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Considerations for resuming global surgery outreach programs during and after the coronavirus disease 2019 (COVID-19) pandemic

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ABSTRACT

Background: The coronavirus disease 2019 pandemic has disrupted the delivery of safe surgical care worldwide. One specific aspect of global surgical care that has been severely limited is the ability for physicians and trainees to participate in global surgical outreach programs in low- and middle-income countries. **Methods:** A narrative review of the literature regarding global surgical outreach programs during the coronavirus disease 2019 pandemic was performed. Factors that must be considered in the reinstatement of global surgical outreach programs were identified, and suggestions to address them were provided based on the available literature and the experiences of the senior authors.

Results: As global surgical outreach programs were canceled at the start of the pandemic, many academic surgeons turned to digital solutions to continue to engage with low- and middle-income country partners. With the advent of coronavirus disease 2019 vaccines and improved access to testing and treatment worldwide, the recommencement of global surgical outreach programs may begin to be considered. Important considerations before initiation include vaccine and testing availability for visiting providers, local staff, and patients, local hospital capacity, staff and equipment shortages, and the characteristics of the patient population and visiting providers. Region- and country-specific factors, including local infection rates and concomitant health crises, must also be taken into account. Expansion of digital collaborative efforts may further deepen international connections and promote sustainable models of care.

Conclusion: With careful consideration, global surgical outreach programs may begin to be safely restarted in the near future. The current article evaluates individual factors that must be considered to safely restart global surgical outreach programs as the coronavirus disease 2019 pandemic is better controlled.

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Introduction

The coronavirus disease 2019 (COVID-19) pandemic has caused significant collateral damage to public health worldwide.¹ From the global surgeon's perspective, the pandemic has not only disrupted local surgical care, but it has also interrupted the ability for surgeons and other healthcare providers from high-income countries

(HICs) to provide surgical services to international patients through global surgical outreach programs (GSOPs).² It is estimated that millions of surgical procedures have been canceled or delayed, and the backlog continues to grow. Low- and middle-income countries (LMICs) are at particularly high risk of facing untold burden owing to the strain of the pandemic atop healthcare systems that are already under-resourced with limited surgical capacity.³ In addition to scant pre-pandemic infrastructure and resources, LMICs additionally face new barriers related to COVID-19 testing, treatment, vaccine access, and personal protective equipment (PPE).^{4,5}

Although the early effect of the COVID-19 pandemic on GSOPs has been previously discussed, there has been little discussion on how the changing landscape of the pandemic will affect the ability for GSOPs to restart.⁶ The aim of this narrative review is to discuss

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considerations for resuming GSOPs in the COVID-19 era. In the first part of the review, the effect of the pandemic on GSOPs from its onset until the present day will be reviewed. In the second part, the factors that must be considered as we enter the next phase of the pandemic (where GSOPs may be resumed) will be discussed. In the third part, a case study using a GSOP site familiar to the senior author will illustrate how these considerations may be implemented in a real-life scenario. The advent of vaccines against severe acute respiratory syndrome coronavirus 2, improved testing technology, better understanding of the disease pathophysiology, advancement in critical care management of the infected individuals, and increased adoption of hand hygiene, mask-wearing, and social distancing practices, in addition to the increasing necessity of surgical care in LMICs, all increase the likelihood of resuming GSOPs. Through this review, we hope to help prepare global surgeons and GSOP teams for their timely return.

Methods

A literature review was conducted to identify studies of interest for this narrative, nonsystematic review. The online database PubMed was used to find relevant full-text articles written in the English language. The search strategy including using the term “COVID” with different secondary search terms, including “global surgery,” “global surgery outreach,” “mission,” “mission trip,” “international mission trip,” “LMIC,” and different regions of the world (“Asia,” “Africa,” “Central America,” “South America,” “Latin America”). References were reviewed to find additional relevant studies. Studies were first divided into 2 categories based on chronology: articles relating to the initial disruption of GSOPs (Part I: Looking Back), and articles relating to ongoing challenges and considerations for resuming GSOPs (Part II: Looking Ahead). After full-text review, articles in the second part were then organized into sections based on common themes, such as vaccine and testing availability, local resources, and specialty-specific and region-specific considerations. As this research activity did not involve intervening upon or interacting with identifiable human subjects and only used publicly available data, it was not reviewed by an IRB.

Part I: Looking Back

GSOPs were halted early at the onset of the pandemic as individual countries put travel restrictions in place. Providers that were already abroad as a part of a GSOP had to quickly implement safety protocols to protect both themselves and their patients and consider terminating the mission trips prematurely.⁷ At the time, it was thought that the best course of action for academic global surgeons and healthcare providers was to go online and engage with LMIC partners by providing expertise and advice through virtual means.^{2,4,6,8} As most individuals found themselves confined to their local environments, innovative uses of technology were explored to maintain international connections and support international partners. For example, American and Haitian stakeholders converted the annual Haitian Annual Assembly of Orthopedic Trauma to a virtual meeting, during which surgeons and surgical trainees from the United States, Canada, Haiti, and Burkina Faso interacted.⁹ To address potential issues with Internet connectivity, grant funds were used to purchase Internet routers and access, and speakers prerecorded their presentations. All presentation slides, recorded presentations, and live discussion sections were translated into English and French to facilitate cross-linguistic discussion. Post-conference surveys demonstrated statistically significant gains in knowledge and high satisfaction for conference attendees. Another annual event that successfully transitioned online was the

American College of Surgeons Clinical Congress, which was held virtually and free of charge in October 2020.

Whereas the previous examples built on established educational initiatives, others created new educational opportunities using videoconferencing technology. The US-based providers of “Operation Airway,” a multidisciplinary pediatric surgical airway teaching mission, instigated a series of telehealth conferences that allowed them to engage with partners from 4 LMICs: Colombia, Peru, El Salvador, and the Dominican Republic.¹⁰ During the conferences, participants reviewed challenging clinical cases and shared guidance regarding the management of patients with COVID-19. A professional interpreter facilitated discourse. These experiences demonstrated the feasibility of international virtual engagement to maintain ongoing connections between institutions in HICs and LMICs that already have established relationships.

Online engagement has not been limited to established global partnerships. Many medical students and surgical residents have strong interests in global surgery, and opportunities for education have blossomed in spite of the pandemic’s restrictions.¹¹ Multiple organizations, including the International Student Surgical Network, the Global Surgery Student Alliance, ReSurge International, the Harvard Medical School Program in Global Surgery and Social Change, InterSurgeon, the Society for Surgery of the Alimentary Tract, the Americas Hepato-Pancreato-Biliary Association, and the International Hepato-Pancreato-Biliary Association, have hosted virtual webinars on topics related to global surgery or provided platforms for discussion and collaboration. Individual clinicians have turned to social media outlets such as Twitter, Instagram, and Facebook to share information and contribute to conversation. Although these opportunities do not provide the same experience to providers or benefits to patients as a GSOP, they allow for the cultivation of ongoing interest in and commitment to global surgery, which can be further acted upon once travel restrictions are lifted and GSOPs resume.

Part II: Looking Ahead

After many dismal months, there is cause for tentative hope. Two COVID-19 vaccines (Pfizer, Moderna) have been given emergency use authorization by the US Food and Drug Administration and are being distributed worldwide, and others are undergoing clinical testing.¹² Multiple pharmacologic therapies for COVID-19 are being evaluated, and one (remdesivir) has been approved under emergency use authorization.¹³ With these advances, we can begin to consider taking slow steps toward return to pre-pandemic activities. For academic surgeons and trainees with an interest in global surgery, this means planning to reinstate GSOPs. However, to do so, there are multiple important considerations to address in order to ensure the safety of both the visiting team and the patients in need (summarized in [Table 1](#)). These include (1) vaccination availability; (2) testing availability; (3) local resources (including PPE, surgical equipment, local hospital capacity, and local staff); (4) surgical specialty considerations; and (5) other region-specific considerations. We will discuss these individual factors in detail below.

Vaccination availability

Multiple vaccine options are in development, have been tested with preliminary trials, and/or are temporarily approved for administration to the public in different countries. Although access to COVID-19 vaccination is improving, it is lacking in many locations around the world. Vaccine availability is limited to certain groups of individuals (ie, healthcare providers, high-risk individuals,

Table 1
Summary of factors to be considered in resuming global surgical outreach programs (GSOPS) and suggestions to address them

Factor	Suggestions
Vaccines	<ul style="list-style-type: none"> • Vaccinate all visiting providers (and household members, if possible). • Assess vaccine availability for local providers and patients.
Testing	<ul style="list-style-type: none"> • Monitor local infection rates and presence of virus variants. • Institute pre-trip and post-trip testing and quarantine periods for visiting providers. • Assess local testing availability. • Institute testing protocols for patients (subject to local policy).
Hospital capacity	<ul style="list-style-type: none"> • Communicate with LMIC partners about local hospital capacity in advance. • Delay trip if there is concern for inadequate OR, intensive care unit, or hospital bed space.
Surgical equipment	<ul style="list-style-type: none"> • Communicate with LMIC partners about surgical equipment availability. • Bring or ship surgical equipment that can be sterilized on site. • Acquire donated surgical equipment from manufacturers that can remain in the LMIC.
PPE	<ul style="list-style-type: none"> • Communicate with LMIC partners about PPE availability. • Bring or ship enough PPE for entire visiting team for entire duration of trip, plus extra for local staff. • Assume all patients and staff are potentially infectious and take precautions accordingly.
Local staff	<ul style="list-style-type: none"> • Communicate with LMIC partners about staff shortages in advance. • Consider bringing additional visiting team members if local staff are occupied.
Specialty	<ul style="list-style-type: none"> • Recognize higher-risk procedures (eg, head and neck) and institute appropriate protocols. • Stratify procedures by urgency/morbidity. • Consider making adjustments that will minimize aerosol-producing procedures (eg, using regional anesthesia instead of general when safe and appropriate).
Region	<ul style="list-style-type: none"> • Be aware of local infection rates, surgical need, COVID restrictions, healthcare infrastructure, and other public health concerns when planning and executing trips.

LMIC, low- and middle-income countries; PPE, personal protective equipment.

essential workers, and the elderly) in most countries and subject to local policy. Current vaccine production rates and distribution strategies implicate that it will be months, if not years, before vaccines will become available to the general public, even in HICs. The majority of destinations for GSOPs are in LMICs, and yet LMICs are at risk of being left behind in the race to acquire vaccine doses. HICs have been able to purchase vaccines directly from manufacturers, whereas LMICs are reliant on programs such as the COVID-19 Vaccines Global Access (COVAX) program, co-led by the World Health Organization and Global Alliance for Vaccines and Immunization. COVAX aims to provide equitable vaccine access across countries, but it is underfunded.¹⁴ HICs representing 14% of the world population have purchased 53% of the available vaccine supply, and LMICs relying on COVAX may only be able to vaccinate 10% to 20% of their populations in 2021.^{15,16} Although the Biden administration is committing significant funds to COVAX,¹⁷ it may be quite some time until visiting GSOP teams can expect their patients and partners in LMICs to be vaccinated.

Undoubtedly, all members of the visiting healthcare team must be fully vaccinated with 1 or 2 doses of vaccine (depending on the vaccine type) to achieve full immunity before traveling. Further, it will behoove all household members of the visiting team members to be vaccinated if they are eligible, because returning providers are at risk of exposing them. Visiting team members will need to be tested and quarantine before and after travel, because it is possible that a vaccinated person may still become infected. In addition, with the development of new variants of the virus, the efficacy of current vaccines may be limited. Thus, ongoing testing and stringent use of PPE will likely be necessary for the local healthcare providers and the visiting team for the foreseeable future.

Testing availability

Testing availability is likely to be higher than vaccine availability in LMICs in the upcoming months. However, testing is still unlikely to be available to the extent that it is in HICs, and modified testing protocols may need to be instituted.^{18,19} Whereas many hospitals in HICs have mandated COVID-19 testing for all patients undergoing surgery, regardless of symptoms, hospitals in LMICs may need to reserve COVID-19 testing for symptomatic patients or patients undergoing procedures that are at higher risk of producing aerosol droplets. There is promise for the development and use of rapid diagnostic tests in LMICs, which may further hasten the withdrawal of travel restrictions and increase the likelihood of GSOP reinstatement.²⁰ Visiting GSOP teams should be aware of the current local rates of vaccination and infection, as well as testing availability, ahead of their planned excursion. As vaccination and testing may not be guaranteed, and mandating quarantine periods are unlikely to be feasible, visiting providers will need to assume that all patients and caregivers are potentially infectious and therefore take all necessary precautions during their interactions.

Due to the limited time that GSOPs have abroad, it is advisable to incorporate telemedicine into the pre- and post-visit evaluations. An advantage of the pandemic is that the use of telemedicine has been expanded, and it provides an excellent tool for virtual patient visits before and after the surgical trip. In addition, facilitating COVID testing within 1 week of arrival of the outreach team would expedite the workflow and make the GSOP more effective.

Local resources

Additional important considerations are the availability of hospital space, surgical equipment, PPE, and local staff. All are precious resources that were often in short supply in LMICs before the pandemic. The additional strain on healthcare systems from COVID-19 has exacerbated these shortages.²¹ It is the responsibility of the visiting team to work with local partners to assess the capabilities and available resources of the site and identify opportunities for the visiting team to provide support. For example, the visiting team can bring their own PPE and portable surgical equipment to be sterilized onsite. For some well-established GSOPs in pre-COVID-19 times, specialized surgical equipment was donated by manufacturers and distributors.²² For others, surgical teams provided their own surgical equipment, ranging from specialized supplies, such as operative microscopes and facial nerve monitors, to standard necessities, such as intravenous fluids and drapes.²³ Shipping supplies ahead of time will further guarantee an efficient experience and ensure that the visiting team can immediately start working upon arrival.²⁴ By bringing equipment and PPE (potentially in excess), the visiting team can limit their imposition on the local infrastructure and even alleviate some of the strain induced by COVID-19 shortages. Visiting teams also must expect and prepare for shortages of local staff. If local staff has been redeployed to other hospital areas (ie, an operating room anesthesiologist is now working in the intensive care unit), there may be an opportunity for additional providers to be added to the visiting team.

Surgical specialty considerations

GSOPs provide a wide range of surgical services to patients in LMICs. Depending on the provider team, they may include surgeons that specialize in plastic surgery, craniofacial, hand, burn, gender affirmation, otolaryngology, ophthalmology, orthopedics, neurosurgery, urology, obstetrics and gynecology, surgical oncology, hepato-pancreato-biliary, transplant, pediatric, or general

surgery.^{23–29} Special consideration of the type of surgery needed and target patient population of a GSOP is critical when assessing its feasibility in the COVID-19 and post-COVID-19 era. A large proportion of surgical procedures performed as part of outreach trips involve the head and neck area, which are high-risk for COVID-19 transmission owing to the potential for aerosolization of respiratory droplets. Salehi et al provided excellent recommendations for craniofacial-focused GSOPs, and many of their recommendations regarding pre-trip planning, on-site management, and post-trip follow-up can be applied to GSOPs with any other surgical focus.⁷ Additional recommendations and protocols should be developed for individual subspecialties that address their unique patient populations, surgical interventions, and resource requirements. Teams may consider stratifying procedures by urgency: performing procedures with the highest risk of morbidity and delaying procedures that can wait for future trips. Teams may also consider instituting operative changes that promote the safety of the surgical team, such as the increased use of regional and/or local anesthesia to avoid intubation.³⁰ Although using regional or local anesthesia may not be appropriate in certain patient populations (ie, pediatrics) or procedures (ie, head and neck surgery, abdominal surgery), it may be possible to increase its utilization in minor surgical procedures and/or procedures involving the extremities.

Region-specific considerations

Central and South America

Countries in Central and South America have been frequent destinations for GSOPs with a variety of surgical subspecialties, including neurosurgery, otolaryngology, cardiac surgery, craniofacial surgery, hepato-pancreato-biliary surgery, surgical oncology, and ophthalmology.^{7,22,23,25,31,32} As some countries in Latin America rely on an underfunded public health system, complex surgical care is often inaccessible to the general population.²² Healthcare workers in Latin America have struggled during the COVID-19 pandemic to receive adequate PPE and support from government entities, and hospitals lack infrastructure to keep providers protected from COVID-19 transmission during surgery.^{33,34} A particular challenge in Central and South America during the COVID-19 era is the concurrent dengue fever epidemic, in addition to the ongoing struggle to address chronic conditions (eg, HIV, tuberculosis, tropical infectious diseases).^{35–37} There is also a risk for worse COVID-19 outcomes owing to both the high obesity and malnutrition rates of the population in many Latin American countries.^{38,39} In Mexico, as hospitals began to reach the maximum capacity, private hospitals entered into a unique agreement with the federal government to expand the capacity for treating COVID-19 and non-COVID-19 patients. Thus, there are many challenges to overcome before the resumption of elective surgery through GSOPs in the current overburdened state of the healthcare system in these countries.

Africa

African nations have also been frequent sites for GSOPs in recent years. Initiatives have included partnerships between local and foreign institutions, periodic mission trips, international electives for visiting surgical residents, and organizing training for local physicians and surgeons.²⁷ GSOPs in Africa have had many different focuses, including pediatric surgery, cardiac surgery, general surgery, and neurosurgery, to name a few.^{26–28,31,40} COVID-19 was initially slow to spread in Africa. There was a fear that COVID-19 could strain the fragile healthcare systems in Africa and that the impact could be devastating in light of the limited resources and endemic disease.⁴¹ However, although the virus has not spared the continent, it has not overwhelmed the healthcare systems or caused

significant morbidity and mortality to the extent of many other HICs. Africa constitutes 17% of the world population, but COVID-19 cases in African countries represents only 3.5% of the global cases. The reasons for this phenomenon are multifactorial and may be in part owing to climate, travel patterns, the young age of the population, familiarity with infectious disease outbreaks, preexisting immunity, genetic factors, and swift government lockdowns.^{42,43} If the number of COVID-19 cases remains steady or begins to decrease as testing availability increases, it may be feasible to consider restarting GSOPs to countries in Africa in the near future.

Asia

Many GSOPs have been active in different regions of Asia and have helped provide specialty surgical care in the fields of craniofacial surgery, neurosurgery, cardiac surgery, general surgery and its subspecialties (hepato-pancreato-biliary, surgical oncology, pediatric surgery, etc), and others.^{24,29,31,32,44} Asian countries were affected early in COVID-19 pandemic. Some countries, such as Vietnam, had early success in limiting the spread of the virus owing to strict lockdowns, border control, contact tracing and testing, and rapid adaptation of measures such as mask-wearing and social distancing, while others, such as Singapore and Indonesia, initially struggled to flatten the curve.^{45,46} To evaluate the feasibility of reinstating GSOPs in Asia, careful country-specific evaluations must be made. As Asian countries were disproportionately affected by COVID-19, particular attention may need to be paid to resuming GSOPs in countries where elective and emergency surgery was most heavily disrupted and where the greatest benefit could be gained from GSOPs.

Ongoing digital collaboration

If it does not seem feasible to safely plan a trip to a site, the visiting team could show their ongoing support through virtual interaction. Teleconferencing among healthcare providers can be used to discuss patients and treatments, as demonstrated by Operation Airway,¹⁰ and telemedicine can be used to evaluate patients alongside local providers to directly contribute to care.⁴⁷ Remote augmented reality training has also been used to improve the performance of surgeons on skills such as cleft diagnosis, counseling, and surgical technique.⁴⁸ Such interventions have the dual benefit of surpassing travel restrictions and developing local capacity, a primary goal of most GSOPs. By developing a solid collaborative foundation before a trip experience, stakeholders will be able to ensure the success of well-planned trips in the future once pandemic restrictions have been withdrawn. Additionally, surgeons may consider seeking out domestic opportunities to provide surgical care pro bono in rural or underserved areas in their own communities.

Part III: A Case Study in Paraguay

Operation Smile has been conducting medical missions to Asunción, Paraguay since 2005. The organization has provided cleft lip/palate repair and other craniofacial surgeries to more than 1,600 children there who otherwise do not have any access to craniofacial care.⁴⁹ The senior author (A.K.G.) has participated in multiple trips to Asunción with Operation Smile.

Paraguay, a South American country of approximately 7 million people, took early steps to control the COVID-19 pandemic, including a rapid lockdown of schools and workplaces in March 2020. Its robust testing and contact tracing policies allowed for early curbing of confirmed cases, a low burden index (calculated with confirmed cases in comparison to intensive care unit beds), and the lowest number of confirmed deaths compared with 7 other

South American countries.⁵⁰ However, case numbers rose in August 2020 as quarantine restrictions were lifted, plateaued for much of the fall and winter, and increased considerably in the spring, putting significant strain on the healthcare system. As of April 2021, there are approximately 300 new confirmed cases per day and a test positivity rate of 35%.⁵¹ For reference, a positivity rate of less than 5% is an indicator of relative control of the pandemic in a given country. The aforementioned considerations (vaccines, testing, local resources, and surgical specialty) will be applied to discuss potential reinstatement of the GSOP in Paraguay.

It is highly unlikely that Paraguay will have widespread vaccination in the upcoming months. The country only recently received its first shipments of vaccine.⁵² Through April 2021, 0.6% of the population have been vaccinated, and low rates of vaccine acceptance have been reported.^{51,53} The situation in Paraguay illustrates how LMICs with the greatest need for care through GSOPs may also have the lowest vaccination rates, and thus will have many challenges to overcome for reinstatement.

As vaccination availability in Paraguay cannot be ensured, testing availability then becomes the driving factor to ensure safe reinstatement. During a typical medical mission in Asunción, the first day consists of screening patients for surgical eligibility. Over the next week, 100 to 125 surgeries are performed by visiting surgeons. The high volume attainable is owing to the operating room structure, where 4 to 5 patients are operated on simultaneously. This allows for optimization of the number of patients treated and collaboration between surgeons. However, this model is only sustainable if all patients have access to a reliable, rapid test for COVID-19. Patients would need to be tested by local partners 1 to 3 days before the visiting teams' arrival. Patients would then need to quarantine until their surgery date, so local housing would need to be provided.

If patients cannot be tested, they would need to be managed as if they are presumed positive. This would mean that full PPE would be worn for all procedures. Due to the nature of cleft and craniofacial surgery, general anesthesia and intubation could not be avoided. Intubation would need to be done with the surgical team out of the room and with a waiting period of 20 minutes for respiratory droplets to settle. Most significantly, the operative capacity would slow to one-fifth of its prior volume, which would likely make the trip unsustainable.

Thus, to plan the reinstatement of the Operation Smile craniofacial GSOP in Asunción, the visiting team would need to communicate with local partners to get an accurate assessment of testing and resource availability. According to government resources, COVID-19 testing is currently available for symptomatic and potentially exposed individuals at public hospitals, and rapid testing is available for a fee through private laboratories.⁵⁴ As such, additional financial support for testing may need to be included in trip costs. If local facilities and providers are available for surgery and postoperative monitoring, and if rapid testing is feasible, then the reinstatement of the GSOP in Asunción may be considered.

In conclusion, the COVID-19 pandemic has altered the global community in numerous ways. While it is far from over, improved testing, treatment, and vaccination all may contribute to a new era where the virus—if not vanquished—is mitigated. As we approach this time, it behooves us to consider reinstating GSOPs for the benefit of patients worldwide. Consideration of multiple factors, including the availability of vaccines, testing, PPE, equipment, and staff, in addition to region- and country-specific policies, resources, and needs, will be critical for the safe recommencement of GSOPs in the COVID-19 and post-COVID-19 era.

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