

PERSPECTIVE

Implementation science: A missing link in global surgery

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Abstract

Poor access to surgical and anaesthesia care is a major cause of global mortality and morbidity, affecting people in low- and middle-income countries (LMICs) most severely. Over 90% of the populations of sub-Saharan Africa and South Asia lack access to surgical and anaesthesia care, compared with less than 7% in high-income countries (HICs). In this perspective, we argue that this disparity exists not because we lack knowledge about the evidence-based surgical interventions and concepts, such as caesarean delivery, hernia repair, trauma care, and cleft lip and palate repair. LMICs are challenged with implementing and scaling these evidence-based practices, which are routinely implemented in HICs, in resource-limited settings. We propose an increase in the use of high-quality implementation science in global surgery to understand contextual factors that affect the scale-up of surgical systems in LMICs. Implementation science is the scientific study of methods to stimulate the systematic uptake of research findings on intervention efficacy into routine practice to improve the effectiveness and quality of healthcare. Evidence from implementation research can be used to design better dissemination and implementation strategies for the rapid scaling up of evidence-based surgical and anaesthesia interventions.

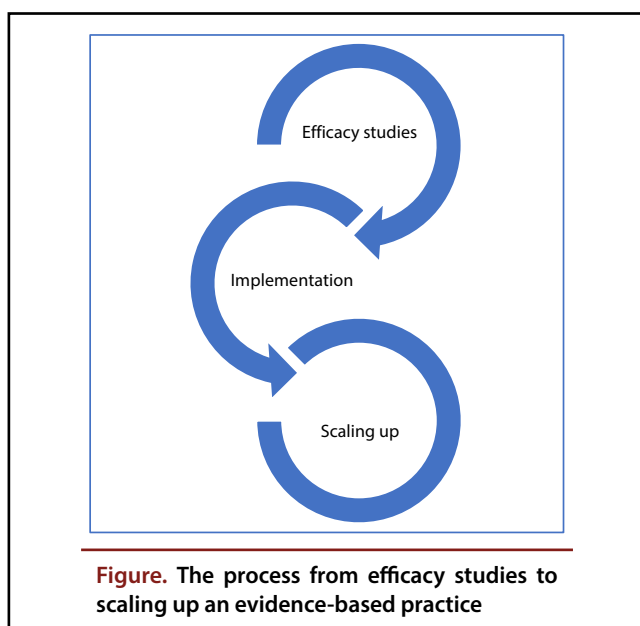
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On 16 October 1846, William T.G. Morton (dentist and father of modern anaesthesia) and his surgeon colleague, John Collins Warren, made history by conducting the first surgical procedure under anaesthesia with ether at Massachusetts General Hospital in Boston.^[1] The discovery of modern anaesthesia revolutionized the way surgery could be conducted, eliminating pain and making it safer for the patient. Since then, advancements in the fields of anaesthesia, sterilization and antibiotic management, and technology have made anaesthesia and surgical care even more effective and safe, drastically impacting the lives of hundreds of millions of people around the world. Yet, more than 170 years after the invention of modern anaesthesia, a majority of people worldwide, particularly people in low- and middle-income countries (LMICs), still lack access to life-saving surgical and anaesthetic services.^{[2]-[5]}

A critical gap exists between the knowledge of the evidence-based interventions needed to manage surgical conditions and the widespread dissemination and implementation of these interventions in LMICs. This gap continues to increase with time as more discoveries are made. We propose an increase in the use of high-quality implementation science in global surgery as a tool to bridge this “know-do gap”.

A preponderance of research shows significant disparities in access to and quality of surgical and anaesthesia care between high-income countries (HICs) and LMICs.^{[4]-[9]} More than 95% of the populations of sub-Saharan Africa and South Asia, for example, lack access to surgical and anaesthesia care, compared with less than 5% in North America, Western Europe, and Australasia.^[3] Life-saving surgical procedures that are routinely performed and sometimes overutilized in HICs are severely lacking in many LMICs. For example, caesarean deliveries, which are critical for the management of obstructed labour, are performed for 32.3% of births in North America, while Africa has an average rate of 7.3%, which drops as low as 3% in West Africa, well below the 10% to 15% recommended by the World Health Organization (WHO).^{[10],[11]} Furthermore, access to care often does not guarantee high-quality care. Patients who have access to surgical and anaesthesia care in LMICs tend to be younger with fewer comorbidities than those in HICs; however, compared with HICs, surgical and anaesthesia care in LMICs is associated with much higher rates of surgical site infection and perioperative mortality.^{[6],[12]}

Today more than ever, evidence-based practices (EBPs) around surgery and anaesthesia exist, yet they fail to reach billions around the world who desperately need it.^[4]



Arguably, a significant majority of the challenges surrounding surgical care delivery in LMICs is not due to the lack of knowledge of surgical and anaesthesia EBPs. Surely, the roughly 16.9 million people who die each year from surgical conditions die not because the world lacks knowledge about how to manage obstructed labour, treat hernias and appendicitis, or manage open fractures after road traffic accidents.[4],[8] The main challenge is how to scale up these EBPs and interventions effectively and sustainably in resource-limited settings.[13] Implementation science can help bridge the current gap that exists between the knowledge of surgical and anaesthesia EBPs and their widespread dissemination, uptake, and sustainable use in LMICs. Implementation science is a missing link in global surgery that can be used to identify dissemination and implementation strategies to move surgical and anaesthesia EBPs from theory into policy and routine practice.

At the beginning of the century, it took up to 17 years for scientific evidence of a particular intervention to transition from research publication to routine use in HIC healthcare systems.[14] Developments in dissemination and implementation science over the past decade have considerably reduced this timeframe in HICs.[15] Given additional challenges with information technology and access to medical literature, this timeframe has likely lengthened in LMICs. Implementation science aims to bridge the gap between EBPs and the dissemination, implementation, and routine application of these EBPs in varying contexts. More specifically, implementation research is the scientific study of methods to stimulate the systematic uptake of research findings on intervention efficacy into routine practice to improve the effectiveness and quality of healthcare.[16] Efficacy studies determine whether an intervention produces the expected results under ideal circumstances, while effectiveness studies determine whether an intervention produces the expected results in a real-world setting.[17] Implementation research differs from efficacy and effectiveness studies in that implementation research recognizes that the real world is con-

stantly changing, and it seeks to evaluate implementation at the organizational level.[17] Also, implementation research aims to understand the impact of interventions, and all of this is done collaboratively among stakeholders.[17] Efficacy and effectiveness studies alone, which appear to be the main focus of global surgery research, will not suffice, as these studies often do not elaborate on how and why interventions work and in which contexts they do.[18]

Unlike many disease-specific public health interventions, such as vaccines, that are more amenable to vertical delivery methods, the delivery of quality surgical and anaesthesia care requires a horizontal systematic approach, focusing on addressing both supply-side and demand-side barriers faced by patients. The surgical management of an open tibia fracture, for example, not only requires a skilled orthopaedic surgeon and an anaesthesia provider, but it also requires nurses, diagnostic equipment, a reliable blood bank, a functional supply chain for drugs and supplies, surgical instruments that are properly sterilized, functioning theatre lights, biomedical engineers for equipment maintenance, and physiotherapists for rehabilitation. Furthermore, prehospital care, including referral systems and ambulatory care, as well as postoperative care and financing systems, are needed to ensure that care is of high quality and not impoverishing. The number of stakeholders and components involved in this process complicates the adoption and diffusion of surgical and anaesthesia EBPs into the surgical ecosystem.[19]

Understanding the local context is crucial. The perception of the benefits, risks, and legitimacy of an EBP by local stakeholders can affect how the EBP is received. EBP uptake can also be affected by broader contextual factors, such as legal frameworks or political priorities and institutions, as well as sociocultural, economic, and historical factors. As countries seek to address the high burden of surgical conditions, implementation science will be crucial for improving the understanding of these contextual factors, generating evidence for dissemination and implementation strategies, and informing programmes and policies, such as national surgery, obstetrics, and anaesthesia plans.[20],[21]

One surgical EBP that has been recommended by the WHO is the surgical safety checklist (SSC). Tailored after checklists used in aviation, the SSC has been shown to reduce surgery-related and anaesthesia-related complications and deaths by up to 36% and 47%, respectively.[22] Recently, at the 10-year anniversary of the SSC launch, a global study was performed to assess the rate of SSC adoption around the world.[23] Unsurprisingly, uptake of the checklist varied significantly, ranging from 90% utilization rates in HICs to 30% in low-income countries. Differences in adoption rates were attributed to “real-world contexts, limited infrastructure, equipment and trained personnel”.[23] Some of the “real-world contexts” included personnel barriers, such as active resistance or noncompliance from team leaders, the structure and language of the SSC, implementation processes undertaken, patient population factors, and available resources, among others. The report calls for the development of implementation and dissemination strategies to increase the uptake and routine use of the SSC, particularly

in low-income countries. We concur with this call. Greater use of high-quality implementation research in global surgery will shed light on such contextual factors that positively or negatively affect dissemination and sustainable use of surgical and anaesthesia EBPs, like the SSC, and allow for improved implementation and dissemination strategies. For example, implementation research has been used successfully in Ugandan, Zambian, and Kenyan hospitals, where it has led to significant reductions in perioperative infection rates.[24] An adaptive implementation research approach was used by experts from the WHO, the United States, and African hospitals to codevelop tools and protocols, as well as surgical site infection prevention measures. This approach led to the reduction in the surgical site infection rate in the aforementioned hospitals from 8% preintervention to 3.8% postintervention. This rate remained constant during the sustainability period as compliance to codeveloped prevention measures remained high.

Implementation research offers an opportunity for collaboration between project implementers, such as public, private, and faith-based care providers, with academic global surgery and social science researchers. There are over 400 nongovernmental organizations (NGOs) delivering surgical services in LMICs, many with decades of experience in resource-limited settings.[25] For example, Operation Smile, an orofacial cleft NGO with almost 40 years of surgical delivery experience, is scaling up implementation research to assess facilitators and barriers to the effectiveness and sustainability of surgical systems strengthening initiatives in its programme countries. Operation Smile is using implementation science principles to codevelop, ensure buy-in, and implement surgical systems strengthening programmes and national surgical, obstetric, and anaesthesia plans in its programme countries. As part of a major multisite surgical strengthening project at hospitals in Nicaragua, Vietnam, and Madagascar, Operation Smile uses implementation research to assess factors that could influence the long-term impact and sustainability of the initiative. Using a consolidated framework for implementation research, Operation Smile, through a series of surveys and interviews with local staff, identifies these factors and works with local teams to design mitigation strategies.

The value of South–South and South–North collaborations in implementation research cannot be overemphasized. Equitable partnerships involving researchers in settings where global surgery projects are being implemented are vital for designing research that prioritizes the needs of the local community and ensures that all contextual factors are considered. Such partnerships driven by researchers and medical leaders on the ground will also enable “reverse innovation”, allowing for EBPs that are developed in LMICs to be transferred to HIC contexts. Examples of reverse innovations in global surgery include Aravind Eye Hospital’s low-cost intraocular lens technology and service delivery model, which have been exported to some HICs.[26]

We must note that implementation research for global surgery should not be seen as stifling innovation.[27] As LMICs work to strengthen their health systems’ capacities

to deliver surgical and anaesthesia care, they must be careful not to replicate the inefficiencies of healthcare systems in HICs. Underdeveloped and resource-constrained surgical systems should foster innovations to overcome challenges and inefficiencies that “more advanced” health systems in HICs face. Local solutions can save time and money and still deliver quality and timely care, i.e., “frugal innovation”. For example, at Narayana Hospital in India, the use of 3D-printed surgical instruments helped reduce operative costs for cardiac surgery to US\$1500 per procedure, compared with US\$144 000 in the United States and \$27 000 in Mexico.[26] Implementation science can be used to guide the scale-up of such frugal innovations in multiple contexts. Implementation research can be used to identify unique contextual challenges, and this information can allow for the development of innovative solutions and care delivery methods relevant to challenges faced in LMICs.

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