De-Risk, Distribute and Develop: Health Care Delivery and Infrastructure Trends Recast

BTY Briefing Note



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Faced by the pandemic, the future of health care needs new and adapted solutions

The impact dealing with the COVID-19 pandemic has laid bare the inadequacies of current healthcare capacity and delivery models worldwide.

It has also created a compelling case for urgent global investment and innovation in new and upgraded models of healthcare delivery, with particular regard to pandemics and other outlier events such as war and natural disasters that create massive surges in demand. While the duration of the pandemic and its continued disruption remains unclear, the need to revisit, rethink and recast where and how healthcare is provided is immediate.

This is reflected in a sharp rise in healthcare spending to combat COVID-19. Even so, overall healthcare spending in the world's 60 largest economies is forecast to drop by 1.1% in U.S. Dollar terms in 2020. Part of the decline is reflected in the strength of the U.S. dollar, which has appreciated sharply during the pandemic. But healthcare spending is expected to rebound strongly in 2021.¹

Total Healthcare spending forecast to rebound by 5.5% (in USD terms) in 2021



Combatting COVID-19 led to a decrease in spending on other conditions, but spending on non-corona virus healthcare is projected to recover as the delivery of non-urgent care returns to more normal patterns as the year progresses.



Supporting decision making for solutions to complex challenges

We have developed this briefing note in support of decision making that our healthcare clients will be undertaking as they re-examine how healthcare can be planned, implemented and delivered to incorporate solutions to the complex challenges identified in the COVID-19 experience.

Facilities and infrastructure are spaces where care models take place. Improving health outcomes will also require re-examining and investing in training, and resource capacity and resilience, which are critical components that are beyond the scope of this briefing note.

With that in mind, we believe the following ideas capture the needs, opportunities and trends shaping the future of healthcare facilities and infrastructure.

Big Ideas Shaping Future of Healthcare







Governments step up spending to counter COVID-19

Canada's federal government has committed \$1 Bn to expand public health measures in response to the pandemic, but the provinces, which deliver healthcare services, are making larger commitments.

- > Ontario leads with a total of \$3.3 Bn in new spending for 2020-2021, with \$2.1 Bn for 1,500 new hospital beds, protective equipment, and funding to ease hospital overcrowding. Long-term care will get an additional \$243 million.
- > British Columbia is offering \$1.7 Bn to expand critical services including health, housing and social assistance, Manitoba is allocating up to \$1 Bn and Alberta is spending \$500 Mn.

https://www.cnn.com/2020/05/07/economy/health-care-downturn-coronavirus-pandemic/index.htm

https://www.appropriations.senate.gov/imo/media/doc/Coronavirus%20Supplemental%20Appropriations%20Summary_FINAL.pdf

US to spend \$175 Bn to support hospitals

The U.S. Congress has stepped in to support the healthcare industry in the U.S.²

- > Health care spending plummeted at an annualized rate of 18% in the first three months of the year.
- > Congress has allocated \$175 billion in its relief packages to hospitals and other health care providers to offset added expenses and lost revenue.
- > Overall, Congress is spending \$340 Bn in a coronavirus emergency supplemental appropriations package.³

Distribution of Care Across Physical & Virtual Realms



Rethinking how and where family medicine is delivered

The experience of COVID-19 should accelerate existing trends to integrate telemedicine as the first entry point for care inquiries and deliver health care services closer to home -- and outside the hospital. Shovel-ready projects may need to be reconsidered in light of COVID-19 design impacts on infection control, programming and planning for physical distancing and pandemic support spaces. Budget clarification and cost monitoring across all projects will be critical in light of increased government spending.



Here are some trends we see developing in this space:



After the SARS outbreak, Infection Prevention/Control gained attention but now becomes imperative as a design principle.



"Fever" or other symptoms become the first indicator; part of the challenge is that fever can be detected at any testing point outside healthcare (airport, restaurant, mall, etc.) requiring the health system to retrieve and treat the individual.



People visit hospitals only when required rather than as a general first step in seeking care.



Ancillary functions such as laboratories, testing and imaging functions could be moved away from the main hospital setting.



Patients are directed to the appropriate health care facility. They go through decontamination and are triaged on pre-entry for infection risk.



First contact inquiries are made using telemedicine options.





Specialized facilities distributed in convenient locations such as pharmacies, imaging centres and labs may be a complementary aspect to the increasing need and demand for online consultation services.

Asian response to COVID-19 models integration of digital and physical realms

The exemplary responses of Taiwan, South Korea, and Vietnam to COVID-19 shared common elements that integrated digital and physical realms to effectively support containment. Key differentiators compared to other countries impacted include the speed of their response, the apparent trust by citizens in the government and health experts, and the wide adoption of telemedicine tools.



Taiwan's early, rapid, systematic response included:

- > Early screening and case identification, containment, and resource allocation.
- > Using the country's national health insurance database and integrating it with its immigration and customs database to begin the creation of big data for analytics.
- > Real-time alerts during a clinical visit based on travel and clinical symptoms, using QR code scanning and online reporting to classify risks based on flight origin and travel history in the previous 14 days.⁴

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South Korea's strategy featured massive testing with prompt

contact tracing and guarantine:

- > Near universal use of smartphones and credit cards there enabled the government to trace where those who tested positive had been, when, and how they travelled.
- > This enabled the government to trace potentially infected populations, using CCTV footage to identify potential contacts.
- > Those in direct contact with the infected were requested to be tested, while indirect contacts self-quarantined for 14 davs.
- > Tracking those in quarantine to ensure they stayed home enabled the country to break the chain of potential infections.
- > South Korea never had to lock down any cities nor quarantine the general population to contain the virus.⁵









https://jamanetwork.com/journals/jama/fullarticle/2762689 https://www.brookings.edu/blog/techtank/2020/04/13/combating-covid-19-lessons-from-south-korea

https://theaseanpost.com/article/vietnams-exemplary-response-covid-19



Vietnam's

response included an early lockdown and contact screening that provided quick identification of infectious contacts based on classifications of infected, suspected, and exposed cases of COVID-19.

- > Rapidly mobilized health professionals, public security personnel, the military, and civil servants conducted the tracing.
- > A reporting system for suspected and confirmed cases of COVID-19, as well as people who were in close contact with them, entered into a database available in real time to the national government.
- > Introduced a mobile app that enabled the public to declare their state of health on a daily basis. ⁶

Establishing virtual and neighbourhood care paths to guide user's health care journey

Establishing virtual and local care paths to guide users to better health outcomes would be another critical step in ensuring that patients get timely access to the type of care needed.



In a virtual ICU, patients are intubated at home with a nurse with a specialist monitoring patient remotely.



De-risking diagnosis and imaging (D&I) delays/bottlenecks by providing more D&I neighbourhood facilities, including labs and pharmacies, and integrating at-home tech.



needing to physically attend an appointment/wait at pharmacy.





Integration of mobility and at-home tech, including internet enabled devices – Internet of Medical Things (IoMT) – that would in turn be part of a larger rapidly evolving digital health ecosystem.

Facilities with Demand Elasticity & Multipurpose Use

The pandemic revealed a built-in lack of flexibility in most modern hospitals for accommodating sudden patient surges. This has made flexible design and greater agility in how hospitals are constructed a prime focus.

New approaches would draw on principles of lean design, which focus on eliminating waste, improving productivity and flow for better quality care.

Lean design also applies to bringing services to the patient instead of the patient to the services. This could help improve social distancing and manage critical contact points.

By enabling clinicians to perform routine check ups and triage without putting either doctor or patient at risk, telemedicine will impact the flow and capacity requirements of exam rooms, waiting rooms and support spaces.

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Other trends may include:



Increased isolation room capacity, with room groupings or whole units or wings that can be negatively pressurized and cut off from the rest of the facility in a pandemic.



Laying out spaces as cells with necessary storage, isolation and flow provisions, including shared areas for staff, increased space at facility entrance.



Triage prior to entry with tele-triage, apps, multiple entries and waiting solutions based on medical need.



Increased surge capacity, within permanent facilities and with temporary structures, to accommodate double or triple the number of patients – which rooms can flex up to intermediate care or ICU, or how surgical prep and PACU can be converted to overflow ICUs.



Development of surge capacity in outpatient centres, including additional patient beds, multipurpose spaces, etc.



Isolation Operating Rooms and Catheterization Labs with the proper airflow and design to protect the patient from surgical infection while protecting the staff in the room and the surrounding facility from the patient.





Adjusting for impact of safety protocols on non-COVID-19 patients and staff. Accommodating visitation protocols, reduction in number of procedures and speed of delivery, and impact on healing communication and touch.

Rapid repurposing of hospital beds and facilities

Another key design focus is the ability to quickly convert regular beds to intensive/crucial care beds or repurpose an entire facility or part thereof. Providers may need to examine their ability to scale up and create multifaceted resources. Such flexibility is rooted in the military field hospitals model and will be key to developing a civilian analog.



One example of the capacity to rapidly repurpose a facility is **Ramban Hospital** in Haifa, Israel. Ramban can convert its underground parking garage into a 2,000-bed hospital in wartime.⁷

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Another is **Rush University Medical Center** in Chicago, which can expand both emergency department capacity and the number of isolation rooms when needed. In normal operations, Rush has 40 negative-pressure rooms that help prevent the spread of potentially infectious diseases through the air. Each room has a negative pressure compared to the outside hallway. This allows air that flows from the hallway into the room to then exit the hospital through a HEPA filter.

Rush's Medical Center can also convert an additional wing into a negative-pressure ward capable of accommodating an additional 32 patients. The emergency department also has three 20-bed units — called pods — that can each be isolated to handle even more potentially infectious patients.⁸

Elastic demand-based health care facility model

The ability for hospitals to expand and contract as needed – an elastic demand-based model – will be able to meet patient surges from pandemics and other events – such as war and earthquakes – will be key.

- > Elastic demand should also consider the capacities of medical gas systems, generators and laboratory services.
- > Planning should include sourcing and inventory management of critical care equipment and PPE.
- > Infrastructure of laboratories, device capacities and test panels must be well calculated to ensure labs are sufficiently resourced for surges.

There is also opportunity for innovation in new partnerships with private sector to leverage underutilised existing assets, such as sports arenas and exhibition centres.

While such facilities converted for emergency healthcare use cannot function as a true hospital and meet compliance standards, they can function as quarantine centers for milder cases so that hospitals can focus on the most seriously ill patients.⁷

Using technology and materials to improve Infection Prevention/Control

Hospital designers are investigating touch-free control for lighting, temperature and other building functions to reduce the spread of diseases via highly used surfaces.



Using materials less hospitable to microbes, such as copper and copper-alloys, to lower the risk of surface transmission.



Incorporating design features that are more easily cleaned and withstand harsher chemicals, greater use of UV light or sterilizing mists in high and medium risk areas.



Renewed focus on traffic and patient flow through robust circulation systems with clean/dirty indicators, factoring in high-acuity and low-acuity needs.



Installing smart elevators.





Utilizing smart glass for interior and exterior glazing and windows which is e-switchable between translucent and opaque, responds to actual amount of sunlight, and is easier to clean.



Using robotics to move goods and supplies through the hospital.

Development of Senior Living and Care Solutions

Investing now provides biggest bang for infrastructure dollars

The high incidence of fatal COVID-19 infections in senior care homes revealed how vulnerable these facilities have become to contagion – and how perilous to an aging demographic that vulnerability is.

It is important to consider the continuum of elder care and the environments that will need to be updated and adapted.

Independent Living provides user led support environment with access to social, health and community resources.

sector business.

Whatever the difference in names for facilities and levels or types of care, there is widespread agreement among government agencies that senior care must be accessible and integrated in the larger society.

It cannot be cut off – it must be of and in the community. The need for all levels of senior care is expected to rise dramatically in the next decade.



Assisted Living provides embedded support environment for users and can be a public sector service or a private

Long-Term Care focuses on palliative care.



Canada's population of people aged 65 and older is forecast to rise by 68% between 2017 and 2037, with the number of those aged 75 and older double over the same time period.⁸



In the U.S., the number of people aged 65 and over is projected to surge by 65% by 2030.⁹



With this projected growth in the senior care user base, a gap in care delivery will only be exacerbated by lack of investment.

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The case for investment in senior care can be assessed by comparing the cost of not doing something versus the cost of doing something. This comparison can serve as a guide for identifying what the priority projects are for investment.



In developed countries, LTC needs new built infrastructure more than any other asset type in health care infrastructure.



Convertibility of senior care facilities will also be an issue. If there is overbuilding, there will be a surfeit of senior care beds when the bulk of the Baby Boom demand has passed.



Any solutions will need to maximize at home services and adult day programs in creating smaller community oriented developments – or rebuilding new and replacements beds – since that is where the elderly really want to be.

The Conference Board of Canada reports that the projected increase in the senior population shown in this CIHI infographic is forecast to require another 199,000 long-term care beds by 2035, a dramatic increase over the 255,000 beds available in 2016.¹⁰





¹¹ https://www.jchs.harvard.edu/sites/default/files/jchs-housing_americas_older_adults_2014-ch2_0.pdf



Canada's Seniors Population Outlook: Unchartered Territory

Over the next 20 years, Canada's seniors population is expected to grow by 68%

Source: Canadian Institute for Health Information



Big Ideas Shaping Future of Healthcare: Development of Senior Living and Care Solution

The opportunity for partnerships across Public and Private sectors to provide solutions



The need for LTC infrastructure that is part of the community can open up new opportunities for public-private partnerships to develop innovative, community-based, economically viable solutions for LTC – P3s for community care.



The innovation would occur on many levels, including land-use that unlocks value and leveraging long-term partnerships with the private sector where standards can be enforced.

A good example of innovation in this space is SHINESeniors, a project by the Singapore Management University (SMU)-Tata Consultancy Services (TCS) iCity Lab.

SHINESeniors aims to deliver more effective community care services to support ageing-in-place.

Research proposes that the best approach to deal with a growth in an ageing population is to allow as many people to stay in their homes as possible.¹¹

The project does so by developing 50 sensorenabled homes and personalised home care for the elderly.

In such homes, the physical environment (such as air quality, noise level, temperature and humidity)



and daily living patterns (such as their mobility patterns at home, medication adherence and sleep quality) can be monitored unobtrusively, without infringing on privacy and comfort.

The technology enables community organisations to improve their operations and increase their effectiveness with the limited number of staff and volunteers they have, while still catering to the elderly person's individual needs.

¹³ https://research.smu.edu.sg/news/smuresearch/2016/07/27/smart-homesenhance-seniors-safety

Top 4 Take Aways

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The integration of physical and virtual realms (telemedicine, remote-monitoring, mobile-testing, AI, etc.) makes the delivery of health care services faster, safer and more efficient while improving understanding of, and response to pandemics.

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Healthcare facilities should be envisioned and designed as flexible multipurpose facilities that can expand and contract with changes in demand.







Infection Prevention/Control has become a key design imperative, not only in healthcare but also every public building type, including factories and processing plants, and almost every other kind of facility.





Infrastructure investment in Senior Care is crucial and holds opportunities for public and private sectors to partner in developing sustainable solutions.