GLOBAL INNOVATION HUB
for Improving Value in Health

Beyond Capacity Management

How health systems can ensure value for money in addressing the elective surgical care backlog created by COVID-19

The Global Innovation Hub for Improving Value in Health brings together countries and global organizations in a partnership for learning and collaboration on value-based healthcare, and to work together to expand the delivery of value-based care at scale.

Contributors:
Dr. John McGhee
Dr. Reem Bunyan
Dr. Meena Cherian
Dr. Sara Al Munif
Dr. Kate Speigelhalter
Terrina Govender

How to cite this document:
The Global Innovation Hub for Improving Value in Health. Beyond capacity management: How can health systems ensure value for money in addressing the elective care backlog created by COVID-19 Riyadh: 2021.

https://g20hub.org/
improvingvalue@phap.sa

GLOBAL INNOVATION HUB for Improving Value in Health

CONTENTS

GLOBAL INNOVATION HUB for Improving Value in Health

EXECUTIVE SUMMARY

This paper sets out the global scale of the surgical care backlog brought about by the COVID-19 pandemic and presents a conceptual framework for policy measures to address this challenge. Sustainable, affordable, timely and safe surgical and anesthesia care services are essential to reduce death and disability across health systems in persons requiring surgical care. The paper sets out key considerations for a value-based approach in using both supply- and demand-side levers to tackle the backlog during this COVID-19 pandemic and in the future through sustainable health systems.

The concept of value in health pertains to a system where health outcomes of the population, communities, and individuals are explicitly prioritized in the way resources are allocated to health and care. Value-based care[1] aims to improve the health outcomes of people while optimizing health system efficiency, responsiveness and reducing health system waste[2] for the money invested. Value-based care puts people at the center of health systems, focusing on creating healthy societies while optimizing health system functions to maximize system performance. Designing health systems that are rewarded for better health outcomes, rather than remunerating for illness, will shape healthcare provision in the 21st century.

The Global Innovation Hub for Improving Value in Health (GIH) serves as a collaboration platform to accelerate the pace of value-based transformation in health systems, globally. GIH works to identify evidence-based case studies for a conceptualization and realization of value-based healthcare models. GIH was mandated to explore the issue of the global surgical care backlog, given the collaborations and expertise of its

[1] Value-based care include health services (as it pertains to public health services)

[2] OECD (2017) defines waste as services and processes that are either harmful or do not deliver benefits; and costs that could be avoided by substitution of cheaper alternatives with identical or better benefits

members, and the knowledge of its previous work on the Value-Based Health Care in the Midst of the COVID- 19 Pandemic Response paper (Global Innovation Hub for Improving Value in Health, 2021).

Approximately 28 million elective surgeries were cancelled or postponed globally during the first wave of COVID-19. Thereafter approximately 2.4 million surgeries could be cancelled globally per week as health systems continue to face disruptions as a result of Covid-19 demand (Lewis et al., 2020). The long-term consequences of this backlog could be critical and include the deterioration in health conditions, potentially resulting in more healthcare system demands. The effect of the COVID-19 pandemic on unmet surgical needs affected all countries and could be particularly devastating for health systems in low- and middle-income countries . Taking a value-based lens could provide useful innovations as countries tackle the backlog.

Surgical backlog data and insights are limited and research is continuously being developed on this topic. To inform policies on COVID-19 surgical plans and address patients' concerns effectively, there is an urgent need for additional high-quality, multicenter research. In addition, proposed solutions need to be integrated with COVID-19 vaccination programs – and closely align with supplies of Personal Protective Equipment (PPE) and implementation of other preventive measures (face masks, hand hygiene, physical distance and air ventilation).

This paper calls for an evaluation framework and a plan to incorporate elective surgical care into the WHO strategies for national health plans and pandemic (Søreide et al., 2020). This paper briefly reviews the global scale of the elective surgical care backlog and proposes a high-level conceptual framework for policy measures to address the surgical backlog, assessing probable impacts on health system value (i.e., costs, clinical and patient outcomes) of each. It also shares country case studies examples for specific levers to address the elective care backlog.

The key areas of consideration include reconceptualizating the surgical backlog problem and examing demand and supply-side strategies that go beyond financial investment

and capacity management. Consideration should be given to demand-side levers, e.g. re-structuring surgical waiting lists and associated infrastructure. The post-pandemic success of health systems must not be judged purely on their performance in reducing existing waiting lists, but also the expedience, equity and innovation applied by health systems in the face of the pandemic.

OECD COMMENTARY

Long waiting times for health services is a recurrent issue in countries of all income levels—and one that has been dramatically worsened by the COVID-19 pandemic. The COVID-19 crisis led to cancelations and postponements of elective surgery and other health services—to protect health workers, vulnerable populations, and to mobilize resources to respond to the crisis.

Waiting times reflect an imbalance between the demand for and supply of health services, either for structural reasons or as a result of a particular shock. OECD work has shown that the most successful policies for reducing waiting times mobilize supply-side and demand-side interventions, together with regular monitoring of progress towards achieving agreed-upon targets.[3] These key ingredients are necessary in addressing waiting times in the aftermath of a public health crisis of the magnitude of the COVID-19 pandemic, as emphasized in this report.

On the supply-side, supplemental resources and funding may be required to reduce the backlog of patients on waiting lists. Some OECD countries, including Canada, Italy, Spain, the United Kingdom, and the United States, have already taken steps to increase the supply of services. Some improvements to the management and efficiency in health service delivery to reduce waiting times (such as optimizing use of operating rooms or creating additional shifts for surgical teams) can be implemented quickly. However, if surgical teams and other resources are already working at full capacity, it will take time for new investments to have an effect, particularly those concerning human resources.

On the demand side, as noted in this report, clinical prioritization tools can be used to re-allocate waiting times to the benefit of patients with the most severe conditions or potential for improvement. Doctors have an important role to play in assessing treatment options and weighing the benefits and risks of surgical interventions, as compared with

[3] OECD (2020), *Waiting times for Health Services – Next in Line*, OECD Health Policy Studies, https://doi.org/10.1787/242e3c8c-en; Siciliani, L., M. Borowitz and V. Moran (2013), *Waiting Time Policies in the Health Sector: What Works?*, OECD Health Policy Studies, https://dx.doi.org/10.1787/9789264179080-en.

non-surgical alternatives. Previous OECD work has highlighted large unexplained variations in medical practices both within and across countries, and that the overuse of surgical interventions may be due to clinical traditions and training, as well as supply-induced demand incentivized by fee for service payment schemes.[4] Long waiting times can provide an opportunity to reconsider the appropriateness of care and to reduce low value care that provides little, if any, benefits to patients.

Beyond surgery, the COVID-19 crisis has demonstrated serious shortcomings in the timely provision of other health services, including primary care, care for people with chronic conditions, and mental health services[5]. A new wave of care backlogs caused by delays in screenings and treatments during the COVID-19 pandemic is likely to have serious consequences on health and well-being in the years to come. New strategies and investments are needed to improve the responsiveness of health service delivery and to make health systems more people centered.

[4] OECD (2017), *Tackling Wasteful Spending on Health*, OECD Publishing, https://dx.doi.org/10.1787/9789264266414-en.

[5] OECD (2021), TACKLING THE MENTAL HEALTH IMPACT OF THE COVID-19 CRISIS: AN INTEGRATED, WHOLE-OF-SOCIETY RESPONSE, POLICY RESPONSES, HTTPS://WWW.OECD.ORG/CORONAVIRUS/POLICY-RESPONSES/TACKLING-THE-MENTAL-HEALTH-IMPACT-OF-THE-COVID-19-CRISIS-AN-INTEGRATED-WHOLE-OF-SOCIETY-RESPONSE-0CCAFA0B/.

GLOBAL INNOVATION HUB
for Improving Value in Health

THE SCALE AND IMPACT OF THE GLOBAL ELECTIVE CARE BACKLOG

The COVID-19 pandemic is generating a growing worldwide backlog in elective surgical care demand, resulting in potential harm to patients experiencing delayed treatment and worsening health outcomes. Countries are proposing a range of approaches to address this issue. Much of the debate has been on the level of investment needed to clear the backlog and the range of supply-side levers available to expand diagnostic and surgical capacity. Less focus has been placed on discussing the applicability of demand-side levers (i.e., approaches to reviewing, refining and re-prioritizing surgical waiting lists). Considering a value-based perspective, it is important to consider the appropriateness and feasibility of simply investing resources to clear the backlog. A value-based approaced examines the the cost and outcome impacts of various approaches and policy options.

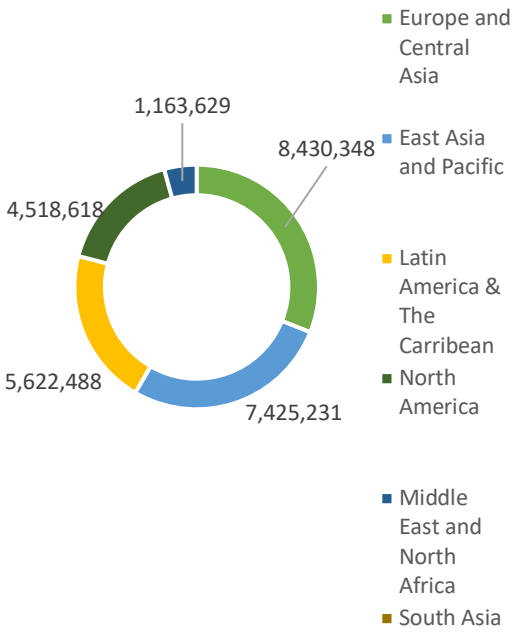

Figure 1 Projected surgery cancellations over a 12-week (March – May 2020) period of peak disruption

Source: Adapted from Collaborative, Nepogodiev and Bhangu, 2020

Emergent data indicates that the scale of the surgical backlog is signficant, suggesting that health systems may require months and years to catch up on the backlog. Early predictive modelling suggests that around 28 million operations were cancelled or postponed globally during the peak 12 weeks of the first wave (Carr et al., 2021) and that 2.4 million surgeries could be cancelled globally per week, the equivalent of 28.4 million (or 72.3% of procedures) over 12-week periods of peak disruption (Lewis et al., 2020).

Another study (figure 1) estimated impacts over the same period by geographic region (Collaborative, Nepogodiev & Bhangu, 2020). The number of patients on the waiting lists will have increased since the initial estimates did not account for potential future waves or surgical delays caused by shortages of personal protective equipment, ventilators, and drugs.

Estimates of the scale of the elective surgical backlog have also been made at the individual country level. For instance, in England, there is a surgical backlog equivalent to 45% of the total number of procedures carried out before the pandemic (Fowler et al., 2020). Benign procedures were predicted to be the most frequently cancelled (estimated at 25 million cancellations worldwide), with cancer surgery cancellations estimated at 2.3 million (8.2% of global cancellations) (Lewis et al., 2020). In Brazil, between March and December 2020, the total surgical backlog included 1,119,433 (Truche et.al. 2021).

There is a significant link between stringent COVID-19 health containment policies and an increase in elective backlog surgeries. COVID-19 health policies that privilege delivery of emergent surgery, show increases in elective backlog surgeries (Truche et.al. 2021). Governments will need to examine additional efforts required to specifically address impact of stringent COVID-19 responses on the elective surgical backlog.

Delayed elective surgeries lead to the deterioration of health conditions, which will result in more costly and lengthy surgeries and worse health outcomes (Independent, 2020; Fu et al., 2020). It has been calculated that delay in cancer treatment could result in a dramatic reduction in long-term survival, with over 30% survival reduction for those with advanced-stage cancers (Sud et al., 2020). Treatment delay of low-grade tumors could also result in more advanced cancers, impacting both morbidity rates and healthcare costs (BMJ, 2020). Additionally, delays to metabolic and bariatric surgeries have potentially deleterious long-term effects with regards to morbidity and mortality if conditions associated with obesity or diabetes are left untreated.

Globally, the effect of the COVID-19 pandemic on unmet surgical needs in low- and middle-income countries could be devastating (O'Reilly-Shah et al., 2020). Impacts of the backlog in some countries could deplete already sparse healthcare resources, in contexts that already experience unmet surgical and medical needs (Ibid.)

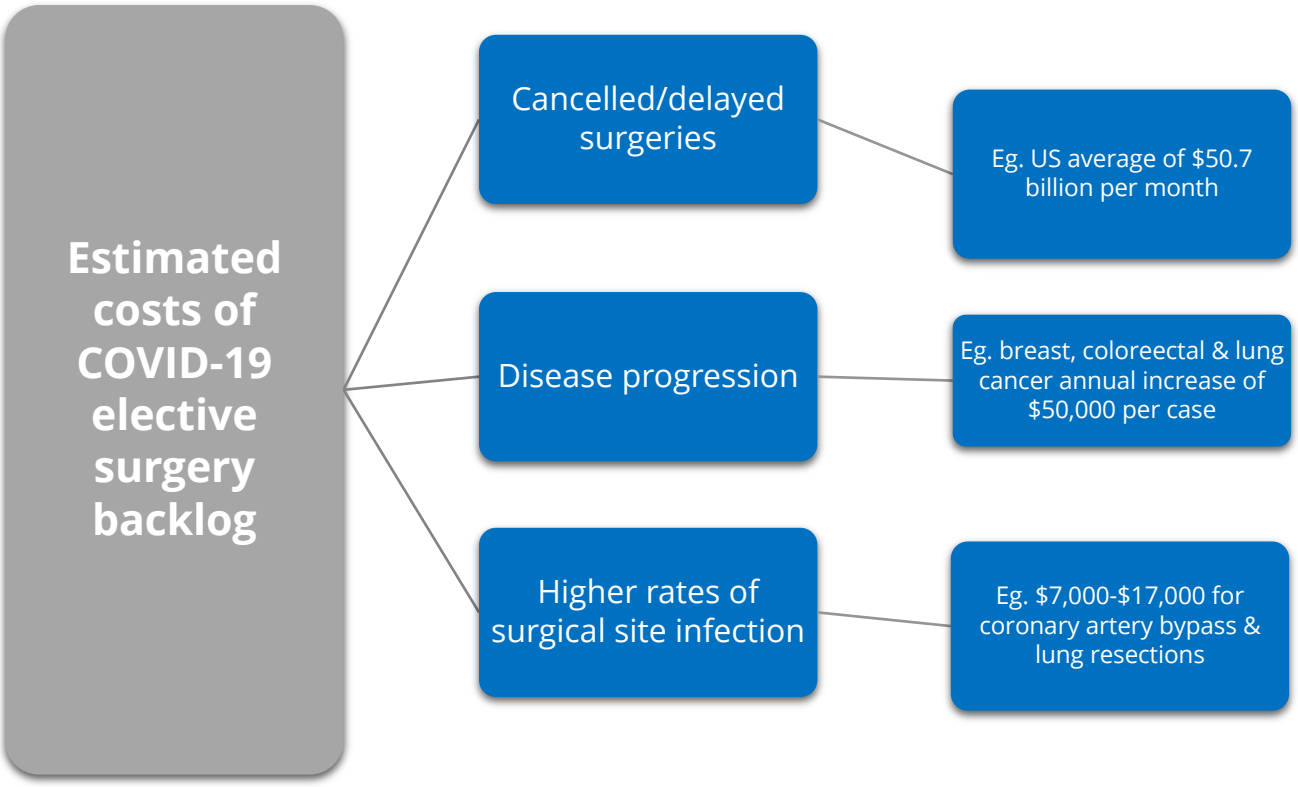

Figure 2: Examples for estimated costs of elective care backlog in the US

Source: Information sourced from Hospitals 2020 and Hook and Kuchler, 2020

LEVERS TO ADDRESS BACKLOG

A rapid review of available evidence, reports and grey literature indicate various approaches by countries to address the backlog. These can be classified into a high-level framework of supply- and demand-side approaches (Figure 3)

Supply-side approaches

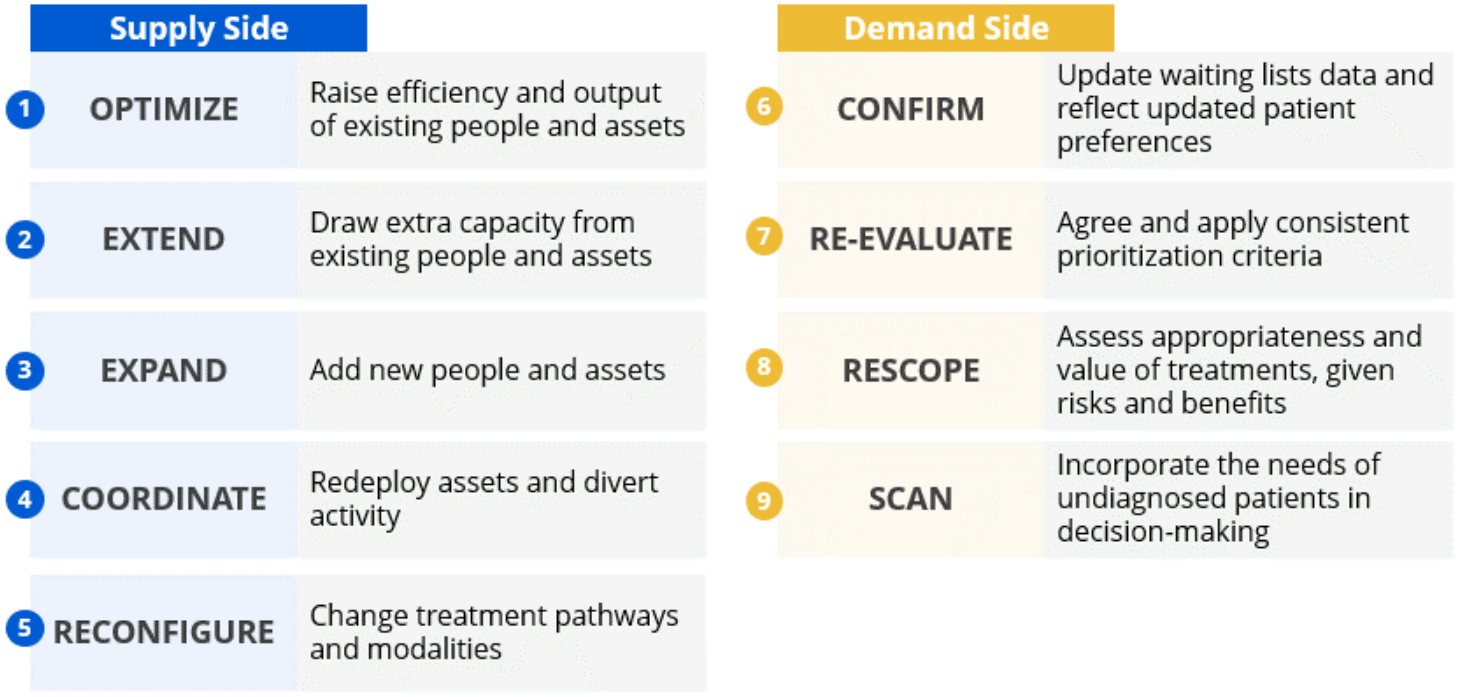

Figure 3 Levers to address the elective care backlog

1. Optimize

Increasing the operational efficiency of existing healthcare facility staff and assets[6].

1.1. Levers

Many health systems have extensive experience in pursuing operational improvement initiatives, achieving reductions in length of stay, increasing surgical operating room (OR) utilization, and ensuring appropriate skill mix in teams etc.

If operating resources are severely limited, dual consultant operating[7] and reducing staff training requirements could be considered to decrease operating times (Collaborative, 2020). Turnover time (TOT) is one of the standard measures of OR efficiency, which is influenced through process improvements.

1.2. Considerations

Examples of process improvement do not detail the complex organizational challenges associated with implementing, expanding, and sustaining change (Kodali et al., 2014). Process improvement complexity could result in additional challenges in a post-pandemic world.

Operational efficiency requires significant effort to design, manage and enforce new processes, in an environment where clinical teams are exhausted by efforts to manage the pandemic.

Engaging frontline staff in operational efficiency change programs will be challenging. The intensity of the pandemic response has had a marked impact on healthcare staff and left the healthcare workforce in a fragile state. In many areas, the same group of staff who have worked through the pandemic, and who are delivering the vaccination program, will be asked to step up once again to recover backlogs. Any plan that

[6] The scope for improvement in productivity and utilization in health care delivery is well discussed (OECD, 2018).

[7] Dual consultant operating is a process whereby one consultant surgeon assisted by associate specialist(s), operates in two theatres, and the surgeons moves between the two with a surgical team

fails to recognize this is unlikely to succeed and not deliver value (NHS Confederation, 2021).

2. Extend

Expanding surgical capacity by drawing more output from existing workforce and assets already in place. This involves financially investing and compensating for additional time.

2.1. Levers

This approach could involve adding dedicated diagnostic and surgical shifts, increasing working hours (within national regulations) and paid overtime, restricting time off, expanding individual or team roles and reduction in activities that are considered non-essential in the immediate term.

Clinical groups have proposed extension of core hours of service (including the availability of staff, facilities, and resources). This extension would occur during the week and weekends as a way of securing additional capacity and more balanced staffing levels throughout busy periods. Extending the staff, facilities, and resources available for a longer period (for example, from 8am to 10pm, including weekend cover) offers the ability to complete more planned elective lists as well as many of the urgent cases that would otherwise compete for a slot on the next day's OR list.

2.2. Considerations

Although this lever would likely have an immediate positive impact on patient outcomes and reducing the backlog of elective surgeries, it would be difficult to sustain in terms of costs and availability of workforce due to the additional pressure it places on already exhausted staff.

Workforce planning and management for supporting existing staff is critical in addressing the surgical backlog with key actions such as revision of job plans to allow more time spent in the OR, and flexible working patterns across extended working days and weeks. (RCS, 2020).

3. Expand

Generate new capacity through addition of new health workforce and assets. The investment can center on human resources, additional equipment, or facilities.

3.1. Levers

The health workforce could be expanded by encouraging non-active staff to rejoin (e.g., retirees or part-time workers). Capacity could also be expanded through the engagement of alternative providers (e.g., private, and independent sectors, international providers).

3.2. Considerations

Assuming such alternative capacity can be identified, strong quality assurance would be necessary to ensure quality, safety, and value. While this might be one of the more expedient routes to addressing the backlog, this will require immediate funding to reduce the backlog.

4. Coordinate

Increase overall system utilization by diverting activity to facilities with available capacity and redeploying staff across sites. Such integrated capacity and workforce management are only possible if there is underutilization within the local or regional health system that can be accessed.

4.1. Levers

This involves collaboration between health providers and/or payer organizations[8] to divert resources from busier facilities to places with excess capacity. Underpinning this is the need for data on utilization rates and service portfolios to achieve this coordinated outcome.

Depending on the structure of the health system, this might be a function whereby the payer would take a leading role.

Redeployment of shortage staff between facilities is an additional lever, which is reliant on local decision-making structures.

4.2. Considerations

Redeployment of staff between organizations may be possible where staff can be cross-credentialled[9]. For example, frequently the expectation

[8] A payer, or sometimes payor, is a company that pays for an administered medical service.

[9] The qualifications that are verified in order to permit a clinician to work at one provider, are accepted by another provider.

from the hospital and surgical leadership is that staff should cross-train to work interchangeably with a diverse range of surgical teams, although it could result in increased risk of error. Though intended to pool limited resources and ease staffing constraints, these traditional models can generate significant inefficiency within the OR e.g. when a newly deployed surgical technician may not be as familiar with a given surgery and thus hinder surgical efficiency compared to an experienced technician familiar in the same type of surgery. This lack of familiarity and pressure to "master-it-all" may also increase the risk of error (Jain et al., 2020). Addressing these risks are core to implementing this lever.

Leaders capable of accurately predicting demand in the coming months and years will be best equipped with strategic and operational plans that enable them to better match supply and demand in real-time across acute and ambulatory assets (Berlin et al., 2020).

5. Reconfigure

Reconfigure services to access additional treatment capacity. This can include altering the way services are being delivered, adjusting facilities, utilizing technology, and restructuring clinical pathways, and mechanisms of payment.

5.1. Levers

Many systems have reconfigured in the short term to reduce the disruption caused by the pandemic by minimizing or diverting non-essential surgical activity away from hospital settings, or segregating COVID and COVID-light sites called "green pathways". This approach may require capital investment.

For the Green Pathway model to work, all supporting services (radiology, pathology etc.) and surgical team staff (e.g., anesthetists, theatre nurses, recovery, and ward staff) need to work in a similar pattern. Creating COVID-light sites and physical pathways separate from COVID-19 environments are therefore essential for the return to planned surgery. These need to have sufficient segregation of both patients and staff from environments where COVID-19 patients are treated, in order to protect low-risk surgical patients from exposure to COVID-19 infection and staff

COVID-free areas ("green pathways") of hospitals, where planned surgery can

continue with substantially reduced risk to both patients and staff, can provide a useful tool for backlog reduction strategies (Carr et al., 2021). In regions where hospital networks already exist, attempts at developing 'COVID-19' and 'non-COVID-19' hospitals may also be a reasonable way to preserve surgical services and normal function, while containing the diseased population away from the non-diseased (Søreide et al., 2020).

Small amounts of quick capital will help to create sites for acute admissions and sites for elective admissions, which will increase efficiency. Simultaneously, funding support for the voluntary sector will help patients to receive more care and support as they wait for their procedures (NHS Confederation, 2021).

Transitioning to outpatient decentralization of care from hospitals to less-intensive care centers or physician office settings is another option (Jain et al., 2020). A quarter of surgical teams depend on the independent sector[10] to provide COVID-light facilities, so contracts with the independent sector need to be extended and include opportunities for surgical trainees to progress their training (RCS, 2020). This approach thus entails using the pandemic as an opportunity to shift to less resource-intensive venues of care e.g., inpatient to day cases. This lever also includes the addition of new capacity (use of private sector capacity, bringing retired and part-time clinical staff back into the workforce); plus, community diagnostic hubs, and regional treatment hubs with ring-fenced resources for planned care (Carr et al., 2021).

Ophthalmology and dermatological surgery have long used the strategy successfully to perform diagnostic and surgical procedure in one outpatient visit. For example, dermatologists treating skin cancer are able to perform Mohs micrographic surgery[11] — which combines tumor removal, complete margin evaluation using frozen section histopathology, and advance

[10] The independent sector includes private—i.e., commercial—enterprise, and voluntary, charitable or not-for-profit organisations

[11] A surgical procedure used to treat skin cancer. Individual layers of cancer tissue are removed and examined under a microscope one at a time until all cancer tissue has been removed. Also called Mohs surgery

reconstruction techniques — all in one visit using local anesthesia in an outpatient office suite. COVID-19 has illustrated the value for more traditionally hospital-anchored surgical specialties to venture into these strategies for lower-acuity cases (Jain et al., 2020).

Given the capacity-constrained, resource-intensive hospital setting, moving care to lower-acuity outpatient settings may increase patient numbers and result in streamlined and focused care.

Surgical teams are encouraged to offer telephone or video consultations, when possible, cancel follow-ups that are deemed non-essential in order to minimize patient contact. In cases where patients must attend hospital appointments, the time patients spend in services should be minimized. They should have a scheduled appointment time and should be advised not to arrive early (Al-Jabir et al., 2020). This approach might help to avoid patient harm and unnecessary hospital admissions.

5.2. Considerations

The pandemic may also create a window of opportunity to make long-desired but difficult to implement changes to treatment pathways and modalities. There is some experience that the pandemic is acting as a catalyst for lower-intensity treatments (e.g., day case and outpatient), virtual services and non-surgical alternatives.

While many patients embrace digital technologies, care must be taken to address the growing digital divide affecting hard to reach groups as well as other emerging health inequalities (Carr et al., 2021).

Demand-side approaches

6. Confirm

Assess and confirm that patients still require treatment and/or prefer treatment under Covid-19 secure conditions

6.1. Levers

Waiting lists are dynamic and patients identified for surgical treatment prior to the pandemic may not still require treatment. Patient conditions may have changed in unanticipated ways and their health and social needs may have changed. Patient preferences for treatment may also have changed, as patients reassess the relative risks and benefits of surgical treatment under

COVID-secure conditions. Substantial clinical and administrative resources may therefore be needed to clear waiting list data and re-consent patients for surgery, but this is a task that should precede securing additional capacity.

Confirming and re-prioritizing waiting lists is key in ensuring the need for surgery and triaging cases. Most health systems have introduced broad, rudimentary guidelines for surgical prioritization. Competition for limited operating capacity may arise among different surgical specialties, therefore protocols should be established to prioritize patient's clinical need. However, the prioritization decision in many cases is left to individual surgeons or a small group of health leaders who use their personal preferences for decision making (Jain et al., 2020).

Patient engagement is the key part for demand-side strategies, including supporting patients to be more engaged in managing illness and engaging in healthier lifestyle choices. By providing optionality and community support, patients can be encouraged to manage their conditions as they wait for treatment (e.g., encouraging at-home therapies for joint replacement surgeries). Regarding the growing acceptance of digital transformation, changes in patient's attitude may help facilitate algorithmic approaches to surgical prioritization (Jain et al., 2020).

6.2. Considerations

The impact of long waiting lists will largely impact primary care, which will need to be supported to enable patients to manage their conditions as they wait for treatment. There is a case for preventative investment to help people take charge of their own health and reduce social isolation while they wait for procedures. There is also an opportunity to invest in the prevention agenda and shift some work upstream, where there is workforce capacity that does not currently exist (NHS Confederation, 2021).

7. Re-evaluate

Develop transparent and consistent prioritization and triage criteria to optimize use of currently available resources.

7.1. Levers

Patients who are best placed to benefit from treatment should be prioritized and

these decisions should be made transparently with the engagement of patients and the public. Consideration should be given to establishing a multidisciplinary prioritization committee and a prioritization strategy that meets the needs of patients while making optimal use of existing facilities for elective cases. This includes:

- proposed approach for prioritizing patients and for a phased increase of OR availability
- flexible planning on a weekly basis
- use of day-case facilities
- using local or regional anesthesia, where such options exist
- employing a smaller team for simpler procedures
- ensuring optimum length of stay
- use of facilities in the independent sector

7.2. Considerations

There is ongoing debate over the ethical basis for prioritization (MacCormick, Collecutt & Parry, 2003). In certain instances, the local-optimization approach is not in the best interests of the health systems and may put patients of less vocal surgeons at risk, leading to poorer health outcomes (Jain et al., 2020). A consistent and transparent prioritization framework has generally been missing from these efforts.

8. Rescope

Review surgical treatment thresholds, risks, and benefits of surgery. Assess if there have been material changes to the risk and benefit profiles of specific procedures in health systems.

8.1. Levers

The pandemic may provide an opportunity to reinvigorate discussions on the need to identify and eliminate low-value care. Some treatments are now of lower value in the context of changed risk profile resulting from the pandemic. For instance, guidelines have changed in numerous countries regarding elective surgery for patients that have tested positive for COVID-19 (e.g., Spain and Italy), with many advising that surgery should be postponed until asymptomatic for 72 hours and tested negative for COVID-19 with two tests 24 hours apart (Lewis et al., 2020).

8.2. Considerations

Clinical associations should rapidly review existing protocols to understand which should be updated rapidly to reflect the changing risk environment post-COVID.

Evidence in this field may be limited and therefore health systems need to both evaluate and assess the risks and rewards of adapting surgical thresholds and consider investing in evidence to inform these changes.

9. Scan

Ensure that health systems are equitable when allocating capacity to address patient needs. Health systems must consider the likely needs of currently undiagnosed patients (e.g., limited diagnostic capacity for early-stage breast cancer).

9.1. Levers

The post-pandemic success of health systems must not be judged purely on their performance in reducing existing waiting lists. Health systems that have access to population health management, profiling and case-finding technologies should use these to identify individuals who are likely to have elective surgical needs but who did not present for diagnosis during the pandemic.

9.2. Considerations

Although the effect of this policy lever will be to increase rather than decrease the demand for elective services, it will have a critical impact on overall population health. Eliminating the backlog should not be pursued at the expense of identifying patients whose needs for elective surgery we would prioritize if their needs had been identified and diagnosed.

KEY CONSIDERATIONS

Health systems need to monitor and track the impact of the levers they deploy over the coming months. This step is key in measuring their impact and providing evidence to validate or refute recommendations (outlined in Figure 4) that health systems should ensure they have fully explored available demand-side levers (e.g., reevaluated their demand and rescoped the thresholds for treatment) before they commit additional resources on the supply side.

To enable the strategies for addressing the backlog, health systems need to collect up-to-date accurate healthcare data. Employing mobile technology with apps and real-time dashboards can assist with bridging the information gap (globalcases.info, 2020). Longer-term, applications could be combined with other data to assist with measurement of global surgical capacity as part of the Global Surgery 2030 initiative (O'Reilly-Shah et al., 2020).

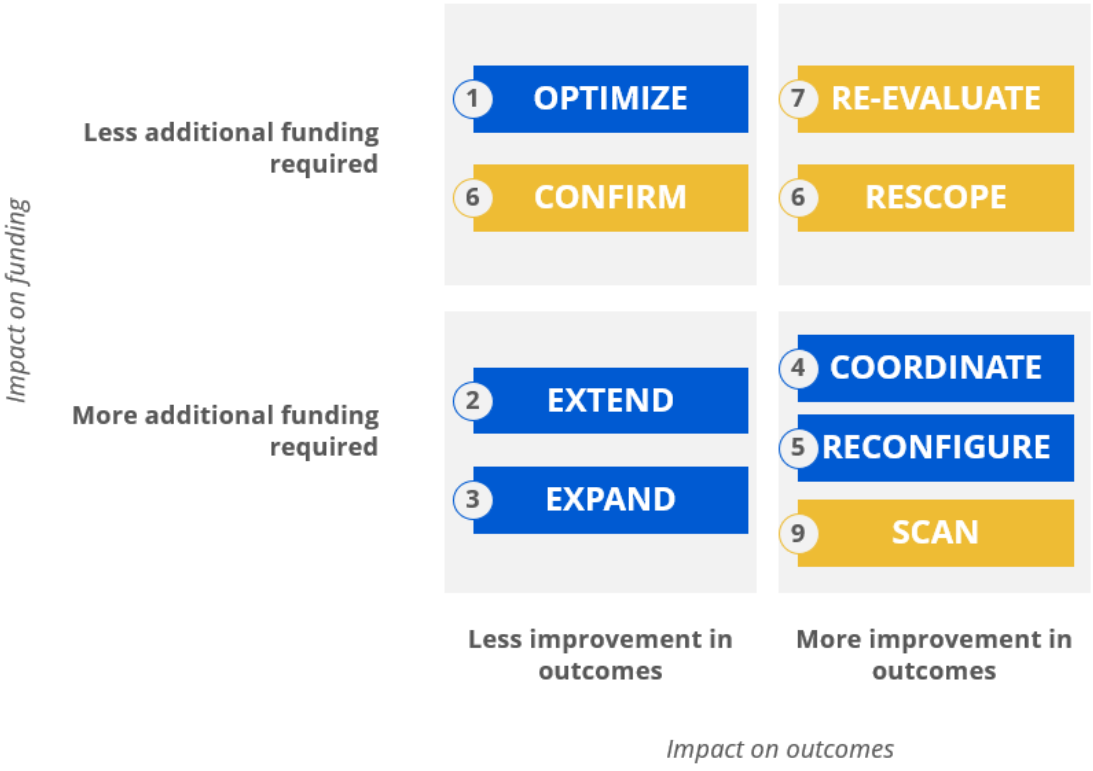

Figure 4 Hypotheses on impacts on costs and outcomes

CONCLUSION

The COVID-19 pandmeic provides an opportuniuty for health systems to employ value-based principles to reset, replan and restart addressing elective surgical backlog. This paper has clearly signified that a framework for evaluation and a plan to incorporate surgical care into the WHO strategies for national health plans and pandemic mitigation is urgently needed (Søreide et al., 2020).

Some of the key levers identified in this review are illustrated in Figure 3.

Creating resilient surgical systems are core to ensure that countries are prepared for health emergencies such as COVID-19. Recognizing that stringent COVID-19 measures can have a direct impact on increasing the size of the elective backlog, health systems must be able to adapt to address the backlog. Using various permutations of the nine levers outlined in Figures 3 & 4 can provide useful strategies to address the backlog, depending on the available resouces and health system priorities.

Patient communication is key to the implementation of both supply and demand-side levers, and is an integral part of value for money of different initiatives. Health systems should ensure they have fully explored available demand-side levers (e.g., reevaluated demand and rescoped the thresholds for treatment) before they commit additional supply side resources. Additionally, patients want reassurance that they will be protected from COVID-19 when they are admitted (Byrnes et al., 2021). Governments must therefore develop evidence-driven communication strategies that identify patient's concerns and misconceptions and risk of infection and provide information that a diverse range of patients can trust (Carr et al., 2021).

ANNEX

Country Case Studies

This section gives examples of how specific countries are applying these different levers, and what the impact has been on value for money in addressing the surgery backlog within those countries.

Currently, most recommendations are based on expert opinion only and there are many areas of uncertainty. To inform COVID-19 surgical plans and address patients' concerns effectively, there is an urgent need for high-quality, multicenter research.

Italy	
Levers	**5. Reconfigure**

Italy had one of the highest 2019 coronavirus disease (COVID-19) clinical burdens in the world. The regional structure of the Italian national health service caused diverse regional responses to the emergency. As of April 15, 2020, the dense Lombardy region (10·08 million inhabitants) accounted for 37% of cases and 53% of deaths of the country (Odone et al., 2020) (Percudani et al., 2020).

Lombardy was hit by the COVID-19 outbreak much earlier than other regions were, with a possibly delayed public health response and uncontrolled transmission between asymptomatic individuals at the community level (Signorelli, Scognamiglio & Odone, 2020). Additionally, the emergence of many cases concentrated within a short period of time stretched hospitals to capacity. High pressure on hospital services might have negatively affected the health services' preparedness. Also, hospital services might not have been sufficiently supported and integrated with community and primary care services.

The first strategy implemented was to centralize severe trauma to specific hospitals, increasing capacity in other hospitals for admission of patients with suspected COVID-19 (Collaborative, 2020).
Two further epidemic control strategies were implemented: Veneto (another region in Italy) opted for strict containment of the outbreak and piloted mass testing in selected areas (i.e., 4·4% of the population were tested, compared

with 1·8% in the rest of Italy), whereas Lombardy reported high transmission and disease rates and strengthened hospital services to meet a massively increased demand for hospitalization and intensive care unit beds (Odone et al., 2020).

Spain	
Levers	**4. Coordinate**
Crises and disasters are often marked by a heightened need to seek information, as seen in the current COVID-19 outbreak. In Madrid, instant messaging groups linking different hospitals aided rapid identification of regional critical bed availability, facilitating rapid patient transfers (Collaborative, 2020). The impact of this lever in value for money in addressing the care backlog has not been identified.	

South Korea	
Levers	**5. Reconfiguration**
Elective surgery continued throughout the COVID-19 outbreak. Patients were screened for respiratory symptoms and tested for COVID-19 infection before admission to minimize cross-infection risk (Collaborative, 2020). Seoul National University Hospital (SNUH) converted an existing facility into a Community Treatment Center (CTC) to isolate patients who had confirmed COVID-19 but mild or no symptoms (Kang et al., 2020). Patients reported self-measured vital signs and symptoms twice a day by using a smartphone application. Medical staff in a remote monitoring center at SNUH reviewed patient vital signs and provided video consultation to patients twice daily. The CTC required few medical staff to perform medical tests, monitor patients, and respond to emergencies. In terms of value for money, South Korea opened its first CTC on March 2, 2021, and by March 26, a total of 3,292 patients were admitted to 17 CTCs, representing 35.6% of the 9,241 cumulative confirmed COVID-19 cases in the country. During those 24 days, no deaths or instances of respiratory failure were reported in the 17 CTCs operated. The CTC model offers safe monitoring and isolation for asymptomatic or mildly symptomatic patients with diagnosed COVID-19 during the pandemic. During shortages of medical resources, appropriate triage of patients and allocation of resources are needed so that critically ill patients receive the highest level of care and patients with less severe infection can	

be safely monitored and treated. The CTC model also could be useful during natural disasters in which the demand for medical care overwhelms the supply.

Singapore	
Levers	**5. Reconfiguration**
'Hot teams' were established to manage acute surgical admissions, while 'cold teams' continued elective work. Contact between hot and cold teams was minimized to reduce cross-infection risk (Collaborative, 2020). The value for money of this lever is best seen in terms of patient safety, but this has not been quantified.	

England	
Levers	**5. Reconfiguration** **7. Reevaluation**
Hot and cold sites were also applied to determine the safety of urological admissions and procedures during the height of the COVID-19 pandemic in the UK (Stroman et al., 2021). In terms of value, given that the hospital was at the center of the pandemic in London in a severely affected area, this model was a relatively safe method of continuing to deliver urological care. One challenge going forward will be dealing with increased waiting lists and delivering safe care on a larger scale. There was a significant reduction in the elective service during the time of the study; the described department typically has between 600 and 1000 inpatient episodes monthly, in contrast to the 200 per month described.	

Hong Kong	
Levers	**1. Optimize**
In Hong Kong, public hospitals implemented early measures to reduce the nosocomial spread of infection, including prohibiting visitors, and requiring everyone to wear masks on hospital premises (Collaborative, 2020). According to Lagasse (2020), these infection control measures have been effective in protecting healthcare workers from the virus. At the start of the outbreak, the Hong Kong Hospital Authority inventoried the infection-control measures enacted (Cheng et al., 2020). The infection control measures appear to have the intended effect: While those hospitals dealt with 42 confirmed cases of the coronavirus, no hospital-acquired infections occurred among healthcare workers in Hong Kong's public hospitals in the six weeks studied. The team began their calculations using data from December 31, 2019, which they consider "day one" of the outbreak. In total, 413 healthcare workers treated the 42 confirmed cases. Eleven of those workers had unprotected exposure and were quarantined for 14 days, but none had contracted the virus.	

Ghana	
Levers	**2. Extend**
Dedicated theatres and holding bay facilities were established in isolated infectious disease facilities (Collaborative, 2020). Ghana has one of the best testing capacities in Africa (Zang, Nonvignon & Mao, 2020), one reason behind the country having the fourth-highest number of COVID cases in sub-Saharan Africa. 7,791 health facilities and 18 intensive care units (ICUs) were used to respond to COVID-19. In late April 2020, the government announced that three new infectious disease centers would be built. In terms of the rest of the African continent, data modeling assists governments in predicting the evolution of the pandemic against the prescribed confinement and de-confinement measures. It can also provide innovative solutions for Africa's context. For example, to counter the limited availability of diagnostic test kits, Rwanda adopted mathematical modeling to implement a pool testing method that reduces the number of tests required for an accurate infection count (Travaly & Mare, 2020).	

South Africa	
Levers	**3. Expand**
The South African government proactively set up a National COVID-19 Modelling Consortium as the primary source for all COVID-19-related projections. A PhD student there developed an intuitive web-based COVID-19 dashboard to share real-time updates on the pandemic in South Africa and other countries. However, data modeling capacity on the continent is still very low. Centers like the African Institute for Mathematical Sciences (AIMS), which launched a master's degree program in machine intelligence in 2018, are critical for building data modeling capacity. Investments to scale these centers and other training and research institutes in data science are vital for the development of human capital in the field (Travaly & Mare, 2020). Beyond capacity building, more needs to be done to build resilient infrastructure as well as provide researchers access to data with specific research and policy goals given that the devastation of the climate crisis will only get worse, and Africa is already feeling its impact.	

Senegal	
Levers	**3. Expand**
According to WHO official Nsenga Ngoy, Senegal is "one of the model countries in terms of implementing COVID-19 prevention measures and it has reaped the benefits" (Medical Press, 2020). However, Senegalese health experts, and the WHO, have also warned against an overly optimistic interpretation of the virus situation in the country. So far, data collected on the continent presents marked differences in infection rates between urban and rural areas. For example, Senegal's capital city of Dakar has accounted for the majority of the country's infections—providing an important incentive for building better urban health and planning foresight capacity (Travaly & Mare, 2020).	

England	
Levers	**3. Expand** **6. Confirm** **7. Reevaluate**

In the early part of the pandemic, elective services were postponed as leaders looked at the experiences of Italy and Spain, emptied hospitals and cleared bed capacity to deal with an uncertain and unpredictable first wave. Over the summer, hospitals recovered as much elective capacity as they could, with enhanced infection prevention and control requirements meaning that operating efficiency was much reduced. Then came the second and third waves of infections over autumn and winter 2020/21 (NHS Confederation, 2021).

The National Health Service (NHS) entered into partnerships with independent sector providers to support both the treatment of patients with COVID-19 and also to deliver urgent operations and cancer care. The NHS receive an additional £.6.bn in 2021/22 to help services address the pandemic and recover after the COVID-19 pandemic [versus the £11bn actually required] (Rimmer, 2020).

Impact on value for money in addressing backlog: The Royal college of surgeons England have provided guidance that patient prioritization should have clear local guidelines based on national and local needs. They also suggest NHS England are undertaking a similar gap analysis as this paper offers, although this is not yet available (Macdonald et al., 2020). According to the NHS Confederation (2021), the additional £1bn agreed in the Spending Review for 2021/22 will not be enough to clear the backlog. The healthcare sector will need honesty from political leaders to help manage the inevitable change in public opinion when there are further delays in treatment.

The NHS has identified the cancer patients which are most at risk during the outbreak and who are likely to become seriously or critically unwell if they were to contract the virus. These include patients on active chemo- or radiotherapy, immunotherapy or any antibody treatments, or immune system modulation therapy (e.g., protein kinase inhibitors or post-transplantation immunosuppressants). This group also includes patients with blood or bone marrow cancers i.e., leukemia, lymphoma, or myeloma (Al-Jabir et al., 2020).

United States	
Levers	**2. Extend** **6. Confirm**

It has been estimated that if US health systems were to operate at an average 10% increase above baseline volumes around 20 months would be required to work through the pent-up demand from 2020 (Berlin et al., 2020).

One important example of success is a multidisciplinary Pivot Plan implemented in May 2020 with the primary outcome of a phased resumption of elective surgery and procedures. This took place within an academic healthcare system located in one of the initial COVID-19 hotspots in the US. The plan entailed the integration of electronic medical record, order entry automatization, perioperative staff utilization, partnering with primary care providers, and a stepwise COVID-19 testing algorithm based on a predetermined hierarchy of case acuity and timeliness of patient care. As testing capability increased, the seven-hospital system has been able to increase added elective surgery and procedures capacity from 13 cases per day to 531 cases per day. In turn, they have seen the case volume increase by 52% (Serrano et al., 2021).

A prioritization algorithm, being developed through work at Johns Hopkins Medicine and the Hopkins Business of Health Initiative, is inspired by multi-criterion decision analysis and considers three types of factors: surgical risk factors (e.g., patient age, surgical urgency), capacity requirement factors (e.g., OR time, PPE consumption, ICU bed requirements), and COVID-19 risk factors (e.g., COVID-19 status, case transmission risk, and COVID-19-specific comorbidities) (Jain et al., 2020).

Along with preoperative testing processes, the plan designed an informed consent module to give providers an opportunity to educate their patients and caregivers about the risks of having elective surgery and procedures during the pandemic. In addition to providing informed consent, this educational component enabled the provider to give real-time updates about knowledge and recommendations on COVID-19 among Hartford HealthCare (HHC), Connecticut, and New England. For many self-restricted patients, this provided realistic and practical knowledge about whether it was safe to proceed with elective surgical procedures (Serrano et al., 2021). Patients should be counselled about the potential risks of both postponing and going ahead with surgery (Collaborative, 2020).

Canada	
Levers	**2. Extend**

Daily operating hours will be increased, including scheduling procedures on evenings and weekends. Additionally, new Operating Rooms (ORs) and unused ORs will be (re)

opened (pay implications and staff exhaustion issues here) (Lewis et al., 2020).

Ontario's fiscal watchdog says it will take the province approximately three and a half years to clear the care backlog from the COVID-19 pandemic, with the Financial Accountability Office (FAO) projecting that the backlog of cancelled surgeries will reach 419,200 procedures by the end of September 2021, working with the assumption that hospitals will be able to operate at 11% above pre-pandemic volumes in the coming years (The Canadian Press, 2021).

Country Case Study: United States

Most states in the U.S.A. enforced a temporary ban on elective surgery from March - May 2020 in order to reduce the risk of infections to patients and providers, and conserve critical resources — such as PPE, ventilators, and intensive care (ICU) beds —. This led to a backlog of planned surgical procedures, as well as a continuing backlog of surgeries in the health system of diminished capacity.

The US has also seen a decrease in cardiac surgery procedures of nearly 50% during the pandemic. Post-pandemic backlog will exceed one million cases for spinal fusions and joint replacements in orthopedic services alone (Jain et al., 2020), and cumulative backlog of more than one million total joint and spine surgery cases by mid-2022. It is estimated that the country may need up to 16 months to work through the backlog of orthopedic care (Berlin et al., 2020).

Country Case Study: England

Before the onset of the pandemic, there was considerable increase in the number of people waiting on elective pathways. In late 2016, the number rose from around 3.5 million to over 4.3 million by the end of 2019, as the NHS's ability to keep pace was outstripped by increased demand.

2020 brought unprecedented disruption to elective activity. By the end of the year, there were:

- 1.4 million fewer completed admissions in 2020 compared to 2019 (a 39% fall).
- 3.3 million fewer non-admitted pathways compared to 2019 (a 25% fall).
- 32% of patients (1.5 million) waiting longer than 18 weeks.
- 21% of patients (970,000) waiting longer than half a year.
- 5% of the entire waiting list (224,000) waiting for longer than a year.

This produced the largest official waiting list on record, with 4.52 million people waiting for their treatment to begin in December 2020, up from 4.3 million a year before. Yet despite setting records, this official number is far short of where it could be (NHS Confederation, 2021). There were 5.9 million fewer new referral-to-treatment (RTT) pathways in 2020 compared to 2019, a 30% fall. This number represents the scale of a hidden waiting list of people yet to join the official queue. The specialties most disrupted were trauma, orthopedics, and ophthalmology – with many conditions that will steadily worsen if left untreated.

Not all patients among this hidden group will eventually join the official surgical waiting list, some will seek care elsewhere while others may never seek treatment. But it is reasonable to assume that many, probably a sizeable majority, will eventually find their way onto the official waiting list (Ibid.).

Though the number of surgical patients treated within the 18-week NHS standard is improving from its worst point in the first wave of the pandemic, the number of patients who have already waited more than a year for treatment has

reached 138, 401, a 153-fold increase from 904 in November 2019, and growth shows no sign of slowing (Carr et al., 2021).

- Trauma and orthopedics, oral surgery, and plastic surgery seem particularly affected, but even cancer surgery has been delayed: the percentage of patients having cancer surgery within one month of the decision to treat dropped from 92% to 88% over the same period (NHS England, 2020).
- 28,000 heart-related procedures (including implanting of pacemakers and stents, dilatation of blocked arteries to the heart, and tests to diagnose heart diseases) have been delayed.
- Delay in cancer treatment could result in a dramatic reduction in long-term survival, with over 30% survival reduction for those with advanced-stage cancers.

At current activity and referral levels, we could expect to see a waiting list exceeding 5.6 million by the end of the year. Importantly, the hidden waiting list would also grow significantly, as the NHS would still see fewer patients join RTT pathways each month than it would typically expect. This approach would not be acceptable to the government, clinicians, or carers (NHS Confederation, 2021).

International research and collaboration

Surgeons from around the world have begun to unite to protect patents through an international cohort study named COVIDSurg. The GlobalSurg Collaborative, an international network of more than 80 countries that conducts collaborative international research into surgical outcomes, established COVIDSurg on 28th March 2020, with the aim of assessing outcomes after surgery in COVID-19 patents by capturing real-world data from around the globe (Lewis et al., 2020).

Glossary of Terms

COVID-19	Corona Virus Disease of 2019
CTC	Community Treatment Center
ICU	Intensive Care Unit
NHS	National Health Service
OR	Operating Room
PPE	Personal Protective Equipment
UK	United Kingdom
US	United States of America
VBHC	Value-based health care
WHO	World Health Organization

References

Al-Jabir, A., Kerwan, A., Nicola, M., Alsafi, Z., Khan, M., Sohrabi, C., O'Neill, N., Iosifidis, C., Griffin, M., Mathew, G. and Agha, R., 2020. Impact of the coronavirus (COVID-19) pandemic on surgical practice-Part 2 (surgical prioritization). International journal of surgery.

Berline, G., Bueno, D., Gibler, K. and Schultz, J. 2020. Cutting through the COVID-19 surgical backlog. McKinsey & Company

BMJ 2020; Mortality due to cancer treatment delay: systematic review and meta-analysis; 371 doi: https://doi.org/10.1136/bmj.m4087

Byrnes, M.E., Brown, C.S., De Roo, A.C., Corriere, M.A., Romano, M.A., Fukuhara, S., Kim, K.M. and Osborne, N.H., 2021. Elective Surgical Delays Due to COVID-19: The Patient Lived Experience. Medical Care, 59(4), pp.288-294.

Canadian Press (2021) Ontario's surgical backlog will take more than 3.5 years to clear, fiscal watchdog says. CTV News. Accessed at: https://toronto.ctvnews.ca/ontario-s-surgical-backlog-will-take-more-than-3-5-years-to-clear-fiscal-watchdog-says-1.5421321

Carr, A., Smith, J.A., Camaradou, J. and Prieto-Alhambra, D., 2021. Growing backlog of planned surgery due to COVID-19.

Cheng, V.C., Wong, S.C., Chen, J.H., Yip, C.C., Chuang, V.W., Tsang, O.T., Sridhar, S., Chan, J.F., Ho, P.L. and Yuen, K.Y., 2020. Escalating infection control response to the rapidly evolving epidemiology of the coronavirus disease 2019 (COVID-19) due to SARS-CoV-2 in Hong Kong. Infection Control & Hospital Epidemiology, 41(5), pp.493-498.

Cima, R.R., Brown, M.J., Hebl, J.R., Moore, R., Rogers, J.C., Kollengode, A., Amstutz, G.J., Weisbrod, C.A., Narr, B.J., Deschamps, C. and Team, S.P.I., 2011. Use of lean and six sigma methodology to improve operating room efficiency in a high-volume tertiary-care academic medical center. Journal of the American College of Surgeons, 213(1), pp.83-92.

Collaborative, C. and Collaborative, G., 2021. SARS-CoV-2 vaccination modelling for safe surgery to save lives: data from an international prospective cohort study. The British journal of surgery.

Collaborative, C., 2020. Global guidance for surgical care during the COVID-19 pandemic. The British journal of surgery.

Collaborative, C., Nepogodiev, D. and Bhangu, A. 2020. Elective surgery cancellations due to the COVID-19 pandemic: global predictive modelling to inform surgical recovery plans. British Journal of Surgery.

Collar, R.M., Shuman, A.G., Feiner, S., McGonegal, A.K., Heidel, N., Duck, M., McLean, S.A., Billi, J.E., Healy, D.W. and Bradford, C.R., 2012. Lean management in academic surgery. Journal of the American College of Surgeons, 214(6), pp.928-936.

COVIDSurg Collaborative. Elective surgery cancellations due to the COVID-19 pandemic: global predictive modelling to inform surgical recovery plans. Br J Surg 2020;107:1440-9.p

Fowler, A.J., Dobbs, T.D., Wan, Y.I., Laloo, R., Hui, S., Nepogodiev, D., Bhangu, A., Whitaker, I.S., Pearse, R.M. and Abbott, T.E.F., 2021. Resource requirements for reintroducing elective surgery during the COVID-19 pandemic: modelling study. British Journal of Surgery, 108(1), pp.97-103.

Fu SJ, George EL, Maggio PM, Hawn M & Nazerali R. 2020. The Consequences of Delaying Elective Surgery: Surgical Perspective. Annals of Surgery

Global Cases Info (2020). Approximate Global Surgical Case Volumes. Accessed from: https://globalcases.info/

Hook L, Kuchler H. 2020. How Coronavirus broke America's healthcare system. The Financial Times 30th April, 2020. Accessed from: https://www.ft.com/content/3bbb4f7c-890e11ea-a01c-a28a3e3fbd33

Hospitals, A.H.A., 2020. health systems face unprecedented financial pressures due to COVID-19.

Hoyler, M., Finlayson, S.R., McClain, C.D., Meara, J.G. and Hagander, L., 2014. Shortage of doctors, shortage of data: a review of the global surgery, obstetrics, and anesthesia workforce literature. World journal of surgery, 38(2), pp.269-280.

Independent, 2020. NHS on life support: Up to one in six will be on waiting lists as health service turns to private hospitals. Independent. Accessed from: https://www.independent.co.uk/news/health/coronavirus-nhswaiting-times-surgery-privatisation-a9550831.html

Jain, A., Dai, T., Bibee, K. and Myers, C.G., 2020. COVID-19 created an elective surgery backlog. How can hospitals get back on track. Harvard Business Review, 10.

Kang, E., Lee, S.Y., Jung, H., Kim, M.S., Cho, B. and Kim, Y.S., 2020. Operating protocols of a community treatment center for isolation of patients with coronavirus disease, South Korea. Emerging infectious diseases, 26(10), p.2329.

Kitano, T., Kitano, M., Krueger, C., Jamal, H., Al Rawahi, H., Lee-Krueger, R., Sun, R.D., Isabel, S., García-Ascaso, M.T., Hibino, H. and Camara, B., 2021. The differential impact of pediatric COVID-19 between high-income countries and low-and middle-income countries: A systematic review of fatality and ICU admission in children worldwide. PloS one, 16(1), p.e0246326.

Kodali, B.S., Kim, D., Bleday, R., Flanagan, H. and Urman, R.D., 2014. Successful strategies for the reduction of operating room turnover times in a tertiary care academic medical center. journal of surgical research, 187(2), pp.403-411.

Lagasse, J. 2020. Infection control measures in Hong Kong have protected healthcare workers from COVID-19 coronavirus. Healthcare Finance. Accessed from: https://www.healthcarefinancenews.com/news/infection-control-measures-hong-kong-have-protected-healthcare-workers-COVID-19-coronavirus

Lewis, A., Polatidis, B., Charitou, E., Karapatsia, A., Nielsen, A.A., Olesen, C.B., Gargavanis, A.A., Halimah, S., Tsianos, G.I., Polydorou, D. and Holt, K., 2020. Backlog to Surgery due to COVID-19 and Considerations to Address to Catch-up Safely. Journal of Advanced Research in Medical Science & Technology, 7(3), pp.4-10.

Lu Z., Lin Z., Jinwen L., Zhifang Y., Wenzhuang S., Xingrui L. [The treatment proposal for the patients with breast diseases in the central epidemic area of 2019 coronavirus disease] Chin. J. Surg. 2020;58

MacCormick, A.D., Collecutt, W.G. and Parry, B.R., 2003. Prioritizing patients for elective surgery: a systematic review. ANZ Journal of Surgery, 73(8), pp.633-642.

Macdonald, N., Clements, C., Sobti, A., Rossiter, D., Unnithan, A. and Bosanquet, N., 2020. Tackling the elective case backlog generated by COVID-19: the scale of the problem and solutions. Journal of Public Health, 42(4), pp.712-716.

Medical Press (2020). 'Senegal's coronavirus success divides experts'. Accessed from: https://medicalxpress.com/news/2020-11-senegal-coronavirus-success-experts.html

NHS (2020); Clinical guide for triaging patients with suspected colorectal cancer 24 April. Version 1. Accessed from: https://www.bsgar.org/static/uploads/PUBLICATION%20C0384_%20Clinical%20guide%20for%20triaging%20suspected%20colorectal%20ca%20v1%20April%2024.pdf

NHS 2021. NEW 'GREEN PATHWAY' RESTORES SURGERY AT HOSPITAL OF ST CROSS, RUGBY. Accessed from: https://www.uhcw.nhs.uk/news/new-green-pathway-restores-surgery-at-hospital-of-st-cross-rugby/

NHS Confederation. 2021. NHS Reset: delivering the recovery. Accessed from: https://www.nhsconfed.org/NHSreset

NHS England. Cancer waiting times. 2020. Accessed from: https://www.england.nhs.uk/statistics/statistical-work-areas/cancer-waiting-times/

O'Reilly-Shah, V.N., Van Cleve, W., Long, D.R., Moll, V., Evans, F.M., Sunshine, J.E., Kassebaum, N.J., Harrison, E.M. and Jabaley, C.S., 2020. Impact of COVID-19 response on global surgical volumes: an ongoing observational study. Bulletin of the World Health Organization, 98(10), p.671."

Odone, A., Delmonte, D., Scognamiglio, T. and Signorelli, C., 2020. COVID-19 deaths in Lombardy, Italy: data in context. The Lancet Public Health, 5(6), p.e310.

Percudani, M., Corradin, M., Moreno, M., Indelicato, A. and Vita, A., 2020. Mental health services in Lombardy during COVID-19 outbreak. Psychiatry research, 288, p.112980.

Prin, M., Guglielminotti, J., Mtalimanja, O., Li, G. and Charles, A., 2018. Emergency-to-elective surgery ratio: a global indicator of access to surgical care. World journal of surgery, 42(7), pp.1971-1980.

Public Health England. 2020. COVID-19: Guidance for maintaining services within health and care settings. Accessed from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/954690/Infection_Prevention_and_Control_Guidance_January_2021.pdf

Radha, S. and Afzal, I., 2020. Evidence based suggestions for the return to elective orthopaedic surgery following the COVID-19 pandemic.

Transient Journal of Orthopaedic and Coronavirus. Published online, 1.

Rimmer, A., 2020. COVID-19: NHS will get£ 3bn of "recovery" funding to tackle pandemic fallout.

Royal College of Surgeons. 2020. Managing elective surgery during the surges and continuing pressures of COVID-19. Accessed from: https://www.rcseng.ac.uk/coronavirus/recovery-of-surgical-services/tool-7/

Paul Truche, Letícia Nunes Campos, Enzzo Barrozo Marrazzo, Ayla Gerk Rangel, Ramon Bernardino, Alexis N Bowder, Alexandra M Buda, Isabella Faria, Laura Pompermaier, Henry E. Rice, David Watters, Fernanda Lage Lima Dantas, David P. Mooney, Fabio Botelho, Rodrigo Vaz Ferreira, Nivaldo Alonso, 2021,Association between government policy and delays in emergent and elective surgical care during the COVID-19 pandemic in Brazil: a modeling study, The Lancet Regional Health - Americas, Volume 3, (https://www.sciencedirect.com/science/article/pii/S2667193X2100048X)

Sayburn, A., 2020. How can surgery be supported to recover safely from COVID-19?. The Bulletin of the Royal College of Surgeons of England, 102(6), pp.236-239.

Serrano, O.K., Orlando, R., Papasavas, P., McClure, M.H., Kumar, A., Steinberg, A.C., Cohen, J.L., Shichman, S.J., Singh, R.K., Sardella, W.V. and Schipper, B.M., 2021. Getting back to work: A framework and pivot plan to resume elective surgery and procedures after COVID-19. Surgery open science, 4, pp.12-18.

Signorelli, C., Scognamiglio, T. and Odone, A., 2020. COVID-19 in Italy: impact of containment measures and prevalence estimates of infection in the general population. Health, 25, p.01.

Søreide, K., Hallet, J., Matthews, J.B., Schnitzbauer, A.A., Line, P.D., Lai, P.B.S., Otero, J., Callegaro, D., Warner, S.G., Baxter, N.N. and Teh, C.S., 2020. Immediate and long-term impact of the COVID-19 pandemic on delivery of surgical services. The British journal of surgery.

Stroman, L., Russell, B., Kotecha, P., Kantartzi, A., Ribeiro, L., Jackson, B., Ismaylov, V., Debo-Aina, A.O., MacAskill, F., Kum, F. and Kulkarni, M., 2021. Safety of "hot" and "cold" site admissions within a high-volume urology department in the United Kingdom at the peak of the COVID-19 pandemic. Bjui Compass, 2(2), p.97.

Sud, A., Jones, M.E., Broggio, J., Loveday, C., Torr, B., Garrett, A., Nicol, D.L., Jhanji, S., Boyce, S.A., Gronthoud, F. and Ward, P., 2020. Collateral damage: the impact on outcomes from cancer surgery of the COVID-19 pandemic. Annals of Oncology, 31(8), pp.1065-1074.

Travaky, Y., and Mare, A. 2020. Learning from the best: Evaluating Africa's COVID-19 responses. Brookings. Accessed from: https://www.brookings.edu/blog/africa-in-focus/2020/07/08/learning-from-the-best-evaluating-africas-COVID-19-responses/

Walker, P.G., Whittaker, C., Watson, O.J., Baguelin, M., Winskill, P., Hamlet, A., Djafaara, B.A., Cucunubá, Z., Mesa, D.O., Green, W. and Thompson, H., 2020. The impact of COVID-19 and strategies for mitigation and suppression in low- and middle-income countries. Science, 369(6502), pp.413-422.

Wang, J., Vahid, S., Eberg, M., Milroy, S., Milkovich, J., Wright, F.C., Hunter, A., Kalladeen, R., Zanchetta, C., Wijeysundera, H.C. and Irish, J., 2020. Clearing the surgical backlog caused by COVID-19 in Ontario: a time series modelling study. CMAJ, 192(44), pp.E1347-E1356.

West, M (2017) Collaborative and Compassionate Leadership. Accessed from: https://www.kingsfund.org.uk/audio-video/michael-west-collaborative-compassionateleadership

Wilson, C (2020) Mental health impacts of COVID-19 on NHS healthcare staff. UK Parliament post. Accessed from: https://post.parliament.uk/mental-health-impacts-of-covid-19-on-nhs-healthcare-staff/

Zhang, Nonvignon and Mao, 2020. How well is Ghana—with one of the best testing capacities in Africa—responding to COVID-19? Brookings. Accessed from: https://www.brookings.edu/blog/future-development/2020/07/28/how-well-is-ghana-with-one-of-the-best-testing-capacities-in-africa-responding-to-COVID-19/