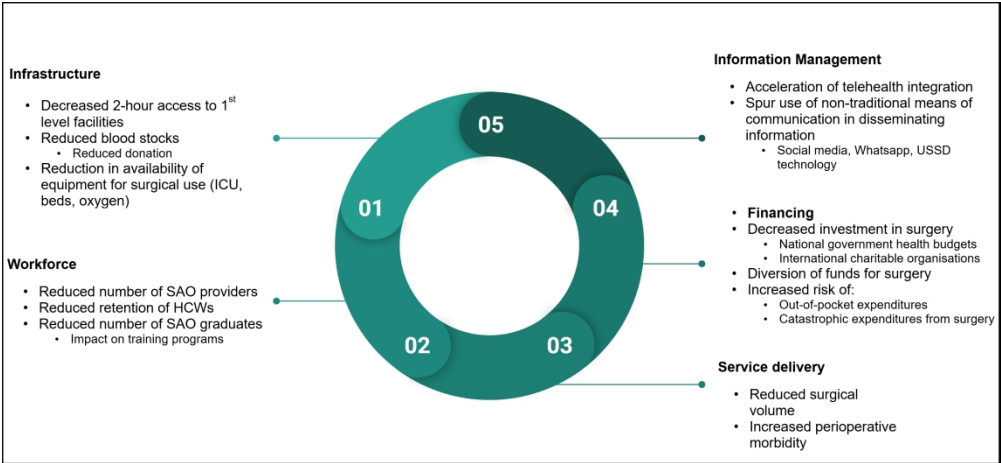




## Exploring the impact of COVID-19 on progress towards global surgery goals

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A schematic image depicting the projected impact of the COVID-19 pandemic on each of the 5 components of global surgery

Table 1. The 5-component-framework for global surgery and indicators used to evaluate each component [6]

Component	Indicators
1. Infrastructure	<ul style="list-style-type: none"><li>• Proportion of the population with 2-hour access to a first-level facility</li><li>• WHO Hospital Assessment Tool (a structured appraisal of equipment electricity, water and sundries)</li><li>• Proportion of hospitals fulfilling the safe surgery criteria</li><li>• Blood bank donation rate and distribution</li></ul>
2. Workforce	<ul style="list-style-type: none"><li>• Density and distribution of specialist SAO providers</li><li>• Number of SAO graduates and retirees</li><li>• Proportion of surgical workforce training programmes accredited</li><li>• Presence of task sharing or nursing accredited programmes and number of providers</li><li>• Presence of attraction and retention strategies</li><li>• Density and distribution of nurses, and ancillary staff including operational managers, biomedical engineers, and radiology, pathology, and laboratory technicians</li></ul>
3. Service delivery	<ul style="list-style-type: none"><li>• Proportion of surgical facilities offering the Bellwether procedures</li><li>• Number of surgical procedures done per year</li><li>• Perioperative morbidity and mortality</li><li>• Availability of system-wide communication</li></ul>
4. Financing	<ul style="list-style-type: none"><li>• Surgical expenditure as a proportion of gross domestic product</li><li>• Surgical expenditure as a proportion of total national health-care budget</li><li>• Out-of-pocket expenditures on surgery</li><li>• Catastrophic and impoverishing expenditures on surgery</li></ul>
5. Information management	<ul style="list-style-type: none"><li>• Presence of data systems that promote monitoring and accountability related to surgical and anaesthesia care</li><li>• Proportion of hospital facilities with high-speed internet connections</li></ul>

## TITLE PAGE

**Full title**

Exploring the impact of COVID-19 on progress towards achieving global surgery goals

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Introduction

Coronavirus Disease 2019 (COVID-19) is a novel viral disease that has spread to nearly all countries of the world [1], reached pandemic status [2] and caused a substantial human and socioeconomic toll. This calamity has been called a once-in-a-century pandemic [3] and the human cost has been compared to that during times of war [4]. This is the defining crisis of this generation and it will leave an indelible mark on our lives.

The extraordinary demands being placed on global health systems are unprecedented, and while surgical services are only indirectly affected, they have not been spared. Surgical diseases account for one-third of the global burden of disease [5]. There is a significant population however, that lacks access to safe and affordable surgical care and people in low-and medium-income countries (LMICs) are disproportionately affected [6]. Global surgery efforts focus on scaling-up surgical services to this underserved population in a bid to save lives and avoid the estimated USD12.3 trillion blow to their economic growth prospects if the status quo persists [7].

In a double-punch to surgical service provision: postponement of nonessential clinical work has almost halted surgical activity while stay-at-home orders instituted by local governments have imposed mobility restrictions on prospective patients. This “double-lockdown” has led to major disruptions in the provision of surgical care and is expected to have devastating consequences particularly in LMICs where the surgical burden is considerable [8]. Diversion of health-care resources also threatens to impede or even reverse progress toward achieving the goals set by the Lancet Commission on Global Surgery (LCoGS). The ramifications for global surgery may stretch beyond the duration of the pandemic and have far reaching consequences for the future.

A key goal of the LCoGS was the creation of “strong, resilient surgical systems that can provide consistent, high-quality care” [6]. Health system resilience is defined as “the capacity of health actors, institutions, and populations to prepare for and effectively respond to crises; maintain core functions when a crisis hits; and reorganise if conditions require it” [9]. The resilience of our surgical systems will be rigorously tested during this time and the current pandemic has provided an opportune moment to observe a stress-tested surgical system and identify vulnerable points. We are more than one-third of the way to the deadline for the goals set by the LCoGS for 2030; if progress towards those goals is to continue unabated, these fault lines should be attended to.

This article explores the potential impact of the current pandemic on surgical care in LMICs, taking key lessons from the past, identifying vulnerabilities and looking to the future.

We used the 5-component framework developed by the LCoGS for surgical systems planning and evaluation [6]. These 5 components are shown in Table 1. We have evaluated the potential impact on each of the 5-components of the framework in Figure 1.

Infrastructure

Travel restrictions on patients will affect the effective proximity of the population to first-level facilities, while surgical ICUs, wards, oxygen and sundries may be diverted or repurposed for non-surgical uses. Lockdowns will also affect the mobility of potential blood donors and will have a significant impact on the blood pool that is so crucial to surgical care. Exemptions to stay-at-home orders and testing for blood donors may be considered where appropriate. The WHO has recommended a variety of measures to protect the blood pool including providing transport for donors and recall of healthy repeat donors while reducing whole blood donation intervals [10]. Pre-pandemic stockpiling of blood products is another strategy to protect against expected acute shocks. In Italy the national blood service initially instituted a 28-day rule which deferred donation by any person at risk. This was subsequently reduced to 14 days but may have exacerbated blood shortages [11] estimated at 10% decline in weekly donations. This decline was reversed a week later after a public blood donation campaign [11].

## Workforce

Healthcare workers are a vital part of surgical systems resilience. Past pandemics, particularly in LMICs have exposed the deficit of trust between healthcare workers and their employers [12]. Fear of the disease among healthcare workers [12] and shortage of personal protective equipment [13] undoubtedly affect the willingness of the surgical workforce to carry out their clinical duties. This has been demonstrated during SARS-CoV-1 [14], MERS-CoV [15], Ebola [12] and the current pandemic [13] and this appears to be playing itself out as a spate of industrial actions in many countries during the current COVID-19 pandemic [16] [17] [18]. Prioritisation of healthcare worker welfare and training are vital to maintaining morale and cohesiveness particularly in LMICs where healthcare worker motivation is already low [19]. Healthcare worker welfare has a direct bearing on surgical service provision, in one hospital in Sierra Leone during the Ebola outbreak, surgical volumes plummeted to 3% of baseline accompanied by the death of 25% of the surgical workforce [20]. Many countries are unlikely to reach the SOA workforce goals set by the LCoGS by 2030, without deliberate intervention, however ongoing losses from the 'brain-drain' as well as the impact of covid-19 will worsen the situation [21].

## Service Delivery

Evidence from previous outbreaks of contagious viral diseases paint a grim picture of the potential impact on surgical service provision. A study from Sierra Leone during the 2014 Ebola outbreak showed a precipitous drop in surgical volume by 41% from pre-outbreak levels [22] [23]. This is similar to the experience in Toronto, during the SARS outbreak where stringent restrictions on nonessential surgical care are thought to have exacerbated the decline with only modest increases in outbreak-related surge capacity [24]. Strict surgical rationing policies have been discouraged in the African setting because of the prospect of exacerbating the already substantial surgical burden [8] [25]. There is a delicate balance to be struck between social distancing and the detrimental effects on surgical services. Current surgical rationing thresholds are based on an estimation of surgical urgency, however an approach that considers demand elasticity for surgical procedures or size of waiting lists may help mitigate against large post-pandemic backlogs [26].

## Information Management

Telecommunications infrastructure can play an important role in maintenance of surgical services during a pandemic. Telehealth has been called "a medical necessity" during outbreaks [27] and its integration into surgical practice is being accelerated by the current pandemic [27]. Telehealth allows care to continue while allowing compliance with social distancing and lockdown rules. When used effectively it should markedly improve system resilience. In LMICs where distances to health care facilities and travel is prohibitively expensive, telehealth provides significant opportunities. While the internet penetration in LMICs is rapidly growing, there are some places where penetration and speeds are so low that internet-based telehealth remains difficult to deploy effectively [28]. Social media systems also provide a potential avenue for rapid dissemination of information for guidelines, information, and encouraging dialogue, particularly for surgeons around the globe [29]. Furthermore, USSD based and WhatsApp based technologies may also be able to provide information and group-based network answers to expand available information [30] [31].

## Financing

Many African countries have yet to meet the obligations of the Abuja declaration, let alone the investment required to scale up surgical access that has been estimated at 4–8% of total annual health expenditures among LMICs [32]. A modelling study from 2015 showed that only half of LMICs would achieve goals for surgical scaleup at current rates of spending without additional funding [32]. It is estimated that external funding from international charitable organisations constitutes as much as 55% of surgical care delivered in LMICs [33]. There is generally a preference in funding for elective surgical diseases and a disproportionate allocation to specific conditions such as cleft lip and ophthalmology which together accounted for 75% of global surgery expenditure in LMICs from 2007-2013 [34]. This may leave global surgery services in LMICs vulnerable to funding cuts due to external shocks (such as a global pandemic)

and potentially lead to further asymmetries in funding to certain conditions at the expense of others. Expenditure in global surgery is dominated by ‘surgical delivery’ and ‘operations management’ line items while spending on local capacity building, such as infrastructure or surgical training ranks lowest [35]. This is counterintuitive to creating a resilient system and that paradigm requires reappraisal.

The pandemic and associated national lockdowns are estimated to reduce income and increase poverty, particularly among the informally employed in LMICs [36]. This will leave them vulnerable to out-of-pocket expenditures and catastrophic health expenditures in the event of a surgical illness.

The current pandemic threatens to derail long-term investments in LMICs to tackle the 2030 sustainable development goals [37]. Continued investment and private-public partnerships may help ensure long-term sustainability of current healthcare and surgical capacity efforts in Africa, particular those that are at risk of seeing declines in overall country investment [38]

**Conclusion**

Surgical systems as they are currently constituted, (particularly in LMICs) have multiple stress points within them that make them vulnerable during crises such as pandemics. One of the key ambitions of the global surgery movement is creation of resilient surgical systems. As we scale-up surgical and anaesthetic care and make steady progress towards our goals for 2030, it is necessary to evaluate the durability of our existing systems and test their resilience to external shocks. This will allow us to fortify fault lines in order to minimise the disruption to surgical scale-up in the future. More research is needed to characterise the magnitude of the impact the COVID-19 pandemic will have on surgical service provision. Looking ahead to the future, we hope to create a sustainable case for investment and development of surgical capacity in Africa and LMICs globally.

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