Health <Transformation> Lab

RMIT UNIVERSITY

CISCO

Dynamic Health Capacity

Towards adaptable health systems in times of crisis

HEALTHCARE + TECHNOLOGY + CYBERNETICS

6 August 2020

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Introduction and roadmap

> Intelligence is the ability of a system to adjust appropriately to a changing world.
>
> - Christopher Evans

The challenge of adaptation

Never before in living memory have our health systems been so clearly and obviously challenged. The global COVID-19 pandemic has threatened to overwhelm our systems in ways that trouble existing processes, places, spaces and contexts across the healthcare domain.

We must adapt. We must become dynamic. We must find ways to help our health systems, spaces, and capacities become more responsive – rather than merely just overborne by or even resistant – to change.

The secret in doing so lies in new blended digital and physical environments, innovative collaborations, and institutionalised experimentation.

We must re-define what we think of as health infrastructure.

We must re-calibrate what we think of as health spaces and re-define what we imagine as health capabilities.

We must establish the spaces and forums to learn, iterate, and showcase new value.

This paper

This paper explores the need for dynamism and adaptability in our health systems.

Drawing from leading examples from across the globe, we seek to highlight how systems and health providers are finding new ways to adapt strategically using technology to:

1. make existing health spaces dynamic;
2. transform non-health spaces into health spaces; and
3. make health spaces mobile.

Charting a path forward through new approaches to collaboration and impact, we suggest preliminary recommendations to help health systems and leaders act boldly – and wisely – in an uncertain future.

Some preliminary recommendations for health system adaptability

Our rapid tour of health system adaptation and dynamism highlights a number of preliminary recommendations for health leaders, providers, and policymakers:

1 Be flexible 'by design'

Adaptability is an attribute of entire institutions and whole systems – across spaces, buildings, technologies, processes and interactions. And so the ability to flex must be – as much as possible – a principle of design, as we build networks of *both* digital infrastructure and physical spaces. Modularity, configurability, versatility are critical.

2 Plan in and for uncertainty

Adaptable and dynamic institutions and systems recognise that capacity and activity may need to deal with radically unexpected uses. The ability to deal with surges in demand – and types of demand not yet imagined – matters. This, flexibility is king. Single-use spaces are deemphasised. And user-centred re-purposing is touchstone.

3 Prioritise digital to create the foundations of rapid reconfiguration

Today's dynamic health capability must rebalance – and re-understand – infrastructure, embracing digital means to create and augment the ability to make fixed infrastructure more adaptable and configurable. Platforms, networks and systems race to the frontline of strategy – dynamism results from blending the physical and the digital.

4 Not all digital infrastructure is equal

Everything mission critical needs to run on a connected network that is both robust and resilient. Security must be embedded deeply: while experimentation is key to dynamism, workarounds cannot come at the cost of cyber resilience. When digital is the source of adaptability, there can be no dynamism without tech stability.

5 Institutionalise learning and collaboration

Seek contexts and partners for collective experimentation and impact. Draw from a broad ecosystem and make innovation a practice. Gravitate towards communities of innovation and anti-disciplinarity. Engage with the forums, zones and infrastructure where the future can be demonstrated, today.

Adapting in a time of crisis

Beyond the shock of 'unprecedented times'

The coronavirus pandemic has hit our social and healthcare systems like a sledgehammer: placing stress and strain of a kind previously imagined by most only in science fiction or fringe examples of scenario-based planning – proposed but easily dismissed.

These kind of events are sometimes referred as 'black swans' – completely unexpected and highly improbable but with great consequences. While debate rages concerning how 'foreseeable' the pandemic might have been, one thing is certain: we cannot again allow ourselves to be caught off-guard by such wide-ranging and potentially devastating events.

> "…it is not the most intellectual of the species that survives; it is not the strongest that survives; but the species that survives is the one that is able best to **adapt** and **adjust** to the changing environment in which it finds itself."
>
> - Leon Megginson
> (**NOT** Charles Darwin)

The challenge of adaptation

The ability to cope with complex and fast-changing situations is not a hallmark of our contemporary health systems.

The need to make order out of complexity – to deal with co-morbidities and quality demands, with aging populations and high-acuity interventions, with individual care and population-level risks – has driven our health systems to seek scale, repeatability, and process-laden certainty. This is all crucially important, and should not be undervalued.

But what is also crucial is the need for flexibility and dynamism – the need for our systems to adapt to changing circumstances, demands, and stressors. And in this, our healthcare systems have often become too rigid, unprepared for rapid change and adaptation.

In the context of the pandemic, as systems across the globe have struggled – and continue to struggle – to make sense of the demands of the emergency, the need to rapidly scale capacity in and around our health service infrastructure has become paramount.

There are numerous examples of dynamic adaptation: repurposing existing spaces and resources, converting general wards into ICUs, releasing new capacity to take re-directed elective surgery activity, creating whole new hospital capacity in parks, convention centres, and parking lots.

Just the beginning

It may be tempting – when the immediate threat of the pandemic recedes – to wipe our brows and conclude that the need for adjustment has passed. But we'd be wrong to do so.

If we are to be prepared for the multiple waves of this pandemic, and future emergency situations that surely lie just over the horizon, our health systems need to continue the task of innovation and adaptation. We need to embrace dynamic, design for and create dynamism in our health systems.

Side note: how systems deal with strain

When confronted by profound shifts in context or operational parameters, systems respond in different ways.

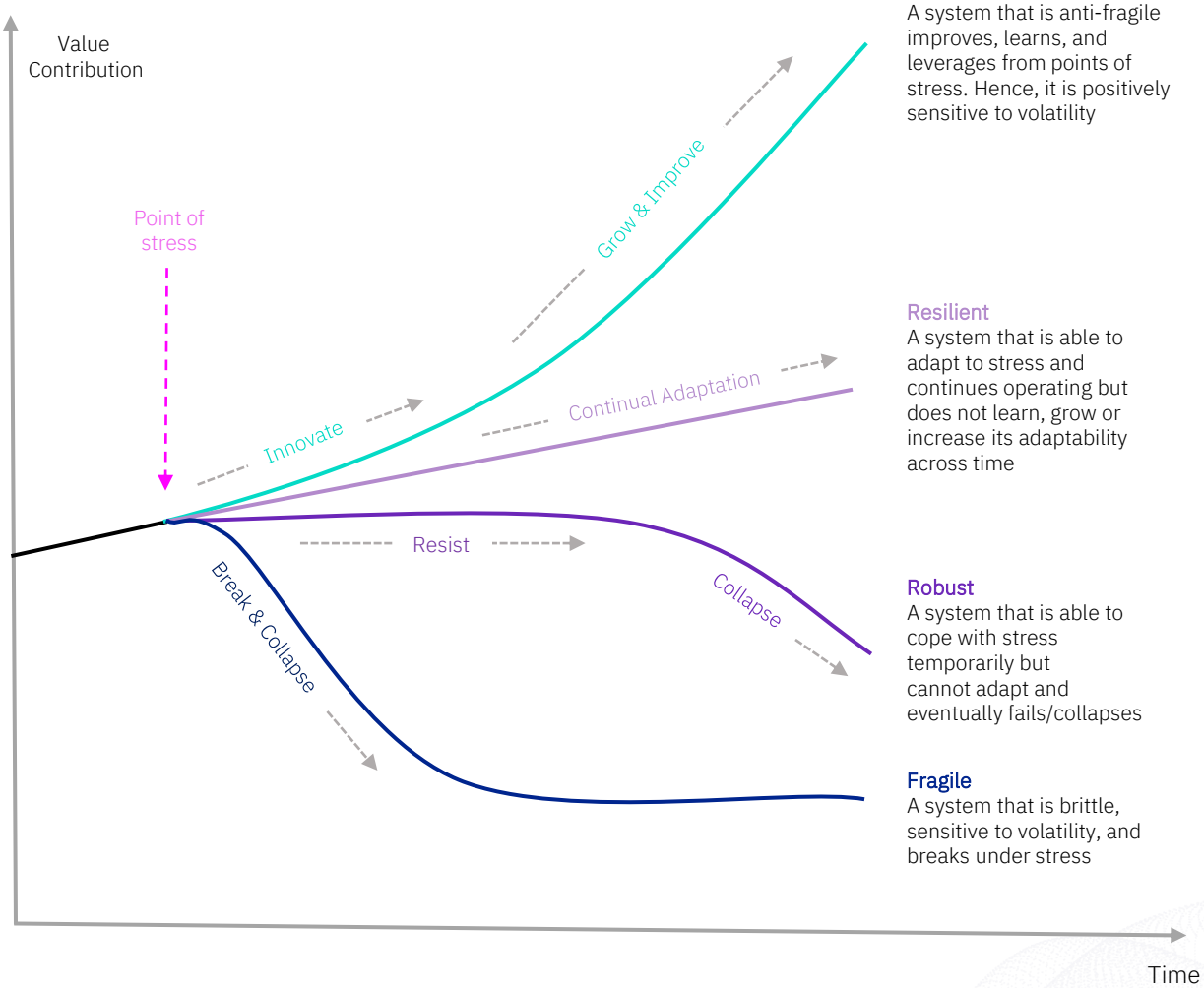
The diagram below sets out 4 such ways:

1. **Fragile systems** break under stress and erode value
2. **Robust systems** resist stress for a time before ultimately bowing to the strain over an extended period
3. **Resilient systems** maintain value generation by adapting to changed circumstances.
4. **Anti-fragile systems** use innovation to thrive and improve in contexts of change and strain.

Ultimately, in order to cope with strain, health systems must seek strong dynamics of robustness, resilience and anti-fragility, and especially the latter two.

To be clear, not every element, institution, or actor within a system needs to be able to withstand strain in specific ways; rather the system *as a whole* needs to be able to cope productively with change.

In short, this paper explores how health system capacity can be configured and reconfigured to help health systems embrace dynamism through anti-fragility and resilience - in infrastructure, in processes, and across systems.



Anti-fragile
A system that is anti-fragile improves, learns, and leverages from points of stress. Hence, it is positively sensitive to volatility

Resilient
A system that is able to adapt to stress and continues operating but does not learn, grow or increase its adaptability across time

Robust
A system that is able to cope with stress temporarily but cannot adapt and eventually fails/collapses

Fragile
A system that is brittle, sensitive to volatility, and breaks under stress

The digital infrastructure of adaptation

Re-understanding and re-orienting our infrastructure focus

Dynamism and adaptability should not be seen as the enemy of order – quite the contrary: they can help systems to create new order – new value – from crisis, strain, and disorder.

To do this, however, we need to make health spaces and health capacity more responsive – rather than more resistant – to change, building anti-fragility and resilience in the whole system.

The key to this is a specific type of flexible and adaptable infrastructure.

Beyond spatial infrastructure

Of course, 'infrastructure' is not only about buildings and physical spaces – the bricks and mortar that makes up specific healthcare environments and institutions. It is also about a broad range of systems – digital and non-digital – which are coordinated, interoperable, and give cohesion to the health space, and indeed to the health system as a whole.

The COVID-19 pandemic has taught us we can no longer presume that the physical infrastructure we design or build can or will be solely used for its original purpose.

While spatial infrastructure is important, the key to creating dynamic spaces and capabilities is increasingly physical and digital *networks*: adaptable connections and dynamics that can learn, reshape, and redesign processes, capacity, and indeed spaces – allowing for quick responses to unexpected situations and improvement in response to volatility.

Infrastructure is increasingly about digital platforms and capability as much as bricks and mortar.

Indeed, COVID-19 has helped to reinforce the fact that the single piece of infrastructure that needs to be permanently accessible is technological: the network.

> "The old network was like the circulatory system, pumping blood to and away from the heart using a series of pipes...

A hospital's network infrastructure transports and secures mission critical data and puts it in the hands of people who can make decisions on the basis of that data. But the digital infrastructure does much more than that - it supports a range of applications including clinical and non-clinical systems. It connects patients to clinicians, clinicians to each other, and patients to their families.

That underlying digital infrastructure is increasingly a platform for innovation and an accelerant in times like the COVID-19 response where fast workarounds had to be found to deal with complex, time-critical challenges.

And just as COVID-19 has taught us not to rule out another pandemic, it has also taught us not to underestimate the utility and importance of digital infrastructure. But not all infrastructures are equal - a fact borne out of this COVID crisis.

Some health providers and systems have managed to adapt more speedily and more effectively than others in the face of adversity – many of those are referenced in this document. The degree of adaptability often came down to their ability to blend and enable physical dynamism through digital, non-physical, and modular-based recalibration.

We now turn to consider how.

> ...the next-generation network will work more like the nervous system, taking in sensory information, learning from it and changing its behaviour based on its sensory environment."
>
> – Barbara Casey

Some models of health system dynamism

Understanding styles and dimensions of transformation

> "The art of the possible often consists of making the potential tangible."

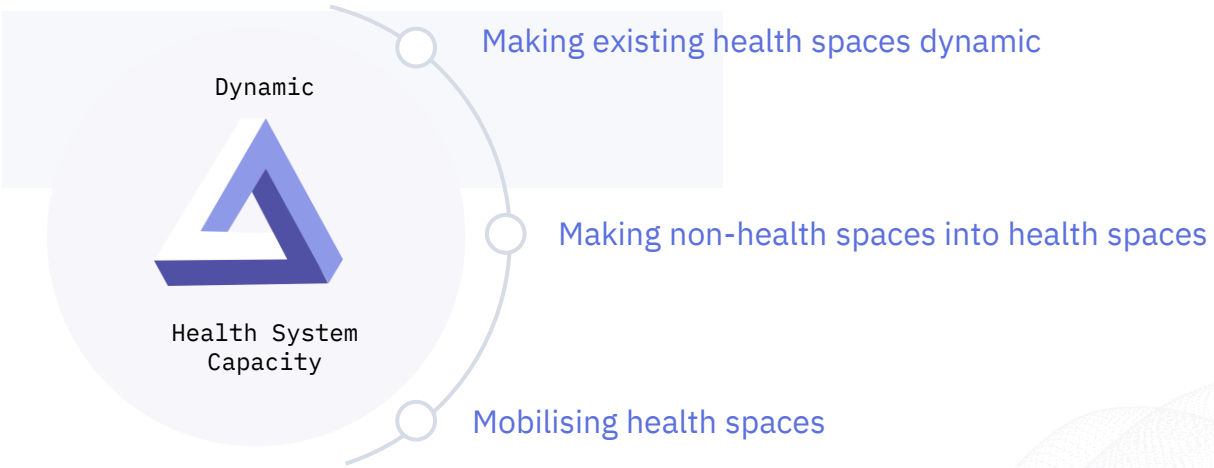
As we consider the possibility of more dynamic health spaces and capacity, and understand the characteristics of their infrastructure that allow them to be adaptable, it can be useful to recall that great strides have already been made around the world.

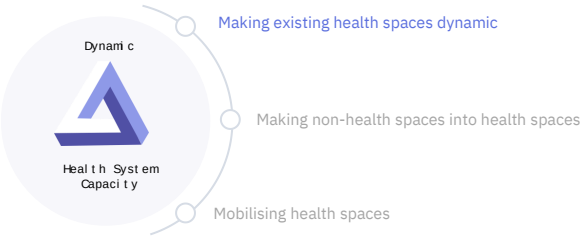
To illustrate the possibility of more adaptable health spaces and capacity, the following pages present some examples and case studies from elsewhere, specifically organised under a framework of:

1. Existing health spaces made dynamic;
2. Non-health spaces being transformed into health spaces; and
3. Health spaces being made mobile.

Health spaces and capability can be made responsive and dynamic across several dimensions:

1. **Degree of 'isolation-ability':** ability to adapt to different requirements for separation amongst patient groups (e.g. the need to constrain contagion in pandemic situations)
2. **Degree of 'calibrate-ability':** ability to 're-purpose' spaces and capacity for specific health uses (e.g. to accommodate switching between intensive care and other health uses)
3. **Degree of 'accommodate-ability':** ability to accommodate rapid changes in volume or complexity (e.g. emergency response surge)
4. **Degree of 'cover-ability':** the ability to cover specific geographies and populations where needs or demands emerge.





Making existing health spaces dynamic

Creating surge and reorientation capacity

Adaptive capacity designed into the infrastructure of a hospital allows the health space to be dynamic. When emergencies create demand surges and incoming patient volumes exceed a hospitals normal servicing capacity, dynamic health spaces not only survive but thrive.

Rambam Medical Centre – Haifa, Israel

Officially named The Sammy Ofer Fortified Underground Emergency Hospital, Rambam Medical Centre 's underground hospital was built in response to the Second Lebanon War in 2006, when numerous rockets bombarded the area surrounding Rambam. The region, prone to quick and unpredictable escalation of hostilities, required a hospital with surge capacity. Crucially, the centre's three-floor carpark can be transformed into a 2,000-bed emergency hospital, can be set up in just 72 hours.

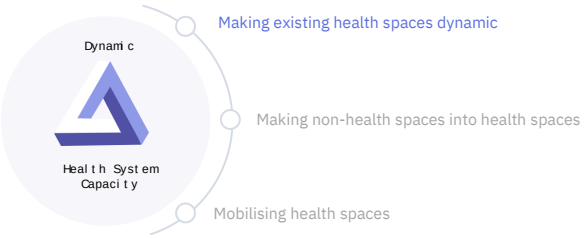
Foresight in design is key – hospital-grade ventilation, filtration and digital infrastructure were hardwired into the design process. A variety of medical equipment including beds, oxygen tanks, dialysis machines are stored within the walls, ready to be deployed.

The emergency hospital is built eight meters below sea level and has the capacity to generate its own power. It stores medical supplies, oxygen and drinking water sufficient for up to three days. Twice a year, the equipment is examined, and anything that has expired is replaced. The facility, however, is not just for wartime deployment; the lowest floor of the facility is set up with isolation equipment, initially intended for the treatment of Ebola patients.

Adaptability pervades the entire space. For example, the underground facility has *not* been used in respect of COVID-19 treatment. Instead, a whole floor of the main hospital was converted into a dedicated COVID-19 department, with a segregated ambulance entrance and elevator. Air from the rooms will be pushed through a filter before exiting the building. Rooms are equipped with phones and video equipment in order to talk with family and medical professionals, with the aim of minimizing contact but enabling connection.

Key lessons and provocations:

- The ability to repurpose spaces should be designed into hospital infrastructure at every level – and broad passive digital infrastructure is critical.
- Expandability, scalability and 'repurposability' is enabled by digital infrastructure as much as by special infrastructure.
- Existing infrastructure should be considered for its possibilities rather than its limitations – storage, power, and water supply are all crucial and not to be overlooked.
- Dynamism requires planning for things that may not have happened yet – and flexibility allows adaptation for as-yet-unforeseen uses.



Rush University Medical Centre – Chicago, USA

Rush University Medical Centre was built after 9/11 to specifically handle a surge of patients that could come from large-scale emergencies such as industrial accidents, terror attacks, or pandemics. As such, it had all systems in place to respond to the onset of the COVID-19 pandemic.

The facility's emergency department is split into three 20-bed units — each of which have the potential to be isolated with separate air handling. Though the ER has 60 beds, during a surge, each unit can be doubled to increase capacity to 120 beds. The facility has 40 negative pressure rooms, but in two hours, it can convert a wing of the hospital into a negative pressure ward to accommodate more patients, increasing their isolation room capacity by 32.

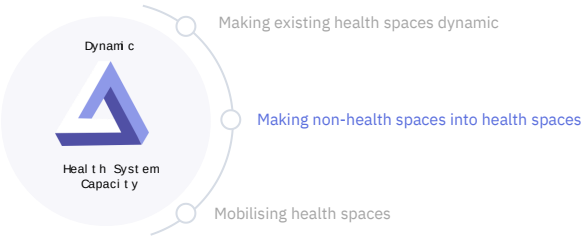
Under surge conditions, the building's main atrium, converts into "a MASH unit," and is completely cut off from the patients in the emergency department. Regular ER patients — someone with a broken arm, for example — are handled in the converted atrium. The atrium's design, which includes passive infrastructure, allows quick transformation as hidden in the supporting columns are panels which are access points to oxygen and other necessary medical gases, as well as electricity. Non-emergency physicians, get reassigned to staff the converted atrium.

The Emergency Department can also be rapidly converted to enable high-volume screening. It can expand to increase screening to see an additional 100 patients a day (in addition to their usual volume). An expansive covered sally port, where ambulances deliver patients, can be sealed by rolling-down doors at the vehicle entrance and exit to accommodate the decontamination of people and vehicles in case of a massive chemical accident or bio-terror attack.

Rush University Medical Centre is also in the process of adding more passive infrastructure to become the first hospital to use standards-based 5G in the United States. The technology will allow the connection of various applications, phones, medical devices, robotics equipment, enable augmented reality, increase the capacity of remote monitoring, patients will have the bandwidth to video chat with family, clinicians will be able to do more with virtual care, and much more.

Key lessons and provocations:

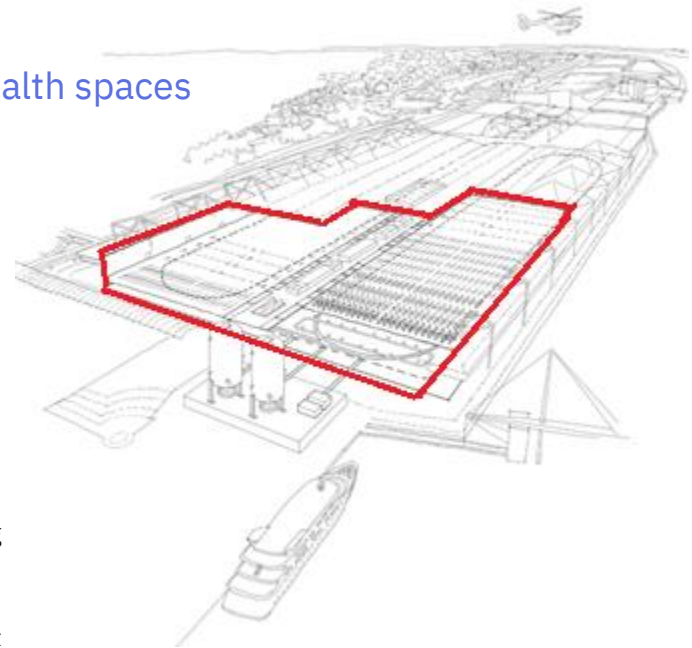
- Features that can be added or removed depending on demand makes the space useful in multiple contexts.
- Passive technology infrastructure lowers the barrier to repurposing spaces and allows for connection despite isolation.
- Using the entrances and exits as flexible spaces allows greater control over the space inside with regards to containment.
- Centralized operations, monitoring, and technology infrastructure can help to maintain safety and adaptability throughout the building; enabling the space – and the people and capabilities within it – to work as a whole.



Turning non-health spaces into health spaces

Rapid repurposing for health impact

Converting non-health spaces into health spaces is not quite replicating a hospital environment, but rather 'jerry-rigging' – making the best out of existing assets and doing enough to make them workable.



Field Hospitals in Convention Centres

With adaptable floor space, electricity, heating, lighting, water supply, broadband connection, loading docks for moving equipment, high-powered ventilation systems, and disability compliant bathrooms, convention centres are ideal places to set up temporary patient-care and recovery facilities.

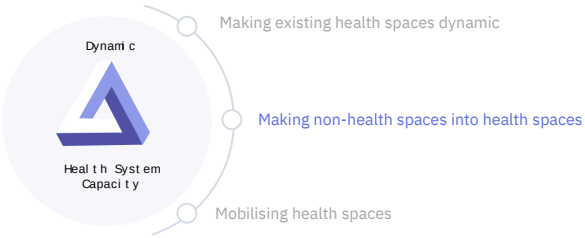
Formally opened in April 2020, London's ExCel centre was converted into the NHS Nightingale; specifically constructed to support all NHS London hospitals in the event of a surge of COVID-19.

Initially set up with 500 beds, its design allowed for an expansion to fit up to 4,000 beds. The rapid conversion of the convention centre was made possible by the team simultaneously designing and constructing the facility after the initial scope.

BDP building engineering services principal James Hepburn who worked on the conversion said that, "Minimal building intervention is essential to ensure rapid project delivery, so it is vital that building assets are used to the maximum" and that "solutions have to be simple, repeatable, and modular." This insight applies equally to physical *and* digital infrastructure.

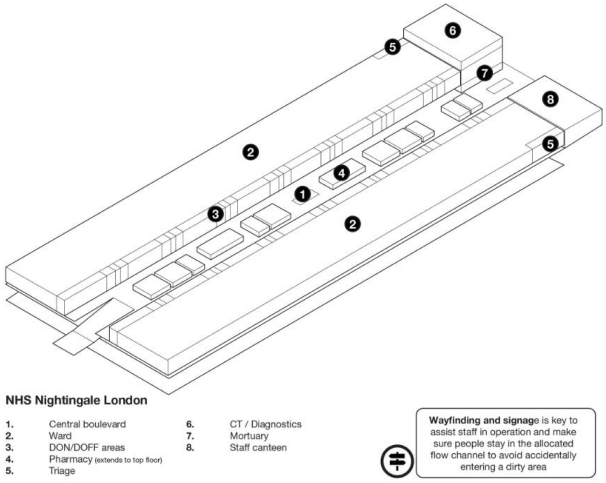
The Cisco Webex video conferencing platform was instrumental in helping co-ordinate the collaboration between all the different entities to get the facility built. The platform is end-to-end encrypted, everything on the platform – from video calls to shared documents – are all encoded to ensure privacy.

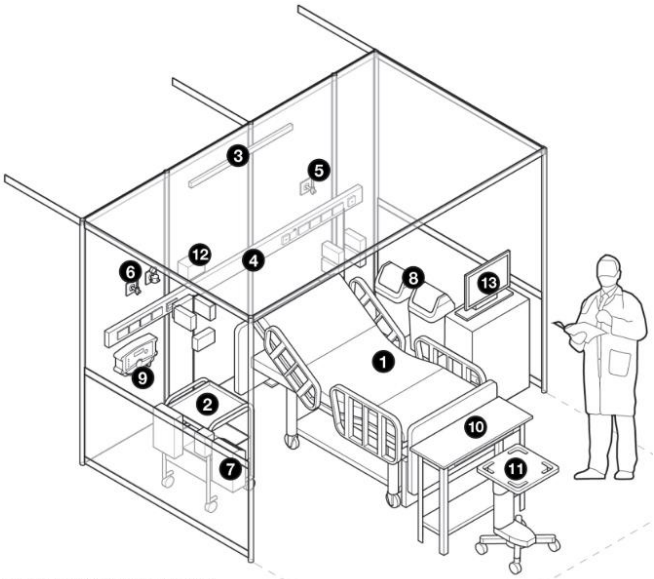
Every bed was connected to Wi-Fi so that patient care could be provided at the bedside at nursing stations or from a hospital. A dedicated 111-style telephone system was also set up by Vodafone at the hospital in order to direct calls across the facility more easily.



The conversion process started with scoping the layout of the convention centre to best utilize the existing infrastructure and all that was available rather than attempting to procure and build anew.

Spaces were designed to be easily reconfigured and highly serviced. Equipment flows were planned out to balance speed with quality. IT & communications connections to the space were also part of the consideration.



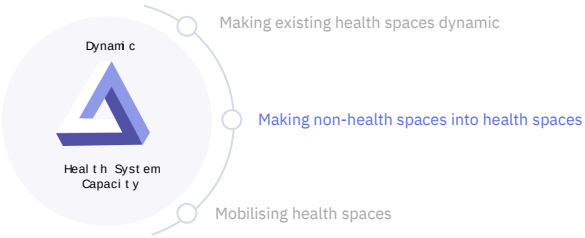


Typical Bed Bay Clinical Equipment

1. Bed bay [3500W x 4300L]
2. Consumaries trolley
3. LED overhead light [1200mm]
4. Bed trunking [3000W x 150H]
5. 1x Oxygen
6. 1x Oxygen & 1x Medical Gas
7. Dispensers and sharps bin
8. Clinical waste bins
9. Oxygen monitor
10. Chart table
11. Stool
12. Ventilator
13. Electronic patient records

Key lessons and provocations:

- A non-healthcare space repurposed to provide care should not be considered equivalent to a hospital but can ease the pressure on them.
- Non-medical space is ideally a ‘cold shell’ fit out which can be added to with ease and does not include extraneous items or structures.
- Using larger spaces for repurposing (i.e. convention centers / hotels / carparks) allows for adaptability in containment AND capacity.
- The innovative use of technology can allow for flexible use of space, even where physical infrastructure appears relatively ‘fixed’.
- Solutions have to be simple, repeatable, and modular to allow for fast and easy configuration at physical as well as technological levels.



Drive-Through COVID-19 Testing

Pioneered in South Korea, low-contact testing centers such as the "drive-thru" COVID tests allow people to be tested without having to leave their vehicles – a method that also means health workers do not have to disinfect the area after conducting each test.

Initially implemented in Goyang, in the Gyeonggi province, getting tested – which includes registration, symptom checks, swab sampling, and a car disinfection – lasts 10 minutes on average for each person, whereas previous testing procedures took roughly 30 minutes.

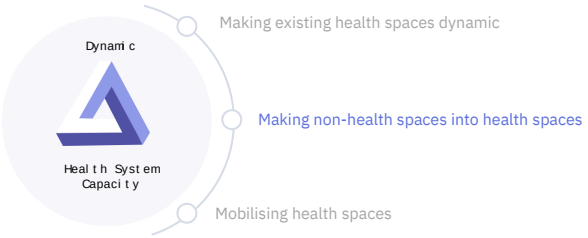
Between 4-8 staff are required to operate the drive through test area. Roughly 1-3 handle the registration, vehicle entry/exit management, and education; 1–2 doctors conduct symptom check and sampling; and 1 person disinfects the vehicle.

Safety procedures extend all the way through into car air conditioning, where it was advisable to make sure the recirculation option was active so that if a patient did have COVID, it would keep the pathogens within the car, and avoid infecting the medical personnel operating the testing facility.

Results are sent through text and are usually delivered the following day.

Taking the lead from South Korea, drive-through clinics are quickly catching on elsewhere, including in Australia amongst many other countries. With drive-through clinics, roughly 10 people an hour can be screened, which is nearly double the rate of an indoor clinic.

Though not consistently used, network systems that remote clinicians can access, and update can rapidly speed the effectiveness and efficiency of 'pop-up' testing facilities. Careful use of EHRs, secure network or cellular systems, and remote coordination technologies allows the remote testing site to coordinate with other remote sites as well as central agents and systems. It also allows for faster and more robust locational and population-based health responses.



CISCO Meraki Powered – COVID Clinics

Similarly in Australia, a drive through COVID Clinic-in-a-Box was set up in a tie up between CISCO and WA Health (pictured right). Cisco Meraki technology was deployed by WA Health to create additional COVID testing capacity quickly by leveraging trusted technology in shipping containers.

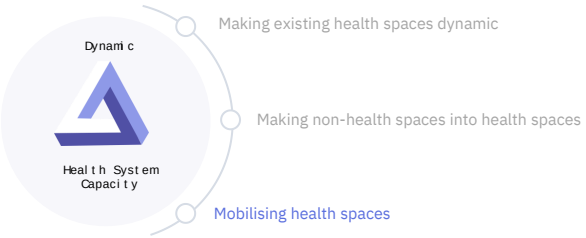
Also set up, was a Covid19 Pop Up Medical Clinic, at South West Regional Health Alliance (SWARH), which used Cisco's Meraki technology that will be supporting the facility while it is running.

SWARH is an Alliance of public health agencies in the South West of Victoria covering an area of approximately sixty thousand square kilometers connecting all public acute hospitals and associated health services in the region extending from west of Melbourne to the South Australian Border.

Within a week of running, the pop-up clinic had already carried just over 7000 screenings.

Key lessons and provocations:

- Temporary infrastructure can reduce the load on permanent infrastructure especially with mass testing programs.
- 'Pop-up' testing facilities require digital record keeping, which is only viable with a steady and stable internet connection.
- Technology allowing for rapid, efficient and simple communication between 'pop-up' spaces and more permanent spaces enables distributed functionality.
- Coordination of digital infrastructure across the 'system' is critical even in mobile / 'pop-up' settings.
- Health services can be made accessible for 'pop-up' locations, where the quality and efficiency of the system is improved through connection to a centralised system.



Mobilising health spaces

Overcoming the tyranny of distance and fixed infrastructure

Mobile clinics are amongst the most versatile mobile healthcare spaces. Designed to be mission-specific, these are purpose-built vehicles shatter the connection between health capacity and fixed infrastructure, using digital infrastructure to take system capacity to communities and localities that need it. They offer flexible and viable options for treating isolated and vulnerable groups of people.

CISCO Medibus

The Medibus – essentially a medical practice on wheels – was initially deployed in the state of Hesse in Germany. It exists to serve in two situations:

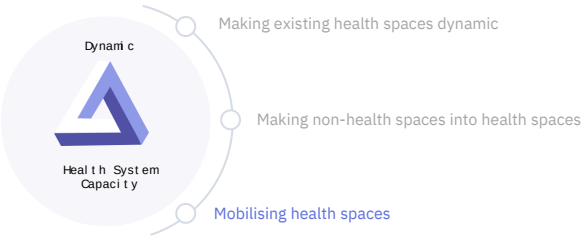
1. Locations where no medical practice exists.
2. Areas where existing infrastructure is insufficient to meet specific location-based demand for healthcare.

In addition to having all the equipment one would expect in any other medical practice, including a check-in area, laboratory, and exam room, the bus features state-of-the-art IT infrastructure.

This technology allows doctors to provide several different health services such as primary care, remote diagnosis and second opinions via telemedicine, consultations with patients who speak a foreign language through video translation services, vaccination campaigns, and health events, including blood pressure measurement or diabetes counselling.

Key lessons and provocations:

- Bringing health care to a specified location removes barriers for patients and provides the best option for coverage.
- Mobile setups require intrinsic flexibility to be able to adapt to the situation appropriately. Configurability (and re-configurability) of capability is key.
- Having combined purposes lowers time to ‘discharge’ which decreases load on infrastructure (i.e. patients can receive test results rapidly).
- Uses base-level digital infrastructure to make health capacity mobile, and it allows active technologies to be incorporated strategically depending on need.



Cisco – Refugee First Response Centre

At a refugee registration center in Hamburg CISCO with other organizations launched a Refugee First Response Center (RFRC). Construction began with a 20-foot international shipping container, which was transformed into an emergency medical facility in six weeks from its conception.

The RFRC comes fitted out with advanced communication technology, such as Wi-Fi for doctors and refugees and systems allowing remote language interpretation enabling consultations through high-definition video.

Clinicians utilising the RFRC had access to 750 interpreters, specifically trained in medical translations. Collectively, the interpreters could speak fifty different languages, though the most common languages spoken by the patients were Farsi (for Afghans, Iranians and Iraqis), Arabic (for Syrians), Urdu (for Kurds), Albanian, Tigrinya (for Eritreans and Ethiopians), and Serbian.

In total, eleven of this RFRC units were made. Some of which were sent to be deployed in Greece and Lebanon. The success of these units inspired the development of the CISCO Medibus.

Key lessons and provocations:

- Shipping container clinics can be easily deployed to various remote areas of the world and are ideal for their inherent strength and relatively low cost.
- Specialisation of technology within specific interventions (in this case, specific containers). Each container allows for diversity of tailored care.
- The integration and complementarity between mobile and local infrastructure is key for an adequate provision of health services.
- Modularisation allows clustering and re-clustering to create supply for specific constellations of demand and specific health-related functions.
- Network infrastructure connecting the modules together allows for them to act as a flexible system.
- The materials that compose that space can be anything that allows the technology to function within and between spaces.

The ‘How’: experiments in dynamism

A sandbox for adaptive infrastructure

As part of becoming resilient and antifragile health spaces and capacities must extend themselves to incorporate new tools, technologies, safeguards, and configurations.

Experimentation facilitates adaptation

Central to the concepts of resilience and anti-fragility in health systems is the idea that dynamism demands experimentation. Without the ability to trial, reconfigure, and explore using different tools, technologies and techniques, it is impossible to generate the kind of adaptation and innovation that can carry systems, contexts, and institutions through periods of stress and strain.

Having a dedicated place to experiment, learn, and demonstrate is something many health care systems and spaces lack. Care provision, understandably, demands risk mitigation, repeatability, and stability. This is where Labs and sandbox setups come in to their own: unique places for trialing and testing new technology, equipment, configurations, practices, and systems.

RMIT and Cisco create a home for health transformation

The RMIT-Cisco Health Transformation Lab is a place for collaborative experimentation and innovation.

A place that is open to the system – institutions, private companies, startups, academics, social innovators, designers, and the community.

A central element of the Lab – consciously and rapidly invested in as part of addressing health system challenges implied by the pandemic and its after-shocks is a hospital-themed digital technology sandbox.

The Sandbox: infrastructure for a rapidly changing world

Equipped with Cisco virtual care and connection technologies, the Sandbox will become a zone for the Australian health system and its leaders to experiment, explore, display, and test a range of interconnected, interactive, health-focused tools, applications and interventions.

COVID-19 has demonstrated how these experimental and innovation-driven environments – that can leverage, explore, augment, and drive value from the intersection of technology and health) are critical in fostering:

- constant innovation within the health system in ways that draw together technologists, researchers and broader industry players;
- linkage and between health and its broader technological context;
- rapid mobilisation of partners from across markets, ecosystems and contexts to create fast impact and address urgent and emerging healthcare needs and requirements.

Wollongong ICU: Connecting Patients – and beyond

In the context of COVID-19 and the need for strict isolation protocols, Cisco, Taleka, and Citrus, came together with Wollongong Hospital to create a virtual connection platform that allows patients to see and talk to their loved ones – in some cases for a last time.

Using Cisco Webex Teams and Meetings platforms, along with Cisco DX80 and tablet technologies, Cisco and its partners were able to deploy the *HowRU Connecting patients and family* solution overcoming isolation restrictions and facilitating secure, direct, and private communication between patients and their families.

Seeing the immense human and healthcare value being generated at Wollongong, this technology solution is being brought into the Sandbox for further iteration, exploration, and experimentation, including:

- extension of the model and solution in partnership with additional technology partners (including Samsung);
- exploration of clinical and staff-based use cases for the solution and its future iterations; and
- augmentation of the solution with additional capabilities, including intra-hospital connectivity, remote monitoring additions, 'command-centre'-based approaches, and extension into community and aged care settings.

New engagements, new collaborations, new technologies and new interventions grow – from idea to action – in well-tended, experimental environments.

From the analysis and examples we have seen that, at base, a dynamic health system is one that can *learn* and *respond*.

The Cisco-RMIT Health Transformation Lab and the Sandbox allow this to happen. Fast.

Some preliminary recommendations for health system adaptability

Our rapid tour of health system adaptation and dynamism highlights a number of preliminary recommendations for health leaders, providers, and policymakers:

1

Be flexible 'by design'

Adaptability is an attribute of entire institutions and whole systems – across spaces, buildings, technologies, processes and interactions. And so the ability to flex must be – as much as possible – a principle of design, as we build networks of *both* digital infrastructure and physical spaces. Modularity, configurability, versatility are critical.

2

Plan in and for uncertainty

Adaptable and dynamic institutions and systems recognise that capacity and activity may need to deal with radically unexpected uses. The ability to deal with surges in demand – and types of demand not yet imagined – matters. This, flexibility is king. Single-use spaces are deemphasised. And user-centred re-purposing is touchstone.

3

Prioritise digital to create the foundations of rapid reconfiguration

Today's dynamic health capability must rebalance – and re-understand – infrastructure, embracing digital means to create and augment the ability to make fixed infrastructure more adaptable and configurable. Platforms, networks and systems race to the frontline of strategy – dynamism results from blending the physical and the digital.

4

Not all digital infrastructure is equal

Everything mission critical needs to run on a connected network that is both robust and resilient. Security must be embedded deeply: while experimentation is key to dynamism, workarounds cannot come at the cost of cyber resilience. When digital is the source of adaptability, there can be no dynamism without tech stability.

5

Institutionalise learning and collaboration

Seek contexts and partners for collective experimentation and impact. Draw from a broad ecosystem and make innovation a practice. Gravitate towards communities of innovation and anti-disciplinarity. Engage with the forums, zones and infrastructure where the future can be demonstrated, today.

Health
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