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ADVANCING SURGICAL CARE

Humanitarian Surgery:
The Way Forwards?

Authors

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Image on the front cover. Credit: Max Bender/Unsplash.

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Executive summary

Executive summary

The Humanitarian Surgery Initiative (HSI) is an international collaboration led by the Royal College of Surgeons of England, which aims to explore the potential role and contribution of technology and data-driven evidence in building humanitarian surgical capacity in low-resource settings.

Sustainable education systems, mentorship and knowledge exchange are pivotal with respect to building surgical capacity to deliver surgical care in humanitarian crisis situations. The literature is filled with examples of operational, financial and human resource constraints and challenges. This report will explore the barriers and propose potential solutions for the provision of sufficient surgical care of an international standard in crises. The goal is to support and guide the work being undertaken by HSI.

In a sudden-onset disaster, the first responders are local surgical providers and managing the surge of injured patients overwhelms routine systems. Local health system mobilisation, with greater capacity and ability to respond, is at the heart of the first phase of the response. This is reinforced by the arrival of regional and international assistance through World Health Organization-accredited Emergency Medical Teams (EMTs) and international nongovernmental organisations that work, in accordance with humanitarian principles, to support overwhelmed local health systems, perhaps for weeks or months. These responders will carry out surgery on injured people, but must also engage with and address the full continuum of surgical care, including undertaking triage, perhaps performing damage-control interventions, or providing palliative care and considering the need for rehabilitation.

What is humanitarian surgery?

A definition is important and must accommodate the full breadth of the issues presented. This report suggests there are three clear levels for providing surgical capacity:

(1) Developing and providing global surgery with its wider surgical capacity building mission;

(2) within this, the timely provision of surgery in emergency care settings; and

(3) the provision of emergency surgical care in overwhelmed healthcare settings.

Building on the work of HSI, this report aims to explore the literature and begin to map the humanitarian surgical landscape. A formal literature review was undertaken, analysed thematically and summarised. Beginning with seeking a definition of the field of humanitarian surgery and clarifying who is providing it, key themes and trends were sought and identified.

The evolving themes were presented to and explored with a range of international humanitarian surgery stakeholders through a series of semi-structured interviews.

These qualitative discussions, when blended with previous work from HSI, clarified three principal areas of focus:

1. the need to provide **specialist surgical education and training** to practitioners to support the development of a unique skill set in extremely challenging environments;
2. the **building of communities of practice in humanitarian surgery between practitioners,** with the intention of providing both professional and moral support;
3. the potential **role of technology in providing education, mentorship and support** to practitioners in the field.

The findings from these two phases were used as a starting point for an 'ideation exercise' held in March 2024. A group of experienced international surgical stakeholders, humanitarian surgeons, national surgical leaders and local surgical providers in low-resource settings were brought together for a series of virtual focus group discussions to seek their opinions, ideas and suggestions for how to progress the development of humanitarian surgery and surgical capacity.

The output of the three-stage process has been brought together to create a series of recommendations for developing sustainable humanitarian surgery capacity in challenged and low-resource settings.

The collaborating partners of HSI should consider each of the recommendations and how they can contribute to their achievement.

A destroyed ambulance at the Nasser Hospital in the southern Gaza Strip city of Khan Younis, Feb. 2024. Credit: Rizek Abdeljawad/Xinhua/Alamy Live News

Recommendations

1. **McKnight's definition of humanitarian surgery** should be adopted and applied consistently.
2. Providers of humanitarian surgical support in crises must **integrate their efforts with local surgical services,** cooperating with national and international EMTs and the United Nations-appointed Emergency Relief Coordinator to deliver a system-wide approach to the full breadth of emergency surgical need.
3. Surgical authorities, particularly professional colleges and networks, **should cooperate to support and build on existing and established local and regional surgical networks in crisis-affected areas.** Where such bodies do not exist, partners should facilitate their establishment.
4. Surgical colleges should **collaborate to describe and support the setting of standards to guide governance and accountability in education** to support the provision of humanitarian surgery.
5. Developing humanitarian surgical initiatives must recognise that **proactive capacity and relationship building are the foundation** of sustainable partnerships.
6. A **structured, interdisciplinary curriculum in humanitarian surgery that delivers a broad skill set and results in internationally recognised accreditation** should be created and endorsed by all surgical colleges. The colleges should collaborate with regional humanitarian surgical education hubs to deliver this programme.
7. The surgical colleges should **collaborate with professional bodies for anaesthesia, surgical nursing and allied health professionals to build and endorse multidisciplinary surgical team** education and skills programmes to support humanitarian surgery.
8. International surgical professional bodies and networks should **actively support the development of communities of practice** within humanitarian surgery. Regional surgical bodies should act as partnership hubs, facilitating connections between humanitarian surgeons within a region.
9. **HSI should engage collaboratively with others in the design and creation of an open-access surgical learning library** for humanitarian surgery.
10. HSI should engage with partners and technology companies to **develop and optimise the technological platforms on which a resource library could be built** and through which distance learning could be delivered.

HSI commissioned this report to provide the partnership and the wider humanitarian surgery ecosystem with a clear set of recommendations focused on building sustainable capacity in low-resource contexts.

If adopted and championed by representative surgical bodies of sufficient international standing, the steps presented in this report will achieve a paradigm shift from the traditional model of surgical support in crises and set a new collaborative trajectory for the delivery of humanitarian surgery to those in need.

Introduction

Introduction

The Humanitarian Surgical Initiative (HSI) at the Royal College of Surgeons of England (RCS England) has identified a need to create a clear pathway to building surgical capacity to support increasing demand for surgical interventions in humanitarian crises.

Recent publications identify barriers to provision of sufficient accessible surgical care involving both providers and recipients, including financial barriers, geographical and human resource challenges, and a deficit in education and training.[1–9]

In 2013, the World Health Organization (WHO) published its *Classification and Minimum Standards for Emergency Medical Teams*, known as the 'Blue Book', which outlined the types of surgical capabilities required, along with an expectation of compliance with international governance standards on communication with patients, informed consent and medical documentation.[10] These standards have since been revised and extended.[11,12] The publications describe the need for proficiency in a range of emergency procedures and set professional standards for humanitarian surgery responders. WHO focused on describing minimum levels of service for international responding agencies and nongovernmental organisations (NGOs) to address perceived failings of previous international humanitarian surgical services.[13,14]

When a disaster occurs, first responders from local communities step forwards and begin to provide resuscitation and emergency care. Local health systems mobilise their 'mass casualty plans' and try to deliver life- and limb-saving surgical interventions in the first few hours and days.[15] It is when they are clearly overwhelmed that the international humanitarian system, in particular through the United Nations (UN) Inter-Agency Standing Committee (IASC) and the Office for the Coordination of Humanitarian Affairs (OCHA), mobilises to support a global humanitarian response to the disaster.

A more substantial and capable local health system, in place and working at the time the disaster occurs, would be better able to surge and absorb more of the initial emergency challenge, achieving more before international organisations arrive in support. In this way, building stronger and more resilient local surgical systems and capacity can have a huge effect on the surgical response to a disaster.

McKnight *et al* define surgical involvement in the multifaceted wider humanitarian response as humanitarian surgery, suggesting that it "focuses on the coordinated provision of emergency surgical care, in accordance with the humanitarian principles, in conflict and post-conflict zones, in areas of sudden-onset disasters, and when the local health system is overwhelmed".[16] The authors recognise that the scope of the term is contentious, acknowledging that a holistic surgical continuum of patient care, including services such as palliative care and rehabilitation, is not expressly mentioned; but they emphasise that the international response should build on and support local services.

In approaching this investigation into humanitarian surgery, it is recognised that specifically trained and competent clinicians are needed to increase surgical capacity in crisis settings; this scope of practice is a distinct subset of both emergency surgery and global surgery. Those involved in delivering care in a disaster or humanitarian setting must be educated and trained for both the environment and the context.

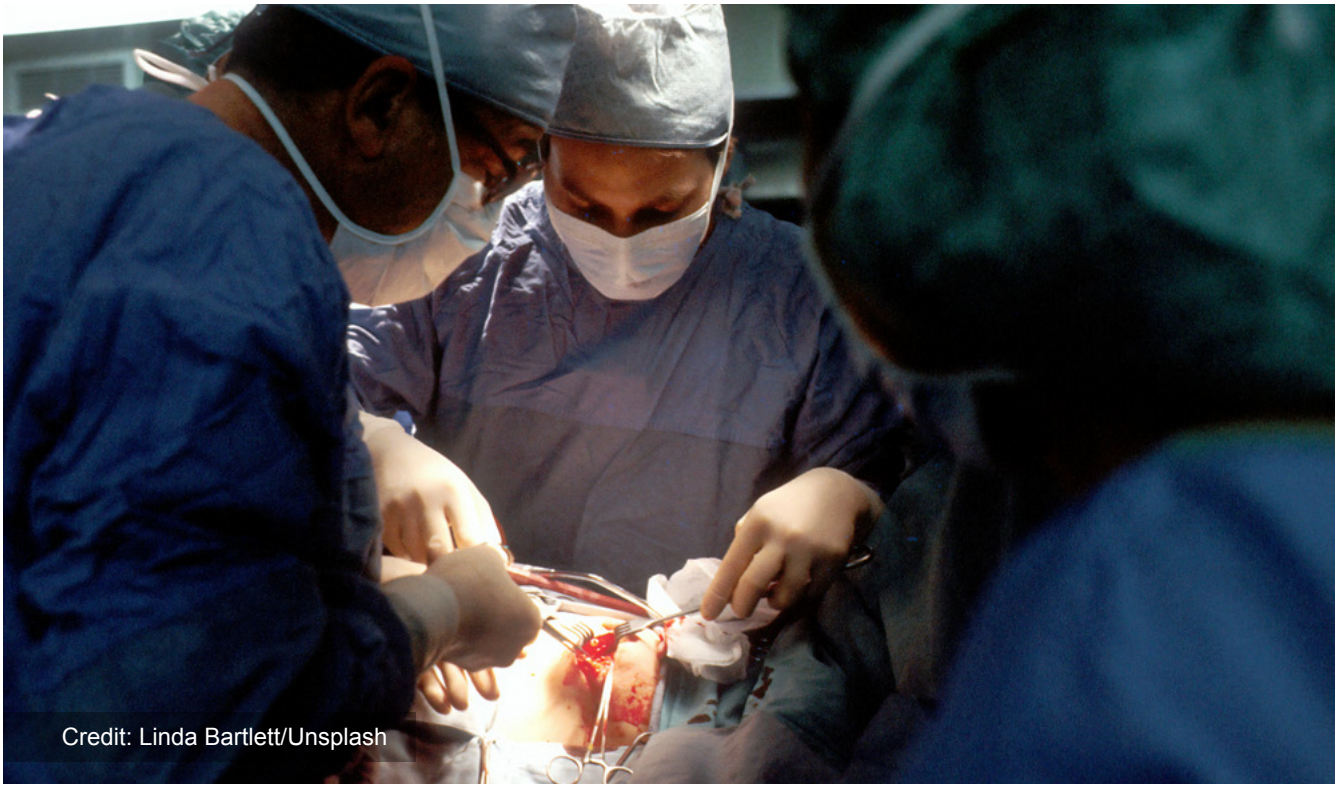
Approaches to increasing local surgical capability and capacity to deliver emergency surgery in a disaster or conflict, with a similar scope of practice demanded of those responding internationally, is a clear part of building a pathway for delivering surgical interventions in humanitarian crisis settings.

This report was undertaken in three phases.

1. **Aiming to consolidate the work to date of HSI, a formal review of peer and grey literature was undertaken.** The aim was to explore the current state of published scientific literature and map the humanitarian surgery landscape. Each paper identified was considered in detail and mapped to distinct evolving themes.
2. **From the literature review, key humanitarian surgical stakeholders with local, national and international perspectives were identified** and invited to take part in targeted, semi-structured qualitative interviews. Key themes and challenges from the literature were explored and clarified in these interviews.
3. **Findings from the first two phases focused on challenges to developing humanitarian surgery and building surgical capability.** They were used as starting points for an 'ideation exercise'. This consisted of a virtual series of conversations and focus group discussions that included international humanitarian surgeons, national surgical leaders and local surgical providers. Each group explored the identified key thematic areas and provided suggestions on how to move the humanitarian surgery agenda forwards.

Previous work from HSI indicated that three areas were of particular interest: provision of specialist education and training; the development of communities of practice; and the role of technology in delivering training and supporting practitioners.

The aim of this HSI project was to develop a series of policy recommendations for humanitarian surgery, drawing on lessons from previous surgical deployments and considering the current state of practice, development and networking in the field.



Credit: Linda Bartlett/Unsplash

Methodology

Methodology

Research objective

There have been many reports about the capacity to deliver surgical services in humanitarian crises and the quality of these services. They came into particular focus after the response to the Haitian earthquake of 2010, and led to the WHO Emergency Medical Teams (EMT) initiative and the setting of surgical standards.[10,14]

The research objective was to identify priorities for the development of sustainable humanitarian surgical capacity and capabilities in low-resource settings and when responding to humanitarian crises. This prompted one overarching research aim with three subsections, which focus on building capacity in humanitarian surgery.

Aim

Through a structured review of the literature and by interviewing key stakeholders, the aim was to identify barriers to development and facilitate the scaling of humanitarian surgical capacity. The purpose was to identify a series of recommendations to create a road map for the development of capacity in humanitarian surgery. The focus was on the following factors.

1. **Education and training**: to improve the humanitarian surgical knowledge base and sharing of best practice among the international surgical community, particularly in disaster-prone countries.
2. **Community of practice**: exploring the evolution of surgical networks and programmes focusing on humanitarian surgery, both in building capacity and in supporting and sustaining research partnerships.
3. **The role of technology**: exploring the potential role of technological innovation in the training and capacity building needs of surgeons in low-resource settings and of those who would respond as part of the international response to a crisis. This included the potential of distance learning, web-enabled tools, use of virtual reality and augmented reality, and the potential for real-time collaboration through telecommunications.

Vintage Surgical Tools. Credit: Wendy Scofield/Unsplash

Literature review

Academic literature

A structured search of published academic literature on humanitarian surgery since 2010 was conducted in December 2023; 2010 was chosen as the search start date since this is considered an inflection point in the nature of disaster surgical response following the Haiti earthquake. The search focused on the provision of and potential opportunities for humanitarian surgery, and identified practical issues in the areas of education and training, building communities of practice, and the potential use of technology.

Key search terms were 'surgery' and 'humanitar*', which returned 742 results in Web of Science. One researcher (MG) screened all articles, with support from and consultation with a second researcher (DW). No automation tools were used in this process. To maintain the breadth of the search, no further refining search terms were included. Articles were reviewed for relevance by title and abstract. Papers that focused primarily on a response by military personnel, editorials, clinical case reports and those published in a language other than English were excluded.

The papers meeting the inclusion criteria were gathered into the thematic areas of focus of this research:

1. **the development of humanitarian surgery;**
2. **education and training in humanitarian surgery;**
3. **communities of practice;**
4. **the use of technology to support education and service delivery.**

The majority of the academic papers were published by North American authors, with a minority published in the UK and France. Many of the screened papers focused on wider global surgery developments or the potential value of rotational low-resource training opportunities for high-income surgical residency trainees and were not relevant to the focus of this project.

Grey literature

The grey literature was reviewed throughout the course of the research process. Initially, sites of potential interest were identified through the academic literature review process. Following this, an online web search was conducted, informed by guidelines on public health grey literature search from King's College London and the University of Wolverhampton.[17,18] Search parameters used were similar to the academic review; the date range for the search was from 2010 to present, and key search terms were again 'surgery' and 'humanitar*'.

Following this search, additional grey literature was identified during interviews with key informants, which included pertinent published and unpublished data. Such data typically focused on successful working partnerships and communities of practice that were developing international humanitarian surgical capacities. Moreover, grey literature evidence acquired through interviews focused on the opportunities and challenges of the use of advanced technology in humanitarian surgery.

The grey literature provided significant insights into the progress and potential of innovation that have not yet appeared in the academic literature.

Interviews

For the second stage of the project, a total of 19 semi-structured interviews were conducted with key informants to explore what they considered to be facilitators and barriers to scaling humanitarian surgical training and development, the potential to leverage technology and actions aiming to strengthen creation of communities of practice.

The semi-structured interview narrative was informed by the literature review. Participants were identified through the literature review, through professional surgical networks and by snowball sampling. On accepting the interview invitation, participants were given a participant information sheet and consent form, which they reviewed and returned before the interview. Interviews took approximately one hour and were conducted over Zoom. All participants consented to their interviews being recorded for transcription purposes.

The University of Manchester Research Ethics Committee determined that this study did not require review because the informants were speaking in a professional capacity on subject matters limited to areas strictly within their professional competence.[19]

To strengthen the applicability of the findings, a geographical balance of interviewees was sought, which aimed to ensure a breadth and diversity of opinion. Nine interviews were with surgeons from low-resource settings and ten interviewees worked in humanitarian organisations at headquarters level or in academia in North America or the UK.

The focus of the interviews was on exploring long-term strategic challenges and opportunities for the humanitarian sector, so recruitment targeted senior figures within organisations who possessed in-depth knowledge of the sector, gained through years of experience.

Ideation exercise

The third stage of the Building Humanitarian Surgical Capabilities project was intended to develop potential new directions for focus, and suggest potential solutions to the challenges identified through the literature review and interview process. The ideation exercise took place over three hours via Zoom on 1 March 2024; 24 participants took part and the process was recorded to enable transcript generation to facilitate postevent analysis.

In a manner similar to the interviews, participants were identified via the literature review process, by discussion during the interview process and by snowballing. Sixteen of the participants had already been involved in the interviews and were thus familiar with the project's aims and objectives. Eight participants were new to the project.

To begin, the research team presented an overview of the project's objectives and progress to date, highlighting the three themes identified. This was followed by a short opportunity for questions and answers.

For the first phase of the ideation exercise, three working groups were created to consider each of the three themes of education and training, communities of practice and the role of technology. Each group was facilitated through themed conversations over 20 minutes in each area. In each, a facilitator provided a summary of the research findings and challenges identified in developing humanitarian

surgical capacity. The participants worked together to generate experimental, adaptive and potentially disruptive ideas to overcome the challenges identified.

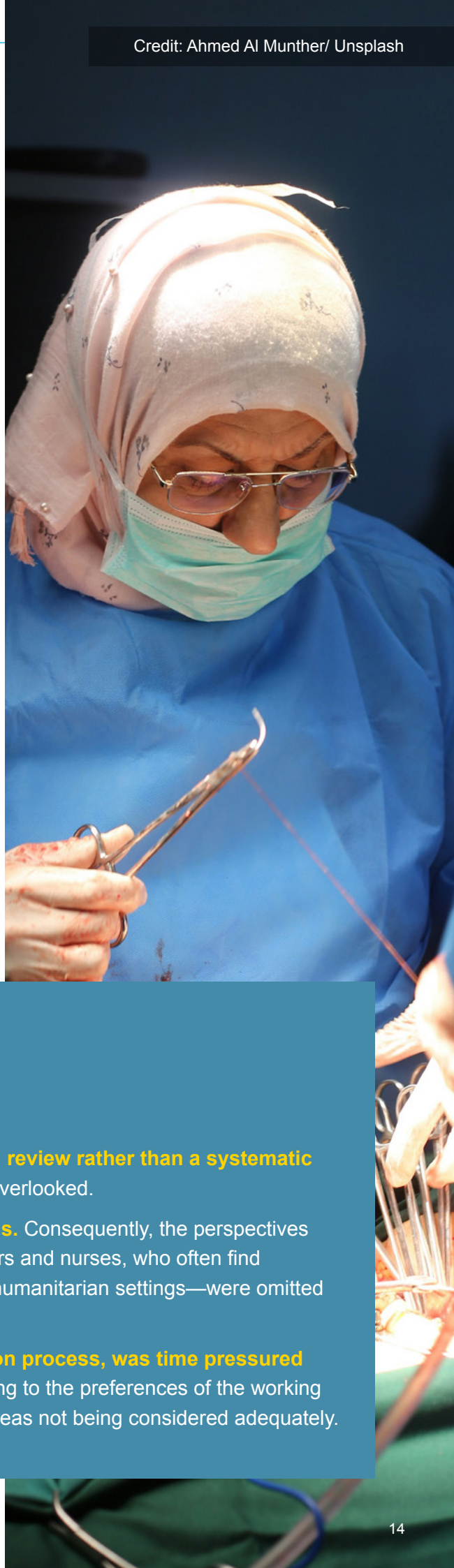
In the second phase of the exercise, participants cycled through each of the three thematic areas again to prioritise the potentially best, most practical and most innovative ideas.

The final data consisted of the transcript generated across the two ideation stages, alongside the documented outcomes of the prioritisation process. The intention was not to necessarily seek the 'right' approach; rather, it was to explore a range of possible ways to develop humanitarian surgery as a field of practice and to build capacity to provide such services.

Data analysis

Data analysis took place between February and March 2024. Interview transcripts were generated automatically by Zoom. The transcripts for the six ideation exercise groups were summarised rather than fully transcribed before analysis.

Inductive thematic analysis was employed, characterised by an open approach that allowed the content of the data to dictate themes and codes. This method was particularly suitable for an exploratory study seeking the perspectives of a diverse range of participants. Microsoft Excel was used in the analytical process.



Credit: Ahmed Al Munther/ Unsplash

Limitations

In this research, the limitations were threefold.

1. **The literature review was conducted as a scoping review rather than a systematic review.** As a result, some literature may have been overlooked.
2. **The participants in this research were all surgeons.** Consequently, the perspectives of the wider surgical team—specifically, clinical officers and nurses, who often find themselves required to operate in low-resource and humanitarian settings—were omitted from the findings.
3. **The ideation exercise, particularly the prioritisation process, was time pressured and outcome focused,** with the facilitators responding to the preferences of the working groups. This may have resulted in some ideas and areas not being considered adequately.

Humanitarian surgery literature review

Humanitarian surgery literature review

Key points

- It is necessary to distinguish between global surgery and the specific activity and context of humanitarian surgery.
- In a crisis, delivering humanitarian surgery requires scaling up local surgical activity and logistics, as well as providing international surgical support from EMTs and humanitarian actors such as NGOs.
- Humanitarian surgery should not simply deal with the specific health consequences of disasters or conflicts, but also needs to be capable of supporting the wider surgical needs of the population.

Development of global and humanitarian surgery on the world stage

As Chung identifies, demand for plastic surgery surged during the First World War in response to the needs of the many patients who had endured traumatic injury and required functional limb use after the harms they had suffered.[20] The consequences of violent conflict have often been the driver of developments in emergency surgical care, but the relative lack of surgical capacity because of the lack of financial, logistic and human resource investment, and disease prioritisation, during the latter years of the 20th century, led to surgical services being described as the 'neglected stepchild of global health'.[21] Surgery in low-resource settings was perceived as an expensive nonessential luxury.[22]

Recognition of the importance of surgical services to global health has grown significantly over the past decade. Chung argues that interest in what has been termed 'global surgery' surged after the 2015 Lancet Global Surgery Commission report entitled *Global Surgery 2030: evidence and solutions for achieving health, welfare, and economic development*.[8,20] This landmark report was based on the findings of four working groups focusing on: key domains for delivery and management; workforce, training and education; economics and finance; and information management. The commission report concludes with five key messages that identify the realities of social, political and economic inequalities determining surgical access and associated outcomes, alongside recommendations to improve surgical care in low- and middle-income countries (LMICs). The stark headlines are that five billion people lack timely access to safe surgical care and 28–32 per cent of the global burden of disease is attributable to surgically treatable conditions.[5]

In response to this, emergency and essential surgical care was prioritised at the 68th World Health Assembly in 2015, with a resolution on "Strengthening emergency and essential surgical care and anaesthesia as a component of universal health coverage" and the addition of essential surgery to the third edition of the *Disease Control Priorities in Developing Countries.*[23,24] Taken together, these set the agenda for surgical capacity development,[9] and, almost a decade later, this report explores the particular subset of patient emergency needs in the context of a disaster and considers how the evolution of global surgery can support the capacity to manage humanitarian challenges.

Forrester *et al* position humanitarian surgery as a response to service needs created by an influx of patients from an emergency or crisis that overwhelms the healthcare system.[25] Health facilities and services are often degraded or destroyed in a crisis—whether a climate event, earthquake disaster or conflict—resulting in inadequate capacity and a subsequent call for outside assistance.[25] A more recent definition is offered by colleagues in HSI at RCS England, who ran a Delphi process with academics and practitioners involved in the leadership of global surgery.[16] They converge on the following definition:

> *"Humanitarian surgery is an area for study, research, and practice that focuses on surgical care in conflict and postconflict zones, in areas of sudden-onset disasters, and when the local health system is overwhelmed".*[16]

A bullet extracted from a Ukrainian soldier at a stabilization center. Credit: Salvatore Cavalli / SOPA Images/Sipa USA/Alamy

Why surgical capacity matters in LMICs

The recognition of the importance of surgery in general to population health, and its reprioritisation, has given rise to familiar ethical debates around the allocation of resources to surgical care in low-resource environments.[26] These debates are often explored from a health economic cost-effectiveness perspective. Fenton *et al* seek to settle the 'deservingness' debate, concluding that most surgical interventions are resource efficient; thus, greater support should be given to surgical interventions.[26] However, they recognise that in settings where provision of potable drinking water and adequate basic nutrition are deficient, redirecting resources to surgical care is problematic.

The provision of primary care in the world's poorest countries is often better developed than surgical services.[27] Successful global health developments against infectious disease—in particular, against the 'Big Three' diseases of malaria, tuberculosis (TB) and HIV—have led to a burden transition from infectious to noncommunicable diseases, such as cardiovascular disease and cancer. In turn, this has led to increased recognition of the need for surgery.[28]

Rather than arguing for more surgical care in low-resource settings centred on Universal Health Coverage or patient quality of life, the justification for providing surgical care has typically focused only on financial cost-effectiveness evaluations, which are perceived to be better arguments for increased investment in surgical systems. For instance, Merchant *et al* detail that, whereas surgery in low-resource settings was previously considered too expensive, recent data demonstrate that it can be cost-effective due to the transformative impact of essential surgery on disease progression and patient quality of life.[27] As an illustration, cleft lip and palate repair is deemed cost-effective, at US$47.74 per DALY (disability adjusted life year).[22]

Borrelli and Mimi argue that developing local capacity to provide plastic and reconstructive surgery could have an immense impact on the economy of a region and gives a significantly positive return on investment.[29]

According to Broer *et al*, approximately two per cent of annual GDP in LMICs is lost to the underdevelopment of surgical systems.[22] In 2018, surgical conditions constituted 11 per cent of worldwide DALYs caused by traumatic injury, malignancy and congenital anomalies.[29] Conflict, road traffic incidents and climate disasters, which predominantly affect the young and active population, injure soft tissues, bones and nerves causing life-long disabilities and financial loss if left untreated. The findings of our literature review echo those of Čebron *et al*, who review the literature on global reconstructive surgery in LMICs, finding that quality of care and the impact of surgical interventions are primarily discussed economically, rather than in terms of patient quality of life.[30]

To determine the viability of an intervention, academic papers incorporate evidence from the WHO-CHOICE database to map whether a surgical intervention is cost-effective, using the DALY framework.[31,32] While recognising and evaluating the economic impact of surgery, there is scope for alternative, noncapitalistic frameworks to reframe our understanding of the value of surgery in health.

What is humanitarian surgery?

There is a dearth of reported experience and available data on surgical interventions in conflict-affected settings, making it difficult to understand what procedures are being performed and assess associated health outcomes. Global health evaluations have typically focused on individual diseases rather than on system development, resulting in a relative neglect of surgical services. Data on safe, essential and life-saving surgical and anaesthesia care in LMICs are very limited. Case fatality rates are high for common and readily treatable conditions such as appendicitis, hernia repair, fracture management, obstructed labour, breast and cervical cancer, and surgery for congenital abnormalities. With the epidemiological transition to noncommunicable diseases, the need for surgical services will continue to increase.[8]

Nevertheless, the literature review identified that demand for these more general surgical interventions is still high during and after disasters and needs to be addressed alongside more widely anticipated traumatic injuries sustained in crises that require orthopaedic and plastic surgical interventions.

Surgical operations reported and detailed in much academic literature are not necessarily those that are most needed, particularly in humanitarian settings. The findings in the review echo those of Čebron *et al*, who identify that, disproportionately, the majority of articles on reconstructive surgery in LMICs focus on repairs of cleft lip and palate (72 per cent), with few articles considering traumatic injury or burns, despite the significantly differing prevalence.[30] Elder *et al* synthesise data from nine projects across seven countries supported by Médecins Sans Frontières (MSF) and demonstrate the need for low-technology surgical care for burn-related injuries caused by open cooking fires and crowded living conditions.[2]

The central importance of plastic and reconstructive surgical care in humanitarian missions is reported by Eells *et al*, who argue that 66 per cent of DALYs attributed to surgically treatable disease could be addressed by specialist plastic and reconstructive surgeons.[33] The spectrum of injuries sustained in conflict settings that would benefit from reconstructive surgery is huge. Wong *et al* advocate sufficient humanitarian surgical capacity to address the acute consequences of conflicts, but there must also be capacity to manage other traumatic injuries, such as those from road traffic incidents.[34] Eells *et al* note that the injury burden from these causes is rising because of a greater incidence of motor vehicle incidents and injuries sustained in the workplace.[33]

The consequence of misrepresenting surgical needs in conflicts can lead to incorrect resourcing of staff and equipment. This is illustrated by de Costa *et al*, who explore differences in mechanisms of injury, injuries sustained, clinical outcomes and resources needed to treat patients in LMIC trauma centres.[35] The authors, working at an MSF surgical care unit in Afghanistan, have published the epidemiology of their trauma cases, outlining the different types of injuries and associated healthcare needs of patients at their unit. Road traffic incidents were the cause of 56 per cent of people injured in Bujumbura, Burundi, and 23 per cent of patients in Kunduz, Afghanistan. These casualties had more head and limb injuries and were 12.5 times more likely to require orthopaedic intervention than those who had experienced trauma from violence. Cases of violence-related trauma required more torso surgery but were less frequent in total. The nature of the surgical need in humanitarian settings may be from more 'routine' causes than from mechanisms related to disasters.

Alongside the limited data on the nature of conditions requiring surgical interventions, the demography of patients is often unknown. Forrester *et al* considered records of all their MSF surgical interventions from 2008 to 2014 to try to define the parameters.[25] There were 49,715 patients treated in the study period, 69 per cent were men and the median age was 24 years old. In conflicts, it is perhaps not surprising that there would be a male predominance from traumatic injury, although civilian injury clearly also occurs. There was also a more surprising gender disparity, with fewer surgical operations on women for noninjury causes, and, perhaps as a consequence, a higher rate of surgery for iatrogenic causes from traditional or clandestine medicine. Wong *et al* identify that Caesarean section was the surgical operation performed most frequently by MSF surgeons.[34]

Drawing on MSF data from 20 countries from 2014 to 2015, Trudeau *et al* conclude that 30 per cent of surgical care involved pre-teen patients (aged <13 years) and 8 per cent involved teenage patients (aged 13–17 years).[36]

Many surgeons do not have sufficient experience or training in paediatric surgery. Porta *et al* report in their findings that, in conflicts, 30 per cent of surgeons conducted surgical operations that they had never done before,[37] something that very clearly does not meet the standards set out by the WHO EMT minimum standards.[11] However, there is evidence that surgeons with predominantly adult experience can provide good care to injured children and that surgical training programmes devised by the military to support surgeons in developing this specialist skill set have proved successful.[38]

Patient Using Prosthetic Leg. Credit: EyeEM Mobile GmbH/iStock

From high- to low- and middle-income surgical interventions: is it humanitarian surgery?

The rise in profile of humanitarian surgery on the global stage has resulted in an increase in the number of surgeons in training in high-income countries who express an interest in developing careers in humanitarian healthcare. Shafiq surveyed 185 junior doctors in the UK via social media; 72.4 per cent of respondents wanted to gain experience in humanitarian surgery.[39] However, those engaging in the study described the many difficulties they encountered in following this career path. Lack of career guidance and senior mentorship was clearly an issue; 86 per cent of respondents did not know anyone involved in humanitarian surgery who could guide them. Securing time away from work was an issue for 31 per cent, and the low salary or unpaid nature of the work was a problem for 43 per cent. There is a perception that humanitarian surgery means being underpaid or working for free.

These findings are consistent across the academic literature; there is an interest in engaging in humanitarian surgery, but financial barriers and the absence of an established community of practice prevent surgeons from moving into the sector. Enthusiasts and innovators identified ways to overcome these challenges, with 93 per cent agreeing that there was a benefit in raising awareness of how to undertake humanitarian surgical work, but 97 per cent were not aware of courses that would help doctors prepare for such work.[39]

One in ten of interested respondents from high-income settings were first- or second-generation migrants who potentially had contextual and linguistic familiarity that would be of benefit for working in some humanitarian settings. This suggests that there is potential and scope for enabling such a career trajectory in countries such as the UK.

Multiple authors referred to their activity as 'humanitarian', but its scope falls outside the accepted definition of humanitarian surgery. This misdescription of activity is common and confuses the literature. For example, discussion in the literature retains an acceptance that short-term vertical voluntary interventions are standard practice, including de Rosa *et al*, De Maggio *et al* and Backer.[1,40,41] These are typically global surgery projects where specialists arrive in a setting and undertake multiple surgical operations of a particular type in a short intensive period before leaving. Writing in *Frontiers in Paediatrics*, Nichani and Nichani detail their overseas volunteering excursion with a UK charity that averages 12 cardiac surgical operations per week, which the authors argue is an efficient use of time and donated funds.[42] They consider follow-up care, travelling two to four times per year to partner countries, and choosing hospitals with a cardiologist who can support and coordinate postsurgical care. The authors encourage mutually beneficial collaborations, as they explain it is their "duty to share their world-renowned expertise and skills with these less fortunate countries to save lives".[42] This is a typical example of a paternalistic and interventionist style of surgical healthcare. Padmanaban *et al*, who provide volunteer maxillo-facial surgery, also encourage such models of care.[43]

Pulvirenti *et al* suggest that the necessity for such global surgery interventions is due to the shortage of surgical staff, lack of investment, cost of the surgical procedures for patients, distances patients need to travel to get to hospital and relative lack of training and experience.[9]

Who is practising humanitarian surgery?

Chu *et al* express concern over the surgical quality of care of humanitarian programmes.[44] They argue that they are often mobilised quickly in response to complex emergencies and lack the systematic rigour to maintain quality of care as a result.[44] The authors identify that surgeons do not need specific credentials to work in humanitarian settings and there is a real need for more trained surgeons to engage in this work. To enable this, Chu *et al* compiled a checklist of clinical protocols for Caesarean sections, burn management, care for open fractures and amputation, recognising the dearth of quality indicators for surgical standards, unlike in many core areas of humanitarian medical care.[44]

Humanitarian agencies and providers rarely report their medical data—one of the key concerns relating to accountability the sector faces.[45] Without such reporting, which is an expectation of the WHO EMT standards, it can be difficult to give assurance on the quality of care.[10] Also confounding the quality judgement is a relatively high staff turnover, and difficulties with gathering patient data and following up on patient outcomes. Patients often do not return for follow-up and can be difficult to trace.[44]

Elahi and Matata explore alternative innovative methods of practice,[46] describing how they have used both public and private funding, and worked with an international NGO to successfully train surgeons in complex surgical care. They recognise the limitations inherent in relying on visiting international volunteers where the development of successful teamwork and interprofessional trust is essential.

How is activity recorded?

Reported surgical activity is largely quantitative—how many operations on how many patients how quickly—with an absence of qualitative data relating to surgical patients in humanitarian settings. Capturing experiences of receiving care and perspectives of surgical care from those receiving it, alongside evaluating staff–patient interactions, have mostly not been reported.[47] Close and Christie-de Jong conducted qualitative research with patients who received surgical care with humanitarian NGO Mercy Ships.[47] They find a ‘user view’ that only foreign surgical teams can be trusted to undertake some of the surgeries. The authors call on international NGOs providing such facilities to take steps to mitigate this consequence, to build more confidence in local surgical systems.

With the absence of clinical governance systems requiring reporting of activity and appropriate data sharing, the outcomes of short-term surgical missions are underreported.[48] There has been little quality control or oversight of these, and an absence of sufficient cooperation between national ministries of health and the international teams. A failure by donors and providers to consider national surgical priorities can lead to objectives and expectations being misaligned.

The absence of a system-wide approach undermines the wider provision of care, disempowers local systems, and leads to a loss of care provision and absence of sustainability after the withdrawal of international medical providers.[49] One suggestion to overcome the challenge of capacity building and delivering quality improvement is to build provider partnerships, perhaps through multinational clinical trials.[50] Involvement in international trials can support the recruitment of provider participants, alongside supporting the implementation of standardised research

protocols, thereby improving the quality of data collection. Increasing support for international surgical clinical trials has the potential to enhance surgical care more widely.

High-income country research funding bodies are increasingly demanding evidence of participant and patient engagement in research bids.[51] This creates an opportunity to address criticism by leveraging community participation, involving those receiving the care in study design, capturing their experiences of surgical provision, and better understanding their concerns about the research and the interventions being provided. Veerappan and Jindal found through a scoping review that approximately 30 papers detailed study populations being involved with research methodology and design processes, but no community participants were involved in disseminating outcomes or implementing findings.[52] The absence of following through on community engagement in projects inhibits local ownership and ultimately the sustainability of surgical initiatives. Patient experience needs to be mobilised.

How is humanitarian surgery being made sustainable?

A key barrier to the safe provision of surgery in low-income communities is dependency on adequate infrastructure and supporting services to allow the provision of safe care.[27] A review of the academic literature provided insights into how surgeons have navigated this potential absence of resources.

Aissaoui *et al* consider alternatives to conventional strategies for the provision of safe and effective anaesthesia in austere environments.[53] They demonstrate that innovative approaches to regional and spinal anaesthesia can be used successfully when adapting to low-resource settings. The authors encouraged practitioners to explore regional anaesthesia techniques, such as thoracic spinal anaesthesia for abdominal surgery as a feasible alternative to general anaesthesia. Faulconer *et al* offer low-resource options for dressing abdominal wounds that are cheap, rapid and reproducible.[54] The authors detail a technique to achieve a negative pressure dressing without continuous suction. Such low-resource alternative methods of practice are essential for surgeons working in settings with fragile logistic supply chains.

To consider how future surgical needs can be met in a sustainable, ethical way, Chung reviews the range of intervention model options in global surgery and proposes three categories[20]: a one-way vertical approach for short-term and disease- or incident-specific interventions; a two-way vertical approach, where surgeons are transported overseas, often to the Global North, to support the development of their surgical skills; and a horizontal intervention approach focused on the sustainable development of surgical teams, healthcare systems and infrastructure in situ.

Chung, citing Patel, lists a potential fourth, diagonal, surgical intervention approach. Here, the focus is on a blend of the approaches for the longer term, driven by patient need but supporting bilateral educational exchange between local and visiting surgical staff.[20,55] Chung calls for an agreed global surgery curriculum, and for technological partnerships to incorporate this diagonal and sustainable combination approach to the development of surgery in low-resource settings.[20]

Credit: Jafar Ahmed / Unsplash

Interviews with experts

Interviews with experts

Key messages

- There is a lack of consensus around what humanitarian surgery is, relative to global surgery.
- Participants questioned the value of continuing to explore a definition of humanitarian surgery that allocates resources to a theoretical endeavour rather than operational advancements.
- The context in which humanitarian surgery is delivered matters.
- Humanitarian surgery is not just trauma surgery: it addresses the full breadth of surgical need of the population.

What is humanitarian surgery?

With the uncertainty found in the scientific literature, it was perhaps not surprising that there was a corresponding lack of consensus among participants about what humanitarian surgery is, where it takes place and who the key actors are. Separating out and distinguishing the specific activity from the broader concept of global surgery was difficult.

Many interviewees believed that the discipline of humanitarian surgery had evolved from the recognition of disaster medicine as a specific field. They argued that, over the past two decades, this itself had transitioned to a more general field of humanitarian healthcare.

One interviewee explored a range of interpretations of humanitarianism, distinguishing between the humanitarian principles and formal systems and structures governing the sector such as the UN and International Humanitarian Law, and what they considered more informal 'everyday' humanitarianism, with smaller and less formal structures and partnerships, and less powerful actors volunteering their skills.

In some cases, participants felt their own organisation was not appropriately aligned with, and providing, humanitarian surgical care. Their activity of providing specialist surgical care to defined populations in need, or working in spaces of poverty providing essential surgical care to those who would otherwise have no access, was not considered to be humanitarian surgery. They felt they were not responding to conflict or sudden-onset disasters and so were not within scope.

The lack of a consensus theme around a definition of humanitarian surgery recurred across the interviews. There was a sense among interviewees that there is no coherent distinction between what humanitarian surgery is and what might be considered more broadly as global surgery.

The recently published definition by McKnight *et al* was offered to interviewees to gauge their perceptions of its suitability.[16] There was a lack of consensus among the interviewees—both geographically, and across areas of expertise—about the purpose of humanitarian surgery.

For some interviewees, the objective of humanitarian surgery is to provide life-saving surgical care in complex emergencies, including during conflicts and when providing disaster relief. For others, the objective was to engage in capacity building in low-resource contexts:

"In a situation where there is no war and there is no acute natural disaster, but still there are needs, I'll call that humanitarian surgery".

Former Surgical Advisor, Italy

Across interviews, participants agreed that the phrase "if the health system is overwhelmed" is an important phrase. Yet the interpretation of 'overwhelmed' differed and there was a sense that they found this lack of clarity frustrating.

All participants had different yet strong opinions about what humanitarian surgery is and should be. The need for there to be an emergency narrative was contested. It was even suggested that a definition should focus less on delivering surgical interventions, and more on developing and building capacity in the system.

This lack of consensus on what humanitarian surgery is, when it is needed and what its objective should be, results in a lack of identification with the term. It leads to the fracturing of any potential community of practice and hinders the creation of a sector-wide surgical plan.

The focus of HSI on humanitarian surgery and attempts to define it were a cause of frustration among interviewees. Participants explained that, from their perspective, such refined terms are not respected by actors in everyday humanitarian practice. They were strident in their belief that humanitarian access would not be improved through a clearer definition of what humanitarian surgery is and felt the allocation of resources to come up with such a definition was a waste of finite resources. For instance, seeking to distinguish between global surgery and humanitarian surgery was irrelevant for a surgeon from Cameroon. Similarly, for another interviewee, the important issue was simply whether the patient got surgical care:

"Keep in mind that people in the South like products, actions more than theories and research. In my opinion, this is a very important issue at the end of the day. If people want to make research, believe me, focus on creating new guidelines for low-resource setting medical practices. This will improve the whole thing".

Hospital Director, Turkey

There was a resounding rejection by many participants of continued efforts to define humanitarian surgery:

"You've got 450 million children under the age of five that don't have access to safe surgery. And we wanna go and spend time and money creating definitions? No disrespect, but …"

NGO Director, USA

Most participants were frustrated by the allocation of resources focusing on defining humanitarian surgery rather than on improving the provision of surgery in what they considered to be humanitarian contexts.

Surgical landscape

Participants suggested that the landscape of humanitarian surgery is changing. In the past, humanitarian surgery was provided in locations such as Yemen and South Sudan that previously did not have access to any surgical services. A surgical advisor argued that this was the context in which the Lancet Commission on Global Surgery had derived its core indicators.[8] It was the type of setting where applying the questionable capacity development logic of 'see one, do one, teach one' in austere, low-resource settings had been the norm (Surgical Advisor, Netherlands).

Today, humanitarian surgery is often conducted in middle-income countries enduring conflict or in the aftermath of a sudden-onset disaster. The surgical advisor pointed to the wars in Gaza and Ukraine, countries with populations that have had access to surgery for years and where providers are familiar with working in high-resource hospitals with the necessary technology. This contextual change meant many interviewees felt it necessary to describe the setting for each of their answers. For example, distinguishing between low- and middle-income contexts, operating in conflict settings and providing support to low-income remote or rural hospitals. Each setting has different levels of available resources and staff training, and faces different challenges.

When interviewees were asked what, from their perspective, humanitarian surgery was and how to support capacity development, they presented four different environments as follows.

- **War:** whatever stage of conflict, but depending on the intensity of fighting, a constant and ongoing state of emergency. The sustained surgical need leads to a programme that looks very different from other humanitarian settings.
- **Disaster response:** short-stay international EMTs are needed to support the management of a surge in patients requiring surgical interventions. While these may not be life-saving, they can be limb-saving and so reduce the burden of disability. In addition, international support can ensure essential core services continue alongside the disaster response.
- **Recovery:** the burden of disability after a conflict or disaster compromises the recovery and rehabilitation of those injured and inhibits the rebuilding of communities. The provision of reconstructive surgery supports the vulnerable and disabled to be more productive members of their communities.
- **Poverty:** in the absence of surgical care, easily treatable conditions cause death and disability. The multifaceted burden of noncommunicable disease, including traumatic injury, causes more illness than malaria, TB and HIV combined. Implementing effective surgical systems in low-income countries can significantly and cost-effectively improve population health, potentially leading to financial growth and poverty alleviation.

Scope of practice

There was consensus that humanitarian surgery involved the full breadth of surgical interventions and was about far more than delivering just trauma surgery.

In humanitarian settings, a dearth of health service availability means that patients often cannot access basic care for common and readily remediable conditions. Complications from delayed treatments of injuries—perhaps infected wounds—can require multiple additional surgical interventions, adding to the burden placed on already stressed health systems.

Some participants considered humanitarian surgery to include surgery for conditions such as appendicitis, hernia repair and obstructed labour; even some cancer surgery was within scope. Interventions for rehabilitation purposes were also described as being neglected at present. For other participants, humanitarian

surgery was elementary or basic surgery completed by clinical officers, technicians and nurses rather than qualified surgeons.

While participants did not share a consistent perspective on the nature of humanitarian surgery, they did feel that two skill sets were required for treatment, best described as:

"...the difference between the medical skill set required for treating a wound and the sociocultural skill set required for treating a patient".

NGO Director, USA

This psychosocial approach to providing interventions and treatment highlighted the importance of being aware of the local context in providing humanitarian surgical services, considering what level of care may be available in the future and what might be considered recovery.

Building surgical capacity

Participants from low-income countries observed that there have been substantial improvements in surgical services in recent years. The evolution of more integrated health systems, with plans for financial support, provision of logistics, and development of personnel are, in places, beginning to have an impact. A Ugandan surgeon described how surgical capacity had evolved from 2 to 100 surgeons, with consequent improvements to surgical accessibility in rural locations in the past 20 years. Others pointed to development and training of nursing staff, which had delivered lower wound infection rates.

In Afghanistan, similar advances in the education and training of surgeons, biomedical engineers and nursing staff were described as decreasing the scale of international support needed. An MSF surgeon explained that, by adopting a focus on training, NGOs enabled staff to continue to care for patients once international organisations had scaled back or withdrawn:

"The knowledge is there. The technique is there, and it will go on".

MSF Surgeon, now in Burundi

Participants spoke of the success of the Royal College of Surgeons in Ireland (RCSI) in creating meaningful change in sustainable, ethical working practices by working with regional surgical societies. In particular, working with, and supporting, the College of Surgeons of East, Central and Southern Africa (COSECSA) had created a model for sustainability, collaboration and impact.

The clear theme was that surgical systems are growing and developing. Rather than simply delivering care, humanitarian surgeons are involved in building and developing capacity, planning for and providing support for the education of multidisciplinary surgical teams, generating sustainable services and creating positive supportive relationships that can deliver real change for those most in need.

Is humanitarian surgery delivering capacity building?

The Lancet Commission on Global Surgery has clearly emphasised the importance of building sustainable surgical capacity in local health systems.[8] Many participants also suggested that the profile and importance of humanitarian surgery was highlighted by reviews of the activities of international surgical teams in response to the Haiti earthquake in 2010.

Participants agreed that humanitarian surgery is gaining international traction. The growth in the number of competent surgeons in this field in an environment where there has been a deficit, and the increasing capacity of these specialists to deliver further local training, is creating a multiplier effect, with a rapidly developing trajectory. The demand for clear clinical standards for surgeons responding to crises and delivering humanitarian surgery,

set out in the WHO Blue Book in 2013, has led to the development of evidence-based and context-specific protocols and guidelines.[10] Several participants referenced publications by the International Committee of the Red Cross and the evolving standards from the WHO Blue Book and supplementary 'Red Book' as crucial resources.[11,12,56] To see a continued trajectory in this area, participants identified four key focus areas to improve capacity development.

- **Protocols and guidelines:** there was a desire for more, clear, evidence-based protocols and guidelines for practice. Of particular interest was more guidance to help navigate the ethical, moral and emotional decisions high-pressure humanitarian settings demand. Medical records and surgical operation notes may not adequately explain the decision making context when reviewed later. Clear protocols and standardisation can support those making the decisions.
- **Cost-effectiveness of interventions:** for many low-income settings and difficult humanitarian responses, participants believed that surgical services had been neglected in favour of addressing the issues of nutrition, clean water and halting the spread of communicable diseases. Although the one-off cost of surgery is greater than providing a mosquito net, for example, it may have a much longer impact in terms of morbidity and disability reduction. Raising the profile, and demonstrating the cost-effectiveness and impact, of surgery in the longer term was essential to securing the financial support to deliver and develop this area of health provision.
- **Partnership working:** building relationships and partnerships takes time. The majority of participants suggested that sustained relationships with international partners were essential to creating a sustainable surgical system. In a crisis, instability and uncertainty inhibit coordinated and organised capacity building. At local, national and international levels, trust needs to be built and confidence developed through secure and established relationships, so responders can rapidly develop trust in working together to deliver the best outcomes for patients.[57]
- **Power hierarchies:** there is a perception that humanitarian surgery is a paternalistic voluntary overseas role from the Global North that is 'done' to affected populations. International NGOs respond to crises and offer the services they believe are needed without engaging with the coordination of systems; they often arrive too late and, tellingly, 'bring junk for Jesus'! This drew negative critiques from those involved in leading responses and created distrust among patients.

Many participants advocated greater emphasis on improving humanitarian coordination at a strategic policy level. One interviewee remarked how organisations assert "you must coordinate with me". The humanitarian surgical sector consists of major power imbalances; while many achievements have been made, there remains a need to move towards equitable coordinated action to achieve capacity development. Greater involvement of local providers would increase engagement and system resilience.

Supporting humanitarian surgery

Participants overwhelmingly agreed that the primary stakeholders in humanitarian surgery are the surgical teams working on the ground, rather than strategic specific coordinating institutions or systems.

All interviewees raised the importance of the entire surgical team to the overall care of patients. Health personnel conducting surgery in low-resource settings are often not qualified surgeons but rather clinical officers, nurses and nurse assistants. Without anaesthetists and theatre nurses, and without adequate ward-level care, continuity of care will fail. Interviewees also noted the importance of those involved in supply chains, procurement and technology.

Many interviewees observed that a large number of international surgeons working in humanitarian surgery are involved in leadership and management rather than in actual surgical operating roles. Local surgical teams were praised for their agility:

"They can do stuff that most surgeons would never be able to do, like take a skin graft with a razor blade … all kinds of crazy things which they need to do, simply because it's a low-resource environment".

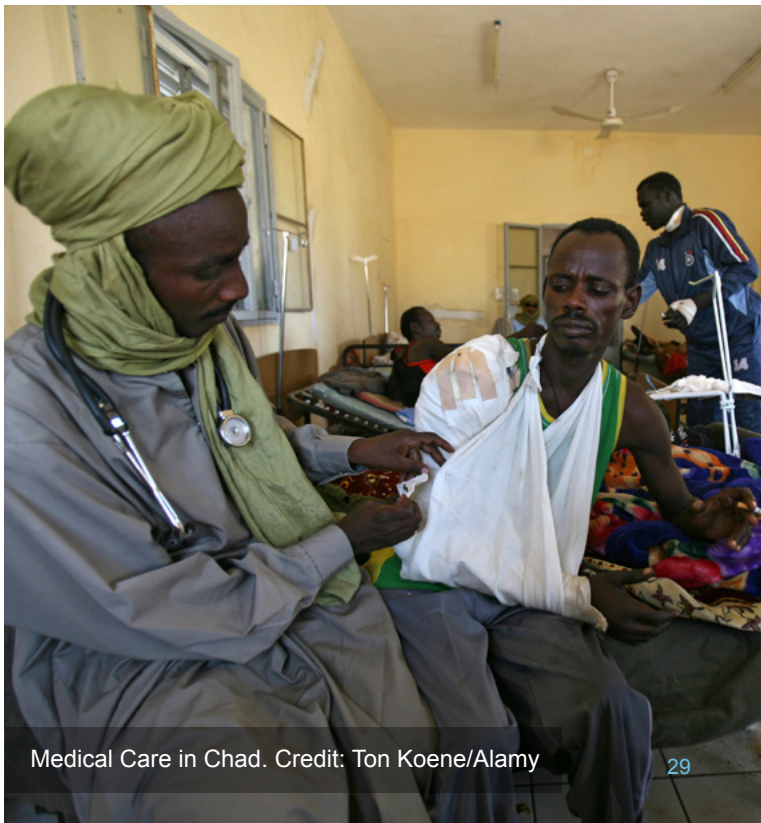
Professor of Surgery, India

International bodies such as from the UN and international surgical networks, associations and colleges were recognised as being vital to the development of a humanitarian surgery community of practice. This community was considered to be much more than the sum of its individual parts.

Recruiting and retaining humanitarian surgeons

The challenge of recruitment and retention of skilled surgeons was a common theme of the interviews. Participants identified a range of barriers and challenges.

- **Salary:** in most LMICs, public or government health systems provide essential and core surgical services. The public sector is typically relatively poorly paid and surgeons move to, or partially work in, the private sector to supplement their incomes. Some participants suggested that this undermined the capacity of the public system and that improved salaries and a better balance between the two sectors was required to sustain capacity building.
- **International deployment:** participants identified the often international nature of engaging in humanitarian surgery. The opportunity to be a part of an EMT was an exciting career opportunity but disrupted the service that surgical providers delivered in their home countries. Doing 'too much' or doing something 'too often' created service deficiencies in the donor system. For those who committed to a more substantial career in humanitarian surgery, the disruption to family life, loss of personal networks and the constraints on travelling home for leave were problematic.
- **Sustainability and risk:** many surgeons are reluctant to work longer term in conflicts or other humanitarian crises because of the risks involved for them and their families. For surgical providers, quality of life becomes more important the longer the length of service required.
- **Isolation:** some participants felt they were simply used as service providers, responsible for delivering 'numbers treated' rather than the more professionally satisfying provision of care in the settings they were involved in improving. This can be very isolating. Networks of providers who collaborate and share experiences are ideal for strengthening and sustaining services, maintaining morale and momentum and delivering improvements.



Medical Care in Chad. Credit: Ton Koene/Alamy

Education and skills training

Education and skills training

Key points

- Create ‘just-in-time’ curricula for low-resource settings.
- Create long-term accredited curricula for low-resource settings.
- Broaden training access for the wider surgical team.
- Localise all aspects of training, including curricula, facilitators and locations to improve relevance and support sustainability.

Literature review

Most of the academic literature identified in the search for this study focused on student education in the UK and US, and how best to equip students for overseas postgraduate surgical positions. There was an absence of literature on surgical training curricula for undergraduate medical students, and for postgraduate doctors in surgical specialty training in LMICs or conflict-affected settings. These trainees are the workforce that will comprise the first responders and core workforce involved in austere settings or in responding to future emergencies.

In many of the papers reviewed, the ethical principles for engaging in global surgery suggest that high-income countries have a responsibility to begin to address population health disparities and system effects caused by colonialism.[33] Increasing recognition of this historical harm may drive the interest of those in training to work in austere and emergency settings. Fulfilling this ambition is hindered by increasing student debt and workplace burnout, with limited resources to travel overseas for work.[33,39]

While interest in developing the necessary skills and travelling to support the international humanitarian sector is high, the increasingly specialised nature of surgical training in current high-income settings creates surgeons who lack the broad-based experience and skill sets needed to work in resource-poor and humanitarian contexts.[58] This absence of skills is increasingly recognised as a challenge in the humanitarian surgical sector; addressing this deficit is becoming a priority in some training institutions.

In the US, some residency programmes encourage trainees to spend training time overseas for exposure to a wider breadth of cases to benefit their training while earning academic credit. Bale and Sifri, writing from the New Jersey Medical School, suggest that their overseas programme supports partner university hospitals that host surgical residents as they receive ‘free’ operations for populations with a high surgical burden.[59] Bale and Sifri also highlight the importance of the cultural experience trainees obtain through these overseas placements.[59]

The importance of adapting surgical skills to work in low-resource settings, maintaining a work–life balance and learning cultural responsiveness was noted by Bhatia *et al*, who suggest the transferability of these skills to domestic rural surgery.[60] This perspective on mutual benefit is also held by NHS England, which says: "Volunteering abroad can provide real benefits for NHS staff".[61]

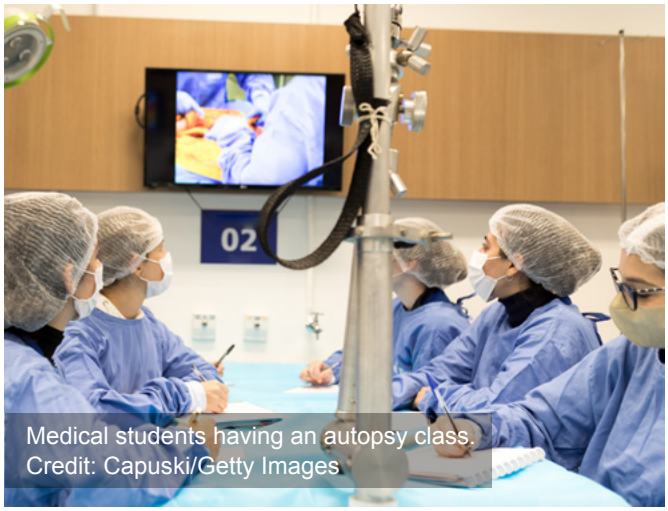
In each of these cases, appropriate supervision and clinical oversight do not seem to receive much attention and perhaps raise ethical concerns of their own. Ho *et al* surveyed plastic surgery programmes in the US to support the American Board of Plastic Surgery in creating policy guidelines for international surgical missions.[62] They highlight that the cases being performed are often not currently recognised as part of the necessary surgical training portfolio or record because of a perceived lack of governance, consistency and quality assurance for surgical operations performed for, and reported by, overseas partner organisations. Ho *et al* recommend the development of a standardised approach to support education and training in this area.[62]

A different development of this concept is described by Donley *et al*, who adapted their 'Transition to Practice' programme.[63] The original fellowship was designed to provide mentoring and support for surgeons who had recently completed their residency programme, gaining experience and greater confidence with broad-based skills over a year of practice that was once considered to complete a surgeon's training. The adapted model gave US surgeons an opportunity to gain experience under supervision in a low-resource setting in Malawi. Local partners provided oversight in designated hospitals, offering an opportunity for US surgeons to gain and broaden their experience, and take greater responsibility, and providing an opportunity to complement their specialist training with the more general surgery skills required in such settings. At the same time, Donley *et al* argue that they are providing assistance to communities with few surgical resources.[63]

These papers by Donley *et al*, Ho *et al*, Bhatia *et al* and Bale and Safri do not explore the power dimensions and perceived paternalism inherent in their partnerships.[59,60,62,63] This type of approach can also lead to a structural reliance on international support and an absence of capacity building at the local level, impairing the development of sustainable surgical systems.[64]

Acknowledging the ethical considerations inherent in overseas surgical placements, the Association of Surgeons in Training in the UK reviewed the engagement of, and roles for, surgical trainees in global surgery.[65] In their consensus meeting, there was agreement that interest in surgical work in LMICs was growing among trainees. They agreed that surgeons in training must undertake work only appropriate to their stage of development, and work within the requirements of the hosting centre rather than trying to meet their own objectives. The meeting concluded that a central repository of information for surgeons hoping to work in global surgery would be a useful resource, alongside recognising these wider experiences in the Certificate of Completion of Training.

Chu *et al* describe how surgeons in South Africa, considered to be a middle-income country, acquire broad-based surgical training experience through their training programme and might therefore be better suited to this type of role, rather than focusing resources for capacity building on residents and surgeons in training in the UK and US.[66]



Medical students having an autopsy class. Credit: Capuski/Getty Images

Short course training

To support the broad skill set needed to work in remote, austere and resource-constrained environments, a number of academic and educational institutions, organisations and international NGOs have developed short, intensive courses designed to supplement more general surgical training programmes.

These intensive study periods, ranging from a weekend to three weeks, include a variety of education and skills development approaches. These include theoretical teaching of surgical knowledge, surgical skills, logistics, international humanitarian law and disaster management.[67] However, designing a course for surgical teams working in complex emergencies in low-resource settings is difficult due to the breadth and variety of contextual needs. Variables include patient types and profiles, types of surgical need, availability of resources and nature of environment (differentiating between low-resource settings and humanitarian crises).

A scoping review of English-language-based surgical courses for austere environments carried out for this report found that the entry requirements for courses required a minimum of three years' surgical experience postregistration. The cost of courses, often in the US, the UK, India and Dubai, ranged from US$1,000 to US$10,000, sometimes with a tiered cost based on country of residence.

HSI also conducted a review of currently available surgical courses with a more specific military and humanitarian focus to look for consistency across course curricula.

Table 1 shows the list of courses running at the time of review and their curricula. The team discovered that many popular courses did not continue operating after the COVID-19 pandemic.

This review notes that all the existing courses, both in person and delivered through distance learning, are based in high-income countries, often with the objective of preparing surgeons from those countries to work in low- and middle-income settings or in complex humanitarian emergencies, rather than being targeted at developing the capacities of surgeons already working in these environments. The consequence of this is that the courses are inaccessible to those who are actually working in such settings due to language, cost, the complexities of travel and commitment of time.

HOSPEX Tabletop training, Addis Ababa, Ethiopia. June 2024. Credit: Bisrat M. Tiramo

Table 1. Surgical courses for austere environments

COURSE (WITH LINK)	INSTITUTION
International Humanitarian Surgical Skills	Stanford Center for Innovation in Global Health
Colorado Humanitarian Surgery Skills Workshop	University of Colorado School of Medicine
Primary Trauma Care	Primary Trauma Care Foundation
Trauma Sciences (Military and Humanitarian) Online MSc	Queen Mary University of London
Emergency War Surgery Course	US Military Health System
Trauma and Disaster Team Response Course (TDTR)	Centre for Global Surgery at McGill University Health Centre
Humanitarian Surgery in Austere Environments	Université Catholique de Louvain (the course has been discontinued.)
Hostile Environment Surgical Training course	David Nott Foundation
Definitive Surgical Trauma Skills (DSTS)	Royal College of Surgeons of England
Damage Control Orthopaedic Trauma Surgery (DCOTS)	Royal College of Surgeons of England
Basics of Trauma Surgery	Munich Technical University
Advanced Cadaveric Trauma Surgery Course	Newcastle Surgical Training Centre
Advanced Surgical Skills for Exposure in Trauma (ASSET)	SSM Health Saint Louis University Hospital
European Trauma Course	European Trauma Course Organisation

The curricula in these courses generally provide both medical and nonmedical training, as shown in Table 2. While recognising that the courses are designed for specific purposes and may not be context transferable, it is evident that they do not have a consistent core content. Emergency system management, including triage and basic resuscitation, tends to feature; for surgeons at this level of training, this should already be core knowledge. This concern is also relevant for basic surgical skills—why require surgical experience and then teach the basics again?

Perhaps necessary for humanitarian surgery are broader surgical resuscitation skills and the opportunity to credential to manage those conditions most commonly found in emergencies but outside the usual scope of a surgeon's specialist practice.

Table 2. Number of courses ABCDE approach to trauma appear in

TOPIC	NUMBER OF COURSES TOPIC APPEARS IN
Airway including anaesthetics	8 of 14
Breathing including chest drains	8 of 14
Circulation including damage control	11 of 14
Disability	7 of 14
Exposure	7 of 14
Ethics, management and systems	11 of 14

As an example of a course that begins to meet this type of need, a 1.5-day short course in generalist surgical skills for resource-limited environments delivered face to face in the US includes:

- management of orthopaedic dislocations;
- fracture management with traction pins and external fixation;
- performing emergency cranial burr holes;
- wound and burn management;
- hand cutting of skin grafts;
- lifting basic skin flaps;
- tendon repairs;
- primary repair of inguinal hernia;
- undertaking a caesarean section;
- management of post-partum haemorrhage;
- uterine evacuation and hysterectomy;
- tropical medicine that creates surgical disease.

It also explores different low-resource anaesthetic techniques. This is a huge curriculum for a very short course. Sufficient experience to be credentialled could not be delivered in this time, but it does give a breadth to the surgical skills that are needed in a humanitarian surgery context and perhaps shows what needs focus.

Interviews

Key messages

- Providers of simple surgical care are often not medically qualified.
- Structured, quality-assured and accredited training programmes are required.
- Education and training of surgeons needs to be delivered as locally as possible.
- Development is needed for the wider multidisciplinary surgical team, not just the person operating.

Training access

There was a consensus among interview participants that any training required the involvement of the whole surgical team, not just the surgeon. The operator may be a qualified surgeon, but many basic and more simple procedures are performed by clinical officers or nurses; the needs of these providers should be incorporated into the approach. In many austere environments or overwhelming humanitarian emergencies, the interventions are undertaken by these providers.

Several respondents highlighted the capacity of nurses working in humanitarian settings. Those interviewed from Cameroon and Uganda agreed that nurses were often the first to attend patients and were involved in triage and decision making in the early stages.

The importance of anaesthetic care, again often provided by clinical officers and nurses, was highlighted. This critical role was often in addition to their core functions. A participant from Turkey suggested that the breadth and responsibilities of supporting team members were such that recruitment and retention were affected. These roles have a high expectation placed on them.

The key message was that education and training is a group activity and requires more than just training the surgeon alone.

Participants described a range of barriers health personnel found when seeking access to education and training in humanitarian surgery.

- **Eligibility for training**: authorities and agencies responsible for overseeing and maintaining the quality of surgical services may not recognise nonmedical providers as eligible for training or recognise their qualifications, even when they have completed the programme satisfactorily. There was a strong preference for sustained and long-term development programmes for the full breadth of providers involved in the system rather than delivering focused, ‘quick fix’, short courses. It was proposed that international and regional surgical bodies could work with nation states to set minimum surgical standards based on a framework of competence rather than one of professional designation or qualification. The scope could be adapted in-country to reflect the health needs and morbidity and mortality challenges faced.
- **Cost of capacity development**: there is a cost to education and many of the existing surgical skills and capacity development courses are prohibitively expensive. This is clearly true for those operating in the Global North, but also includes many run regionally or locally by more local providers.

If sector-wide capacity strengthening is to happen, multidisciplinary team training in humanitarian surgery must be accessible and affordable to all health personnel.

- **Quality of training**: supporting professional adult learners to acquire key new knowledge and competencies requires skill, time and focus. With an increasing number of people needing training, the tendency is towards increasing student to teacher ratios, with a corresponding loss of educational quality. Many institutions do not have the faculty to deliver what is required. Participants spoke of the emigration of skilled educators due to poor local career opportunities and low salaries. This often left the nonmedical personnel to undertake their duties. They talked about the nonfinancial reputational benefits of partnerships with international associations and regional and national surgical colleges to support experienced teachers in local roles. The example of COSECSA was frequently cited as an institution that was supporting education providers and skills development successfully across the breadth of its region to levels, and with resources, that were relevant and proportionate.
- **Accreditation**: there was a demand for recognition of the knowledge and skills acquired. Programmes delivered by universities, surgical colleges and even NGOs should be quality checked and recognised both locally and internationally. Ideally this would also be linked to career progression and even salary, but the qualifications acquired and effort invested must count professionally.

Taken together, the participants identified a series of steps that were necessary to establish a structured approach to delivering education and skills development in low-resource and humanitarian surgical skills. Short courses are insufficient; a more established, longer-term, properly recognised and internationally accredited system is needed.

Local context and relevance

Participants were clear about the importance of delivering education and training locally, with local context and relevance. There was a general sense that curricula are often copied from one setting to the next, losing their contextual relevance for learners. This results in programmes lacking in relevance and local ownership, both of which are crucial to acceptance and sustainability.

Participants recognised that it was essential to include nontechnical skills and an understanding of decision-making processes in deciding whether and when to perform surgery, as well as the knowledge and technical skills for undertaking operations themselves. They organised their insights into the following three levels.

- **Basic training**: this is core training focused on basic decision making and clinical skills suitable for all operative providers, including clinical officers and nurses.
- **General surgical skills**: this phase of development centres on ensuring competency across the breadth of essential humanitarian surgical skills. It is based on the generalist skills all surgeons need to provide services in low-resource or humanitarian settings. Competence and credentialling for these procedures from a nationally or internationally recognised surgical body need to be part of the programme. Several participants proposed training in the form of short online videos to support surgeons in humanitarian settings. Step-by-step illustrations of perhaps 25–50 clinical scenarios to support surgical teams in decision making and management of surgical needs for nonspecialists was suggested. This does not equate to recognising competence but may be helpful in providing support.

- **Education and teaching skills**: for a sustainable system, leaders need to be able to guide and support those they lead. Although not all leaders are educators, they must understand what is needed and, where appropriate, have the skills and techniques to support and mentor less experienced clinicians in their development. Adult continuing education is not a 'nice to have' add-on, it is a specialist endeavour. Senior providers need to engage with, encourage and support the education trajectory to build surgical capacity.

This principled and structured model is logical and sustainable, but it is crucial to set the approach in the country context. At times, this long-term delivery model may appear insufficient. There is an established WHO EMT principle that surgeons should undertake procedures only for which they are trained, credentialled and have experience. A Syrian surgeon suggested that this approach is not always possible in emergency settings—"*We don't have time to open a book*"—and this creates a tension that must be managed for risk. Conflicting pressures can potentially be moderated using protocols and guidelines tailored to the context, but always with the aspiration of maintaining quality of care and patient safety. A localised approach ensures that those in training are taught with equipment and in environments that they can expect to use and see.

To suggest there can be only one system of training for humanitarian surgery is unhelpful. There may be principles and consistent approaches, but the specific local context should have options for accommodation.

The delivery of training locally was considered essential to allow sufficient access for all personnel. Concerns regarding the location of training were widespread among interviewees. Most current specialist surgical training and even short courses have been developed and delivered in the Global North. There was a clear sense that any effort to broaden training delivery to the regions where it was most needed required course projection and local delivery to improve relevance and access.

A consistent view among participants was that on-the-job supervised training was also vital. As expressed by an Afghan participant:

> *"I have to be at the table with the surgeon, and watch the surgeon, be with the surgeon while the surgeon is cutting."*

Where this level of close support is not feasible due to safety concerns for the specialist trainers, some participants suggested running the training in more accessible neighbouring or adjacent countries. This would potentially enable in-person attendance and mitigate some of the cost and travel restrictions.

To achieve true localisation, participants advocated developing regional and local educators and instructors, and integrating them into teaching teams, with the active involvement of local staff in designing curricula, so that acquired knowledge and skills were practical and relevant. Several participants highlighted the importance of personal relationships, familiarity and trust for achieving success.

CPR Dummy. Intubated mannequin medicine simulation surgery. Credit: Tim Cooper/Unsplash

Pedagogical approaches

Adult learning pedagogies

A recurring theme in the interviews was participants' sense that surgical curricula must reflect how adults learn. Several indicated that university training programmes can be traditional and old-fashioned. Novel approaches to training, personal development and skills practice can be difficult to implement in the more rigid hierarchical structures of a clinical environment. Participants stressed their belief that adult learners at all career stages must be educated 'on the job' in a motivating rather than didactic way:

"These guys have been in practice for 20 years. They have some good practices. They have some bad practices, but they are the only providers. So, you take them in, and you treat them with respect because they are adult learners."

Participants agreed that such an educational programme can best be achieved through co-creating the syllabus, asking adult learners what they want to learn, and ensuring that the teaching style is interactive and directly personally relevant. It also encourages relevant system-led capacity building, informed by a local community of practice.

Multimodal learning

Participants generally shared the view that there are three types of educational approach relevant to supporting staff development in humanitarian surgery.

- **Distance learning/online learning:** quality education that provides an understanding of theories and principles can be delivered in this way. Some challenges were identified in this mode of delivery in humanitarian settings; access to an internet connection, sufficient bandwidth, differing time zone issues and poor infrastructure were all cited. Some participants felt that the change in circumstances created by the infection prevention challenge of the COVID-19 pandemic had accelerated the trajectory of e-learning. The development of an asynchronous, self-paced, hybrid learning style has become a much more achievable and accepted form of learning. Many participants felt that a hybrid form of delivery with remote, accredited academic educational content, blended with at-home and local virtual simulation, had real delivery potential.
- **Workshops and practical skills rehearsal:** all participants were clear that practical, hands-on skills development is essential in surgical training. It was stressed that in-person skills development must ideally be delivered close to the local hospital and not in a more remote city centre setting. Travel was often a constraint and convenience facilitated engagement. Participants shared the opinion that skills training should be practice based and delivered in short sessions, with a particular skill focus developed in each session. In support of this, an innovation suggested was for picture-based skills booklets with minimal wording and accessible on mobile phones that could be provided to support sessions:

"[Like] when you're putting together an Ikea table … they come [with] these little comic books, and there's no words … it's drawn, and like a comic book where the need for the language is reduced."

- **Regional specialist training:** perhaps the most disruptive of the training options for service delivery would be to have a regional system of training, where local staff travel overseas to specialist centres according to their recognised in-country learning needs. On their return, they would disseminate their learning and support the development of local protocols, engaging in a 'train the trainer' style distribution of their acquired knowledge.

A significant driver of the desire for in-person skills training for participants was that it also facilitated the development of a community of practice. Participants suggested that real learning happens after they return from training sessions and begin to put their acquired knowledge into practice. Learners find the support of their peers helpful over the following months; shared experience and the development and strengthening of interpersonal connections with a peer network can be powerful. The joint development of local guidelines and peer support, often informal and via communication tools such as WhatsApp groups, are important.

Funding concerns for sustainable training

There was strong consensus among participants that humanitarian surgical training had advanced in recent years, but they expressed concern about how to secure accessible and sustainable funding for education and skills training, noting that political and financial support must be consistent and sustained to maintain momentum.

- **NGO funding:** in the absence of established and recognised humanitarian training opportunities, participants were aware that many of the larger NGOs had created and funded training courses to address a perceived deficit. They expressed concern that this approach, and the procedures addressed, would reflect the experiences and organisational objectives of the NGOs, with perhaps less focus on meeting the needs of those receiving the training or even of patients.
- **Sustainable government funding:** current financial models for training are minimalist in their approach. The salary scales applied to those who have engaged in providing and receiving training often do not reflect the investment of time and energy. The approach does not encourage people to develop their professional skill sets and remain in challenging environments. Their increased surgical skills are marketable and they could potentially be better paid after emigrating, depleting the skilled workforce in their home country:

> *"[T]here's a fundamental tension between wanting to train people to a relatively high level, to provide care in their country, and people with that training not wanting to stay in that country … we have to think about the economics that affect a health workforce as well, and make sure that we're not contributing to brain drain."*
>
> **Surgical Advisor, International NGO**

- **Current cost models:** current courses are prohibitively expensive for those in low-income settings. Prospective students cannot afford to secure the necessary training. Some participants called for an increase in the number of scholarships provided and greater access to financial aid; but this would sustain the current model of education, which is considered ineffective. Finance to support a more sustainable training model is not available.
- **Local logistical resources:** a senior surgeon described how a lack of financing meant that the quality of local educational delivery was seriously impaired. The infrastructure was lacking; not just of mannequins for simulation training, but also of basic source materials, which compromised the delivery of training.

This broad spread of issues underscores the importance of developing a sustainable funding approach for all members of humanitarian surgical teams.

Generalist–specialist dilemma

As identified in the literature review, surgical training in general has experienced a shift from generalist to specialist skills development. Participants suggested that health education systems in general are funnelling surgeons into siloed specialist fields, with narrow skill sets. The humanitarian surgery environment calls for much broader and transferable skills; systems are needed to ensure this breadth of skills is sustained.

There is a growing conflict between high-income system specialisation and the demands of low-income settings and humanitarian surgery. How to robustly address this challenge is unclear.

Advocating specialisation

Several interviewees suggested that this educational trajectory is a positive one and that training needs in Africa should not be any different to those in Europe and more widely. A participant commented that patients can have complex surgical needs in any context and require the involvement of specialist multidisciplinary teams:

"They're not going up and saying, 'hey, would you give us that humanitarian care?' They want complex surgeon training. They want microsurgery training for flaps."

Some participants felt the development of surgeons with such specialist skills was a fantastic indicator of advancement, and that more specialist skill sets, such as for spinal surgery, were needed for patients. A few interviewees expressed the view that the purpose of humanitarian surgical training was to remove the need for international surgical support where possible, and that the evolution of specialist surgery was integral to this direction of travel.

Concerns over specialisation

Some participants considered that a generalist surgical approach was necessary in remote settings. The relative lack of infrastructure and limited number of providers means that surgeons need to retain a full breadth of skills. This theme arose in a discussion about international EMT members leading capacity building training, but not being trained or used to dealing with patients using simpler technology.

A participant suggested that:

"Medical training today emphasizes the technology and not the clinical examination of the patient."

A senior surgeon who leads surgical training in West Africa warned that surgeons are losing generalist skill sets. The surgeon was concerned that the skills being taught for use in conflicts were being lost, warning that:

"[s]uper-specialization has become the order of the day, and these skills are being lost along the way."

Possible solutions

Participants suggested two ways to overcome the specialist–generalist dilemma. The first is for resource-rich organisations to partner with local training institutions to incorporate training modules for postgraduate students in specialist techniques for those harmed by bullets, bombs and mines. The second is to look at how some states in the Caribbean and in rural areas of high-income countries have overcome this challenge. When they have been unable to secure all the necessary specialised skills and supplies, Caribbean states have collaborated across islands, sharing existing practices through networks to overcome the absence of specialists.

Output from the ideation exercise

The discussion around education and training began with a summary of the key findings of the review and interviews. A stimulus question began the conversation: “How might we improve training for surgical teams in humanitarian contexts?”

The consistent themes in these discussions reveal the key strategic areas for development to improve education and training in humanitarian surgery.

- Humanitarian surgeons require a broad-based general set of technical skills for working in humanitarian and/or low-resource settings.
- There should be a specific syllabus for ‘humanitarian surgery’ based on leadership, ways of working, clinical decision making and awareness of ethics, in addition to technical surgical skills. The scope of practice is broad and interdisciplinary; a broad competence is required, which could be focused and streamlined for education and training.
- Just-in-time education, accessible via low-bandwidth internet and supported by training guides, could be used to refine surgical practice.
- There is huge potential for the use of distance learning technologies to support education and skills training.
- Governance and quality assurance are essential to humanitarian surgical practice. Substandard and nonevidence-based practice have no place in the provision of humanitarian surgery.
- Communities of practice developed during training and continuing professional development are vital for peer support. These can be created in advance but can also build organically. Their development should be supported.

Department of Pediatrics of the General Hospital destroyed in the earthquake in Croatia. December, 2021. Credit: Edina Zuko / PIXSELL / Alamy

Focus points to strengthen education and skills training

The ideation exercise identified several workstreams that could form the foundation of a new approach to the delivery of education and skills training for humanitarian surgery.

- **Surgical hubs:** local and regional delivery of hands-on clinical education, experience and mentoring, both for recipients and teachers allows the building of relationships and trust. Linked to the wider surgical educational system, specialist humanitarian surgery centres should be encouraged to develop.
- **Basic surgical skills training:** core knowledge and technical skills should be a requirement for entry into specialist training or before undertaking humanitarian surgery short courses.
- **Broad-based clinical skills:** skills in teamworking and leadership must be included in basic competency training before entering specialist training. Such soft skills, including interdisciplinary working, are core competencies that should be included in curricula for early training. Developing skills in the local environment, with local surgical providers and teams in the health system in which they will operate, ensures familiarity with systems, capabilities and the resources that are available.
- **Create a syllabus for humanitarian surgery:** this should define specific educational needs and identify who needs to be trained in this unique body of specialist knowledge; it would create a specialist discipline. The evidence base for surgical management and recognition of competency in the breadth of decision making and interventions that might be required in a particular setting or context should be part of the accreditation system.
- **Evidence base:** protocols and guidelines based on evidence and experience can help set the standard of care for surgical management and should be the foundation of a subspecialist field of practice. Learning and knowledge exchange as part of a process of continuing professional development and peer networking are core features of professional practice.
- **Training programmes:** a distinction should be drawn between upskilling local surgical specialists to deliver humanitarian surgery and the training and development of surgeons for deployment to humanitarian settings. Both are necessary but have different priorities and needs and must be treated accordingly. The potential for rotation of surgeons between high- and low-income settings for education and training purposes should remain an option but should not be mandatory.
- **Use of technology:** potential roles for distance learning, tele-mentoring from afar and even the use of virtual simulation systems are developing, although the evidence base to support them is still fragmented. Leveraging the potential of digital learning and technology, and developing the breadth of necessary content, is crucial and needs careful evaluation. Hands-on training and in-person learning are essential and cannot be fully replaced.
- **Clinical governance and quality assurance:** providing quality surgical care while building greater surgical capacity must be a focus of the health system. Tools and methods for oversight and monitoring should aim to ensure accredited and credentialed providers consistently provide high-quality care. The need for task shifting to involve clinical officers and nurse practitioners must be recognised and essential surgical skills training also given to these providers.

Communities of practice

Communities of practice

Key points

- Regional and local networks of practitioners are essential to support humanitarian surgeons working in the field.
- COSECSA and the West African College of Surgeons (WACS) were highlighted as exemplary communities of practice.
- International partnerships need to be sustained to develop trust, but 'locals helping locals' is the ultimate goal.
- Low-cost knowledge exchange fora to facilitate information sharing, including providing advice and guidance, and lessons learnt, are essential to support humanitarian surgeons in practice.

Literature review

From the published literature, reported international surgery initiatives have typically been short-term vertical interventions in specific areas. The literature on humanitarian surgery has also largely reported on activity delivered by international partners during crises. The developing narrative in this report is the clear need for local and national engagement and a more collaborative approach. Evidence focusing on the importance and contribution of communities of practice is sparse in comparison with the other themes emerging from the data in this report. The importance of networking and shared ownership was a strong theme in the interviews and discussions; the publication deficit is perhaps surprising.

Writing in the *Annals of Plastic Surgery*, Rockwell *et al* reflect on a collaborative training programme they ran between the US and Ghana.[68] Seeking to incorporate an increased educational component into their global health partnership activities at the University of Utah, they collaboratively conducted an assessment of clinical and educational needs at Komfo Anokye Teaching Hospital (KATH) in Kumasi, Ghana. This investigation identifies management of traumatic injury and burn care as the greatest clinical needs. A team of faculty from Utah deployed for one week to support clinical care and training in these areas using equipment typically used at KATH. The authors describe the collaboration as a reciprocal learning process; the teams continued to communicate via email after the week-long exchange. The authors acknowledge the challenge of such short trips, and the Utah team sought to increase funding for more frequent and sustained engagements. The dependence on virtual connection between visits was felt to have hindered the building of relationships; however, the scope to develop the partnership with sustained direct connection through recurring trips was felt to be achievable and to hold potential. The authors advocate building established and sustained partnerships.

Fisher and Fisher take a more critical approach to international surgical partnerships, describing how hosting institutions often appreciate support from visiting teams but often also feel visits can be overwhelming, displacing the

hosting institutions' own surgical staff from their operating rooms, and feeling judged by the visiting partners.[69] The authors feel that international efforts focus on clinical care and training at the expense of supporting nonclinical operational and system development issues. They feel that this weakens the effectiveness, efficiency and sustainability of collaborations. As an illustration, ministries of health can begin to rely on nonprofit surgical initiatives to meet infrastructure gaps, but fail to adequately direct and coordinate the many transient international NGO relationships, so do not use resources effectively. The authors advocate research to focus on objective measurements to understand the impact and value of humanitarian surgical initiatives. They stress the importance of more coordinated stakeholder engagement to minimise duplication of effort, arguing that effective humanitarian healthcare interventions require partnerships between donor and recipient systems.

Fagan *et al* report on their efforts in managing a partnership between the University of Cape Town and the American Academy of Otolaryngology.[3] The initiative ran head and neck surgery fellowships in South Africa. Ten fellows travelled to South Africa from nine countries across sub-Saharan Africa, returning to their respective countries to establish and develop their head and neck surgery programmes. The American Academy of Otolaryngology supported the University of Cape Town with ongoing virtual support and in-region conference-associated workshops for the surgical fellows as they grew their in-country training systems.[3] The authors reflect on the success of establishing what they describe as an effective and sustainable community of practice. They acknowledge the potential harm of short interventions, including undermining local practices, potential cultural pitfalls and the need for patient follow-up. The authors describe the establishment of fellowship programmes and long-term professional relationships, stressing the importance of outcome measures to guide patient care and demonstrate educational achievements.

The final case study identified describes a partnership initiative that focused on heart surgery services at Lagos State University Teaching Hospital in Nigeria. The hospital aspired to transition from a mission-based approach delivered by international partners to a locally led and more sustainable heart surgery system.[4] The evolution to an appropriate, locally relevant system was made possible by supportive local hospital management and sustained longitudinal skills development support from an international collaboration. The authors recognise that travel restrictions during the COVID-19 pandemic demonstrated how the system had not yet fully broken from its previous dependence on international support in relation to patient trust and financial support for equipment. The authors explore how retaining colleagues with much in-demand skills in the public sector is difficult, but they consider the direction of travel as positive. The system had become sufficiently sustainable to begin an initiative they term 'locals helping locals'. They were rolling out their surgical skills programmes to other heart surgery facilities in the region, reducing wider dependence on international partners.

The literature reporting the impact of communities of surgical practice focuses on initiatives in sub-Saharan Africa. There was no wider published information, indicating a lack of understanding of the role, potential impact or opportunities of partnerships, sustained relationships and communities of practice more widely.

Initiatives, colleges and fora

Whereas the peer-reviewed literature has published little on communities of practice in humanitarian surgical initiatives, a review of the grey literature provided examples of established communities of practice collaborating to develop humanitarian surgical initiatives.

The WHO Global Alliance for Care of the Injured (GACI) was created as a way forwards following the Global Forum on Trauma Care meeting in Brazil in 2009, with the goal of coordinating global improvements in trauma care.[70] Led by WHO, GACI aims to improve trauma care and reduce the burden of injuries worldwide through a cross-sector alliance of governments, international organisations, NGOs, academic institutions and healthcare professionals. Focusing on LMICs in particular, the objective is to strengthen countries' capacity to provide timely, effective and equitable care to injured people, from incident through to rehabilitation. This patient-centred approach requires strategies for each stage of the potential patient's journey, from improving prehospital care systems, to improving trauma care in healthcare facilities, strengthening wider emergency medical services, developing trauma registries for data analysis and implementing evidence-based interventions to prevent injuries. GACI forms a community of practice that leverages shared resources and promotes knowledge exchange. The alliance advocates improved policies and guidelines in trauma care to reduce mortality among populations, particularly where they are marginalised and vulnerable, and who may not have access to healthcare.

Whereas GACI focuses on trauma care response, interviewees for this report argued that a broader approach to health systems strengthening is necessary. Its operation relies on sustained funding commitments from donor countries, which constrains its capacity to evolve. Critics of WHO suggest that inherent power disparities between high-income countries and LMICs are reinforced through this type of global action, where the policies and operations of the WHO are argued to have neocolonial tendencies that, in turn, perpetuate global health inequalities.

WACS was formed 50 years ago by anglophone African surgeons returning from overseas training who wanted to create and support a surgical community of practice in West Africa.[71] Today, WACS is described by the *World Journal of Surgery* as an engine to create networks of surgeons for a range of specialties, providing accreditation, support and coordination, but also acting as an agent to collaborate with international bodies operating in the region. Building regional and local credibility, WACS has become a specialist accrediting body in the region, overseeing and approving institutions to train surgical residents. It runs a two-year fellowship training programme using approved regional college hospitals, aspiring to retain talent that would previously have left the region as part of a 'brain drain'. It currently has 6,000 fellows who support the development of clinical practice and education provision, alongside providing leadership and advocacy to support surgical development in West Africa. Bode *et al* describe how surgeons who graduate from WACS are currently disproportionally from Ghana and Nigeria, rather than more broadly, owing to conflicts in many of the regional countries that prevent surgeons seeking formalised postgraduate training.[71]

Transitioning from the Association of Surgeons of East Africa in 1999, COSECSA comprises 14 member states and trains surgeons across 20 countries in sub-Saharan Africa. It is the largest surgical training institution on the continent of Africa and runs a five-year training programme. This consists of two years of a membership programme, then a three-year senior surgical fellowship programme. COSECSA plays a significant role in improving and expanding surgical training in East and Southern Africa. Like WACS, it has improved retention rates for specialist surgeons; as Mulwafu *et al* report, 88

per cent of graduates now stay in the region.[72] The college hopes to have produced more than 1,000 accredited surgeons by 2025.

In 2007, RCSI and COSECSA signed a memorandum of understanding to improve standards of surgical care by providing education, training and examinations, supported with funding from Irish Aid, the Irish government's official development programme.[72] The two partners work closely on surgical capacity development and are creating an international community of practice. Collaborating of a range of international surgical colleges, the partnership deploys experienced international examiners to support the delivery of high-quality examinations. Through this broad community, the partnership has established recognised centres of excellence, such as the University of Zimbabwe International Centre for Surgical Simulation. This is a joint venture with German medical technology company Karl Storz EndoSkope and is recognised as a centre of excellence for minimal access surgery.[72]

Before the creation of WACS and COSECSA, patients needing surgery tended to be operated on by internationally trained surgeons undertaking overseas 'medical missions'. Over the past two decades, regional colleges have taken ownership of the education and accreditation of specialists trained to best suit the local context.

The colleges are surgical societies, which are creating crucial communities of practice across sub-Saharan Africa and ownership of the challenge of building surgical capacity. They promote innovative approaches to providing surgical healthcare and reducing health inequalities.

The Surgical Education Learners Forum launched in 2020. The ambition was to create a novel, low-cost educational environment, with open-source module content to help surgical practitioners learn new skills. A collaboration between several philanthropic organisations and innovation groups and RCSI, and with the support from technology platform Appropedia, the aim was to create surgical educational content that allowed for independent learning and supported self-assessment. The Surgical Education Learners Forum Symposium in 2023 brought together leaders in surgical training to review objectives and set a forward trajectory. They continue to support the development of international communities of practice, assisting with knowledge exchange focused on surgical education in low-resource settings.

Credit: Jonathan Borba/ Unsplash

Interviews

Key messages

- Local ownership of the health system must be respected.
- Sustained engagement is necessary to build trust—relationships take time and perseverance.
- Relationships are appreciated that support and supplement local capacity, responding to locally recognised needs and bringing support and mentoring.

International intervention and support

Overall, there was a spectrum of opinions ranging from support for, but also resistance to, international surgical interventions in humanitarian settings, depending on their nature. Some participants supported the role of international surgical interventions in conflicts, recognising that many healthcare professionals leave a country at the onset of a war, seeking safety for themselves and their families, and that this loss of capacity needs to be replaced. In support of interventions, participants highlighted the importance of international solidarity in humanitarian settings and filling an important human resource gap.

Other participants expressed reservations over international assumptions about the need for humanitarian surgery. They questioned the professional knowledge of respondents. Several highlighted the harm of this perceived need. One international responder recounted being:

"surprised at not being met with open arms, but rather with slight hostility. The military who were governing state hospitals were insulted that the NGO arrived to provide humanitarian healthcare. They perceived this as offering to 'bail them out' when they felt they could cope. The NGO offered both financial and operational assistance. Over time, the local team could not sustain the long hours working in the conflict setting and our support began to be welcomed."

This account is similar to narratives found in the literature. Local surgeons felt that they had lost control of their system and, with the arrival of EMTs, experienced a sense of being judged.

Relationships and trust are at the heart of partnerships, but they take time to build and are created through working together. Another participant recounted how a hospital received donations from NGOs providing humanitarian surgery, but explained that this support was not welcome unless the participant had developed trust through in-person interactions with visiting individuals. Such relationships are crucial to developing the necessary trust. Building a community of practice takes time.

Another participant described the harm of short-term interventions and reiterated the importance of long-term relationships when trying to build trust:

"Because you come in and then you do great work, and then you disappear. And the community which has just got used to getting a service suddenly has no service. When you do humanitarian surgery intermittently, you do more harm."

"But if you were to give me a fixed set of services for six months, I know what to do with you: if you came for ten days, and the next person came for ten days, and [the] next person came, I would run a program

for the community that would be more useful than what you're doing."

The clear message from the interviews was that relationships must be built through work, and over time, with the local providers. It requires creating a workstream that complements and sustainably adds to existing services. Brief stand-alone visits cause challenges for local surgeons and for the wider health system.

International partnerships

Participants generally called for an increase in partnerships between international universities and hospitals overseas to support capacity development and the training of junior surgeons. A clear message that emerged from interviews was that there are currently too few surgeons working with too few resources in humanitarian surgery settings. Under this pressure, they do not feel they have the capacity to also engage in training the next generation of surgeons. Participants explained that international partnerships are needed to support capacity building by creating and supporting the skills development needed in humanitarian settings.

Participants generally shared the view that COSECSA's approach to communities of practice is exemplary. A participant shared their perception of the organisation:

"COSECSA, 20 countries, surgeons from all over Africa, the most diverse continent in the world. Different languages, all kind of religious backgrounds, all kind of socio-cultural backgrounds, 142 different hospitals in all these 20 countries provide a standardized set of training tools, so that when these young surgeons are asked a question about how to manage a cancer of the stomach, they give you perfect responses. So, to me that is a tremendous reflection of something that has had an incredible impact on surgical education. Not just surgical education, but medical education as a whole."

The work achieved at COSECSA, through its international partnerships, was described as an incredibly successful and sustainable effort.

A second example of a beneficial network of international surgical support was the mentorship approach taken by WHO's EMT initiative. Participants explained how working with this supportive partnership enabled important capacity development opportunities, with collaborative international support to strengthen surgical teams responding to humanitarian crises.

In summary, the interviews highlighted the pivotal role of international collaboration in supporting the capacity development of humanitarian surgery, with exemplars of what can be achieved.

International communication channels

Participants repeatedly articulated how vital robust channels of communication are for developing and sustaining international support systems. They talked of the importance of using encrypted mobile telephone applications such as WhatsApp and VoIP (voice over internet protocol) and internet tools such as Skype and Zoom to secure second opinions in difficult cases. There was a consensus that these communication tools have meaning only if professional relationships already exist and have developed through in-person contact.

A specific illustration given was of a WhatsApp group in Malawi that enables clinical officers to seek advice and decision making support before operating. Notwithstanding potential patient confidentiality information governance issues, participants reflected on how important online communities of practice are in supporting best practice in humanitarian settings.

Output from the ideation exercise

The conversations began with a synthesis of the research findings and posed a stimulus question to participants to start the discussion: “How might we improve support networks for surgical teams in humanitarian contexts?”

Common themes in these discussions outline some fundamental areas of focus on which to build humanitarian surgery communities of practice.

- Relationships and trust are at the heart of communities of practice. These cannot be forced and require time to develop. Inclusivity and a common language can help this process. Leveraging the power of the international diaspora from an affected area can be powerful.
- Local and regional support systems can be the most effective networks; they need to be encouraged and supported. This allows for greater adaptation to the local context.
- An agreed common and usable platform for communication is essential for the community to become established. WhatsApp appears to be a universal medium, but other more technologically sophisticated systems are available. They must be able to function in settings with limited resources.

Focus points to develop communities of practice

Participants proposed a wide range of themes to strengthen the development of communities of practice in humanitarian surgery.

- **Environments to forge relationships:** learning and sharing with peers are at the heart of communities of practice. Creating regional or national hubs can support and facilitate the building of these connections; sharing experience creates camaraderie and must be supported.
- **Building relationships and the humanitarian imperative:** this is a core function of any community of practice. The collective voice of a professional community supports and advocates for those providing care. Ad hoc groups may form to pool resources and share experience, but previously established relationships can mean that these form more quickly and are more trusted. The diaspora may be a useful starting point, with the added benefit that they will know the context and may already have personal contacts. The sense of connection and a collective voice within the humanitarian surgical community can better advocate for and support those providing surgery. Linking to peers can support sustainability and protects the mental health of people in challenging settings.
- **Developing humanitarian surgical decision-making systems:** a network of colleagues with experience and expertise providing indirect support for decision making when there is uncertainty is highly valued. Local dynamics and context may generate political or diplomatic obstacles, but the desire to provide the best outcome for patients through trusted relationships can overcome such barriers.
- **Robust communication systems:** WhatsApp has become recognised as a crucial communication tool for supporting surgeons in remote settings. Backed by policies and guidelines, such virtual support can assist with real-time decision making. Appropriate communication platforms need to be in place to facilitate these connections. From basic telephony to encrypted mobile applications, and web communication tools, a resilient system needs to be established. New innovations are constantly appearing, such as healthcare platform Proximie (https://www.proximie.com/), which uses augmented reality and live video streaming to connect surgeons in different locations. There are often significant logistical and technological hurdles to overcome, but progress in this field is rapid.

Technology

Technology

Key points

- Currently, very little peer-reviewed literature relates to the use of technology in humanitarian surgery.
- 'Frugal innovation' and the robust application of basic systems and processes can achieve much.
- New technologies are beginning to show where they may have impact, but evidence is as yet weak. Caution about their potential role and scale of impact is necessary.

Literature review

The literature review identified very few publications that focus specifically on the role of technology and technological advancements in humanitarian surgery. Some of the benefits identified related to the role of communications technology in supporting long-distance communication and decision-making support. Others found that effective use of good-quality basic care could reduce the demand for more high-technology, and therefore costly, interventions.

Ambroise *et al* published their experience of using telemedicine in what they termed humanitarian surgery, but was actually a global surgery vertical specialist intervention in maxillofacial surgery.[73] The authors, based in France, describe their experience, concluding that telemedicine could be useful in what they consider humanitarian surgical work. They outline the potential benefits of telemedicine, which include case discussion, shared decision making and follow-up of complex cases. The literature review did not identify any papers that discussed the uses and potential benefits of technology from the perspective of a local surgical team.

Elder *et al* warn that deference to sophisticated technological resources can hinder the provision of care.[2] The authors illustrate this through exploring the role of surgical care in the management of burns and their complications. They report their experience of health professionals not providing burn care because of a prevailing 'myth' that treating burns requires modern burn unit technology and infrastructure. Drawing from their experience working in Haiti, the authors argue that humanitarian surgery comprises only a fraction of the whole of patient care, and that attention to basic protocols and management of hygiene practices, infection control, laboratory and blood bank services, and postoperative care are equally important. The authors argue that surgical initiatives should not exclude patients due to a misconception that high-technology resources are necessary. What may be needed in low-resource settings is the concept of 'frugal innovation', coined by innovation and leadership advisor Navi Radjou, where more can be delivered using basic resources well than can be achieved through high-technology interventions.[20]

The Intuitive Foundation is leading innovation in surgery in low-resource settings.[74] Involved in the development of open-access educational resources, the foundation is the philanthropic arm of Intuitive Surgical, better known as a leader in robotic assisted and minimally invasive surgery. Recognised as a key agency in supporting education initiatives in low-resource settings, the foundation's funding and expertise are supporting innovation in and research into the impact of technology in humanitarian settings.

Technology has a clear potential role in supporting humanitarian surgery but the value of newer innovations such as generative artificial intelligence is unclear. As Van den Homberg *et al* recognise, digital humanitarianism and the use of remote data analytics may support proactive activation and mobilisation to action of humanitarian response in anticipation of needs, even specific needs such as surgery, although the real potential and possible implications are unclear.[75] While ideas and predictions of future impact are largely speculative, there may also be accountability and governance issues, perhaps even ethical ones, that the humanitarian sector will need to consider.

Diverse complexities surround data ownership, governance and accountability in decision making that crosses international borders. The dynamics of humanitarian activity in the digital realm are still being explored and discussed.[76] Gutierrez and Bryant recognise the potential of 'big data' to support evidence-based decision making, but also argue for a comprehensive look at the potential consequences surrounding loss of patient identity and possible discrimination that may follow.[77] Introducing these new concepts could lead to potentially significant and valuable developments, but the governance and responsibility remain unclear.

Surgeon using digital tablet technology during surgery.
Credit: SDI Productions/Getty Images

Interviews

Key messages

- Internet connectivity is hugely important to leveraging the potential of communities of practice to support humanitarian surgery.
- Frugal innovation and more robust technological equipment are important during deployment in the humanitarian surgery context.
- Distance learning is crucial to delivering trained surgeons in the numbers required.

The internet is recognised to be the most important tool for supporting technological advancements in humanitarian surgery. While huge advances have been made, there are still significant infrastructural barriers to ensuring sufficient internet accessibility in the everyday lives of surgical teams in low-resource settings. The development and routine incorporation of solid-state technology into systems has made technology more physically robust and easier to deploy and use in austere environments.

Illustrations of technology in humanitarian settings

Several participants had practical experience of using technological innovations in humanitarian settings. They reported varying results.

Possible high-technology solutions

A surgical advisor for an international NGO described trying to livestream a surgical procedure from Nigeria to colleagues in Sweden using a camera and microphone technique. This was unsuccessful because the internet upload speed in Nigeria was inadequate to provide sufficiently clear video of what was happening. In contrast, an NGO director had tried a similar process from the US to St Vincent in the Caribbean using two-way glasses and drawing on a screen to support the operating surgeon. This was reportedly successful.

These real-time streaming approaches appear to have potential, but the bandwidth challenge is significant and may constrain wider adoption. A range of internet options are available, but they have cost and accessibility challenges.

Possible low-technology solutions

A common belief among participants was that less advanced solutions, perhaps not focused on remote support but better local services and equipment, were equally if not more important for humanitarian surgery contexts. Participants shared their experiences of examples such as the use of an affordable haemodialysis machine.

Participants specifically acknowledged South Africa as leading much of the technical development, given the country's breadth of technical skills and broader financial capacity. Examples of frugal innovation involved water filtration conducted using ultraviolet light from the sun, and battery-activated sterilisation kits for surgery without water or electricity.

Existing low-technology solutions

The participants spoke broadly of technological advancements in laparoscopic surgery and also diagnostic testing.

In Cameroon, the introduction of laparoscopic surgery, especially using mobile medical units, has been a significant successful development:

"These kind of miracles have reconnected them [patients] back with their families. Before, they would stay for months with lots of complications. Some of them would end up with infections."

However, participants cautioned against surgeons becoming too reliant on technology in settings where uninterrupted electricity supplies cannot be assured. When electricity fails in the hospital, patients are left waiting; even electronic medical record systems can become unavailable. There was a consistent view that parallel and analogue back-up systems must be in place to ensure continuity of supply.

Participants from high-income settings felt that the scope for technology was greatest. They recognised its potential, but had also experienced some of its constraints. High-technology solutions might bring benefits, but there is a persistent need for lower-technology and frugal innovations to improve the capacity to deliver humanitarian surgery.

Professional surgeons using future medical innovation; Virtual reality, credit: Krisada Tepkulmanonti/iStock.

Potential uses for technology in humanitarian surgery

Participants expressed interest and trust in novel innovations for surgical training and at times excitement in them.

Simulation training

The use of technology-based simulation was a consistent source of enthusiasm among participants. One participant compared humanitarian surgical training with flight simulation training, suggesting that dedicated online resources could help surgeons navigate the learning challenges.

In all cases, interviewees agreed that any use of technology for humanitarian surgical training must involve an independent, competent surgeon with a developed skill set and who is appropriately quality assured. One interviewee said:

"There are some things that I will never be able to teach myself because every time I try to make the recipe of a famous chef, even though I have everything in my kitchen, I usually make a mistake. So, it's not about the recipe. It's not about the simulation. It will be a way of making accessible to people in isolated regions the possibility to become aware of what are the steps to be proficient on a particular operation or a particular skill."

Simulation training is not used widely in humanitarian settings at present. It often requires remote support to run exercises and there are internet-related constraints, particularly around sufficient bandwidth for streaming. But participants envisaged and were confident of rapid technological improvement. The ability of improved technology and communication to support and evaluate real-time practice, giving feedback during simulation activities or in hands-on skills laboratories, was anticipated and received enthusiastically.

Participants suggested that, in the near future, surgeons in training would begin to rehearse and practise procedures on low-cost materials rather than during surgery, when time is limited. Some participants envisaged that future surgical training would involve much more simulation activity, perhaps with environmental challenges added in.

"Drawing inspiration … you have a backpack which has everything, all you need for spinal anaesthesia, you can practice on a watermelon. And so, you do that, and then off you go."

"Now you want to teach to suture the intestine, the gut. You take two cigarette butts, and you get them to stitch them together. You can get the skills up doing that. This is going to be the future because they are not going to come to the surgical colleges and do all those expensive courses."

Technology as a tool to develop trust

Participants recognised the value of communicating in humanitarian settings via messaging platforms such as WhatsApp, using it as a tool to seek guidance and get second opinions. The theme of trust between colleagues arose in discussions about using communications platforms. One participant remarked that in these cases WhatsApp itself is not what is most helpful, rather it is the relationship between the colleagues that is at its heart and most meaningful.

This criterion for remote technological support was echoed across multiple interviews. Surgeons must trust the person on the other end of the technology; typically, such trust can only be achieved through having developed an in-person working relationship.

This technique was felt to be possible only in some contexts. In many emergencies, there would not be time for a phone consultation. Similarly, participants raised caveats about the potential scope and were clear that the surgeon receiving assistance already needed to have the technical skills and the capability to perform the surgery. The guidance was for support with decisions rather than to convey and support technical skills.

A common view among participants was that technology cannot be relied on. As one interviewee put it:

"I have faith in technology. But I think if you want to be a good humanitarian surgeon, you need to go back to the principles underlying any sort of procedure you're doing, and ask yourself, how dependent are you really on that technology? If it's not around, like with a lot of laparoscopic surgery, that doesn't mean you can't do it open, and if you don't know how to do it open, you're useless in any lower-middle-income setting."

Technology as a tool for online learning

Participants recognised the increasing use of technology for distance learning to support surgical practice as a powerful innovation. A surgeon in Uganda playfully suggested that he felt he had learnt more during COVID-19 than during the rest of his career due to access to a variety of free online webinars and distance-learning sessions.

Another participant mentioned the prospect of increasing the use of digital communications to secure virtual mentoring. While videos and lectures can be useful tools for surgeons to refresh their skills and learn new approaches and techniques, participants felt that it was important to have an existing relationship with the institution providing the video so the surgeon could trust the material. For this reason, participants emphasised the importance of in-person events to develop the necessary relationships.

To summarise, participants highlighted the significant potential of technological tools but were clear that surgeons needed to have the

technical skills in the first place. Technology could provide support and mentoring, even guidance in rarely experienced procedures, but the need for basic skills could not be avoided.

The importance of contextualisation

Four broad themes emerged from the discussions about technology in humanitarian surgery contexts. Participants were concerned about the potential consequences of rolling out and implementing technology.

The need for a system to support new technology

There was agreement that technological capacity building initiatives must be proportionate to the procurement and financial capacity of the system. Servicing, maintenance and repair must be available locally at a cost that can be afforded; 'running repairs' must be possible when needed. Participants conveyed frustration when they relayed stories of international medical teams introducing sophisticated technology to improve surgical care but with inadequate attention to the sustainability of tools. The comment below illustrates how a computed tomography (CT) scanner needs technicians and replacement parts. In low-resource and/or humanitarian settings, it may not be possible to procure these promptly either through lack of availability or possibly because of sanctions:

"Another thing to put in your report is that when technology fails. All you see in these African hospitals are junkyards. It is amazing to see rusting metal equipment that broke down. No one knew how to fix it … And now it's useless."

Technology can become a problem if there is no system in place to support it. Participants agreed with the suggestion that trained personnel and sufficient materials must be in place before introducing new technology into low-resource or humanitarian settings.

Quality assurance

Participants expressed concern about the many cheap, and perhaps less reliable, duplicate technologies available on the market that imitated more advanced technologies. As an illustration, participants explained that patients often purchase such items themselves—for their surgeons to use—to enable them to secure more advanced surgery. The subsequent failure of such items causes further harm. Another aspect of this quality concern related to pharmaceutical integrity, where the quality of drugs, such as anaesthetic agents, could not be assured. Several participants advocated improved pharmaceutical quality control.

Operational context

Participants raised concerns over the logistical practicalities of transporting large and fragile pieces of equipment to humanitarian settings. A participant explained how in some locations an x-ray machine would be practical, perhaps a CT scanner, but certainly not a magnetic resonance imaging scanner. Some technological developments are feasible but there are limits.

Participants also cautioned that it was unwise to rely too heavily on technology in active conflicts. They outlined how mobile phone communications are monitored and can be interfered with. For example, a concentration of active foreign SIM numbers could lead to communications being cut and perhaps even targeted by hostile forces.

Proportionate and sustainable financing

Participants felt there had to be sensible, pragmatic and ethical prioritisation of humanitarian budget expenditure. They agreed that budgets must be directed towards basic essentials such as clean water, fuel, medicine, oxygen, immunisation, and maternal and child healthcare rather than technological innovations for surgery.

Commenting on technological innovation in humanitarian surgery in general, one of the interviewees said:

"We must remember our priorities, technology is not always efficient, it diverts resources, costs money and ultimately saves less lives than water and medicine."

Future developments

Participants acknowledged that new innovations may be difficult to shape to their needs, but they are enthusiastic to adopt those that could function effectively in their settings. They anticipate that technological advancements in humanitarian surgical care will be industry driven rather than led by their needs. For-profit biomedical technology enterprises will likely be the originators, and those working in low-resource settings may need to be creative to adapt new technologies for use in their healthcare systems.

Senior Global North professors were enthusiastic about the potential of technological advancements and the promise they hold for humanitarian surgery. Surgeons working in low-resource settings were more hesitant and wary of resources being redirected when basic requirements and logistical needs were not being met.

A senior surgeon in Nigeria estimated there would be a decade-long time lag before low-resource settings acquired the resources needed to support their use of new technologies. During this time, materials will become both more affordable and more durable.

Credit: Mansoreh MotamediGetty Images

Output from the ideation exercise

The possibilities and challenges of leveraging technological solutions were presented to participants. The stimulus question to start the conversation was: “How might we leverage technology for surgical teams in humanitarian contexts?”

Participants held a wide range of views on how to approach the use of technology to strengthen humanitarian surgery. However, three proposed approaches were shared across groups.

- A drive to share specialist knowledge through online virtual forums or communities of practice was a common theme.
- A virtual learning library with just-in-time education and as a repository of specialist information was considered a foundational initiative.
- Feasibility and sustainability in the operational context were vital. High-bandwidth initiatives and new technology had potential for the future, but technological innovation needed to work in the ‘here and now’.

Credit: Artur Tumasjan/ Unsplash

Focus points to leverage the potential of technology

Participants identified a series of possible roles for the effective use of technology.

- **Developing online communities of practice:** a virtual expertise forum was proposed where surgical teams could seek guidance and advice for specialist cases. While recognising the importance of previously established relationships, potentially being able to seek support from specialists across the globe to offer guidance and assist with difficult decisions was felt to be a key opportunity.
- **Protocols for online consultation:** international colleges could agree on a set of 'terms of engagement' for specialist support, with clear lines of responsibility and accountability defined for the advice and guidance given. A pool of international expert support could be accessed through this mechanism, offering virtual technical support but with professional oversight, governance and quality assurance.
- **Using horizontal technology systems:** participants agreed that a reliable system with broad functionality that could be used in a wide range of settings was more important than high-fidelity systems requiring fast internet speeds. Using the technology available needed to be at the foundation, rather than innovation that was dependent on less established systems.
- **Developing an online learning platform:** an open-access library of quality-assured humanitarian surgery information as a source of protocols and guidance, alongside support for continuing professional development, was a high priority. Being able to support just-in-time education with summary documents and how-to videos that could be accessed by mobile devices such as phones was felt to be essential. Using the platform to support remote teaching and simulation, even being capable of supporting virtual reality education, was considered powerful.
- **Offline technological solutions:** the potential for access to core information as a download was felt to be necessary in humanitarian situations and conflicts since communication networks can be vulnerable to attack and may even be targeted.

Some general principles were proposed around the use of technology.

- **Working with simple solutions:** participants stressed the importance of working with low internet speeds or resources that need low bandwidth such as PDFs. High-technology solutions are not always feasible.
- **Using existing functionality:** the power of applications such as WhatsApp has already been established. How could their use be extended further?
- **Being creative and not duplicating efforts:** participants cited their work with existing initiatives such as **SURGhub** (**https://www.surghub.org/**), **UNITAR** (**https://unitar.org/**) and **Touch Surgery** (**https://touchsurgery.com**).

Conclusions and recommendations

Conclusion and recommendations

The importance of global surgery has come to prominence in recent years and its capacity and capability are growing. As a part of this, humanitarian surgery has risen to the challenge of providing surgery in crises.

The challenge set for this report was to explore the humanitarian surgical ecosystem and provide a clear set of recommendations to guide the building of sustainable surgical capacity in such settings and move away from the expectation that the only solution is the deployment of international surgical teams.

The role and value of the deployment of surgical services as part of an international EMT response in a disaster to support the management of a surge of patients in need is clear. However, local surgical capability and capacity are mobilised immediately in crises and form the foundation of the early response. Enabling and empowering these surgical teams ensures that critical services are available quickly, will continue to be present and can be sustained once international teams have departed. They are an essential, but often neglected, sustainable core at the heart of delivering humanitarian surgery.

Previous work by HSI established that key areas of focus were the nature of humanitarian surgery; the need for systems to deliver education and surgical skills training; the importance of establishing communities of practice; and considering how technology can facilitate and empower the development of capable and sustainable humanitarian surgical services.

Drawing on the findings of the literature review, analysis of interviews with international experts, and the ideation exercise to generate key themes and development foci to move the agenda forwards, this report concludes with a series of innovations and recommendations.

Injured Palestinians individuals receiving treatment in Kuwait Field Hospital after Israeli attack, in Khan Yunis, Gaza. July, 2024. Credit: Saber Arar/UPI Credit: UPI/Alamy Live News

Recommendation 1: McKnight's definition of humanitarian surgery should be adopted and consistently applied.

There is frustration that definitions and scope remain a focus of academic discussion rather than moving forwards to create practical solutions. There is recognition that one simple label cannot adequately define all the eventualities of a sudden-onset environmental disaster, a crisis caused by conflict or a remote and austere environment where surgeons are overwhelmed by the burden of disease.

The term 'humanitarian' is used too loosely and this should change. Adopting McKnight's proposed wording for humanitarian surgery as delivering emergency surgical care according to humanitarian principles when a health system is overwhelmed is recommended.

Recommendation 2: Providers of humanitarian surgical support in crises must integrate their efforts with local surgical services, cooperating with national and international EMTs and the UN-appointed Emergency Relief Coordinator to deliver a system-wide approach to the full breadth of emergency surgical need.

Local surgical services are central to responding to humanitarian crises. The role of humanitarian surgery should be to guide, support and, where necessary, supplement these capabilities.

The approach taken should be collaborative, aiming to empower local systems and create sustainable solutions across the full breadth of emergency surgical need in the population. Short-term and vertical surgical interventions have their place but should be part of a system-wide approach that aligns with agreed local, national and regional priorities.

Recommendation 3: Surgical authorities, particularly professional colleges and networks, should cooperate to support and build on existing and established local and regional surgical networks in crisis-affected areas. Where such bodies do not exist, partners should facilitate their establishment.

Sustainable systems for education and skills training in humanitarian surgery need to be built on well-established local and regional networks. Where such professional bodies do not yet exist, their creation should be supported.

The International Federation of Surgical Colleges should support the continued development of these regional bodies, helping them to build their infrastructure, and recognising them as leaders, coordinators and assurers of the quality of surgeons in their geographical area.

Recommendation 4: Surgical colleges should collaborate to describe and support the setting of standards to guide governance and accountability in education to support the provision of humanitarian surgery.

There is huge potential for distance learning and technology to transform the development of humanitarian surgery practitioners. Standards for education in and accreditation of this area of practice need to be defined and their delivery supported.

There is value in multiple different approaches to education, but duplication wastes resources. Coordination and collaboration between providers of humanitarian surgery education programmes will maximise their impact.

Recommendation 5: Developing humanitarian surgical initiatives must recognise that proactive capacity and relationship building are the foundation of sustainable partnerships.

Surgical systems require long-term partnership commitments to be sustainable. Positive progress needs an agreed strategic approach as a foundation for developing surgical education and skills training. The building of relationships and trust between partners leads to a deep understanding of the social, cultural and environmental contexts.

The focus of humanitarian surgery should shift from responding to crises to supporting the needs of low-resource settings, and consider how the engagement of high-income surgical systems can both support the provision of surgical services and build capacity in systems in need.

Recommendation 6: A structured, interdisciplinary curriculum in humanitarian surgery that delivers a broad skill set and results in internationally recognised accreditation should be created and endorsed by all surgical colleges. The colleges should collaborate with regional humanitarian surgical education hubs to deliver this programme.

Short course delivery and just-in-time training is expensive, inefficient and rarely sufficient or sustainable to meet the needs of humanitarian surgery. While having value in raising awareness and guiding decision making, those undertaking the programmes must already have basic surgical skills to benefit from the supplemental learning. Such off-the-shelf intensive courses can then help support responses to complex emergency settings.

The curricula of such programmes are a collation of ideas and opinions, often with indistinct learning outcomes, which results in a very diverse market of unclear benefit to learners. They are not a replacement for formal education and skills training in humanitarian surgery.

A structured curriculum in humanitarian surgery is needed that delivers a broad skill set across the full scope of surgical need. This must be founded on a syllabus with agreed protocols and guidelines, and a robust quality-assurance process, leading to internationally recognised accreditation.

Surgical colleges, international collaborations and regional partnerships should focus on delivering coordinated education programmes to develop specialists in humanitarian surgery. This should recognise and leverage multimodal and hybrid learning approaches. Programmes should be supported locally, delivered in collaboration with international partners, and coordinated and overseen by regional humanitarian surgical education hubs.

Recommendation 7: The surgical colleges should collaborate with the professional bodies for anaesthesia, surgical nursing and allied health professionals to build multidisciplinary surgical team education and skills programmes to support humanitarian surgery.

Humanitarian surgery requires an operator but cannot occur without the involvement of and support from the wider surgical team. This includes the provision of anaesthesia, surgical nursing and pre- and postoperative care.

Humanitarian surgical partnerships should take a multidisciplinary approach to system development and ensure that education and skills training programmes include the development of the wider surgical team.

The necessity of skills transfer for both operating and delivering support services should be recognised and the education and skills training of clinical officers and nurses, up to a level recognised by the local authorities, should be supported.

Recommendation 8: International surgical professional bodies and networks should actively support the development of communities of practice within humanitarian surgery. Regional surgical bodies should act as partnership hubs, facilitating connections between humanitarian surgeons within a region.

Inclusive and respectful communities of practice, where trust can be built, with support and guidance provided when requested, are crucial for humanitarian surgeons. Local ownership and long-term relationships are foundational, and such networking should be encouraged and recognised.

Networks can be created and enabled by professional bodies but must be owned by their membership to be self-sustaining. Infrastructure investment to enable and facilitate networking and communication may be necessary to establish such relationships.

Regional colleges may themselves form a community to enable the sharing of practice, facilitate lessons identified and learnt, and bring participants together for knowledge exchange. There must also be flexibility to allow ad hoc communities to develop.

Recommendation 9: HSI should engage collaboratively with others in the design and creation of an open-access surgical learning library for humanitarian surgery.

A library of quality-assured open-access surgical learning resources for the delivery of the core humanitarian surgical curriculum and offering accessible guidance to providers in the field is needed. With the breadth of information required and diversity of opinions about how to approach the best evidence-based practice, a maintained platform is appropriate. No single authority or body should own the library.

Recommendation 10: HSI should engage with partners and technology companies to develop and optimise the technological platforms on which a resource library could be built and through which distance learning could be delivered.

Humanitarian surgery stakeholders must work with technology companies to create relevant, durable and affordable technology that can operate and be maintained in low-resource settings. Before the introduction of high-technology solutions, training of personnel in their use and maintenance needs to be provided and supported sustainably.

This list of recommendations defines a series of strategic steps for stakeholders who wish to see humanitarian surgery enabled as a recognised discipline and challenges the surgical community to overcome the identified barriers to bring this to fruition.

References

1. De Rosa A, Meyer A, Seabra A *et al.* An international surgical collaboration: humanitarian surgery in Brazil. *Hernia* 2016; **20**: 553–557.
2. Elder G, Murphy RA, Herard P *et al.* Challenging the barriers to accessing surgery in low-resource settings: lessons learned from burns. *Surgery* 2015; **158**: 33–36.
3. Fagan JJ, Aswani J, Otiti J *et al.* Educational workshops with graduates of the University of Cape Town Karl Storz Head and Neck Surgery Fellowship Program: a model for collaboration in outreach to developing countries. *Springerplus* 2016; **5**: 1652.
4. Falase B, Olufemi S, Ikotun F *et al.* Making the transition from cardiac missions to autonomous heart surgery at a Nigerian teaching hospital: challenges and lessons learned. *Semin Thorac Cardiovasc Surg*. Published online July 31, 2023. https://doi.org/10.1053/j.semtcvs.2023.05.002.
5. Kynes JM, Zeigler L, McQueen K. Surgical outreach for children by international humanitarian organizations: a review. *Children (Basel)* 2017; **4**: 53.
6. Malapati SH, Ramly EP, Riesel J *et al.* Safety and sustainability: optimizing outcomes and changing paradigms in global health endeavors. *Plast Reconstr Surg* 2023; **11**: e5256.
7. McDermott FD, Kelly ME, Warwick A *et al.* Problems and solutions in delivering global surgery in the 21st century. *Br J Surg* 2016; **103**: 165–169.
8. Meara JG, Leather AJ, Hagander L *et al.* Global surgery 2030: evidence and solutions for achieving health, welfare, and economic development. *Lancet* 2015; **386**: 569–624.
9. Pulvirenti R, Gortan M, Cumba D *et al.* Pediatric surgery and anesthesia in low-middle income countries: current situation and ethical challenges. *Front Pediatr* 2022; **10**: 908699.
10. World Health Organization. Classification and Minimum Standards for Foreign Medical Teams (Blue Book). https://www.who.int/docs/default-source/documents/publications/classification-and-minimum-standards-for-foreign-medical-teams-in-suddent-onset-disasters.pdf.
11. World Health Organization. Classification and Minimum Standards for Emergency Medical Teams. https://apps.who.int/iris/bitstream/handle/10665/341857/9789240029330-eng.pdf?sequence=1&isAllowed=y.
12. World Health Organization. A Guidance Document for Medical Teams Responding to Health Emergencies in Armed Conflicts and other Insecure Environments. https://apps.who.int/iris/bitstream/handle/10665/341858/9789240029354-eng.pdf?sequence=1&isAllowed=y.
13. Wren SM, Wild HB, Gurney J *et al.* A consensus framework for the humanitarian surgical response to armed conflict in 21st century warfare. *JAMA Surg* 2020; **155**: 114–121.
14. Redmond AD, Mardel S, Taithe B *et al.* A qualitative and quantitative study of the surgical and rehabilitation response to the earthquake in Haiti, January 2010. *Prehosp Disaster Med* 2011; **26**: 449–456.
15. World Health Organization. Mass Casualty Preparedness and Response in Emergency Units. https://reliefweb.int/report/world/guide-mass-casualty-preparedness-and-response-emergency-units.
16. McKnight G, Friebel R, Marks I *et al.* Defining humanitarian surgery: international consensus in global surgery. *Br J Surg* 2024; **111**: znae024.
17. King's College London. Searching for Systematic Reviews & Evidence Synthesis: Grey Literature. https://libguides.kcl.ac.uk/systematicreview/greylit.
18. University of Wolverhampton. Guide to Searching Grey Literature. https://www.wlv.ac.uk/lib/media/departments/lis/skills/study-guides/LS124-Searching-Grey-Literature.pdf.
19. University of Manchester. *University of Manchester Research Ethics Tool.* University of Manchester; 2023.
20. Chung KY. Plastic and reconstructive surgery in global health: let's reconstruct global surgery. *Plast Reconstr Surg Glob Open* 2017; **5**: e1273.
21. Farmer PE, Kim JY. Surgery and global health: a view from beyond the OR. *World J Surg* 2008; **32**: 533–536.
22. Broer PN, Jenny HE, Ng-Kamstra JS *et al*. The role of plastic surgeons in advancing development global. *World J Plast Surg* 2016; **5**: 109–113.
23. World Health Assembly. World Health Assembly Resolution WHA68.15: Strengthening Emergency and Essential Surgical Care and Anaesthesia as a Component of Universal Health Coverage. https://apps.who.int/gb/ebwha/pdf_files/WHA68/A68_R15-en.pdf.
24. Debas H, Donkor P, Gawande A *et al. Essential Surgery. Disease Control Priorities.* 3rd edn, vol 1. Washington, DC: World Bank; 2015.
25. Forrester JD, Forrester JA, Basimouneye J-P *et al.* Sex disparities among persons receiving operative care during armed conflicts. *Surgery* 2017; **162**: 366–376.
26. Fenton KN, Cardarelli M, Molloy F *et al*. Ethics in humanitarian efforts: when should resources be allocated to paediatric heart surgery? *Cardiol Young* 2019; **29**: 36–39.

27. Merchant A, Hendel S, Shockley R *et al.* Evaluating progress in the global surgical crisis: contrasting access to emergency and essential surgery and safe anesthesia around the world. *World J Surg* 2015; **39**: 2630–2635.

28. Makam P, Matsa R. 'Big three' infectious diseases: tuberculosis, malaria and HIV/AIDS. *Curr Top Med Chem* 2021; **21**: 2779–2799.

29. Borrelli MR. What is the role of plastic surgery in global health? A review. *World J Plast Surg* 2018; **7**: 275–282.

30. Čebron U, Zuo KJ, Kasrai L. A bibliometric analysis of the most cited articles in global reconstructive surgery. *Ann Plast Surg* 2019; **83**: 334–339.

31. World Health Organization. *Health Systems Governance and Financing.* https://www.who.int/teams/health-systems-governance-and-financing/economic-analysis.

32. Grimes CE, Henry JA, Maraka J *et al.* Cost effectiveness of surgery in low and middle income countries: a systematic review. *World J Surg* 2014; **38**: 252–263.

33. Eells AC, Oliver JD, Forte AJ. International humanitarian work: a mindset for success in plastic surgery training. *Ann Plast Surg* 2019; **82**: 361–362.

34. Wong EG, Trelles M, Dominguez L *et al.* Surgical skills needed for humanitarian missions in resource-limited settings: common operative procedures performed at Médecins Sans Frontières facilities. *Surgery* 2014; **156**: 642–649.

35. De Costa J, Briskin E, Trelles M *et al.* The burden of road traffic accidents in trauma in low-resource settings: a retrospective cohort analysis of patient admissions to 2 Médecins Sans Frontières trauma facilities. *IJS Global Health* 2022; **5**: e68.

36. Trudeau MON, Baron E, Hérard P *et al.* Surgical care of pediatric patients in the humanitarian setting: the Médecins sans Frontières experience, 2012–2013. *JAMA Surg* 2015; **150**: 1080–1085.

37. Porta CR, Robins R, Eastridge B *et al.* The hidden war: humanitarian surgery in a combat zone. *Am J Surg* 2014; **207**: 766–772.

38. Sheridan RL. Austere surgical care in the era of specialization. *Pediatr Crit Care Med* 2018; **19**: 384–385.

39. Shafiq U, Rehman U, Al-Asali N *et al.* How can we inspire junior trainees to consider a career in plastic surgery as a basis to pursue humanitarian work? *Eur J Plast Surg* 2023; 6: 1389–1395.

40. Di Maggio F, Nkurunziza J, Caravaggi P. Uterocutaneous fistula due to held placenta in a low resource setting. *Clin Case Rep* 2018; **6**: 1665–1667.

41. Backer CL. Humanitarian congenital heart surgery: template for success. *J Thorac Cardiovasc Surg* 2014; **148**: 2489–2490.

42. Nichani S, Nichani S. The unexplored benefits of paediatric cardiac humanitarian work in the developing world. *Front Pediatr* 2021; **9**: 555085.

43. Padmanaban V, Hoffman D, Aziz SR, Sifri ZC. Developing a sustainable program for volunteer surgical care in low-income and middle-income countries. *Oral Maxillofac Surg Clin North Am* 2020; **32**: 471–480.

44. Chu KM, Trelles M, Ford NP. Quality of care in humanitarian surgery. *World J Surg* 2011; **35**: 1169–1172.

45. Jafar AJ, Norton I, Lecky F *et al*. A literature review of medical record keeping by foreign medical teams in sudden onset disasters. *Prehosp Disaster Med* 2015; **30**: 216–222.

46. Elahi MM, Matata BM. To the editor: humanitarian cardiac surgery care for developing countries: role in achieving sustainable global health. *Int Surg* 2021; **105**: 753–754.

47. Close KL, Christie-de Jong FTE. Lasting impact: a qualitative study of perspectives on surgery by adult recipients of free mission-based surgical care in Benin. *BMJ Open* 2019; **9**: *e028235.*

48. Johnston PF, Kunac A, Gyakobo M *et al.* Short-term surgical missions in resource-limited environments: five years of early surgical outcomes. *Am J Surg* 2019; **217**: 7–11.

49. Fox CM, Rozen WM, Mirkazemi M *et al.* Microvascular reconstruction for neglected facial tumors in the Third World: bringing humanitarian aid home. *Plast Reconstr Surg* 2012; **130**: 214E–220E.

50. Søreide K, Alderson D, Bergenfelz A *et al.* Strategies to improve clinical research in surgery through international collaboration. *Lancet* 2013; **382**: 1140–1151.

51. Russell J, Greenhalgh T, Taylor M. *Patient and Public Involvement in NIHR Research 2006–2019: Policy Intentions, Progress and Themes*. Oxford, UK: National Institute for Health Research; 2019.

52. Veerappan VR, Jindal RM. Community participation in global surgery. *BMJ Glob Health* 2021; **6**: e005044.

53. Aissaoui Y, Bahi M, El Khader A *et al.* Thoracic spinal anaesthesia for abdominal surgery in a humanitarian military field hospital: a prospective observational study. *BMJ Mil Health* 2024; **170**: 26–30.

54. Faulconer ER, Davidson A, Bowley D *et al*. Negative pressure temporary abdominal closure without continuous suction: a solution for damage control surgery in austere and far-forward settings. *BMJ Mil Health* 2019; **165**: 163–165.

55. Patel PB, Hoyler M, Maine R *et al*. An opportunity for diagonal development in global surgery: cleft lip and palate care in resource-limited settings. *Plast Surg Int* 2012; 2012: 892437.

56. Giannou C, Balden M, Molde Å. *War Surgery: Working With Limited Resources in Armed Conflict and Other Situations of Violence.* Vol 2. International Committee of the Red Cross; Geneva, 2013.

57. McLaren M, Loosemore M. Swift trust formation in multi-national disaster project management teams. *Int J Proj Manag* 2019; **37**: 979–988.

58. Lin Y, Mukhopadhyay S, Meguid RA *et al*. The Colorado humanitarian surgical skills workshop: a cadaver-based workshop to prepare residents for surgery in austere settings. *J Surg Educ* 2018; **75**: 383–391.

59. Bale AG, Sifri ZC. Surgery resident participation in short-term humanitarian international surgical missions can supplement exposure where program case volumes are low. *Am J Surg* 2016; **211**: 294–299.

60. Bhatia MB, Darkwa L, Simon C *et al.* Uncovering the overlap of global and domestic rural surgery for medical trainees. *J Surg Res* 2022; **279**: 442–452.

61. Cochrane M, Chisholm G, Tomlinson N. *Engaging in Global Health: the Framework for Voluntary Engagement in Global Health by the UK Health Sector.* https://assets.publishing.service.gov.uk/media/5a7516de40f0b6397f35d95e/Engaging_in_Global_Health__1_.pdf.

62. Ho T, Bentz M, Brzezienski M *et al.* The present status of global mission trips in plastic surgery residency programs. *J Craniofac Surg* 2015; **26**: 1088–1090.

63. Donley DK, Graybill CK, Fekadu A *et al.* Transition to practice: a global surgery approach. *J Surg Educ* 2018; **75**: 392–396.

64. Donley DK, Graybill CK, Fekadu A *et al*. Loma Linda global surgery elective: first 1000 cases. *J Surg Educ* 2017; **74**: 934–938.

65. Mohan HM, Fitzgerald E, Gokani V *et al.* Engagement and role of surgical trainees in global surgery: consensus statement and recommendations from the Association of Surgeons in Training. *Int J Surg* 2018; **52**: 366–370.

66. Chu KM, Karjiker P, Kruger D *et al*. South African surgeons are appropriately trained for humanitarian surgery. *J Am Coll Surg* 2018; **227**: e27.

67. Thoma M, Dominguez L, Ledecq M *et al.* Teaching humanitarian surgery: filling the gap between NGO needs and subspecialized surgery through a novel inter-university certificate. *Acta Chir Belg.* Published online December 17, 2020. https://doi.org/10.1080/00015458.2020.1846943.

68. Rockwell WT, Agbenorku P, Olson J *et al.* A model for university-based international plastic surgery collaboration builds local sustainability. *Ann Plast Surg* 2015; **74**: 388–391.

69. Fisher QA, Fisher G. The case for collaboration among humanitarian surgical programs in low resource countries. *Anesth Analg*. 2014; **118**: 448–453.

70. Joshipura M. Global alliance for care of the injured. *Inj Prev* 2012; 18: 69.

71. Bode CO, Nwawolo CC, Giwa□Osagie OF. Surgical education at the West African College of Surgeons. *World J Surg* 2008; **32**: 2162–2166.

72. Mulwafu W, Fualal J, Bekele A *et al.* The impact of COSECSA in developing the surgical workforce in East Central and Southern Africa. *Surgeon* 2022; **20**: 2–8.

73. Ambroise B, Benateau H, Prevost R *et al.* The contribution of telemedicine to humanitarian surgery. *J Craniomaxillofac Surg* 2018; **46**: 1368–1372.

74. Intuitive Foundation. Philanthropy, Research and Education. https://www.intuitive-foundation.org/.

75. Van den Homberg MJ, Gevaert CM, Georgiadou Y. The changing face of accountability in humanitarianism: using artificial intelligence for anticipatory action. *Politics Gov* 2020; **8**: 456–467.

76. Martin A, Sharma G, Peter de Souza S *et al.* Digitisation and sovereignty in humanitarian space: technologies, territories and tensions. *Geopolitics* 2023; **28**: 1362–1397.

77. Gutierrez M, Bryant J. The fading gloss of data science: towards an agenda that faces the challenges of big data for development and humanitarian action. *Development* 2022; **65**: 80–93.

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