Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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Original Research

Emergency and essential surgical healthcare services during COVID-19 in low- and middle-income countries: A perspective

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ABSTRACT

The COVID-19 pandemic resulted in significant changes in health care systems worldwide, with low- and middle-income countries (LMIC) sustaining important repercussions. Specifically, alongside cancellation and postponements of non-essential surgical services, emergency and essential surgical care delivery may become affected due to the shift of human and material resources towards fighting the pandemic. For surgeries that do get carried through, new difficulties arise in protecting surgical personnel from contracting SARS-CoV-2. This scarcity in LMIC surgical ecosystems may result in higher morbidity and mortality, in addition to the COVID-19 toll. This paper aims to explore the potential consequences of COVID-19 on the emergency and essential surgical care in LMICs, to offer recommendations to mitigate damages and to reflect on preparedness for future crises. Reducing the devastating consequences of the COVID-19 pandemic on LMIC emergency and essential surgical services can be achieved through empowering communities with accurate information and knowledge on prevention, optimizing surgical material resources, providing quality training of health care personnel to treat SARS-CoV-2, and ensuring adequate personal protection equipment for workers on the frontline. While LMIC health systems are under larger strain, the experience from previous outbreaks may aid in order to innovate and adapt to the current pandemic. Protecting LMIC surgical ecosystems will be a pivotal process in ensuring that previous health system strengthening efforts are preserved, comprehensive care for populations worldwide are ensured, and to allow for future developments beyond the pandemic.

1. Introduction

In a matter of weeks, the COVID-19 crisis led to the cancelation and indefinite postponements of countless surgical clinics and elective surgeries in favor of redirecting resources towards the pandemic preparedness and response. As the pandemic paralyzes some of the world's most robust health systems, how will surgical ecosystems in LMICs cope with the crisis, in which health systems are comparatively weaker?

Access to quality and affordable surgical healthcare–including the entire surgical ecosystem, obstetrics, gynecology, and anesthesia–is a crucial component of population health [1]. In low- and middle-income countries (LMICs), where a focus on infectious diseases and maternal and child health has prevailed, access to quality surgical care is especially deficient [2]. The world's poorest third receive only 6% of the global surgical volume, despite incurring a more considerable burden of surgical diseases [3,4]. To address the unmet need for surgical healthcare in LMICs, it is estimated that an additional 2.2 million surgeons, obstetricians, and anesthesiologists are needed, in addition to investments in the surgical equipment and infrastructure [2]. The decades-long omission of comprehensive health systems strengthening efforts in LMICs has left health systems inadequately resourced and sub-optimally organized and governed especially in regard to surgical healthcare services. Now, the novel coronavirus disease 2019 (COVID-19) pandemic could overwhelm the frail health systems found in several LMICs, inevitably wiping out the already limited and scanty surgical healthcare services in many countries around the world. This situation calls for the need to reflect on the consequences of the pandemic on emergency and essential surgical care, especially in LMICs, and to elaborate on solutions to prevent and minimize them.

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2. Impact of COVID-19 on emergency and essential surgical healthcare

Despite noted efforts to shift surgical priorities to manage COVID-19 patients, such as canceling all non-essential surgical elective procedures and outpatient clinics, urgent and emergent surgical diseases will continue to occur and contribute to avoidable morbidity and mortality. Though the need for trauma care for road traffic incidents may have declined due to COVID19 response measures of quarantine and self-isolate, emergency and essential surgical healthcare will remain a significant need due to other indications [5]. These include difficult and complicated childbirth, acute abdomen, falls, burns, strokes, aortic dissections, myocardial infarctions, and soft tissue infections, amongst many other conditions. It is estimated that 15% of pregnancies require surgical care, including the management of postpartum hemorrhage, obstructed labor, and cesarean sections [6]. Children continue to be born with congenital defects that require lifesaving surgical management, including congenital heart defects, gastroschisis, neural tube defects, and other conditions. Failure to manage these surgical conditions would result in decreased quality of life, increased morbidity, and many lives lost. Conversely, by still managing these patients during the current pandemic, infection risks may be heightened amongst healthcare professionals due to higher viral load as a result of prolonged exposure and limited personal protective equipment (PPE). Moreover, the positive pressure maintained in the few well-equipped operating rooms in LMICs, and the experimental evidence suggesting potential airborne and, especially, surface stability of SARS-CoV-2 is of concern–creating a potential wind tunnel of viral particles [7].

COVID-19 has produced profound and unprecedented shifts within the surgical workforce at a global level. In most epicenters worldwide, the explosive number of COVID-19 patients has pulled surgical staff out of operating rooms into the emergency department and intensive care units (ICUs). Although health workers fight to contain COVID-19 and treat the most vulnerable and critical patients, they are at heightened risk of becoming infected themselves–ultimately turning into disease vectors themselves. As PPE constraints grow, the number of infections of health care workers grows accordingly. In Spain and Italy, 10–15% of all SARS-CoV-2 infections were frontline health care workers taking care of patients [8,9]. In Wuhan, the first days and weeks of the outbreak before the true gravity was known, patients were operated on non-stop until it became clear that surgical providers were becoming infected one by one [10]. In Boston, a city that is comparatively well-resourced in terms of health infrastructure and systems, more than 150 health care workers tested positive for COVID-19 early in the US outbreak, whereas cities across the US have been witnessing the first deaths of healthcare workers [11,12]. It is to be expected that these developments have even more grave consequences in LMICs, where the luxury does not exist to pull the limited surgical workforce out of the operating rooms whilst maintaining emergency and essential surgical care delivery, and where screening, testing, and PPE is even less accessible.

3. Impact of COVID-19 on surgical ecosystems in LMICs

A loss of sparse health care workers in LMICs could have devastating effects on health care delivery. While most LMICs have yet to climb the curve as North America and Europe, others are racing steeply upwards [13]. For instance, as of May 9th, 2020, Iran has surpassed 106,000 reported cases while Turkey and Brazil keep ascending with over 137,000 and 148,000 confirmed cases, respectively, with potentially much higher numbers given limited testing capacity [13]. Unfortunately, unless stringent precautions are taken, it will be only a matter of time before the virus floods LMIC hospitals, where healthcare workers, especially those involved in emergency and surgical care, will be significantly exposed to COVID-19. This may have unprecedented ramifications for the surgical workforce in LMICs. The Lancet Commission on Global Surgery estimated a need of 20 surgeons, anesthesiologists, and obstetricians (SAO) per 100,000 population for LMICs to strive for, in order to meet the growing burden of surgical disease [2]. Today, low-income countries average only 1 SAO per 100,000 population, whereas lower-middle-income countries have 10 SAO per 100,000 population [2]. While data on LMIC ICU capacities are scarce, it is estimated at 0.1 to 2.5 ICU beds per 100,000 population, which is not comparable to high-income countries, with 5–30 ICU beds per 100,000 population [14]. Disturbingly, Italy, with 12.5 ICU beds per 100,000 population, is completely overrun, whereas New York State, with 15.4 per 100,000, is slowly facing a similar fate [15,16]. More recent data suggest even worse indices for LMICs: excluding South Africa, sub-Saharan African countries have a density of less than five ICU beds per 100,000 population [17]. Similarly, ventilators are a scarce resource: cries for more ventilators stem from both Italy (5 ventilators per 100,000 population) and the United States (51.3 per 100,000 population in New York State), whereas LMICs rely on barely 1 per 100,000 population [16,18,19]; Mali, for example, only has one ventilator per million population [19].

Current experiences with COVID-19 show that the virus does not discriminate in age, affecting individuals at all ages with potentially fatal or severe complications, and the potential loss of the surgical workforce and those in training is a real threat. This potential shortage of both qualified personnel and resources means that LMICs may face more severe versions of the ethical dilemmas faced in Europe and, increasingly, North America at a sooner rate. Reports from Italy indicate the need to ration ICU beds and ventilators based on expected clinical outcomes, commonly prioritizing younger patients and those with fewer comorbidities. In response, ethical principles and rationing guidelines have been released in the United States to ensure that clinicians and facilities can cope with the anticipated overwhelm [20]. While clinicians in the United States, Spain, and Italy risk their lives intubating patients with COVID-19 respiratory failure one after another, a lack of workforce and necessary equipment means that a similar spike could happen in low-income countries; respiratory failure, then, would automatically be a death sentence. Socioeconomic extremes within fee-for-service, fragmented, and nascent health systems will become an additional challenge for accessing health care, where disparities will further fall most heavily on the poorest and most marginalized. This is further illustrated by the difficulty of local populations to quarantine and isolate, as a large part of LMIC populations live on, at most, a few dollars per day, not having the luxury to remain at home. Crowded urban neighborhoods further complicate social distancing, posing threats to the proposed public health measures.

4. Practical steps to mitigate adverse effects

How, then, do we answer the persistent wave of surgical needs in LMICs and protect surgical providers–and the entire health workforce–in countries subject to substantial system-wide resource constraints?

4.1. Recommendation 1: Empower the community with information and build solidarity

As health systems in LMICs have various levels of working capacity, their biggest strength lies in the collective knowledge of their population to respect social distancing, seek care only when appropriate, and care for their family and community outside of the hospital setting. Preventive measures to limit the spread of COVID-19 will become their biggest weapon to protect not only themselves but also their healthcare system.

4.2. Recommendation 2: Cancel elective procedures and free up operating rooms

Postponing care for emergent and potentially urgent conditions will

depend on the delicate balance between population-level welfare to allocate resources (justice) and individual beneficence (or, in many cases, non-maleficence–first, do no harm). Operating rooms can serve as additional space to monitor and care for critically ill patients, especially under the supervision of surgeons and anesthesiologists, who have undergone critical care training as part of their residency training.

4.3. Recommendation 3: Train surgical providers to adequately and safely treat COVID-19-positive patients

Specific measures to safely don and take off COVID-19-appropriate PPE ought to be taught to all health care workers involved with operative care to minimize infection and spread. Rapid sequence endotracheal intubation, only provided that there are adequate material resources and physical protection for the clinician, is recommended for COVID-19 patients [21]. Ensuring a reliable fine-particle filter between the ventilator and the patient, as well as care in avoiding tubing disconnections, are necessary precautions. Reorganization of surgical teams, such as dedicating specific individuals to treat surgical patients with COVID-19, should be established with the objective of decreasing staff rotation, contamination of personnel, and optimizing the distribution of limited surgical staff.

Similarly, recognizing the vital role of critical care nurses in the delivery of care for COVID-19 patients in the ICU and on ventilation, surgical providers ought to engage with and learn the management of critical care patients to serve in the same role when and where needed. Surgical on-call teams can be formed to support the emergency department and ICU in, for example, placing central venous lines and intubating patients.

4.4. Recommendation 4: Secure adequate maintenance of PPE stocks

In order to take care of patients, providers first have to take care of themselves. PPE is paramount to protect health care workers from contracting the virus and becoming disease carriers. Make-shift recommendations have included the use of cloth masks and bandanas, although the moisture retention, reusability, and filtration is inferior to that of surgical and N95 masks [22].

While counterintuitive, healthcare workers ought to consider refraining from caring for patients in the absence of PPE, as observed during the plague, Spanish Flu, and Ebola outbreaks when PPE shortages were widespread [23]. Heroism is critically dangerous given the need to self-isolate–and thus falling out of the workforce–or spreading the virus, if not succumbing oneself.

5. The bright side: Moving forward

The silver lining for LMICs? Decades of resource constraints and the fight against endemic infectious diseases and outbreaks have led to the development of robust public health surveillance systems and innovation in rapidly deploying population-level interventions to mitigate spread [24]. As a result, LMICs have already empowered their communities to work within and beyond structures of the local health system to spread community awareness, especially in times of crisis [25]. The Ebola outbreaks in West and Central Africa, including the prominent 2014–2015 outbreak, have brought important lessons on adequately maintaining hygiene and ensuring swift contact tracing–crucial, especially so with a condition as fatal as Ebola [26]. In Southeast Asia, the SARS and MERS epidemics equipped countries with emergency preparedness plans to swiftly identify asymptomatic carriers at the borders, whilst normalizing a culture of public mask-wearing [27,28]. This latter practice indirectly maintained large volumes of surgical and N95 masks in stock. Previous crisis experiences primed authorities and populations in LMICs for better cohesion towards public health rules, which contrasts with the tempered approach in several North American epicenters. Furthermore, as LMIC surgeons face a chronic shortage in personnel and resources, prioritizing and task-shifting are everyday practices, even though the weight of the pandemic will require further adaptation for this scarce workforce. The COVID-19 pandemic can highlight the value of the surgical system as a source of immediate treatment capacity. As such, building up surgical capacity in the LMIC serves to improve surgical access but also contributes to pandemic readiness.

In this time of crisis, high-income countries are encouraged to integrate innovative practices in order to bring in low-cost, low-resource, and accessible solutions rapidly to scale. Low-resource settings have been breeding grounds for innovative ideas, often having to rely on ingenious methods to provide the care that is needed–for example, finding means to sterilize and re-use equipment and consumables. Now, with the need to find solutions to an impending shortage of ventilators, lessons may be learned from our colleagues in LMICs to develop low-cost, rapid, and temporary solutions to develop make-shift ventilators and maximize treatment capacity. A prime example has been the recent development of a multidisciplinary collaborative involving the surgical innovation team and the department of surgery at Boston Children's Hospital to produce quality N95-like masks costing only 3 US dollars per unit, in response to the emergent lack in PPE [29]. Besides material needs, HICs can also inspire themselves from LMICs' task-sharing and task-shifting practices both within and beyond the surgical ecosystem [30]. This practice could imply a temporary change in the skill set of non-physician health care professionals in carrying out simple but necessary tasks and assignments in response to the shortage of physician staff in hospitals.

Countries with COVID-19 experience, especially those who are currently flattening their curves like China and South Korea, have a window of opportunity to help prevent the future strains the pandemic will bring upon LMICs health systems. As several North American surgical societies have already shared COVID-19 resources on their webpages, communication, and collaborations with their African, South Asian, and Latin American counterparts should be encouraged. Exchanges can pertain from their learnings on providing patients outside their area of expertise to dealing with prioritizing surgeries. These messages are increasing in urgency as cases in Africa, South Asia, and Latin America are climbing fast, with countries such as India and South Africa recently entering national lockdowns [31,32].

6. Conclusion

Eventually, the pandemic will come to an end. However, emergency and essential surgical care will continue to be needed, both throughout the pandemic and beyond. Protecting our surgical healthcare workers is critical to ensure optimal care delivery for patients during a time in which health systems around the world risk becoming overwhelmed; it is particularly important in countries facing severe baseline workforce shortages, including low densities of surgical specialist workforce. Adhering to best practices and involvement of governments to maintain adequate PPE and critical care capacity will be vital to saving the lives of thousands of individuals, including frontline healthcare workers.

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Xiya Ma: Conceptualization, Writing, Reviewing and Editing. Dominique Vervoort: Conceptualization, Writing, Reviewing and Editing. Che L. Reddy: Writing, Reviewing and Editing. Kee B. Park:

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Xiya Ma: Investigation, Writing - original draft, Writing - review & editing. **Dominique Vervoort:** Investigation, Writing - original draft, Writing - review & editing. **Ché L. Reddy:** Writing - original draft, Writing - review & editing. **Kee B. Park:** Supervision, Writing - original draft, Writing - review & editing. **Emmanuel Makasa:** Supervision, Writing - original draft, Writing - review & editing.

Declaration of competing interest

None.

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