

# Improving surgical systems in low- and middle-income countries: an inclusive framework for monitoring and evaluation

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High disease burden and inadequate resources have formed the basis for advocacy to improve surgical care in low- and middle-income countries (LMICs). Current measures are heavily focused on availability of resources rather than impact and fail to fully describe how surgery can be more integrated into health systems. We propose a new monitoring and evaluation framework of surgical care in LMICs to integrate surgical diseases into broader health system considerations and track efforts toward improved population health. Although more discussion is required, we seek to broaden the dialogue of how to improve surgical care in LMICs through this comprehensive framework.

**Keywords:** Global health, Global surgery, Monitoring and evaluation, WHO

## Introduction

Health systems in low- and middle-income countries (LMICs) are faced with high burdens of surgical disease, insufficient surgical practitioners and frequent shortages of essential implements for basic surgical care.<sup>1</sup> Within countries, these deficiencies have been enumerated using WHO's Global Initiative for Emergency and Essential Surgical Care (GIEESC) Situational Analysis Tool (SAT) and other methods.<sup>2</sup> Recently, the Lancet Commission for Global Surgery ([www.globalsurgery.info](http://www.globalsurgery.info)) proposed six indicators for monitoring access to safe surgical care addressing access to timely essential surgery, specialist surgical workforce density, surgical volume, perioperative mortality rate and protection against impoverishing or catastrophic expenditures.<sup>3</sup> However, current measures fail to fully describe how surgical diseases interact with broader population health concerns, or how surgical care can be more fully integrated into health systems.<sup>4</sup>

Health systems are defined as the institutions, organizations and resources (physical, financial and human) that provide services to improve health.<sup>5–7</sup> WHO has expanded this definition into the building blocks model for health systems (Figure 1), which forms the basis for a monitoring and evaluation (M&E) framework.<sup>8,9</sup> The goal of these indicators is to organize, plan and track efforts toward improved population health and to integrate specific disease states into broader health system considerations.

We propose an M&E framework based on WHO's building blocks model to link inputs to population impact (Figure 2). This

merges components from the WHO SAT with the Lancet Commission indicators, and responds to recommendations from the disease control priorities goal to assess surgical care within primary health systems.<sup>1–3</sup> This model includes indicators in four categories: inputs and processes, outputs, outcomes and impacts. Although more discussion and validation of our proposed monitoring and evaluation tool is required, we seek to broaden the dialogue by proposing a comprehensive synthesis of indicators to enhance understanding of surgical care within health systems.

## Inputs and processes

The WHO GIEESC SAT is the most frequently used tool for assessing surgical care within LMICs and covers four input categories: infrastructure, human resources, procedures, and equipment and supplies. This has been the basis for developing alternative models.<sup>10–14</sup> These emphasize the measurement of inputs in facility-based assessments, whereas our proposed framework includes input and process indicators across all levels of the LMIC health system.

Governance of health systems in LMICs includes consideration of policy development, financial oversight, interaction with donors, and regulatory and quality assurance. Government commitment to surgical care may be demonstrated through national or regional plans for district level surgical service priorities, surgical education curriculum and accreditation standards and surgical care financing.

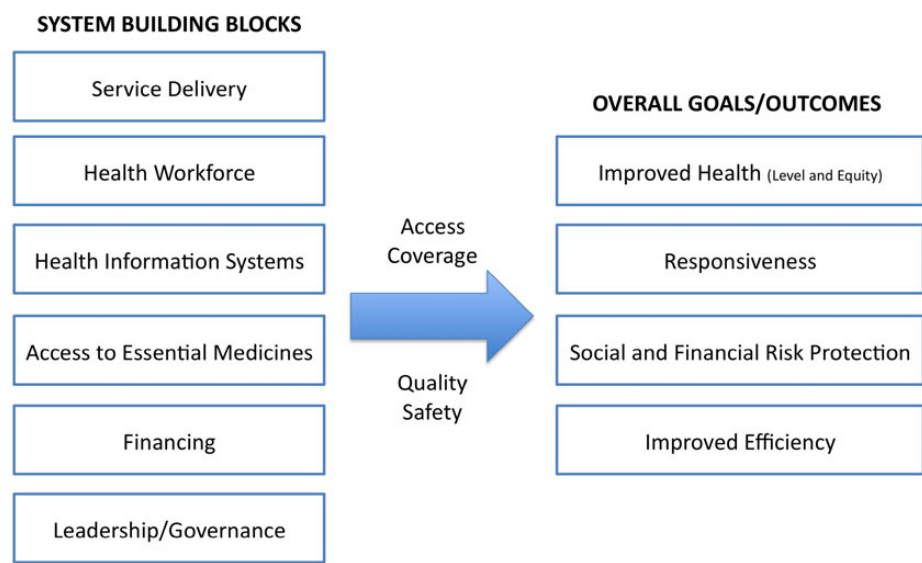


Figure 1. WHO health systems framework.<sup>8,9</sup>

Inputs and Processes	Outputs	Outcomes	Impact
<p><b>Governance</b></p> <ul style="list-style-type: none"><li>•National plan for district level surgical services</li><li>•Surgical education curriculum and accreditation standards</li></ul> <p><b>Financing</b></p> <ul style="list-style-type: none"><li>•Surgical care as % of total healthcare budget</li><li>•External funding for surgical care as % of total spent for surgical care</li><li>•Cost to patients for key procedures</li></ul> <p><b>Infrastructure</b></p> <ul style="list-style-type: none"><li>•Functioning operating rooms per 100,000 people</li><li>•Surgical beds per 100,000 people</li><li>•Availability of running water, electricity, generator</li></ul> <p><b>Health Workforce</b></p> <ul style="list-style-type: none"><li>•Operators per 100,000 people</li><li>•Anesthetists per 100,000 people</li><li>•Nurses per 100,000 people</li></ul> <p><b>Supply Chain</b></p> <ul style="list-style-type: none"><li>•Availability and adequate supply chain of select pieces of equipment and supplies and essential medicines related to surgery</li><li>•Ability to repair select equipment</li></ul> <p><b>Information</b></p> <ul style="list-style-type: none"><li>•Collection of baseline/interval surgical epidemiological data</li></ul>	<p><b>Service Access and Readiness</b></p> <ul style="list-style-type: none"><li>•Average distance patient travels to receive surgical care</li><li>•# of surgical admissions per year</li><li>•# of patients receiving major and minor surgery per year</li><li>•# of children &lt;15 receiving operations per year</li><li>•# of patients transferred to higher level of care per year</li></ul> <p><b>Service Quality and Safety</b></p> <ul style="list-style-type: none"><li>•Management guidelines for prioritized interventions</li><li>•Demonstrated provider competency in prioritized surgical interventions</li></ul> <p><b>Monitoring and Evaluation</b></p> <ul style="list-style-type: none"><li>•Regular mortality and morbidity conferences</li><li>•Annual review of educational resources within facility</li></ul>	<p><b>Coverage of Interventions</b></p> <ul style="list-style-type: none"><li>•# of all surgical cases per 100,000 people</li><li>•# of prioritized interventions per 100,000 people (i.e. Cesarean section or trauma resuscitation)</li><li>•Cesarean section : vaginal delivery ratio</li><li>•Strangulated : elective hernia repair ratio</li></ul> <p><b>Surgical Outcomes</b></p> <ul style="list-style-type: none"><li>•Intraoperative mortality rate</li><li>•30-day postoperative mortality rate</li></ul> <p><b>Risk Factors and Behaviors</b></p> <ul style="list-style-type: none"><li>•Presence of public health prevention programs related to surgical disease (i.e., road traffic accident prevention, burn prevention, smoking cessation)</li><li>•Education of primary care providers on surgical conditions for stabilization and quicker referrals</li></ul>	<p><b>Improved Health Outcomes and Equality</b></p> <ul style="list-style-type: none"><li>•Maternal mortality rate</li><li>•Trauma mortality rate</li><li>•Change in unmet need for surgical care over time</li><li>•Equity of access to surgical care</li></ul> <p><b>Social and Financial Risk Protection</b></p> <ul style="list-style-type: none"><li>•Surgery-related out-of-pocket expenditure as a % of total health expenditure</li><li>•Economic impact of surgery-related and trauma-related mortality and morbidity</li></ul> <p><b>Responsiveness</b></p> <ul style="list-style-type: none"><li>•Patient satisfaction</li><li>•Patient perception of surgical care within primary health care</li><li>•Population perception of value of surgical care</li></ul>

Figure 2. Proposed monitoring and evaluation tool for surgical systems in low- and middle-income countries.

Financial commitments to the provision of surgical care can be measured by calculating surgical care as a percent of the total healthcare budget and the proportion of external funding allocated to surgical care. Cost to patients for key procedures can also evaluate the commitment of policymakers to provide accessible, affordable healthcare.

A more actionable set of infrastructure indicators could include metrics such as the number of operating rooms and surgical inpatient beds per 100 000 people, and the availability of running water and electricity.

To evaluate the health workforce, indicators should consider the numbers of practitioners in the context of the population, such as the number of operators, anesthetists and nurses per 100 000 people. We classify these practitioners broadly according to role rather than rank because in many LMICs, non-physician surgeons and nurse anesthetists serve as the primary providers.

Instead of solely counting available medications, equipment and supplies at a single point in time, evaluating the supply chain can provide more tangible information regarding surgical system performance. Our proposed M&E tool measures the ability to acquire new supplies or repair equipment directly related to surgical care.

Information such as epidemiological data, which is frequently used for program planning for other diseases, should be better utilized in the field of surgery for resource allocation. Standardized metrics will help calculate the population prevalence of surgical diseases within communities, which can then be used to evaluate the ability of hospitals to perform interventions to meet community needs. Identifying regional variation in surgical disease burden over time could justify alterations in health worker allocation.

## Outputs/outcomes

Output indicators measure the availability of surgical care, quality assurance programs and competence required for safe surgical care, while outcome indicators identify the difference made by output variation.

Existing frameworks measure outputs by tabulating the annual number of major and minor procedures performed, number of patients referred to a higher level of care and distance traveled by the average patient. These metrics evaluating service access and readiness are easily collected and allow for straightforward comparisons.

Quality and safety programs can be measured by the presence of management guidelines for prioritized interventions and demonstrated provider competency in these interventions. The use of internal monitoring and evaluation tools, such as regular mortality and morbidity conferences and annual review of educational resources within facilities, are other potential output indicators.

To measure access to surgery and coverage of interventions, population parameters of select priority interventions should be better tracked over time. Highlighting priority interventions would enable deeper analysis of regional, demographic and time-specific difference in these procedures. In addition, variables such as the ratios of cesarean section to vaginal delivery and strangulated to elective hernia repair can evaluate the extent to which procedures are emergent versus elective. Urban versus rural availability of interventions is also important when considering accessibility.

Surgical outcome indicators in our M&E framework are designed to respond to service quality and safety output variation. Intraoperative and 30-day postoperative mortality rate should be collected, along with raw mortality rates and deaths per 100 000 cases. A great strength of these indicators is that they can be risk-adjusted to account for co-morbidities.

Since many surgical diseases can be prevented, it is important to include surgical care within preventative public health programs by evaluating risk factors and behaviors. Examples include interventions to prevent road traffic accidents or burns, antenatal care and primary healthcare worker education on surgical conditions for improved medical stabilization and quicker referrals.

## Impacts

Improved health outcomes and equality indicators include the maternal mortality rate and the trauma mortality rate, data routinely collected for the millennium development goals and other national health plans. As crosscutting indicators, they tie surgical care to broad social and public health programs, as well as direct interventions to improve surgical care.

Social and financial risk protection indicators could include surgery-related out-of-pocket expenditures as a percentage of total health expenditures and the economic impact of surgery- and trauma-related mortality and morbidity. Responsiveness indicators such as patient satisfaction and public perception of the value of surgical care would help to assess surgery's contribution to healthcare in ways not currently captured.

## Discussion

We believe this proposed surgical M&E tool can help measure quantitative and qualitative improvements to surgical care in LMICs. By including outputs, outcomes and impact along with existing input indicators, we promote integration of surgical care into national health systems.

Important next steps will be to validate these indicators in a variety of settings. Some indicators may need to be customized to meet country- and region-specific needs and to facilitate the implementation of appropriate, specific and measurable interventions. Feedback channels should also be developed to enable efficient modification of health system priorities based on the results of this M&E tool.

We hope this will be widely discussed among policymakers, donors, health system managers and providers in the LMIC surgery community. Coming to consensus on key indicators to measure success is the first step to improve surgical care in LMICs. Measuring the success of surgical care requires more than simply counting scalpels and sutures, it requires a broad assessment of surgical disease and care as essential components of LMIC health systems.

## Supplementary data

Supplementary data are available at [International Health Online \(http://inthehealth.oxfordjournals.org/\)](http://inthehealth.oxfordjournals.org/).

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