

RECOVERY OF SURGICAL SERVICES IN THE POST-PANDEMIC ERA

SURGERY 2020-2025





..... *Talent wins games, but teamwork and intelligence win championships*

– *Michael Jordan*



EXECUTIVE SUMMARY



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Surgery is an essential part of all health systems. With one in four people undergoing an operation in their lifetime, surgery remains the mainstay of cure for most cancers and it underpins the treatment of virtually all non-communicable diseases. Even before the COVID-19 pandemic, 5 billion people lacked access to surgical care and 143 million more operations per year were required globally. There was already a major global inequity in access to safe and affordable surgery across low and middle-income countries, with an urgent need to expand capacity.

This pandemic has acutely worsened that situation and placed a spotlight on the need for change in how surgery is delivered. During COVID-19 peaks, at least 28 million elective operations have been postponed around the world, with the backlog further increasing during recovery. Whilst the immediate safety of surgery needs to be ensured, capacity needs to expand and a new post-pandemic surgical horizon needs to be established. In response to the COVID-19 pandemic, the COVIDSurg international research collaborative of 120 countries was launched in March 2020. This collaborative has provided data needed to support this change in the fastest time frame ever seen by a surgical research group, with >30,000 patients' data collected in 3 months.

High impact publications in major journals, with wide mainstream media coverage, signalled the importance and quality of the data collected.

This report aims to deliver 3 key aims:

1. To summarise the published COVIDSurg data as a guide to future safe surgical practice
2. To guide effective surgical recovery plans
3. To provide a 5-year vision of safe and effective surgery that addresses global challenges

This report is aimed at a range of key stakeholders who are needed for post-pandemic surgical planning, including providers, healthcare leaders, patients, governments, financiers, and industry. It is meant to be globally applicable and address global challenges, with the ability to be locally adaptable in both low and high resource settings. The contents are meant to support individual hospitals, regions, and countries during a major global reorganisation of surgical services whilst entering the post-pandemic phase.

Cite this report as: COVIDSurg Collaborative. Recovery of surgical services in the post-pandemic era: Surgery 2020-2025. Version 1.1

5 KEY MESSAGES

- 01 • During the first COVID-19 peaks, more than 28 million operations have been cancelled worldwide due to COVID-19. New cases being added during the pandemic recovery will further increase the backlog.
- 02 • Increased surgical capacity is urgently needed. No one solution fits all, but priorities include networked local hospitals, with independent and mobile providers. Ambulatory surgery should be promoted as much as possible.
- 03 • Provision of elective surgery will include setup of COVID-19 free surgical units. These will include separate hospitals but also COVID-19 'cold' surgical pathways within major hospitals.
- 04 • 'Digital surgery' will become central to providing surgery around the world, in both low and high resource settings. This will include digitalising the whole patient pathway, procedure selection, complication recognition, communication, training and efficiency.
- 05 • High value surgery will become the cornerstone of post-pandemic surgery 2020-2025, in terms of procedure selection, use of technology, minimising complications, and maximising throughput.

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DATA

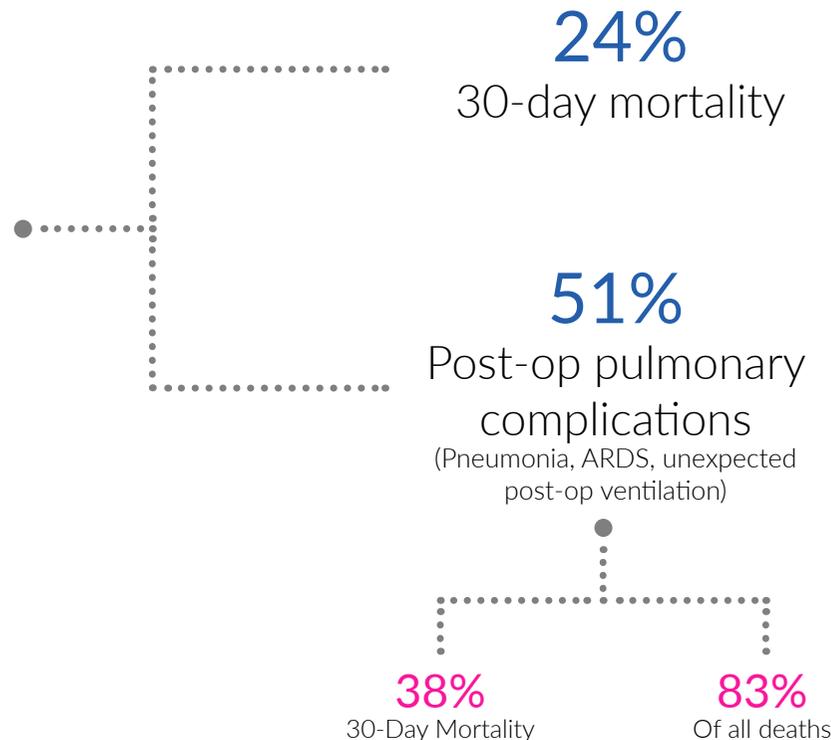


COVID-19 RISK IN PATIENTS UNDERGOING SURGERY

The COVIDSurg cohort study assessed 30-day outcomes of surgery in patients who had a perioperative SARS-CoV-2 diagnosis.



Data from **1128 patients** undergoing surgery who were diagnosed with perioperative SARS-CoV-2 infection



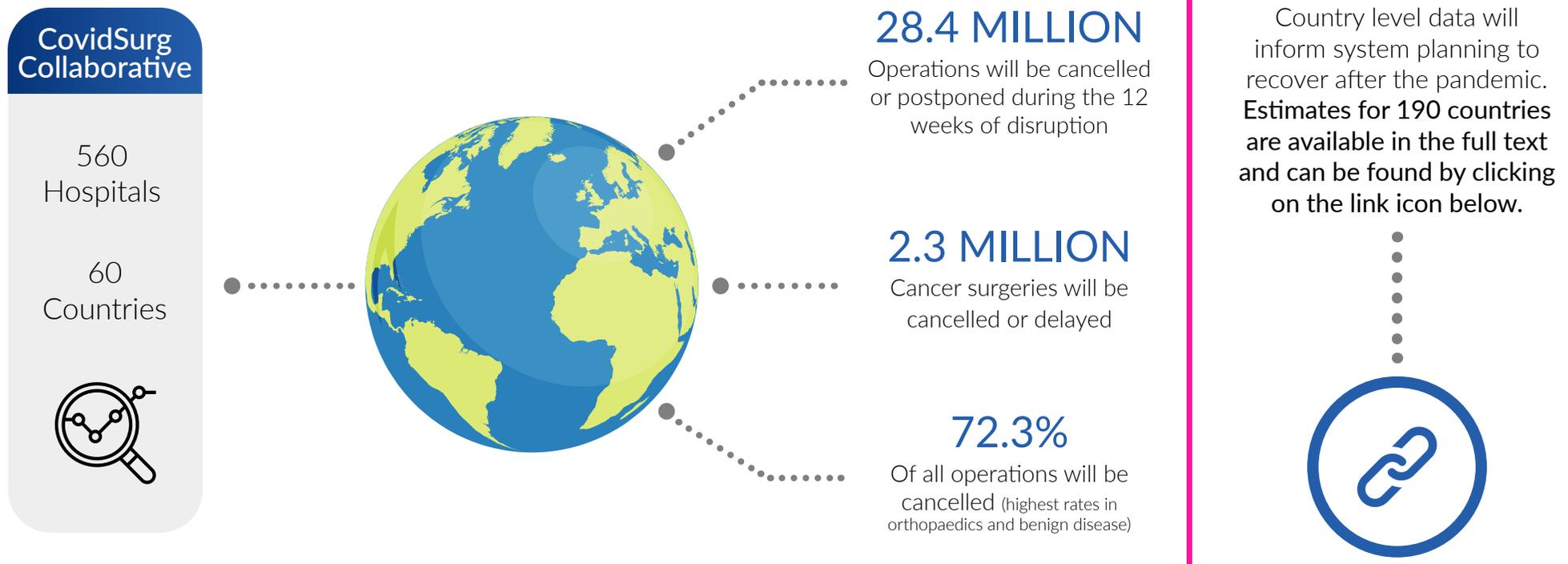
RISK FACTORS FOR MORTALITY

- Male Sex
- Sex \geq 70
- ASA Grade III-V
- Cancer Diagnosis
- Emergency Surgery
- Major Surgery

IMPACT | Mortality among surgical patients who are diagnosed with perioperative SARS-CoV-2 infection is far higher than similar patients in the pre-pandemic era, meaning that surgery during the pandemic should be avoided whenever possible. Risk stratification and risk management will become central to precision surgery, allowing identification of very low risk patients in whom surgery can continue during future COVID-19 outbreaks, and to identify those who will benefit from non-operative strategies.

EFFECT OF COVID-19 ON ELECTIVE SURGERY 1

The following infographic presents the highlights of a predictive model that estimated the total number of cancelled elective operations due to COVID-19 outbreaks of 12 weeks' duration. It was published in the British Journal of Surgery and attained global media coverage.

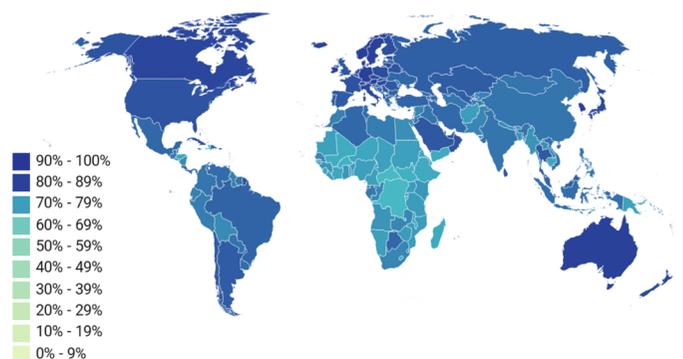


IMPACT | COVID-19 is an unprecedented global crisis that forced surgical services to cancel high numbers of elective operations. This study predicted the time and additional surgical activity needed to clear the backlog created by the first waves of COVID-19.

EFFECT OF COVID-19 ON ELECTIVE SURGERY 2

This table shows the volume of cancelled surgery over 12 week COVID-19 peaks around the world, highlighting the top 3 cancelled specialties per region.

	Europe and Central Asia	East Asia and Pacific	Latin America and the Caribbean	North America	Middle East and North Africa	South Asia	Sub-Saharan Africa	Total
Colorectal	370,947	429,080	289,478	66,360	216,938	51,498	39,253	1,463,554
Gynaecology	615,432	726,822	438,252	109,110	413,412	108,772	92,479	2,504,279
Head & neck	1,273,813	1,145,636	1,040,920	161,277	599,701	56,571	46,237	4,324,155
Obstetrics	118,086	93,227	108,147	25,184	25,855	35,266	35,846	441,611
Orthopaedics	1,552,527	2,026,572	1,040,757	244,121	1,196,372	144,637	90,054	6,295,040
Plastics	177,608	344,224	113,308	48,738	173,955	48,222	36,341	942,396
Upper gastrointestinal and hepatobiliary	782,347	747,601	668,231	113,529	335,765	46,355	28,253	2,722,081
Urology	758,344	889,675	561,714	120,947	484,983	73,061	62,031	2,950,755
Other surgery	1,776,126	2,027,511	1,361,682	274,363	1,071,638	159,448	89,964	6,760,732
Total	7,425,231	8,430,348	5,622,488	1,163,629	4,518,618	723,829	520,459	28,404,603

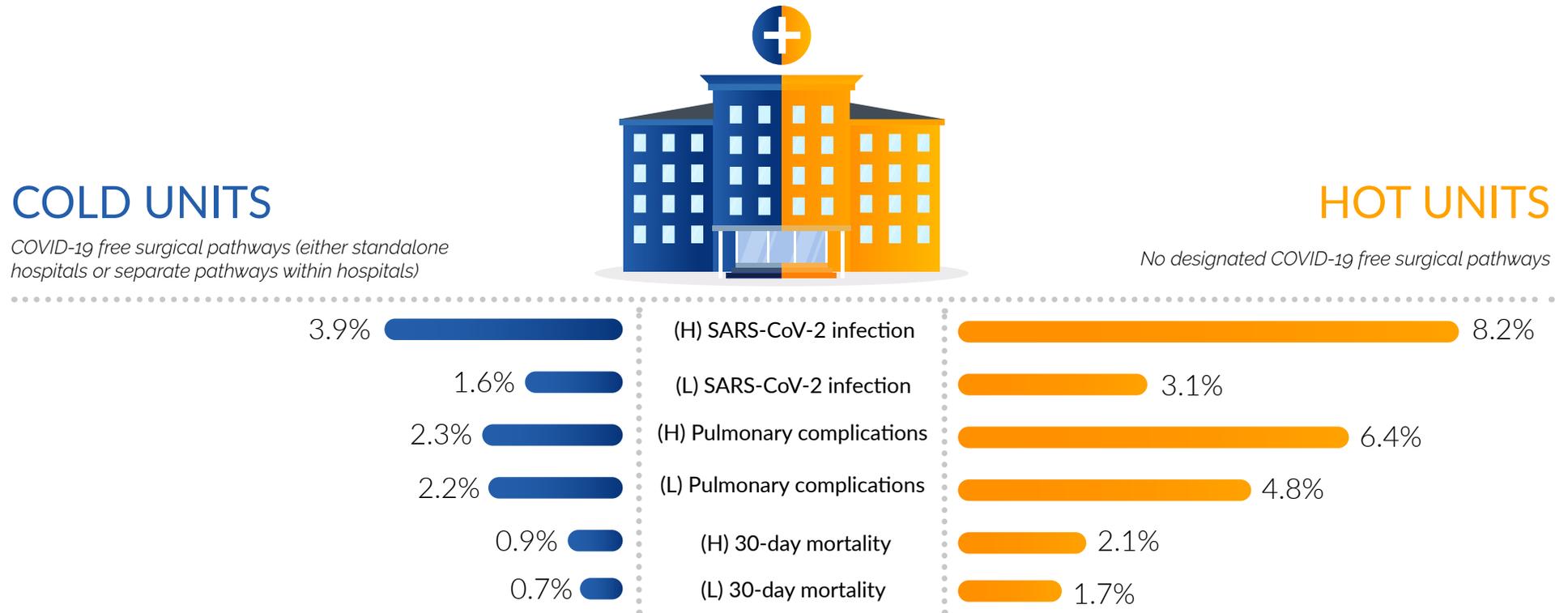


IMPACT

- 90% of cancelled surgery due to COVID-19 was benign surgery, mostly orthopaedics
- Waiting lists will expand further, as new cases are added during recovery phases
- Elective surgery capacity is likely to remain lower than before the pandemic, due to precautions and preparations for second waves. Context specific management will be needed to mitigate consequences for patients.

COVID-19 HOT AND COLD SURGICAL UNITS

The COVIDSurg Cancer study assessed 30-day post-operative COVID-19 infection rate among patients planned for curative cancer surgery. It quantified the rates of post-operative pulmonary complications and mortality in 'hot' versus 'cold' surgical units.'



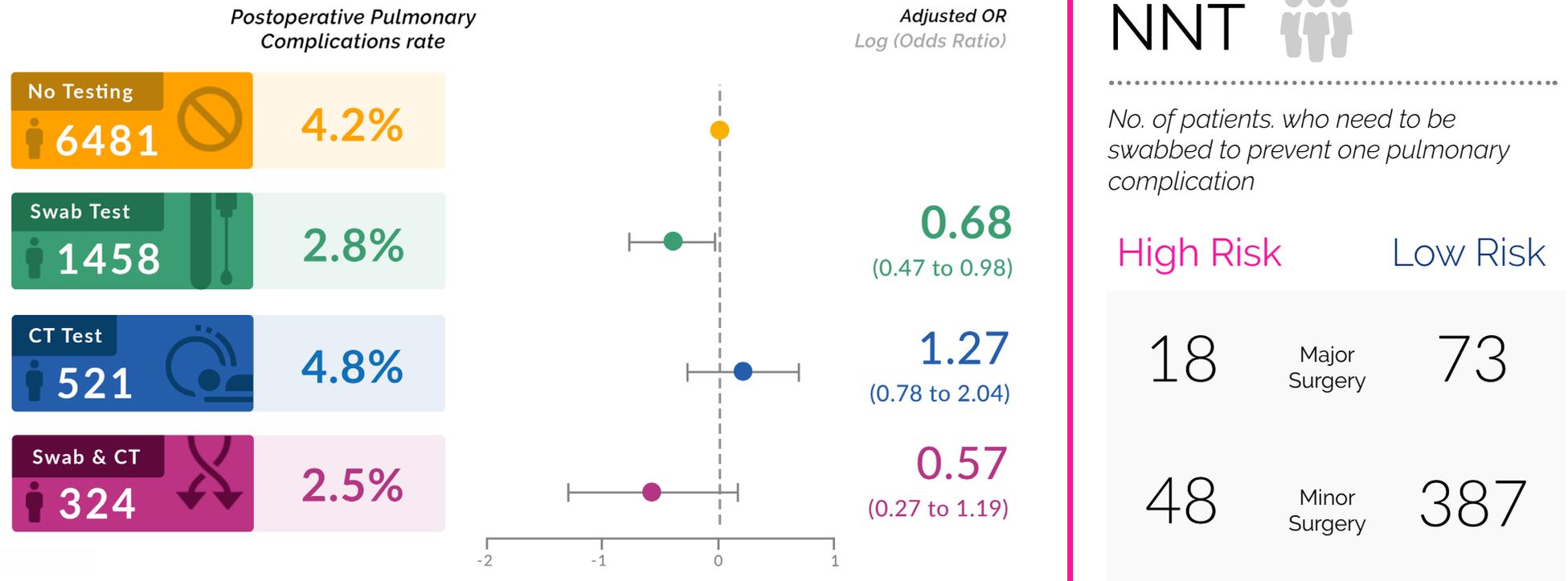
(H) = High community SARS-CoV-2 incidence area | (L) = Low community SARS-CoV-2 incidence area

IMPACT:

- During SARS-CoV-2 outbreaks, outcomes were better in cold units.
- The benefit of cold surgical units was greatest where populations SARS-CoV-2 rates were high
- There is a selection bias, with higher risk patients undergoing surgery in hot units. However this effect was seen despite adjustment for patient, disease, and operation factors in multi-variable models.
- During COVID-19 outbreaks, elective cancer surgery appears safer in cold surgical units. The setup of these units is discussed in this report.

ROUTINE PREOPERATIVE SARS-COV-2 TESTING

The COVIDSurg Cancer study also explored the impact of routinely testing asymptomatic patients before elective surgery using one or more nasopharyngeal swab tests, and/or a CT scan of the thorax.

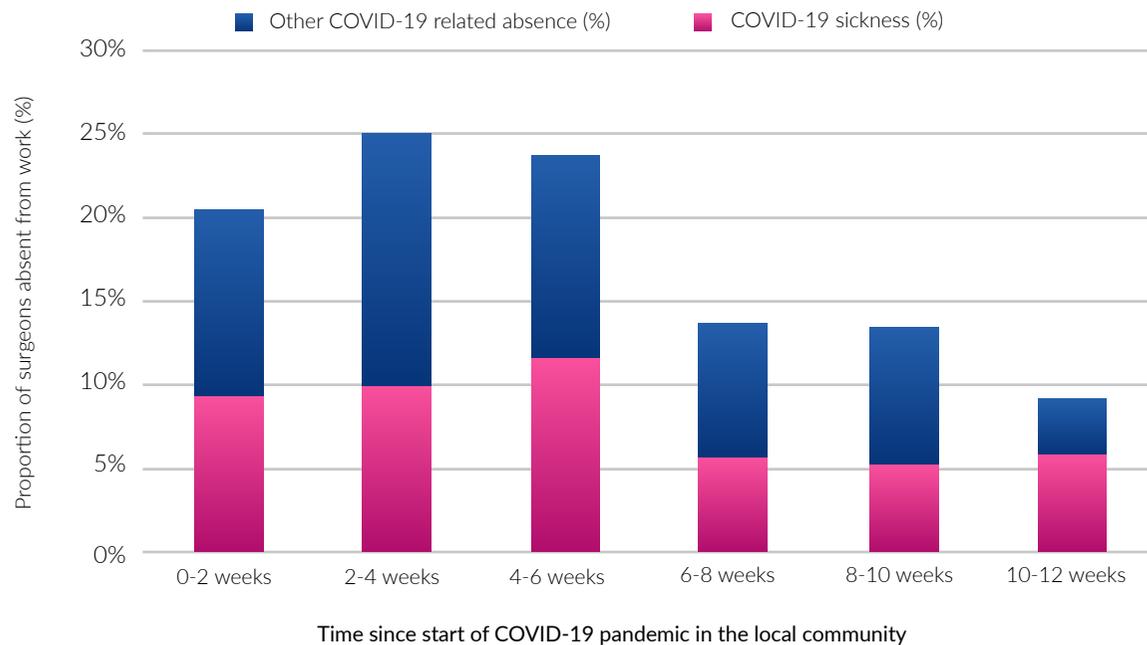


IMPACT:

- A single negative preoperative swab test was linked to a reduced risk of postoperative pulmonary complications
- Surgeons identified asymptomatic SARS-CoV-2 infected patients and postponed their surgery, avoiding potential harm.
- There was no benefit to the addition of a preoperative CT thorax, or with repeat swab testing
- Swab testing should be routinely implemented for all patients undergoing major surgery or surgery in a high SARS-CoV-2 risk area.
- The rate of pulmonary complications after minor operations in low risk areas was very low. Routine testing is unlikely to be of benefit for this group.

COVID-19 SURGICAL WORKFORCE PLANNING

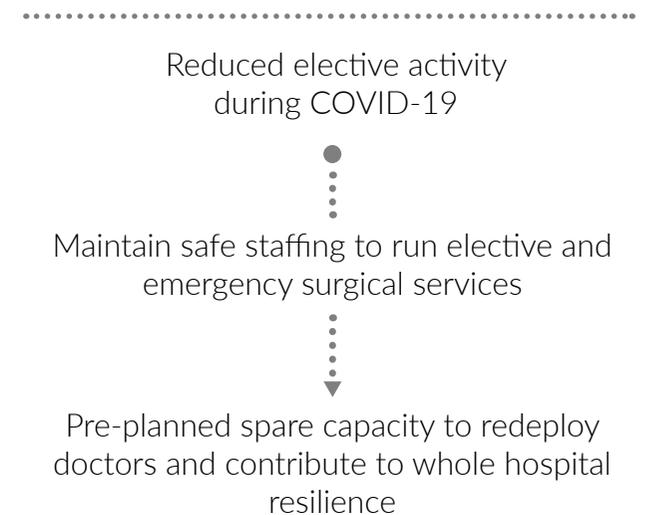
Whilst many hospitals are recovering from initial COVID-19 staff absences, workforce planning strategies are urgently needed to prepare surgical services for the future.



After taking absence rates into account **surgical teams can maintain 75% of their usual elective activity** in pandemic conditions.

Predicted absence rate of surgical doctors:

20-25% Week 1-6 10-15% Week 7-12



IMPACT | Workforce capacity and the risks to elective patients should guide elective work planning in future surges. This is to prepare both for future COVID-19 surges and provide safe staffing to continue elective surgery as COVID-19 rates fluctuate.

5 KEY MESSAGES: DATA FROM THE COVIDSurg STUDIES

1



During the first COVID-19 peaks, more than 28 million operations have been cancelled worldwide.

2



Hospitals will need at least 12 months to clear the backlog resulting from delayed and postponed operations, although reduced capacity and new cases mean that it could take significantly longer.

3



COVID-19 around the time of surgery is associated with an aggressive phenotype that has a high mortality. Patients need careful selection for surgery and protection from the virus.

4



Outcomes from COVID-19 cold surgical units are better than those from hot surgical units. Cold elective surgical pathways are needed on a global scale.

5

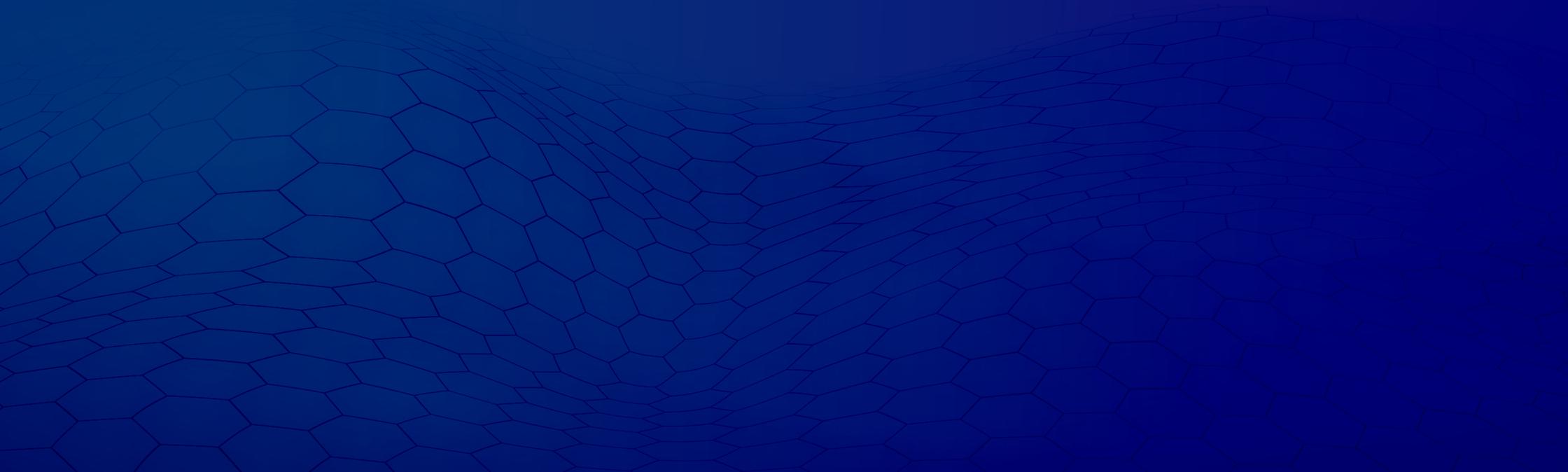


Proactive and flexible workforce planning will enable staffing of emergency and elective, hot and cold surgical units. This will be central to recovery.

5 research questions for the next phase:

- Does pre-operative drug prophylaxis of post-operative COVID-19 work?
- Can machine learning identify the risk factors for a poor post-operative outcome during future COVID-19 peaks?
- What is the optimum waiting period before operating on someone with a previous SARS-CoV-2 infection or COVID-19?
- Should laparoscopic surgery continue during future peaks?
- How can hospitals be reorganised to protect surgical patients from COVID-19?

RESILIENCE



COVID-19 PATHWAYS IN SURGICAL PATIENTS

Understanding how patients undergoing surgery are affected by COVID-19 is central to setting up safe surgical services. This figure shows the different pathways by which an individual patient undergoing surgery can be affected by COVID-19.

KEY

No Infection

SARS-CoV-2 infection

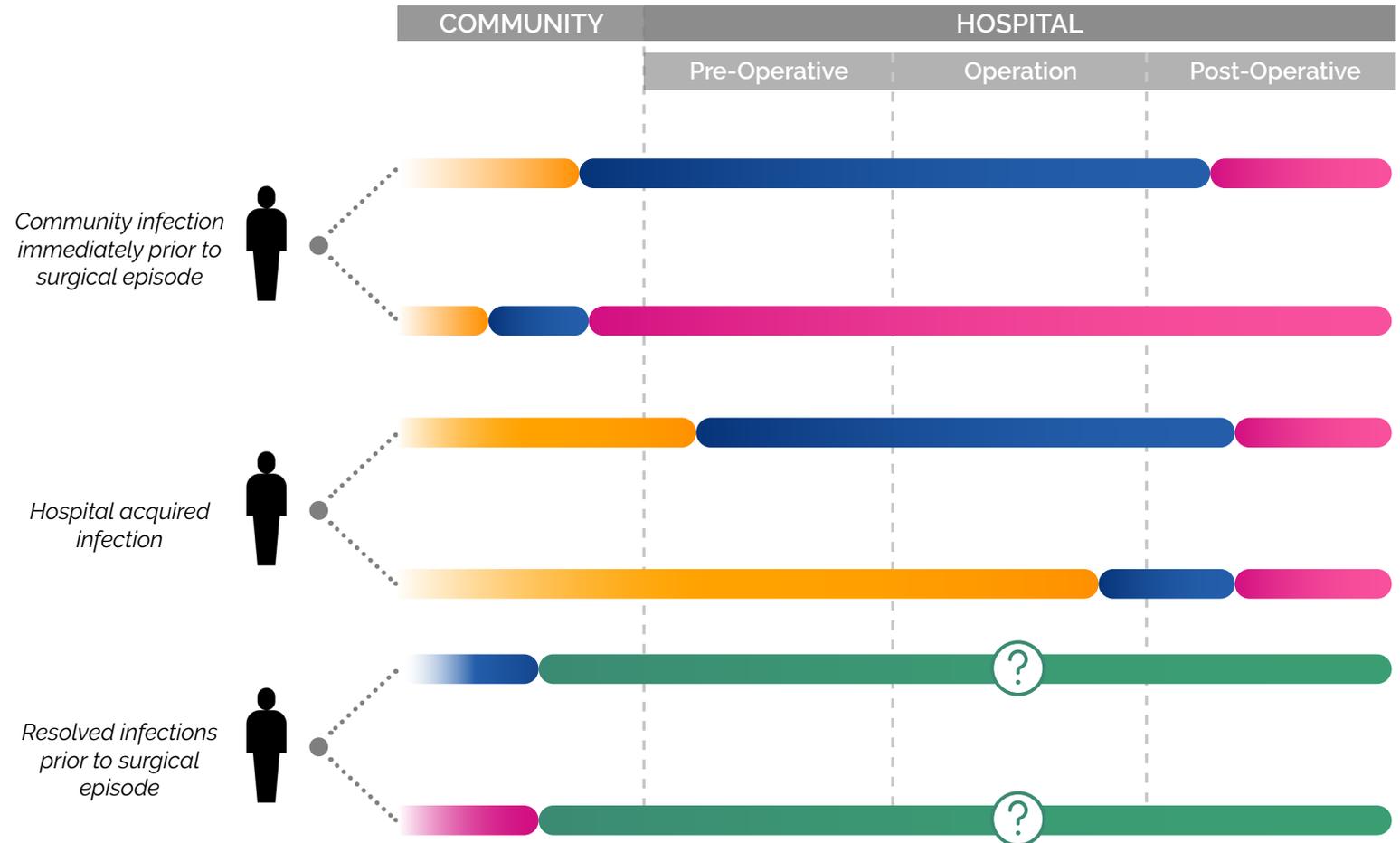
Asymptomatic / presymptomatic state (before symptoms start). Not everyone with a SARS-CoV-2 infection develops symptoms.

Symptomatic COVID-19

Including pulmonary complications: pneumonia, acute respiratory distress syndrome (ARDS), unexpected ventilation. Symptoms can develop at one of several time points. It is currently unknown if it can develop again.

Previous infection

The effects of operating on a patient who now has no respiratory symptoms but did have previous SARS-CoV-2 infection or COVID-19 are currently unknown.



IMPACT | Post-pandemic reorganisation of surgical services must protect patients from in-hospital exposure to COVID-19.

RE-STARTING SURGERY: PRIORITY DECISION MATRIX

This matrix guides surgeons and providers to prioritise individual patients and procedures, focussing on those that will bring the most benefit. Prioritisation is a constant process, that can then be used to triage patients into available capacity, especially during and immediately after COVID-19 surges. This guidance should be adapted locally and with increasing detail; this matrix provides an overview.

	PATIENT BENEFIT	PROCEDURES
HIGH PRIORITY	Significant survival benefit	Emergency surgery
	Low morbidity and mortality	Elective cancer surgery
	Early return to work	Life changing benign inpatient surgery
MEDIUM PRIORITY	Not life saving or prolonging	Life improving benign inpatient surgery
	Early to medium return to work	Day case surgery
	Some morbidity and mortality	Major complex cancer surgery
LOW PRIORITY	No survival benefit	Very high risk surgery
	No effect on return to work	Unproven technologies and techniques
	High morbidity and mortality risk	Low value surgery

Elective benign inpatient surgery

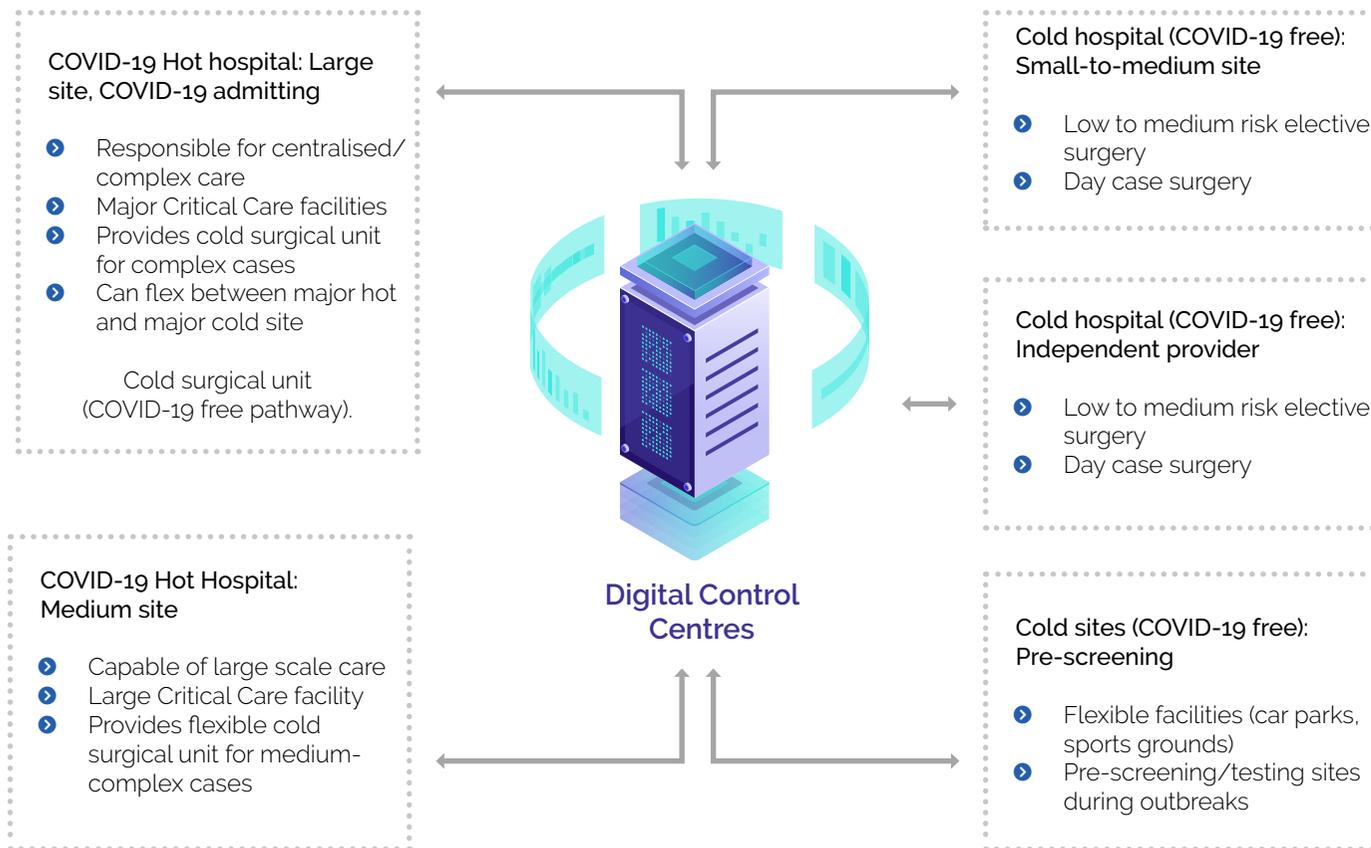
This represents the major burden on cancelled surgery (90%). Unless high value benign surgery is prioritised, there will be a decline in population health. Due to competition for space with elective cancer surgery, dedicated capacity will be needed.

IMPACT | Post-pandemic surgery will:

- Focus on safety in the post COVID-19 pandemic era
- Re-prioritise high and low value surgery, including benign and ambulatory surgery
- Expand capacity, including flexible teams and locations
- Secure COVID-19 free surgical pathways

CREATING SURGICAL RESILIENCE: NETWORKED HOSPITALS

Surgeons and providers will need to deliver COVID-19 free surgical pathways over the next 24 months. No one solutions fits all. These principles can be adapted to local context and resources, applying to major multi-network systems and also resource limited rural networks. This schema lays out an example of a networked surgical system.



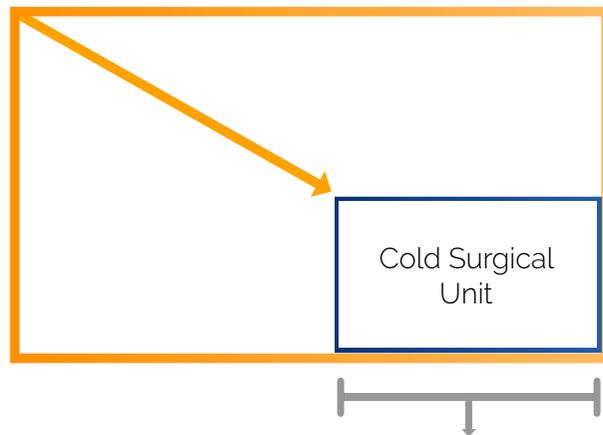
CHALLENGES:

- Digital platforms to centralise test requests, imaging, operating lists, patient results, patient communication and clinical coding. Platforms will need to be accessible from any site in the network.
- A major restraint of cold units will be the ability to provide a regular workforce that can support surgical services in both the hot and cold sites. For example, this includes nursing staff, anaesthetic staff, and porters
- Efficient pathways to transfer elective patients between sites for complication rescue when emergency surgical and medical care will be needed.

CREATING SURGICAL RESILIENCE: COVID-19 COLD SURGICAL UNITS

Some hospitals will have to set up cold surgical units within their existing physical boundaries. These may be hospitals that are geographically isolated and unable to network, or major hospitals that provide complex surgical services but also critical care facilities for COVID-19 outbreaks. Both of these sites will have to provide responsive surgical services that can flex in capacity based on COVID-19 surges, and other capacity issues (e.g. winter pressures). This schema outlines an example flexible model.

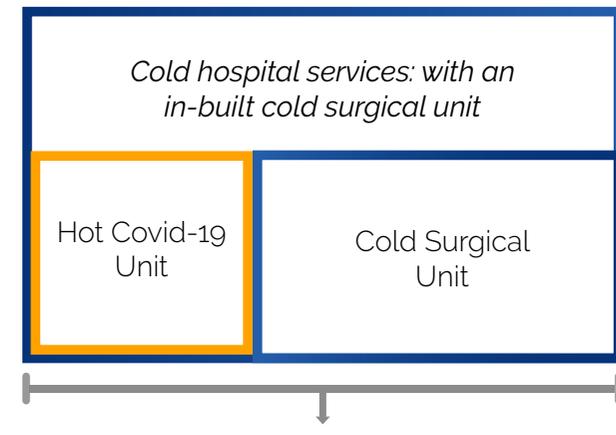
HOT HOSPITAL



Cold Surgical Units should consider providing, where resources allow, COVID-19 free:

- Pre-admission testing (including CT scans)
- In-hospital transfer routes
- Post-operative emergency care pathways
- Critical Care
- Agile SARS-CoV-2 free workforce (e.g. regular testing and rotation)

COLD HOSPITAL



Hospital plans should be designed to rapidly flex to need (including future COVID-19 outbreaks), to maintain essential elective surgical capability.

Agile hospitals need to develop surgical resilience plans.

IMPACT | No two surgical units are the same. Setting up safe surgical services with cold units needs to be done with front-line leaders in local settings, taking into account resources available in higher and lower income areas.

SURGICAL RESILIENCE MATRIX

During the resilience phase, surgical teams need to be able to flex to COVID-19 surges. Sudden increases in admissions will put pressure on critical care beds, theatre space, and supply chains. Creation of capacity and systems that can adapt to surges will allow elective surgical activity to continue as safely and efficiently as possible. This matrix presents the key features that will allow surgical units to continue elective surgery despite external pressures.

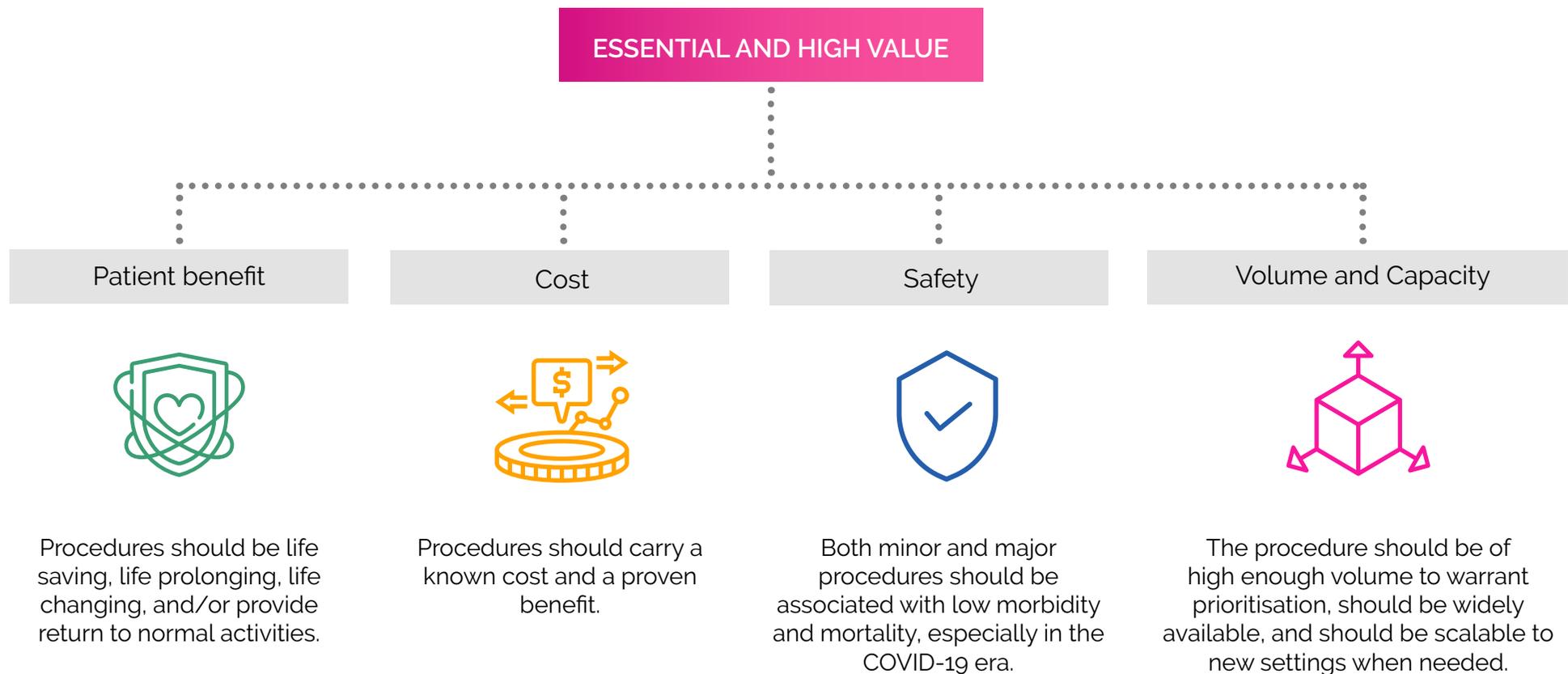
	Capacity	Critical care	Workforce and supply chain		Surgery response to surges	Impact
REACTIVE	<ul style="list-style-type: none"> COVID-19 mixed theatre and ward environments Case load not prioritised No plans for COVID-19 cold areas 	<ul style="list-style-type: none"> Surges fill critical care Elective services stopped when critical care full 	<ul style="list-style-type: none"> Redeployment unavailable and unplanned Intermittent PPE supply chain 	→	Stop all elective surgery	<ul style="list-style-type: none"> Worsening cancer and non-cancer waiting lists Major impact on population health
RESPONSIVE	<ul style="list-style-type: none"> Prioritised case load Some capacity for COVID-19 cold areas 	<ul style="list-style-type: none"> Critical care can be expanded under pressure High risk operating stopped 	<ul style="list-style-type: none"> Redeployment available but not planned Adequate PPE supply chain 	→	Continue low risk cancer surgery	<ul style="list-style-type: none"> Benign waiting lists increase Major impact on population health for non-cancer disease
AGILE	<ul style="list-style-type: none"> Flexible cold surgical units can continue during surges Isolated COVID-19 cold surgical units available Fully prioritised case load 	<ul style="list-style-type: none"> Step-wise plan to expand critical care to need Ability to maintain COVID-19 free critical care unless in extreme conditions 	<ul style="list-style-type: none"> Proactive redeployment plan based on elective activity scenarios Plans for testing and isolation Resilient PPE supply chain Staffing plans to cover hot and cold pathways 	→	<ul style="list-style-type: none"> Continue low to medium risk, high priority surgery (cancer and non-cancer) in COVID-19 free environment Continue day case procedures in COVID-19 free environments 	<ul style="list-style-type: none"> Lower impact on waiting lists Minimise impact on population health

VALUE



HIGH VALUE SURGERY

The post-pandemic phase gives surgical stakeholders the chance to re-define essential surgery. Rather than list procedures (the importance of which will vary depending on local context), the guiding principles can be considered and locally applied. Different global areas will have different needs, based on population health and resources available. Each provider – either by national, regional, or local guidance – should tailor procedures offered by priority and value.



REDUCING LOW VALUE SURGERY

Reducing surgical procedures that have no proven patient benefits will save valuable resources and release much needed capacity. Reducing them is a complex process that requires multi-stakeholder agreement.

Also known as procedures of *limited clinical value*, low value surgery includes procedures that:

- Have no proven clinical benefit
- Provide benefit, but only in the right circumstances
- The high costs outweigh the low patient benefits



Examples include:

- Asymptomatic groin hernia repair
- Early and non-recurrent haemorrhoids
- Lump removal for cosmetic benefit
- Unselected hip replacement
- Cataract surgery with minimal symptoms
- Surgery for lower back pain

IMPACT: Limiting low value surgery will save significant resources for patients and providers, especially during a major post-pandemic recession.

IMPACT EXAMPLES FROM THE NHS

Stopping 5 high volume, high cost general surgical procedures would save:

£153 Million
per year

Decommissioning a wider range of pre-defined low value procedures could save:

£0.3-0.5 Billion
per year
(Across England)

IMPACT PLANNING

Providers should plan to limit low value surgery. This should either be at a central level (e.g. NHS), or at provider level. This is a global issues, across all income settings and provider types.



Central Level



Provider Level

AMBULATORY SURGERY: BETTER VALUE

In the UK (1998-2014), increased day surgery rates generated savings of around £2 billion and enabled 1.3 million more elective patients to be treated. The post-pandemic phase gives surgeons and providers a unique opportunity to better establish day-case pathways, across both high and low resource settings. Ambulatory care ideally needs dedicated, cross-speciality capacity to ensure that it is appropriately prioritised and does not compete against emergency and/or inpatient cancer surgery.

Prioritising high value surgery

There is global potential to expand ambulatory surgery. This in turn will allow more elective inpatient (major) surgery to be performed. Minimally invasive operation's to replace surgery, should be considered to further reduce risks and hospital visits.

Reducing overnight stays

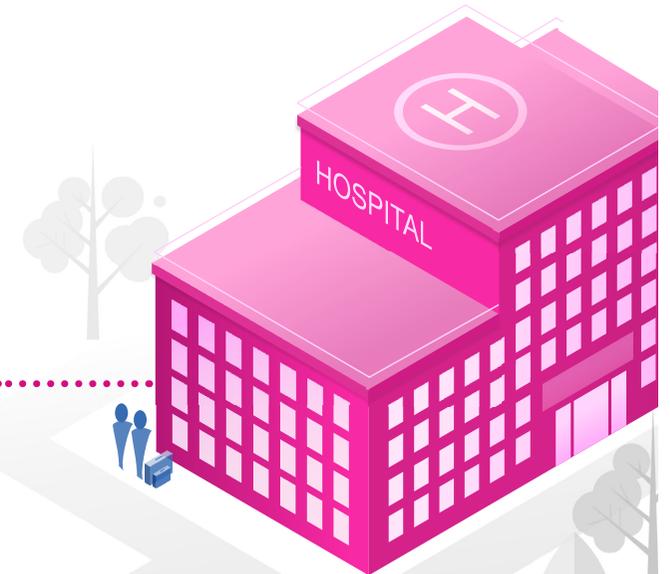
Fewer overnight stays reduces healthcare costs, reduces exposure to SARS-CoV-2 and improves overall patient satisfaction.

Using flexible locations

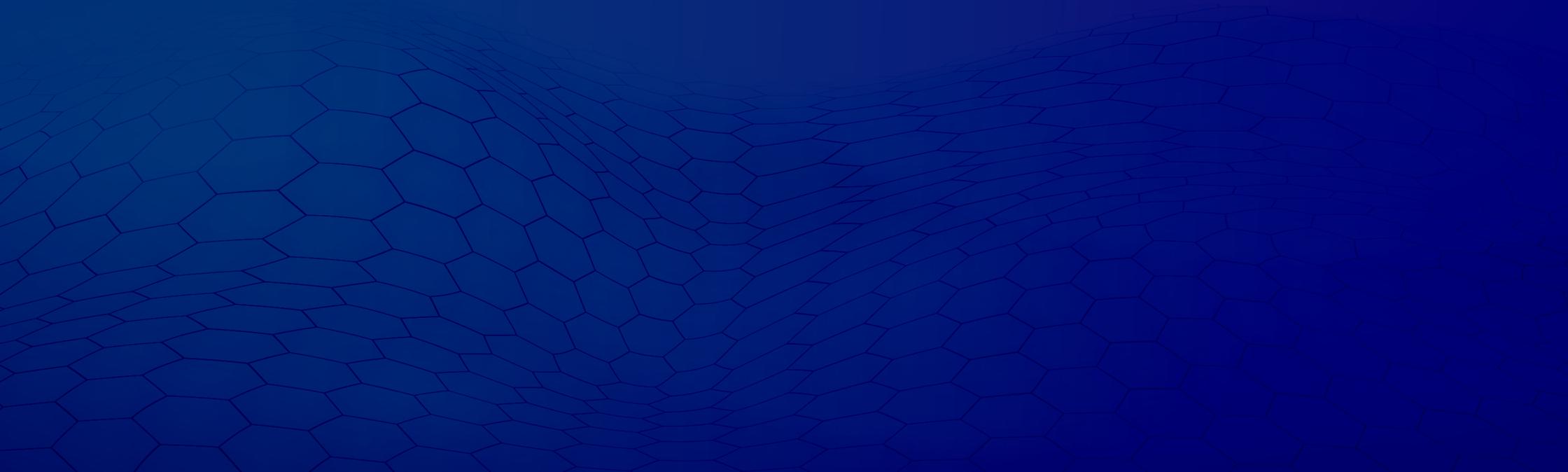
Ambulatory care can be provided in cities affected by COVID-19, by utilising novel areas that include alternative providers, day-case units and mobile operating theatres. This will also reduce competition for elective surgery resources.

2018/2019 NHS daycase rates:

➤ Laparoscopic cholecystectomy:	59.8%
➤ Unilateral, primary inguinal hernia repair:	79.0%
➤ Tonsillectomy:	62.5%
➤ Cataract surgery:	98.9%



PARTNERSHIPS



PATIENTS: SHARING KNOWLEDGE AND WORKING TOGETHER

In large-scale health service changes, patient and public involvement should be enlisted at the earliest opportunity to create shared understanding as services evolve. Early participation promotes trust and reduces cynicism around changes.

Patients shaping the agenda

The COVIDSurg group convened a Patient Advisory Group who identified key concerns of surgical patients during the pandemic:



Digitalisation of patient care

Digital innovation will be central to the patient experience. It will prevent unnecessary trips to hospital by providing:

- ▶ Integrated digital medical records with remote access
- ▶ Digital pre-operative assessment at home
- ▶ Digital patient information, including videos
- ▶ Digital consent
- ▶ Digital follow-up



Proactivity enhances patient confidence

Provision of accessible digital resources will rapidly increase. The COVIDSurg group's patient information booklets, about having an operation during the pandemic, are freely accessible online.



IMPACT | Patient groups should be convened at the earliest opportunity by decision makers in surgical service planning. Attempts should be made to represent all key groups. Invited participation improves acceptability of large-scale changes.

GOVERNMENTS

Governments will take responsibility for short and longer term strategic change, making bespoke country level plans. These plans will address both surgical resilience and longer term surgical sustainability.

Capacity

Governments will make strategic decisions around expanding capacity, across the public sector and also interactions at the public-private interface.

Universal Health Coverage

32.8 Million people are plunged into catastrophic expenditure due to out-of-pocket payments for surgery.



Affordable surgery is a core pillar of Universal Health Coverage, with different models globally. Whichever model is chosen, even with part payments by patients, catastrophic expenditure should be prevented.



Prioritisation

The strategic selection of priority surgical services for surgery 2020-2025 should be evidence based and involve government stakeholders.

Financial planning

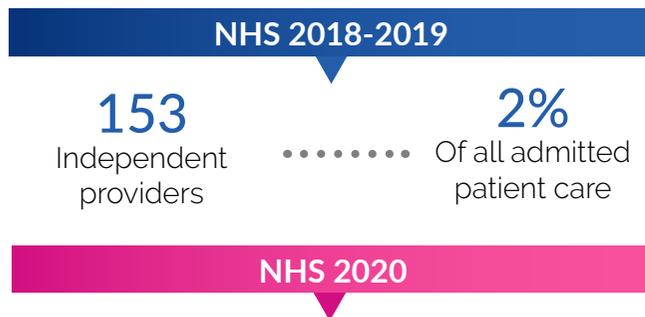
Investment in surgery pays dividends for population health, returning people to normal life in short timeframes and reducing dependency on other health services.



Maximum effectiveness comes from surgery with low complication rates, so governments should have a focus on safety. Surgery can only be sustainable with sound financial planning that supports both emergency and elective care.

EXPANDING CAPACITY: PUBLIC PRIVATE PARTNERSHIPS

Part of expanding capacity at a global level will involve building sustainable collaborations with independent providers. These need to provide value for money to taxpayers, creating sustainable public-private partnerships (PPPs).



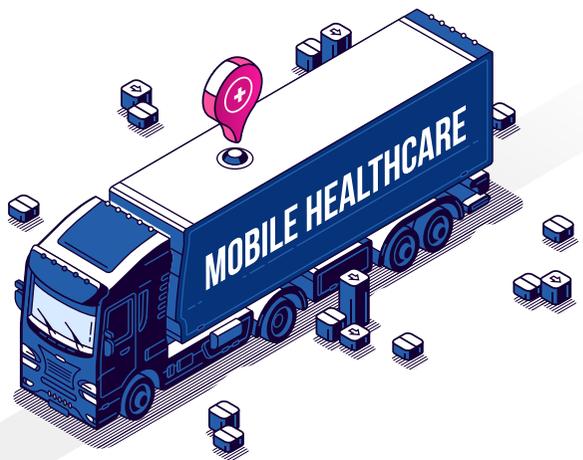
The NHS acts as an example of how to expand capacity. During COVID-19 the NHS secured all available inpatient capacity from independent providers across England, for a minimum 14 weeks period. These were delivered at a regional level and coordinated with local NHS providers, being financed through central NHS.

The role of the private sector is discussed more here:



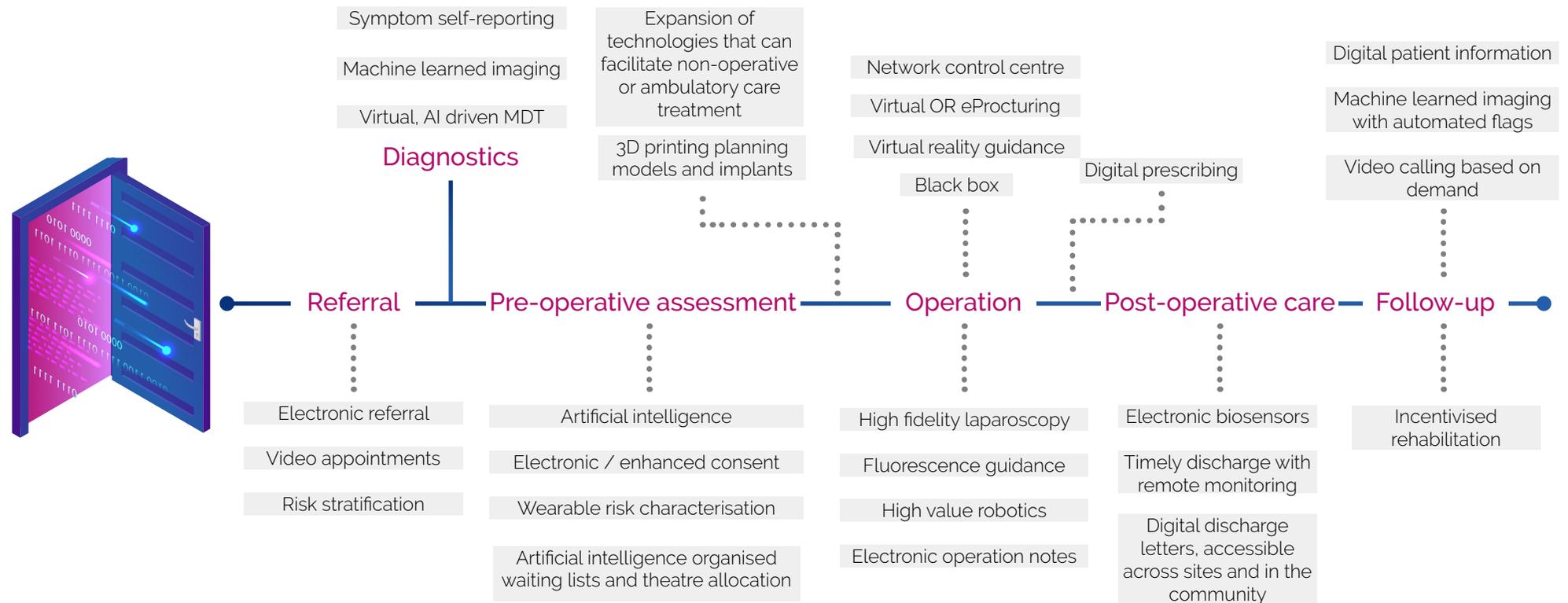
IMPACT: Going forward, public-private partners in healthcare will be globally important in order to expand public sector capacity. They will have an increasing role in delivering:

- ▶ Low, medium, and selected high risk elective inpatient surgery for both benign and malignant conditions.
- ▶ Day case (ambulatory)
- ▶ Mobile operating theatres (e.g. Vanguard Healthcare) will add capacity for day case and/or low risk surgery across a range of flexible sites.



COVID-19 DIGITAL ACCELERATION IN SURGERY

During the initial phases of the COVID-19 outbreaks, there has already been an acceleration of digital pathways in surgery, which will continue to heavily influence surgery 2020-2025. This figure demonstrates the accelerating digitalised patient pathway flow.



IMPACT | COVID-19 has accelerated digital innovation, initially focussed on the urgent need for digital communication with patients and between surgeons. In order to keep well patients separated from hospitals except for key components of their journey (e.g. major surgery), digital innovation will play an increasingly important role.

INDUSTRY COLLABORATION

Industry collaboration will be crucial for surgery 2020-2025. It will support multi-site working, flexible workforce models, COVID-19/winter surges, and economic uncertainty. However industry needs to be prepared for major changes in surgical delivery.

Procedure selection

Post-pandemic procedure selection is likely to change to focus on high value. This will give priority to proven, beneficial surgical procedures.

Diagnostics

Ensuring sufficient capacity, especially during pandemic recovery. Acceleration of digital diagnostics (artificial intelligence, deep learning, robotics).

Procedure volume

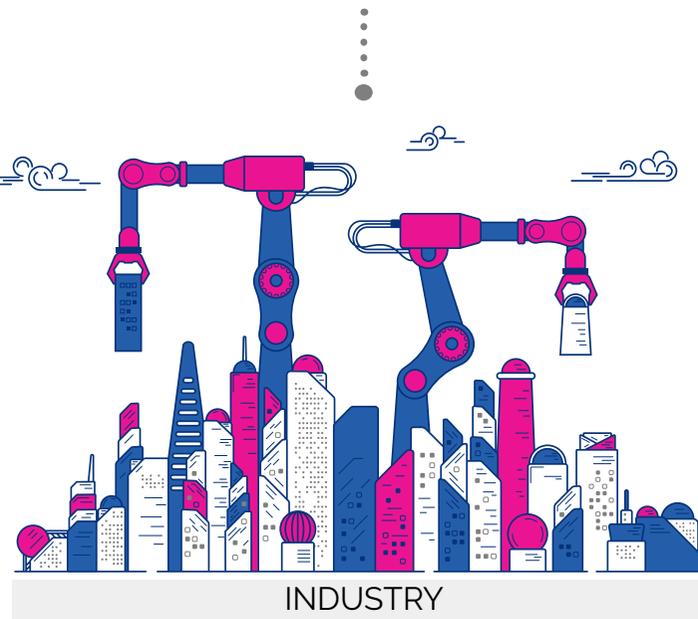
Waiting lists are likely to increase, with an early focus on cancer surgery. Major complex benign surgery may reduce in volume until capacity to prioritise it is achieved.

Digital innovation

Digital surgery has accelerated due to COVID-19, and is likely to continue. There should be major investment in this area.

Supply chains

Flexible, regional, and predictive, working across networks (central procurement) for fixed prices and supplies. Each elective list may achieve less in total due to COVID-19 precautions, but extended lists across networked sites will expand capacity. Planning time before operations (and thus predictability) is likely to reduce.



Devices, technology, and robotics

Novel devices and technologies should be supported by safety and cost data whilst entering the marketplace. Pre-pandemic, robotic surgery was an emerging field. There will likely be changes to its provision in terms of locations, although it is still likely to take a strong market hold over the 5-10 year window.

SUMMARY

MEDIA COVERAGE

COVIDSurg's research has gained worldwide media attention, showing that provision of safe surgery in the post-pandemic era is an area of public interest.

82 News outlets | 2861 Tweets



Medscape

The Economist

LATERCERA

Forbes



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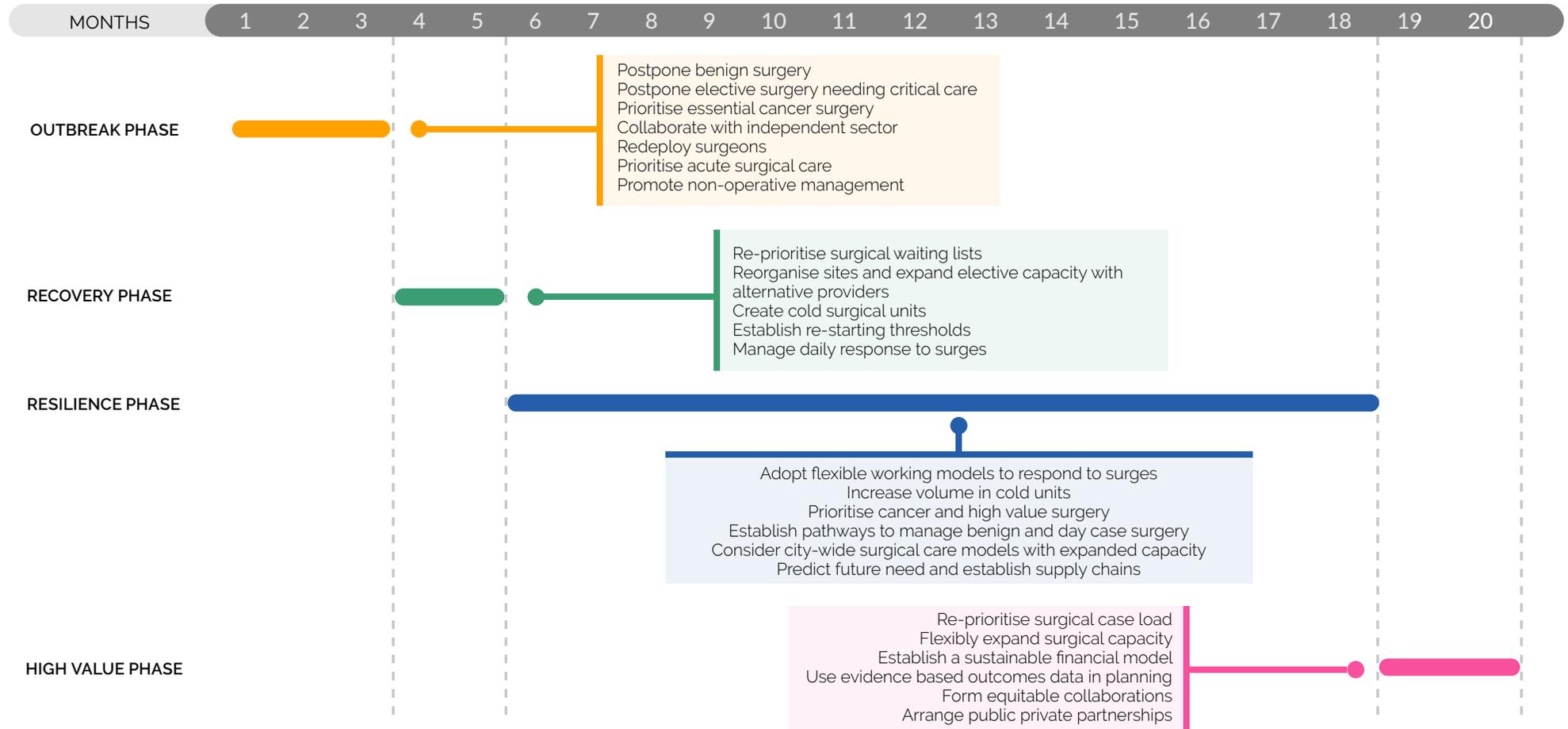


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ROADMAP: SURGERY 2020-2025

This roadmap summarises the key phases for recovery of surgery in the post-pandemic era. It maps out the proactive approach that all stakeholders need to take, to ensure patient safety and deliver a robust set of surgical services.



IMPACT | The post-pandemic phase provides a unique chance for the global reorganisation of surgical services. This includes a focus on safety, expanded capacity, digitalisation, and procedure selection.

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