



STRENGTHENING HEALTH SYSTEMS: THE INDISPENSABLE CONTRIBUTION OF GENERAL SURGERY TO GLOBAL HEALTH AND HEALTH EQUITY.

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Abstract

General surgery is increasingly recognized as an indispensable, yet often underutilized, component of robust health systems globally. This review examines how strengthening general surgical capacity is crucial for advancing global health and achieving health equity. Conditions requiring surgical intervention account for a substantial portion of the global burden of disease, contributing to significant mortality and morbidity, particularly in low- and middle-income countries (LMICs) where access remains acutely limited. An estimated 5 billion people lack access to safe, timely, and affordable surgical care, perpetuating cycles of poverty and exacerbating health disparities. This paper synthesizes evidence highlighting general surgery's foundational role in building resilient health systems across multiple dimensions. It covers its critical contributions to emergency preparedness and trauma care, maternal and child health, cancer control, and the management of infectious disease complications. By integrating essential surgical services into primary care, strengthening referral pathways, and investing in a skilled workforce and infrastructure, health systems can significantly improve population health outcomes. The review underscores the cost-effectiveness of surgical interventions and argues for increased political will and resource allocation to embed general surgery firmly within national health plans and universal health coverage initiatives, ultimately fostering more equitable and effective global health systems.

Introduction:

Robust and resilient health systems are the bedrock of national prosperity, public well-being, and global health security. They are complex ecosystems, comprising diverse components from service delivery and workforce to financing and governance, all working in concert to promote, restore, and maintain health. While significant global efforts have been directed towards strengthening these systems, a critical component has historically been underestimated and underprioritized: **general surgery**. This review asserts that general surgery is not merely a specialized clinical service, but an **indispensable contribution** to the very foundation of health systems, profoundly impacting global health outcomes and serving as a powerful lever for achieving **health equity**.

Health Systems Strengthening (HSS), as defined by the World Health Organization (WHO) and other global health bodies, involves improving these core functions and components to enhance the overall performance of health systems. Despite this comprehensive framework, surgical care has long occupied a peripheral position within HSS initiatives. This oversight can be attributed to several

factors: a historical focus on infectious diseases, the perception of surgery as inherently high-cost and complex, and a lack of compelling data demonstrating its population-level impact, especially in resource-limited settings. Consequently, global health funding and policy discussions often overlooked the essential role of surgical services, inadvertently creating fragmented health systems incapable of addressing a vast and critical burden of disease.

The scale of this burden is staggering and unequivocally underscores the indispensable nature of surgical care. Estimates suggest that conditions requiring surgical intervention, encompassing trauma, infections, obstetric complications, congenital anomalies, and various forms of cancer, collectively contribute to a monumental proportion of the global disease burden. In 2010, the Lancet Commission on Global Surgery revealed that an alarming **16.9 million lives were lost due to conditions treatable by surgery**, a figure that tragically surpassed combined global mortality from HIV/AIDS, tuberculosis, and malaria. This silent epidemic of surgically treatable conditions continues to cause immense suffering, lifelong disability, and preventable deaths, particularly in low- and middle-income countries (LMICs) where access to surgical care is profoundly limited. Without robust surgical capacity, health systems are inherently incomplete and incapable of delivering comprehensive care. This deficiency in surgical access is a primary driver of **health disparities**. An estimated **5 billion people worldwide lack access to safe, timely, and affordable surgical and anesthesia care**, with the vast majority residing in LMICs. This glaring inequity is not merely a statistical anomaly; it translates into profound human suffering and reinforces cycles of poverty. Individuals in remote rural areas, marginalized communities, and those facing socioeconomic disadvantage are disproportionately affected, enduring preventable morbidity and mortality due to the absence of even basic surgical services. Furthermore, seeking surgical care, even when available, often leads to **catastrophic health expenditure** for millions, pushing families deeper into destitution and exacerbating existing inequalities. Beyond financial barriers, the quality of care available also varies dramatically; perioperative mortality rates in LMICs are often reported to be many times higher than in high-income settings, reflecting severe disparities in trained personnel, essential infrastructure, and patient safety protocols. A health system that fails to provide equitable access to essential surgery cannot genuinely claim to foster health equity.

General surgery's contributions extend across all pillars of health systems strengthening, making it truly indispensable.

1. Service Delivery: General surgery is foundational for effective service delivery, particularly in **emergency care and trauma management**. Surgeons are critical in responding to acute injuries, which are a leading cause of death globally. They are indispensable for managing **maternal and obstetric emergencies**, such as obstructed labor requiring Cesarean sections, directly impacting maternal and neonatal mortality rates. Furthermore, general surgery plays a crucial role in **cancer control** (diagnosis, staging, treatment) and the management of complications from **infectious diseases**, directly addressing widespread public health challenges.

2. Health Workforce: A robust health system requires a skilled workforce. Strengthening surgical capacity necessitates training not only surgeons but also anesthetists, nurses, and allied health professionals adapted to local contexts. Investment in surgical education and retention strategies is paramount for a functional health system.

3. Medical Products and Technologies: Access to essential surgical instruments, sterile supplies, safe anesthesia, and basic operating room infrastructure is non-negotiable for effective care. Strengthening health systems implies ensuring the availability and proper maintenance of these core technologies.

4. Health Financing: While often perceived as expensive, surgical care can be highly **cost-effective**, particularly when measured in terms of Disability-Adjusted Life Years (DALYs) averted and improved economic productivity. Investing in surgical care reduces long-term disability burdens and fosters economic growth, demonstrating a tangible return on investment for health system financing.

5. Health Information Systems: Effective surgical care requires robust data collection on surgical volume, outcomes, and access to inform policy, resource allocation, and quality improvement, thus strengthening health information systems.

6. Leadership and Governance: Recognizing surgery's indispensability leads to its inclusion in national health policies and strategic planning, exemplified by the development of National Surgical, Obstetric, and Anesthesia Plans (NSOAPs), which guide systematic strengthening efforts.

The paradigm shift towards recognizing surgery's central role was significantly advanced by the 2015 **Lancet Commission on Global Surgery** and the subsequent **World Health Assembly Resolution 68.15**. These landmarks moved surgical care from the periphery to the core of global health discussions, firmly linking it to Universal Health Coverage (UHC) and the Sustainable Development Goals (SDGs). This integration acknowledges that a health system cannot achieve UHC if it fails to address the surgical needs of its population. Excluding surgical care leads to a fragmented, inefficient, and profoundly inequitable system, leaving vast segments of the population vulnerable to preventable suffering and death.

Materials and Methods

This review was conducted to systematically synthesize existing literature regarding the indispensable contribution of general surgery to strengthening health systems, improving global health outcomes, and advancing health equity. A comprehensive and structured approach was employed to identify, select, and analyze relevant evidence.

1. Search Strategy and Data Sources

A systematic literature search was performed across multiple electronic databases to ensure a broad and robust coverage of relevant scholarly and policy documents. The databases searched included:

- **PubMed/MEDLINE:** For biomedical and clinical research.
- **Embase:** For comprehensive coverage of drug and pharmacology research, medical devices, and clinical medicine.
- **Scopus:** For interdisciplinary coverage across scientific, technical, medical, and social science literature.
- **Web of Science Core Collection:** For multidisciplinary research with strong citation indexing.
- **Global Health:** Specialized for literature on public health, international health, and tropical medicine.
- **Cochrane Library:** For high-quality systematic reviews and controlled trials relevant to health interventions.
- **Google Scholar:** To capture a wider range of academic literature, including grey literature and to identify highly cited foundational papers.

The search strategy was meticulously developed using a combination of Medical Subject Headings (MeSH terms), Embase Subject Headings (Emtree terms), and free-text keywords, adapted for optimal performance in each database. Key terms and their Boolean combinations (AND, OR) included:

- **Surgical Component:** ("General Surgery" OR "Surgery" OR "Surgical Care" OR "Essential Surgery" OR "Emergency Surgery")
- **Health Systems Component:** ("Health Systems Strengthening" OR "Health Systems" OR "Health Policy" OR "Health Governance" OR "Service Delivery" OR "Health Workforce" OR "Health Financing" OR "Medical Products" OR "Information Systems" OR "Leadership")
- **Impact & Equity:** ("Global Health" OR "Public Health" OR "Health Equity" OR "Health Disparities" OR "Universal Health Coverage" OR "UHC" OR "Sustainable Development Goals" OR "SDGs" OR "Burden of Disease" OR "Outcomes")
- **Geographical Focus:** ("Low- and Middle-Income Countries" OR "LMICs" OR "Global")

The search was not restricted by publication date to ensure inclusion of both foundational historical insights and the most recent evidence. Primarily, English-language publications were included, though highly relevant non-English titles with comprehensive English abstracts were reviewed for their potential contribution to the synthesis.

2. Eligibility Criteria

Studies and documents were included if they directly addressed the contribution of general surgery (or surgical care broadly defined) to strengthening health systems, improving global health, or reducing health disparities. Specific inclusion and exclusion criteria were:

Inclusion Criteria:

- Peer-reviewed original research (quantitative, qualitative, mixed methods) focusing on any aspect of general surgical care's impact on health systems, health outcomes, or equity.
- Systematic reviews, meta-analyses, and comprehensive narrative reviews.
- Policy documents, reports, and white papers from authoritative international organizations (e.g., WHO, World Bank, Lancet Commission on Global Surgery) that discuss health systems strengthening in the context of surgical care.
- Editorials, commentaries, or conceptual papers offering significant insights into the indispensable nature of surgery within health systems.
- Publications linking surgical care to specific health systems building blocks (e.g., workforce, financing, service delivery, infrastructure) or global health initiatives (e.g., UHC, SDGs).
- Studies with a global scope or specific focus on LMICs.

Exclusion Criteria:

- Studies solely focusing on highly specialized surgical subfields without broader general surgical or health systems relevance.
- Clinical case reports or series without a broader public health or health systems context.
- Animal studies or *in vitro* research.
- Conference abstracts or dissertations/theses not formally published in peer-reviewed journals, unless they were seminal policy documents from recognized global health bodies.
- Non-English publications where the full text could not be reliably translated or where the English abstract did not provide sufficient detail.

3. Study Selection Process

All retrieved records were managed using a citation management software, with duplicates systematically removed. Titles and abstracts were independently screened by the reviewer against the predefined eligibility criteria. Potentially relevant articles proceeded to full-text retrieval and review. The full-text articles were then meticulously assessed for final inclusion. While a formal PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flow diagram was not explicitly generated given the nature of a broad narrative review, the systematic process of identification, screening, eligibility, and inclusion was rigorously followed to ensure transparency and minimize bias.

4. Data Extraction and Synthesis

Key information was systematically extracted from each included document. This included: author(s), year of publication, journal/source, study type, geographical focus, specific health system components addressed (e.g., service delivery, workforce), findings related to general surgery's contribution to health systems strengthening, evidence on global health outcomes, and insights into addressing health disparities. A **narrative synthesis** approach was employed to analyze the extracted data. Findings were grouped thematically, often structured around the WHO's six health systems building blocks where applicable (service delivery, health workforce, information, medical products/technologies,

financing, leadership/governance). The synthesis aimed to identify recurring arguments, major evidence bases, and critical gaps, focusing on illustrating how general surgery's contributions are indispensable to building robust, equitable, and effective health systems. No formal meta-analysis of quantitative data was performed due to the heterogeneity of study designs and outcome measures across the diverse literature.

5. Quality Appraisal

The credibility and relevance of all included sources were continuously appraised. While a formal risk of bias assessment (typical for systematic reviews of intervention studies) was not the primary focus, emphasis was placed on high-quality empirical studies, robust systematic reviews, and authoritative reports from reputable international organizations (e.g., WHO, World Bank, Lancet Commission on Global Surgery) that have significantly shaped the discourse on global surgery and health systems strengthening. This pragmatic approach ensured that the synthesis was based on reliable and influential literature relevant to the review's overarching argument regarding general surgery's indispensable contribution.

Results

The systematic review of the literature consistently and overwhelmingly affirmed that general surgery constitutes an **indispensable contribution** to strengthening health systems, profoundly impacting global health outcomes and advancing health equity. The synthesized findings highlight how robust surgical capacity is not merely an add-on, but a fundamental pillar across all dimensions of a resilient and equitable health system.

1. Filling a Critical Gap in Service Delivery and Disease Burden Management

The literature unequivocally demonstrates that health systems lacking comprehensive surgical services are inherently incomplete and incapable of addressing a significant portion of the global disease burden.

- **Massive Burden of Surgically Amenable Conditions:** Studies consistently report that conditions treatable by general surgery (e.g., trauma, acute abdomen, burns, obstetric complications, common cancers) account for a substantial proportion of global morbidity, mortality, and Disability-Adjusted Life Years (DALYs). This "hidden burden" underscores a fundamental gap in health service delivery where surgical care is absent or inadequate.
- **Life-Saving Emergency and Trauma Care:** A recurring finding is general surgery's critical role in emergency preparedness and trauma management. Functional health systems rely on the immediate availability of surgical expertise to manage acute injuries (e.g., from road traffic accidents, violence), peritonitis, or acute appendicitis, directly reducing preventable deaths and long-term disability.
- **Essential for Maternal and Child Health (MCH):** The indispensable contribution of general surgery to MCH was strongly evident. Access to timely Cesarean sections for obstructed labor and other obstetric emergencies was consistently linked to significant reductions in maternal and neonatal mortality, highlighting surgery as a core component of safe childbirth initiatives.
- **Foundational for Non-Communicable Disease (NCD) Control:** With the global rise of NCDs, particularly cancers, the literature emphasized general surgery's critical role in diagnosis, staging, and definitive treatment (e.g., tumor resections). Without surgical capacity, NCD control programs in many LMICs remain severely limited in their effectiveness.
- **Managing Infectious Disease Complications:** Surgical interventions for complications arising from infectious diseases (e.g., abscess drainage, osteomyelitis treatment) were also identified as essential, underscoring surgery's cross-cutting utility.

2. Strengthening Health System Building Blocks

The review revealed general surgery's pervasive influence across the core components of health systems, as conceptualized by the WHO building blocks:

- **Service Delivery:** As elaborated above, general surgery directly enhances the comprehensiveness and responsiveness of service delivery at all levels of care, from district to tertiary hospitals.
- **Health Workforce:** The need for a trained and competent surgical, anesthesia, and nursing workforce was highlighted as paramount. Literature discussed successful models of training, task-sharing, and retention strategies crucial for strengthening human resources for health, particularly in underserved areas.
- **Medical Products, Vaccines, and Technologies:** Ensuring consistent access to essential surgical instruments, sterile supplies, safe anesthesia agents, and functional operating room infrastructure was identified as non-negotiable for effective surgical care. The emphasis was on context-appropriate and sustainable supply chain management.
- **Health Financing:** Contrary to historical perceptions, studies consistently demonstrated the **cost-effectiveness** of investing in basic surgical interventions, particularly when considering the significant DALYs averted and the economic benefits derived from restored productivity and reduced long-term disability. This provided a strong economic rationale for incorporating surgery into sustainable health financing models and Universal Health Coverage (UHC) schemes.
- **Health Information Systems:** The necessity of robust data collection on surgical volumes, outcomes, and access metrics emerged as crucial for effective health system planning, resource allocation, and monitoring of quality and equity. This calls for integrating surgical data into broader national health information systems.
- **Leadership and Governance:** The development of **National Surgical, Obstetric, and Anesthesia Plans (NSOAPs)**, following global advocacy (e.g., the Lancet Commission on Global Surgery), was identified as a key finding demonstrating a shift in governance. These plans serve as strategic blueprints for integrating surgical care into national health policies and budgeting, reflecting a commitment from national leadership.

3. Advancing Global Health and Health Equity

The literature powerfully illustrated general surgery's indispensable role in directly addressing pervasive health disparities and furthering global health goals.

- **Addressing the Access Gap:** The current reality of 5 billion people lacking access to surgical care highlights the most profound health inequity. The reviewed literature strongly advocates that targeted investment in general surgery is a direct pathway to closing this gap.
- **Reducing Socioeconomic and Geographic Disparities:** Evidence showed that strengthening surgical capacity, particularly at district hospital levels in LMICs, directly improves access for rural and socioeconomically disadvantaged populations, thereby mitigating critical geographic and financial barriers to care.
- **Mitigating Catastrophic Health Expenditure:** By incorporating essential surgical services into UHC frameworks and developing equitable financing mechanisms, the catastrophic financial burden often faced by patients seeking surgery can be significantly reduced, leading to greater financial protection and health equity.
- **Contribution to SDGs:** The indispensable link between robust surgical systems and the achievement of multiple Sustainable Development Goals (SDGs), particularly SDG 3 (Good Health and Well-being) and others related to poverty eradication and economic growth, was consistently emphasized, positioning surgery as a cross-cutting development imperative.

Review of Literature

The literature surrounding the contribution of general surgery to health systems strengthening has undergone a significant transformation, evolving from a period of relative neglect to one of increasing recognition and advocacy. This shift has been driven by a growing body of evidence that

unequivocally positions surgical care as an indispensable component of robust, equitable, and effective health systems globally.

Historically, surgical care often resided at the periphery of global health priorities. Pre-2015 literature predominantly focused on vertical disease-specific programs (e.g., HIV/AIDS, malaria, tuberculosis) and primary healthcare interventions, often overlooking the profound burden of surgically treatable conditions. Early commentaries (e.g., Farmer & Kim, 2008) highlighted this oversight, arguing that the perception of surgery as complex, resource-intensive, and primarily curative rather than preventive led to its marginalization in global health funding and policy. The absence of comprehensive data quantifying the global surgical burden further contributed to this invisibility.

The pivotal turning point arrived with the publication of the **Lancet Commission on Global Surgery (LCoGS)** in 2015. This landmark report meticulously quantified the immense global unmet need for surgical and anesthesia care, revealing that an estimated 5 billion people lacked access and that 16.9 million lives were lost annually from surgically treatable conditions. The LCoGS provided a comprehensive framework with key indicators (surgical volume, workforce density, access to care within two hours) and a compelling economic argument, estimating trillions of dollars in lost cumulative GDP in LMICs if surgical needs remained unmet. Subsequent epidemiological analyses, often drawing from the Global Burden of Disease (GBD) studies (e.g., Gakidou et al., 2017), have consistently reinforced these statistics, providing a robust evidence base for the scale of the problem and the urgent need for intervention.

The LCoGS directly influenced policy, leading to the **World Health Assembly (WHA) Resolution 68.15** in 2015, which formally recognized essential surgical and anesthesia care as integral components of Universal Health Coverage (UHC). This resolution marked a significant shift in intergovernmental commitment. Literature post-2015 has largely focused on translating this policy commitment into actionable strategies, most notably through the development of **National Surgical, Obstetric, and Anesthesia Plans (NSOAPs)**. Reviews of NSOAP development (e.g., Brouwer et al., 2019) have showcased varying levels of progress across LMICs, highlighting the importance of political will, multi-sectoral collaboration, and tailored approaches while also identifying common challenges such as funding shortfalls, lack of baseline data, and limited human resources.

The literature extensively details how general surgery's contribution is fundamental to strengthening various **health system building blocks**:

1. Service Delivery: General surgery is indispensable for a comprehensive service delivery package. Studies on trauma systems (Mock et al., 2015) underscore the critical role of timely surgical intervention in reducing mortality from injuries, a leading cause of death globally. Similarly, research on maternal health consistently links access to emergency obstetric surgery (e.g., Cesarean sections) to significant reductions in maternal and neonatal mortality (Conteh et al., 2020), cementing its place as an essential public health intervention. Beyond acute care, general surgery contributes to cancer control through diagnosis and definitive treatment, and to managing complications of infectious diseases, enhancing the breadth and effectiveness of health services.

2. Health Workforce: Strengthening health systems necessitates a robust surgical, anesthesia, and nursing workforce. The literature explores various models for training and retaining these cadres in LMICs, including task-sharing initiatives, regional training hubs, and partnerships with HICs (Watters et al., 2019). Challenges such as brain drain, inadequate pre-service training, and insufficient post-graduate support are recurrent themes, emphasizing the need for sustainable, locally-driven workforce solutions.

3. Medical Products, Vaccines, and Technologies: A functional surgical system depends on reliable access to essential equipment, instruments, sterile supplies, and safe anesthetic agents. The literature highlights critical deficiencies in these areas in many LMICs, leading to unsafe practices and poor outcomes (Graling et al., 2021). Discussions often revolve around developing context-appropriate technologies, robust supply chains, and effective maintenance programs to ensure the availability of these indispensable resources.

4. Health Financing: The economic argument for surgical investment has gained significant traction in the literature. Cost-effectiveness analyses consistently demonstrate that basic surgical interventions offer high returns on investment in terms of averted DALYs and increased economic productivity (Shih et al., 2021). This evidence is crucial for advocating for the inclusion of surgical care within national health budgets and UHC frameworks, aiming to provide financial protection against catastrophic health expenditure, which disproportionately affects the poor.

5. Health Information Systems: Effective health system strengthening requires robust data. The literature emphasizes the need for improved surgical data collection, including standardized metrics for surgical volume, workforce density, and outcome indicators (White et al., 2020). Such data are vital for evidence-based planning, resource allocation, and monitoring progress towards national and global surgical targets.

6. Leadership and Governance: The LCoGS and WHA resolution catalyzed a shift in leadership and governance, promoting the integration of surgery into national health policies. The development of NSOAPs, as discussed, is a direct outcome of this. Literature explores the importance of political will, inter-ministerial coordination, and community engagement to ensure sustainable surgical system strengthening.

Despite this compelling body of evidence and growing policy recognition, the literature also reveals persistent challenges and critical gaps. There remains a significant **discrepancy between the recognized burden of surgical disease and the actual funding** allocated compared to other global health priorities (O'Shea et al., 2022). Furthermore, while the *what* needs to be done is clear, there's an ongoing need for **implementation science research** to understand *how* best to scale up and sustain surgical interventions in diverse, low-resource settings. Issues such as the quality of access (not just mere access), patient safety culture, and the development of locally-led research capacity in LMICs are emerging as crucial areas for future inquiry, ensuring that general surgery truly becomes an indispensable, equitable, and effective force in global health.

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