does not mean that patient safety is perfect; patients may still be harmed even when the important elements described in the Helsinki Declaration of Patient Safety in Anaesthesiology[45,46] are incorporated into care.

Developing an improved culture of safety is an overarching necessity if we are to improve patient safety further. If we build good safety cultures, many other benefits will follow. Culture is developed from the top, from the minister of health down through the whole system, even in a relatively low-hierarchic environment like Norwegian health care. Good safety culture includes open disclosure, not only examining critical incidents but also exploring deviations from planned courses systematically. Example of elements within good safety cultures include the concept of "learning incidents"[47] and the support of peers after serious incidents. We must report incidents, but these reports must be analyzed systematically and, when appropriate, action plans developed and implemented to improve practice.

Prehabilitation is an important next step forward in anesthesia patient safety. Norwegian anesthesiologists have been involved throughout the perioperative period for years, but we are increasingly involved in preoperative optimization of patients, including tobacco cessation in line with recent World Health Organization recommendations.[48] These initiatives should be augmented in the coming years.

Norway introduced New Public Management in health care in 2001, including the principle of "management by objectives and results." Despite good intentions, this has led to more bureaucracy, much more reporting, less time for health personnel to concentrate on clinical work, and sometimes leaving the impression that our specialty's advice for improvement is unwelcome. Health care leaders must not only lead according to budget measures but also request improvements on patient safety measures and facilitate anesthesiologist-patient interactions.

PACIFIC ISLANDS/VANUATU (ROBINSON TOUKOUNE, MMED AND WAYNE W. MORRISS, MB CHB)

The Pacific Ocean covers more than 30% of the Earth's surface. Scattered across this vast area are a number of independent Pacific Island countries, including the Cook Islands, Fiji, Kiribati, Marshall Islands, Federated States of Micronesia, Nauru, Palau, Samoa, Solomon Islands, Tonga, Tuvalu, and Vanuatu. In addition, there are nonindependent states and territories (eg, Guam and French Polynesia). The United Nations classifies these countries as Small Island Developing States, and they share similar health care problems to island nations in other parts of the world (eg, a number of Caribbean islands) and other resource-poor countries.[49]

The independent Pacific Island countries had a combined estimated total population of 2364,000 in 2020. For example, Vanuatu had a population of 307,000 in 2020 and is a lower middle-income country. It had a physician anesthesia provider ratio of 1.51 per 100,000 population in 2016.

A well-trained anesthesia workforce is a prerequisite for safe patient care, and there has been significant development of the workforce during the last 2 decades.[50] However, there is still much work to do.

Small Island Developing States are uniquely vulnerable to the economic and social effects of climate

change. This directly impacts delivery of health care services, including surgical care and anesthesia.[51] Climate change threatens to stretch already limited health care resources, and resourcing for safe anesthesia needs to be prioritized in coming years.

The Pacific anesthesia workforce is characterized by low anesthesiologist numbers and professional isolation.[17] Vanuatu, for example, has 4 anesthesiologists and 5 nurse anesthetists serving a population of 307,000 living on more than 65 islands spread over a large area of ocean. Postgraduate training programs in Fiji and Papua New Guinea are producing high-quality anesthesiologists, but more graduates will be required to achieve a sustainable and safe workforce. Virtual continuing education is also playing an increasing role in maintaining knowledge and reducing professional isolation.

In common with many resource-poor countries, collection of safety and quality data is very limited in the Pacific. The Lancet Commission on Global Surgery called for collection of indicator data to guide efforts to increase access to safe surgical care and anesthesia.[43] Some good quality data have been collected in the Pacific region, but ongoing monitoring will be required.[52]

PAKISTAN (FAUZIA A. KHAN, FRCA)

Pakistan had an estimated population of 220,892,000 in 2020 and is a lower middle-income country. It had a physician anesthesia provider ratio of 1.64 per 100,000 population in 2016.

The anesthesia workforce in Pakistan provides safety challenges. Although our country has an adequate number of physicians, we have not attracted or retained sufficient numbers of physicians in anesthesiology. Our efforts have been hampered by inadequate exposure to the specialty at the undergraduate level for medical students. In addition, young physicians sense that anesthesiology is a dependent specialty, resulting in low recruitment compared with many other specialties. Two other factors impact the distribution and retention of our physician anesthesia providers. First, most of our anesthesiologists wish to live in our cities because of the limited social and community opportunities in our underdeveloped rural areas. Second, a number of anesthesiologists migrate to other countries due to better economic factors and future life prospects. Expansion of a middle cadre diploma program may help strengthen our workforce in rural areas. However, incentives and opportunities for career growth while working will need to be provided.

In general, quality enhances patient safety. At this time, there is little awareness among health care personnel, including anesthesiologists, on the importance of quality management and initiatives to improve processes of care delivery and patient outcomes.[53] Quality and safety are not emphasized in anesthesiology curricula. In many hospitals, the World Health Organization's Surgical Safety Checklist is not followed, and perioperative documentation is poor. Patient safety committees are nonexistent in many hospitals and at a national level. We are advocating for patient safety and quality curricula to be introduced in medical school and anesthesiology residency teaching and training. We also support efforts to emphasize the importance of quality and push for separate budgeting to support quality and safety activities in our hospitals.

Regrettably, we currently lack safety-related research in Pakistan. Local data on anesthetic facilities, providers, patient-based outcomes, workflow patterns, and other safety-related practices are almost nonexistent. There is no anesthesia-related national database. In general, hospitals do not keep records of anesthetic or surgical mortality. Constraints include staffing issues, service pressures, the general lack of basic research skills in patient safety, and the absence of mentors. Safety-related surveys and audits should be encouraged, and there needs to be a mechanism to award this kind of activity. In the coming decade, we will advocate for expanded data collection that can be used to improve quality management and anesthesia patient safety.

RUSSIA (KONSTANTIN M. LEBEDINSKII, DSC MED)

Russia had an estimated population of 145,934,000 in 2020 and is an upper middle-income country. It had a physician anesthesia provider ratio of 20.91 per 100,000 population in 2016.

Perioperative patient safety has been recognized only recently as a systemic problem in Russia. However, it is difficult to quantify the epidemiology of perioperative complications in the country because of a lack of nationwide statistics. According to the International Civil Aviation Organization's safety culture maturity classification,[54] Russian health care would be categorized at a reactive level in which activity depends on the occurrence and severity of accidents.

At this time, health care safety studies are focused mainly on "care quality defects" instead of systematic investigation of processes, risks, and quality of clinical pathways. In practice, this leads to searches for culprits instead of systematic root causes. This defect approach is partially related to a relatively recent explosion of patient complaints about poor care that are addressed to various investigative committees. These committees can open investigations that may result in criminal actions. For example, in 2015, the total number of medicolegal complaints against physicians in Russia was 3775, and only 3 anesthesiologists

were found guilty and criminally sentenced. By 2018, the same figures rose to 6623 and 16, respectively.[55]

Strict adherence to the guidelines and safety rules is required in Russia and established in clinical guidelines by federal law.[56] International guidelines are often inapplicable in Russia as the level of care may be quite different and depend on each specific institution's capabilities. Many internationally recognized life-saving drugs are not registered in Russia and are, therefore, prohibited. For example, dantrolene, phytomenadione, and digoxin immune fab can be imported only with one-time permission from the Health Ministry and for a specific patient. In addition, investment in public health care is decreasing compared to a decade ago.

The National Medical Chamber and the All-Russian Federation of Anesthesiologists and Reanimatologists believe that it is crucial for the government to provide sufficient health care financing to support initiatives to improve anesthesia patient safety and patient safety in general, to decriminalize medical errors, and to institute educational programs in patient safety.

SPAIN (DANIEL ARNAL, MD)

Spain had an estimated population of 46,755,000 in 2020 and is a high-income country. It had a physician anesthesia provider ratio of 16.26 per 100,000 population in 2016.

Unique Spanish factors, such as having a dominant public health system, have led to peculiarities in advances in patient safety awareness and improvements in anesthesia in the last 2 decades. On the one hand, most of the hospital perioperative areas across the country are quite homogeneous, sharing similar problems and facility capabilities and a common language between anesthesiologists and surgical personnel. On the other hand, improvements in patient safety have relied primarily on the voluntary commitment of health care professionals due to the lack of patient safety-oriented resources allocated by the public health system. For example, the founding of the Spanish Anesthesia Incident Reporting System (SENSAR) was made by anesthesiologist advocates who, although short on funding, were full of enthusiasm. They have built a strong learning network and patient safety educational programs. However, this approach to further improvements in safety may be constrained into the future without the allocation of resources specifically oriented to anesthesia patient safety initiatives.

The surgical checklist initiative has proven within Spain to be an example of how a poorly implemented, top-down tool can hinder rather than help improve patient safety. The way in which surgical checklists are implemented needs to be revisited with a goal of reducing its bureaucracy, emphasizing the value of its communication role among the health care professionals, and investing proper resources to reimplement it and audit its progress.

During the last decade, patient safety education in our country has raised awareness about the importance of identifying human factors and how they impact the outcomes of critical perioperative problems. We believe it is crucial to increase the availability of anesthetic and surgical simulations across the country. We have to provide opportunities and the means for Spanish anesthesiologists to reap the patient safety benefits of simulation.

Thus far, our educational efforts with anesthesiologists, surgeons, and nurses to improve the culture of safety in operating rooms in Spain have been reasonably effective. However, we also believe that to augment patient safety, we must include patients as active participants in their care. Patient empowerment, shared decision-making, and speaking up, among other topics, need to be incorporated in patient safety improvement initiatives. We will advocate for their increased inclusion in the coming years.

UNITED STATES (DANIEL J. COLE, MD AND MARK A. WARNER, MD)

The United States had an estimated population of 331,003,000 in 2020 and is a high-income country. It had a physician anesthesia provider ratio of 20.82 per 100,000 population in 2016.

During the past decade, the United States experienced dramatic improvements in a variety of patient safety issues. For example, the incidences of perioperative vision loss associated with spine surgery and ulnar neuropathy had 65% and 85% reductions, respectively.[57,58] The rate of medical malpractice claims per 100 anesthesiologists decreased from 4.9% to 3.2% during the period of 2010 to 2019.[59] The percentage of closed claims involving an anesthesiologist within the overall number of closed claims for all specialties fell from 11.7% in 2010 to 8.0% in 2019. Nonetheless, patients continue to be harmed during anesthesia and perioperative care.

We believe that we must improve the culture of safety in our operating rooms, procedural areas, and settings in which perioperative care is provided. Inclusivity of opinions, observations, and communications from all individuals involved in surgical care (eg, nurses, anesthesiologists, surgeons, technicians, and patients and their families) is absolutely required to recognize and prevent potential mishaps.

We must improve the detection and prevention of perioperative deterioration. While intraoperative deaths and preventable harm to patients have decreased in the past decade, the frequency and severity of postoperative harm have not. Improved postoperative monitoring, increased use of clinical

pathways, and better understanding of postoperative deterioration (eg, evolving sepsis, myocardial ischemia, and opioid-induced ventilatory impairment) will be needed to improve overall surgical and anesthetic morbidity and mortality.

We must proactively address patient safety-related issues in nonoperating room environments. More than 50% of surgical, diagnostic, and interventional procedures in the United States is now being performed outside of typical operating rooms. The American Society of Anesthesiologists' Closed Claims Project and other reports highlight the increased risk of harm to patients who receive anesthesia care in nonoperating room settings. Specific efforts are needed to address the unique issues (eg, remoteness and decreased support resources) of anesthesia care provided in nonoperating room environments.

It seems as though more change in health care has occurred over the last few years than the previous 30 years, and the next decade promises a tsunami of change. For example, multidisciplinary care pathways that incorporate precision medicine and are designed to improve outcome for patients by integrating preoperative risk assessment, prehabilitation, standardized intra- and postoperative management, and home rehabilitation will continue to grow and become commonplace. Home rehabilitation is likely to involve microsensors, remote monitoring, and the "hospital at home" model of care. Other technology advances include automated systems of anesthesia delivery, machine learning, artificial intelligence, and telehealth. All of these disruptive innovations will require that we learn about and carefully analyze these technologies to ensure that safety is not compromised and that safety standards are proactively embedded into new processes of patient care.

DISCUSSION

These short summaries on the current and anticipated issues in anesthesia patient safety during the coming decade from diverse and globally dispersed countries highlight the unique challenges faced by anesthesiologists worldwide as they work to improve global anesthesia patient safety. Ironically, despite the significant spectrum of health care resources available in these countries, they share a number of common issues. These are listed in Table 2. These issues may be used in anesthesiology and perioperative care professions to address current problems and develop new initiatives that may be applicable to all countries.

Implementation of National or International Standards of Intraoperative Care

Standards of care have been present in anesthesiology since the 1980s. In 1992, the WFSA first endorsed standards of intraoperative anesthesia care.[12] These standards have since evolved,[13] and in 2018, the WFSA and the World Health Organization together developed international standards for the safe practice of anesthesia.[14] Many national societies of anesthesiology have approved standards. As described by the authors of this article, a key issue is getting standards accepted and implemented. In some instances (eg, Nigeria), there are resource issues that inhibit their implementation. In others, cultures of safety that support the use of standards of care in anesthesiology have not been embraced broadly within the health care environments. The WFSA/World Health Organization's international standards now have the support of the ministries of health in a number of countries. In 2015, the Lancet Commission on Global Surgery introduced a framework for national surgical, obstetric, and anesthesia planning.[43] This framework provides ministries of health with guidance and will hopefully play a critical role in linking health care policies with actions to improve surgical outcomes and safety.[60]

Sustained Efforts to Support Appropriate Numbers and Distribution of Physician Anesthesia Providers

There are many efforts to increase training opportunities for physicians in anesthesiology. However, in many countries, there are impediments culturally, professionally, and financially to increasing numbers and countrywide distribution of anesthesiologists.

Table 2. The Top 10 Anesthesia Patient Safety Issues Worldwide[a]

- Implementation of national or international standards of intraoperative care in each country
- Sustained efforts to support appropriate numbers and distribution of physician anesthesia providers
- Support at national levels to provide access to appropriate anesthesia-related equipment and drugs
- Development and implementation of databases to track patient and safety outcomes
- Extension of patient safety initiatives from intraoperative to perioperative care
- Improvement and use of surgical/anesthesia safety checklists
- Initiatives to detect and prevent death from perioperative deterioration
- Establishment of cultures of safety and teamwork in intraoperative and perioperative care
- Elimination of punitive outcomes and criminalization of medical errors
- Allocation of safety research and resources to nonoperating room anesthesia practices

[a]Based on anesthesiologist leaders' reports on the current state of anesthesia patient safety in their countries and highlighted in this article. The issues as shown are not listed in order of importance.

For example, a number of countries have disincentives for physicians to train in the specialty. In Russia, there is a progressive trend for anesthesia medical errors to result in criminal investigations. In Pakistan, the specialty is identified as one that is dependent on or secondary to surgeons and other proceduralists, decreasing its desirability for graduating medical students. Pakistan and other countries, including high-income countries such as the United States, face an anesthesiologist distribution problem, with many anesthesiologists opting to work and live in urban areas where there are amenities not available in vast rural areas. Lebanon provides a recent example of countries that lose anesthesiologists to higher income or more politically stable countries. All of these issues can be addressed, but they are difficult challenges and require concerted efforts nationally as well as globally. One hopeful sign is that anesthesiologists in small countries such as Vanuatu are finding that online access to educational materials, consultations, and meetings reduces the professional isolation that is often present in these unique environments. Specific comments on how nonphysician anesthesia providers are needed in many countries are found in this article's Limitations and Comment section.

Support at National Levels to Provide Access to Appropriate Anesthesia-Related Equipment and Drugs

The problem of having a paucity of anesthesia-related equipment and drugs continues, especially in lower resource countries. For example, there is a lack of multimodal monitors and a number of widely used anesthetics and nondepolarizing muscle relaxants in Nigeria. Russia does not have access to a broad spectrum of life-saving drugs (eg, dantrolene). The Lifebox Foundation, Safe Anaesthesia Worldwide, and other nonprofit chartable groups are helping to fill these gaps, but it will take continued pressure on governments, nongovernmental agencies, and universal organizations such as the WFSA and World Health Organization to help resolve these issues.

Development and Implementation of Databases to Track Outcomes

Data collection is difficult, even in high-income countries. The development, implementation, and sustainability of both local and national databases to track patient safety issues in anesthesia and perioperative care require strong leadership that supports the use of resources for this purpose. The WFSA and national societies will need to partner with Ministries of Health and other groups to develop financially viable and clinically useful databases for perioperative outcomes. In addition, these organizations will need to work with anesthesia and health care patient safety organizations (eg, the Anesthesia Patient Safety Foundation and the Patient Safety Movement Foundation) to support the development of patient safety-trained clinician investigators, patient safety scientists, and others who will acquire the skills to lead these data collection activities and analyze the data so that the results may be used to improve patient safety.

Extension of Patient Safety Initiatives From Intraoperative to Perioperative Care

There are many examples, especially in European countries, of anesthesiologists being very involved in the full spectrum of perioperative care. For example, Norwegian anesthesiologists are increasingly involved in prehabilitation of patients in addition to leading many perioperative services. German anesthesiologists are often leaders in prehospital emergency as well as postoperative intensive care services. Australia and New Zealand, among other countries, are pursuing specific training requirements and qualification in perioperative care, whereas in Japan, they are introducing the concept of perianesthetic care teams. Other countries (eg, the United States) are slowly expanding their responsibilities to the full spectrum of perioperative care.

Improvement and Use of Surgical/Anesthesia Safety Checklists

The World Health Organizations' 2009 Surgical Safety Checklist[61] was developed with core objectives to improve teamwork and communications within operating room environments and consistency of care.[62] The checklist was designed specifically with encouragement to allow additions and modifications to fit local practices. In general, the checklist with and without modifications has been shown to have a positive impact on reducing surgical mortality and improving teamwork and interprofessional communications.[63] However, these successes appear to be very dependent on promotion by strong institutional, surgical, and anesthesia leadership. The implementation of the checklist requires considerable time and effort to be effective. Willful compliance with the checklist is required to have a positive impact on patient care. Many of the countries in this article have experience with the use of the Surgical Safety Checklist and describe the challenges they face with its successful implementation. Successful implementation of the use of checklists around the world in the coming decade will likely be variable and require strong national leadership of the initiative.

Initiatives to Detect and Prevent Death From Perioperative Deterioration

In general, surgical mortality has decreased over the past several decades globally. However, the decrease

is highly variable between countries and influenced by factors such as hospital bed numbers, the availability and use of high-technology perioperative monitoring equipment, and nurse-to-patient ratios within hospitals.[64] Significant reductions in surgical mortality are primarily associated with reductions in postoperative as opposed to intraoperative death.[65] A majority of unanticipated postoperative deaths are associated with acute perioperative deterioration and the failure of hospital personnel to recognize or rescue affected patients. The presence of institutionally supported psychologic safety, interprofessional communication, and teamwork is highly associated with improved rescue of deteriorating postoperative patients.[66] Since anesthesiologists have unique rescue skills, their active involvement may be associated with improved outcomes and surgical patient survival.[67] Many of the countries in this article are developing or have plans to expand anesthesia practices to perioperative care and initiatives to rescue surgical patients who develop acute, life-threatening postoperative complications.

Establishment of Cultures of Safety and Teamwork in Intraoperative and Perioperative Care

Numerous studies document the important impact of strong teamwork and cultures of safety in the operating room and perioperative environments on surgical mortality and morbidity.[68,69] Improvements of intraoperative and postoperative cultures of safety and teamwork between surgical and anesthesia providers are the top 2 patient safety priorities of the Anesthesia Patient Safety Foundation.[70] The WFSA has promoted both of these important patient safety issues recently,[71,72] and many member countries are pursing initiatives to improve them.

Elimination of Punitive Outcomes and Criminalization of Medical Errors

A number of countries report that there is an increasing movement to criminalize certain health care errors. This results in degradation of the culture of safety and is a deterrent to error reporting. Punitive measures (eg, disciplinary actions and licensure limitations) and criminalization reduce the likelihood of anesthesiologists and other health care professionals reporting errors.[73,74] This erosion in error reporting reduces the ability of the specialty to study and learn from mistakes.[75,76] National anesthesiology societies should collaborate with governmental agencies and legal networks to eliminate the criminalization of medical errors for all but the most egregious situations in which criminal intent is clear. The successful implementation of alternative methods to review health care errors such as health care investigation boards may reduce momentum in a number of countries to criminalize health care errors.[77,78]

Allocation of Safety Research and Resources to Nonoperating Room Anesthesia Practices

In many high-income countries, there is significant growth in numbers of surgical, interventional, and diagnostic procedures for which patients require anesthesia care performed in nonoperating room environments.[79,80] The provision of anesthesia services in these unique and often variable settings raises potential safety barriers related to interprofessional communications, infrastructure, and safety cultures.[81,82] As noted in a number of the summaries in this article, national anesthesiology societies are very interested in learning how to best address these potential barriers, ensure that standards of care are followed, and develop outcome reporting databases to track patient safety and, when appropriate, develop and implement patient care processes to improve safety.

Limitations and Comment

These countries were selected randomly to provide a representative cross-section of populations, health care resource availability, and anesthesia patient safety practices around the world. Clearly, there are other countries that may have unique anesthesia patient safety issues not highlighted in this report. In addition, the representatives of anesthesiologists from countries in this report did not participate in a formal process to collectively select the most important anesthesia patient safety issues. The authors have instead chosen to highlight those issues most often noted in this article's summaries of issues in the various countries. The "top ten" anesthesia patient safety issues (Table 2) are not all-inclusive, but they do describe important opportunities to address anesthesia patient safety worldwide. It is interesting that many of the countries, regardless of their classification of income and anesthesiologist-to-population ratios, reported that they face many of the same issues.

This article did not report on the important contributions in a number of countries of nurse anesthetists and other nonphysician anesthesia providers. The physician anesthesia provider per 100,000 populations that we have reported in the countries in this article (0.58 in Nigeria to 25.50 in Norway) is representative of the broad ranges found worldwide. Clearly, nonphysician anesthesia providers are needed in many countries to fill the workforce needs when there are insufficient numbers of physician anesthesia providers. These nonphysician anesthesia providers must be well trained to provide safe anesthesia care. It is essential that all countries that use nonphysician anesthesia providers have or develop robust training programs for them. Physician anesthesia providers,

especially physicians specifically trained in anesthesiology, should play primary roles in developing and implementing these training programs in their roles as teachers, advocates for patient safety, researchers, and health care leaders.

One specific group of nonphysician anesthesia providers that deserves unique mention is nurse anesthetists. These are well-trained nurses who have a proven track record of delivering safe anesthesia patient care in a wide variety of countries. The International Federation of Nurse Anesthetists currently represents nurse anesthetists in 43 countries worldwide.[83] The organization's primary missions include enhancement of patient safety and quality of care, as set out in its Code of Ethics and Standard of Practice and Graduate Competencies.[84] The federation also seeks to advance the quality of nurse anesthesia education by standardizing educational requirements and practice guidance across countries. In many countries, anesthesiologists play important roles in the education of nurse anesthetists and partner closely with them in improving patient safety.

There are opportunities for collaboration in countries with differing anesthesia care models. Clearly, from a global point of view, both physicians and nonphysicians have a vital role in improving anesthesia patient safety.

CONCLUSIONS

This article provides diverse and useful commentary on current and projected anesthesia patient safety issues and initiatives in a number of unique countries worldwide. The anesthesia patient safety issues faced by these countries are surprisingly similar despite the huge variation in income, health care resources, and available anesthesiologists per capita in these countries. The highlighted issues provide a roadmap for national societies and members of global collaborations to use when prioritizing resources to address opportunities to improve anesthesia patient safety in the coming decade.

DISCLOSURES

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Contribution: This author helped write and review the paper.
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