Liite 1.
Global trends and shifts in smarter capital deployment in healthcare facilities

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Executive Summary

Every publicly funded health system is struggling with the widening gap between demand for health & care services and society's ability to pay. As Western populations grow and stay alive longer with accumulated medical and social complexity, governments cannot keep pace with tax-based financing of the capital and operations of publicly insured health services. There are two options: reduce demand, or more efficiently and effectively use scarce capex and opex . The latter requires rebasing a 150 year old business model that is highly dependent on facilities, labor, equipment & supplies. Centralized, facility-based care has been the dominant paradigm because it was historically the most efficient way to get expertise, services, procedures, therapies and equipment to as many patients or residents as possible. Services that are delivered in large buildings such as hospitals assisted/supportive living residences are major drivers of public healthcare expenditure. Due to advances in information management and technology, and patient/family/community empowerment, health systems no longer need to rely on a "facility first" paradigm for delivering good quality care services, at an acceptable cost to society. In fact, healthcare services are undergoing a shift to *a "home and community first"* paradigm, wherein asking patients to come to a physical place to receive care or live out the final years of their life is discouraged. This is similar to the shift in the 1960's away from admitting people with mental illness into sanitoriums or people with disabilities into congregate facilities. To carefully manage this transition, health system managers require new tools and frameworks for deciding if and when to make capital investments, and when/how to disinvest out of buildings and beds and redeploy the capital for better uses. This report summarizes the state of emerging strategies and care models that are enabling the shift out of facilities and into homes and communities for hospital care of the acutely sick, and longterm care of the elderly.

Global Trends and Shifts Towards Decentralization & Dephysicalization

Nearly every global core sector that historically relied on centralized facilities to distribute cost, labor and capital-intensive services has gone through – or is going through – a dephysicalization and decentralization process. For example:

- Mainframe computers no longer need to be accessed at a few large universities
- Libraries no longer exist to hold books for loan
- Banks no longer rely on retail branches and tellers to safely manage financial transactions
- Shopping malls and large retail centers are no longer the primary way people buy merchandise
- Travel centers with trained travel agents are not the only way people can book complex travel
- Cinemas are no longer the main way people consume film entertainment
- Hotel chains are a diminishing option for people to access short term accommodations
- Churches are not the only way for people to form community and practice their faith
- Post-secondary educational institutions are not the only channel for advanced education

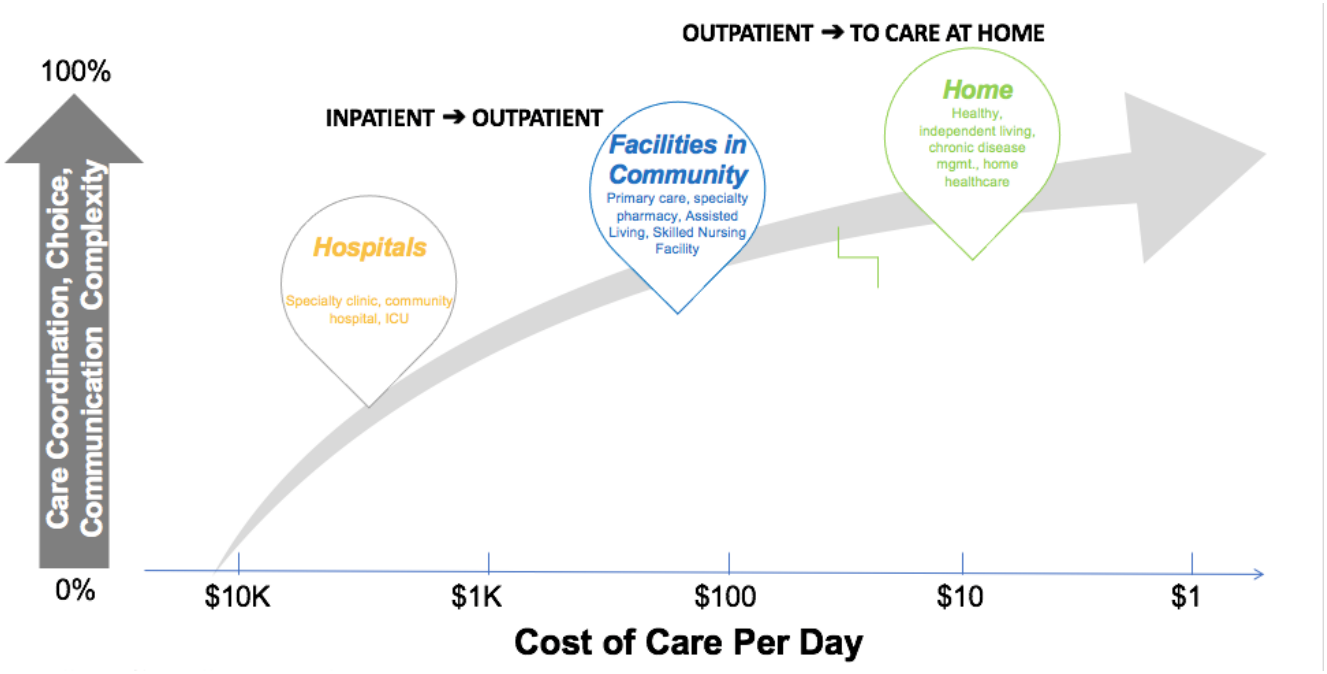
The COVID pandemic has further accelerated these shifts as other traditionally place-based services found ways to deliver a "good enough" value proposition without requiring people to come to centralized facilities, e.g.

- Fitness gyms
- Concert and performance halls
- Clinical trials
- Grocery stores
- Restaurants
- Primary schools

This decentralization and dephysicalization "place-based" services was predicted by business scholar Clayton Christensen in his seminal book, the Innovator's Dilemma in 1997[i]. He followed that book with the *Innovator's Prescription,* a more detailed analysis of how the theory will apply to facility-based healthcare services in 2009[ii]. The theory applies to all health services including hospitals, nursing homes, diagnostic labs, pharmacies, and outpatient clinics such as primary care centers and rehab.

A decade since Christensen wrote the book for healthcare, the shift away from facility-based care that he predicted is now picking up significant momentum, globally. Healthcare services

are moving from “sick care” to “health care”, and ultimately to “self-care”. In parallel, hospital services are shifting from in-patient to outpatient, and outpatient to the home [see image below][iii]. And long term care services are shifting from multi-residential supportive living homes to staying in one’s own home for as long as possible; and from dying in hospitals or nursing homes, to dying at home.



These shifts are driven by 8 key forces:

1) **Change in patient population** - different mix of patients, mix of physical, social & functional care needs is putting pressure on the disease-based paradigm of acute care and residential care. For example, most people have mental health or dementia that is comorbid with multiple complex illnesses. Social complexity due to poverty, literacy or lack of caregiver supports adds further complexity to the patient mix and needs. Facilities are a suboptimal care setting for this mix of patients.
2) **Change in patient & family expectations** – people increasingly do not want to go to buildings or live in facilities that take them out of their community; this preference has changed even more in the past 18 months due to perceived risk of physical contact in hospitals and congregate facilities;
3) **Evidence** - and wider spread acceptance - that many care services can be (better) provided in home & community settings
4) **Quality agenda** that demands higher complexity and acuity care occur in high-volume centres, leading to consolidation of low volume service centres, and the need for decentralized alternatives for the associated outpatient activities.

5) **Value agenda** - advances in clinical knowledge and data/intelligence now enable health system funders and regulators to measure ROI across a full episode of care, not just during the time the patient is in a building
6) **Digital and other technology** tools are now available (at an acceptable cost) that allow the previous (150 years old!) constraints of time, distance, and space in healthcare delivery to be broken. Most tools and equipment that previously needed to be "time shared" in a building, and mediated by highly paid professionals are now democratized into the home setting, with the highly trained professional disintermediated
7) **Fiscal pressures** – society and/or governments are no longer willing or able to keep paying to build and operate care facilities at the current rate, especially given that each investment in facilities is a long term (30+ years) bet.
8) **Workforce shortages** – Difficult to train/hire/keep the health workforce with high regulatory constraints of facility-based labor environments

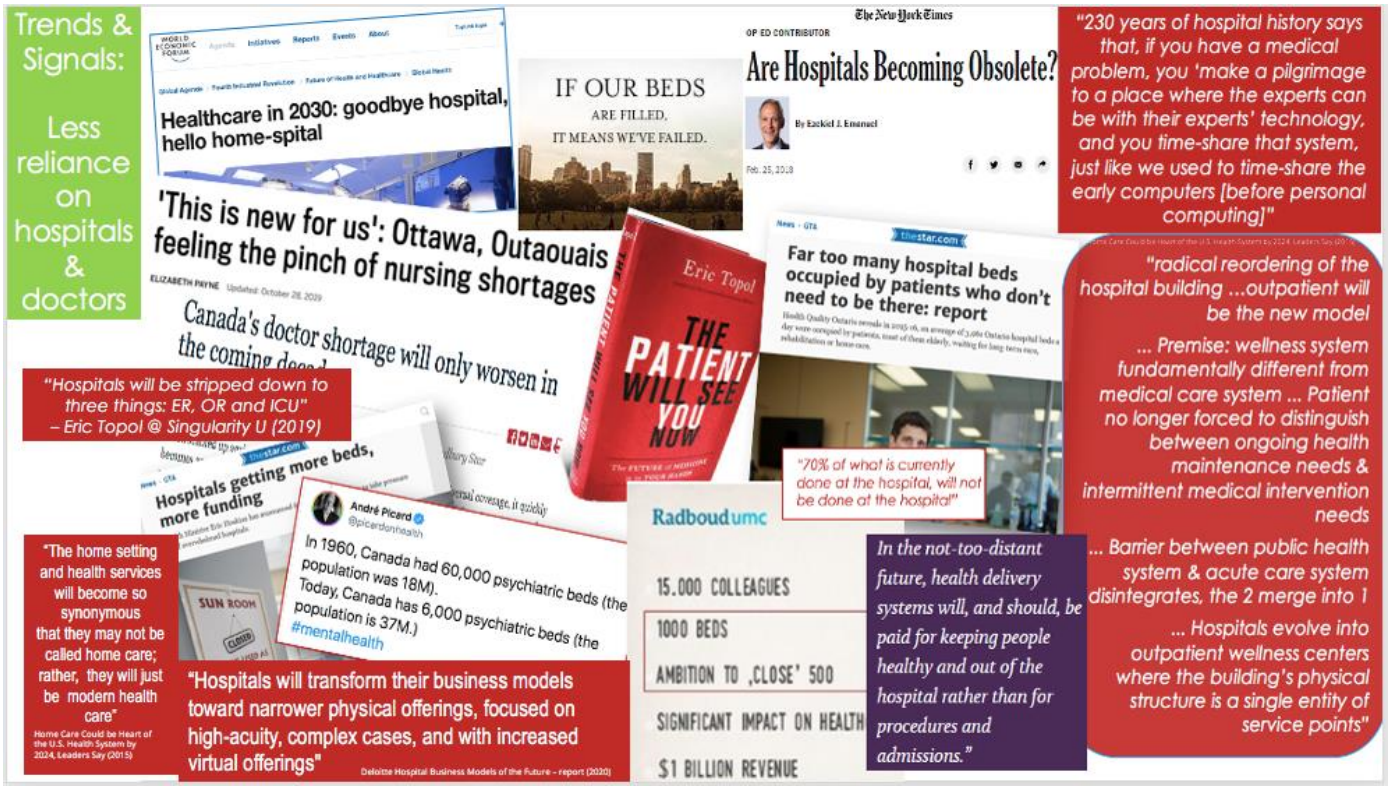
And now, as we emerge from the COVID-19 pandemic, there is a 9th driver for de-institutionalizing care and services: the risk of physical contact. i.e., the need to pandemic-proof. Globally hospitals saw declines of up to 80% of services, and nursing homes + retirement homes are facing the highest vacancy rates in decades.

Health systems at the national, regional and even individual institutions in many jurisdictions have been integrating these forces into their long term planning for hospital-based care and elderly residential care investments and service planning. The following sections highlight leading examples of countries, regions and organizations that have reimagined the role of facilities in their care models, allowing them to better meet the needs of people and staff, while freeing up scarce resources to make the business of caring more sustainable.

Case studies – hospital regionalization, consolidation, virtualization

Hospitals comprise >35% of healthcare expenditures in the EU[iv]. Assuming taxation will not increase at the same rate as demand for hospital services, if health system managers continued to build hospital beds to meet the future demand for services, the proportion of spending on hospitals will continue to grow, and crowd out other vital public goods such as mental health care, social services, public health, primary care and even education and infrastructure. This scan of headlines from around the world signals that patients, academics, thought leaders,

policy makers and providers believe that the dominance of hospitals as the default location for acute, in-patient and out-patient services has reached its peak:



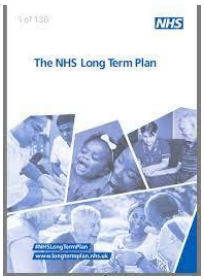
In this context, we explore case studies from the UK, Netherlands and USA to highlight these changing dynamics for hospital investment, and draw out key lessons for health system planners.

UK - Long Range Plan shifts focus away from hospitals and onto home and community

The National Health Service (NHS) has been on a multi-year journey to shift the focus from hospitals to the community. In 2019 the NHS Released its Long Term Plan[v]. A major focus of the plan is to reduce reliance on hospital stays, and to reinvest >£4.5B into primary care in the community.

There are 5 major drivers of this visionary plan:

1. Fiscal pressure
2. Health workforce shortages
3. Increasing inequities
4. Growing and aging population



5. Public pressure to renew the NHS

The NHS calls the plan a *"new service model for the 21st century".* Key elements of the plan include:

Local Integration

The plan lays out a 10 year transformation to create smaller regional integrated systems with ~1M people, eliminating silos and historical competition between organizations. For example, hospitals that used to have their own independent board of directors, are disbanding this governance structure. The investment of £20B over 5 years to fuel this plan represents "*the biggest move towards integrated care of any Western health system in the world"*[vi].

Regional specialty centers

In line with the evidence, the plan involves creating a few specialized, high volume, nationally accredited sites for specialized services. In the new model, patients are empowered to directly access specialists at regional centers, effectively bypassing small community hospitals as the gatekeeper. Examples include trauma (27 sites), acute cardiac care (75 sites) and an acute stroke care (network). [vii]

"Hospitals as physical entities will become specialist hubs, with each specialism concentrated at one or a few hubs within a region, rather than replicated across many generalist hospitals"

Digital Front Door

In creating a digital front door for any citizen to access services, from anywhere, any time, the NHS had to up their game with open standards, virtual care, and the ability for patient data to seamlessly flow between different care settings and silos. They key focus areas for the digital front door are urgent care and emergency care, shifting from a physical first paradigm to digital first. For urgent access to primary care, the shift is to a call centre as the first triage (via phone, text or video via an app, *GP at Hand*[viii]); patients are then routed to an appropriate delivery channel for low acuity care. For emergency services, they are targeting the ~40% of people who show up at the ER who do not need to get emergency services via this physical channel.

NHS @ Home

NHS @ Home is a new delivery model to re-orient channels for citizens to access services, and modernize the health system. *"Care comes to you, instead of you come to us".* As part of the initial launch, the focus is 3 major patient populations - diabetes, obesity, pain. Key enablers for the home as an alternative delivery channel include:

- Remote monitoring of vital signs and other metrics
- Updating payment models

- Upgrading privacy models

So far, publicly reported results suggest that these changes are gaining traction:

- All clinicians can access patient records wherever they are
- In first 5 years of shift to clinical networks:
  - Trauma survival ↑20% (in 5 years)
  - Stroke sites in London went from 31 to 8 sites
  - Stroke length of stay ↓7%, mortality ↓15-17%
- Care is now associated with the person, not the place. Every English citizen can now choose online or telephone consultations, saving time and traveling
- £1B cost savings through redesigned digital outpatient appointments, avoiding 1/3 of in person visits (£700M in administrative cost savings estimated by 2023/2024)

UK Example – St. Mary's Hospital in London changed plans to redevelop the hospital campus

St. Mary's is a local hospital in the north west of London. Before the COVID-19 pandemic, the hospital had planned a £1B redevelopment, with work to start in 2027. The initial goal was to improve efficiency of existing care pathways by shifting resources from inpatient to outpatient care, but still containing the services to the 4 walls of the hospital. Because the COVID-19 pandemic forced the hospital to try things they would not have tried before, they realized many of their assumptions were no longer valid. They also knew that there would be more cycles of pandemics, and so they needed to pandemic-proof. Now – with the leadership of a visionary CEO - the hospital is re-evaluating the approach to all of their patient care pathways as part of the redevelopment. The intention is to:

- Eliminate aspects of outpatient care so that they deliver all of the care outside the hospital
- Primary care physicians take on more responsibility, with help from decision support technology
- Specialist doctors spend more time in community
- Leveraging digital tools as a key enabler

Overall, the keys for success in the NHS to undergo this significant transformation at a UK-wide level are notably:

- Extensive stakeholder consultation to gain a wide consensus: 14 work groups, 200 events, >85K members of the public were engaged, >2500 organizations were tapped for a survey reaching 3.5M individuals
- Secure a funding path - growth of investment in the right areas (3.4% over 5 years) to support demographic changes and new focus on efficiency

- Build on previous initiatives – the NHS has been on a transformation journey well before the Long Term Plan. They built on the prior initiatives that were starting to yield results and provided lived experience.

Netherlands – *"The Dutch Smart Home"*

The Netherlands elected a new minority/coalition government in 2017. Although one would expect that a ruling party with little power is a recipe for getting little change pushed through, the result in the Netherlands is the opposite, as it forces consensus. In addition to political pressure to deliver results, key drivers for change in the Dutch health system were: fiscal constraint, an aging demographic, and the desire to modernize the health system.

One of the first actions the new government took was to split the health ministry up into two different ministries: Cure (hospital care, drugs, devices) and Care (elderly care and primary care in the community). Further, €2B was removed from "cure" budget [hospitals], and €1.5B was added to "care" budget, which forced various players in the system to instantly change how they organize their services. In addition to setting the financial policy framework for moving care out of hospitals and into the community, a key role for central government was to support health organizations with technology infrastructure. Overall, they branded the vision the "*Dutch Smart Home"* and launched a major communication campaign internally and to the outside world, to shift mindsets about the power of accessing care in one's own home. *"From the waiting room to the living room"* was a key tag line. The government also committed to bold top-down targets for the health delivery organizations that they regulate to reach by 2019: 80% of people with a chronic disease must have access to remote monitoring, access to clinicians by a "screen" (if they choose to), and access to their complete digital record.

In addition to bold targets and an aspirational campaign, the Ministry of Health, Welfare & Sport (Min VWS) invested in key enabling infrastructure for their strategy, in highly targeted ways:

- A dedicated team at the Ministry of Health to support the strategy, and help build needed home-based technology. The team looked outside for help, with strong connections to international nodes such as HIMSS (US and Europe) and Singularity University Exponential Medicine.
- Worked side by side with private health insurers so that they would incentivize reimbursement for the top sites who embrace the policy shifts
- Created the Dutch *Health Innovation School*[ix] and, more recently, Health Transformation School, to build needed capacity for people across the entire health system to change how they think and how they work so they can lead the change locally

Overall, the intention is to not add new hospital bed capacity going forward. If anything, hospital beds will close, although it is too early to measure this impact.

Dutch example #1 – A network of hospital-based hematology centres are shifting leukemia care to the home

35 hospitals in the Netherlands have a hematology department that specializes in treating patients with blood cancers and other blood-based illnesses (such as hemolytic anemia). For patients with leukemia, thanks to better drug therapies that are now oral instead of infusion-based, there is little upside in asking sick patients to come to a hospital center to check in with their hematologist in the chronic stages of leukemia care. The network of physicians who lead the hematology departments across the 35 hospitals joined forces to redesign the care pathway of leukemia, starting with Chronic Myogenic Leukemia (CML), shifting it to a purely outpatient model. This includes treatment (oral pills, delivered to the home instead of accessed at the hospital pharmacy), blood work (done in the home), and continuous monitoring of symptoms and side effects via a simple app, CMyLife[x]. In addition to the collaboration of multiple hospital sites to reimagine the care model, three other key enablers were keys to success:

- Lead clinician scientists in hematology re-wrote the care standards for leukemia such that "home first" became the new quality standard, with hospital-based care only used if necessary
- Hematologists worked side by side with the major health insurers to ensure financing reform would be in place to pay for home-based leukemia care
- The network of hematology centers formed an advisory committee to guide the work, made up of leading patient champions, clinicians and pharmaceutical companies who develop the oral therapies

Dutch example #2 – A regional academic medical center is redeveloping its campus to be "mobile first"

Radboud university medical center (Radboudumc) is one of the 8 major academic medical centers in the Netherlands. With Catholic origins, the hospital system was founded in 1956 in a small town of 110,000 in Nijmegen, Netherlands, where it is the anchor employer of the city. It has 15,000 staff, 1000 beds, 3000 students (nursing school, medical school, rehab school), a €1B budget across all specialties, a significant research enterprise, and a large campus that occupies dozens of buildings spanning several city blocks. In 2006, the leadership of Radboudumc decided to reimagine the physical footprint of the hospital for 3 main reasons:

1. Actively mining the trends and signals around the shift towards decentralization, digital enablement, patient self-management, and the ability to deliver care "anywhere"
2. An old, outdated campus and buildings that were in need of redevelopment

3. Desire of the board to be pioneers, and differentiate from other hospital systems in larger cities – as a strategy to attract outside investment, talent and top students.

First, Radboudumc changed its mission statement to "Significant Impact on Health" (not healthcare!). With this new frame of their purpose, they enlisted the commitment of all stakeholders to undergo a major redevelopment of the entire campus. The development is driven by new assumptions about what activities need to remain on site, and what can be done in decentralized locations, including the patient's home. The go forward design assumes that ~70% of what is done on campus will be moved to home and community resulting in closing ~500 of 1000 beds, despite having a patient catchment that is aging and expected to increase demand for services[xi]. To enable this scale of change, a key focus has been 'teaching' innovation and digital to staff, including updating the medical school curriculum every 6 months so that students are trained in the most current methods (conversely, most medical schools require 2 to 15 years to change any aspect of their curriculum). Another key success factor has been partnering well outside of the hospital's city and country with key technology partners (Apple, Google, Philips), and hosting international conferences with top thinkers and doers in health innovation, including TEDx and Singularity University. A decade after this transformation started, the Ministry of Health announced the shift of hospital budgets to the home setting (see above) – Radboudumc was already well on the path to embrace this shift, unlike many of its peer hospitals.

US – Government incentives and health system strategies towards *"care anywhere"*

The US government has a major publicly funded insurance plan for people aged 65+ called Medicare; it is ~$800B, covering care costs for 44 million elderly American citizens. Knowing that enrollment in Medicare is expected to nearly double to 79 million by 2030, the Centers for Medicare & Medicaid Services (CMS) has been using radical policy innovation to ensure that the insurance scheme can continue to support the countries elderly population's care needs. In addition to the need to significantly contain costs of care for the elderly, another major driver for CMS reforms is been major social barriers for the elderly population, including transportation and language barriers that limit ability to access services in a facility-based paradigm.

The "Hospital Without Walls" initiative is the major policy reform to reduce barriers in order to allow hospitals to deliver hospital-level treatment for more serious conditions to patients in their homes. In this scheme, the money follows the person instead of the place; hospitals can directly bill Medicare (public insurance) for services irrespective of where they are delivered. Coverage now includes regular telemedicine, 24/7 remote monitoring and up to ~2X daily home visits for ~30 days, if required.

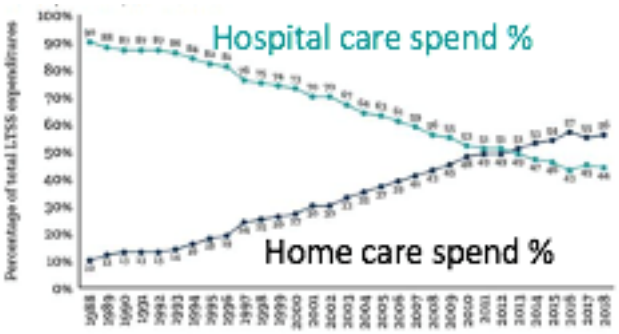
Many hospital services are now available – with funding – at home, with the list growing annually (especially since COVID-19)[xii]:

- Diagnosing conditions, including COVID19, to determine if need to come in person
- Low-risk urgent care & other services for people who lack transportation
- Primary care providers and specialists for mental and behavioral health issues, chronic health conditions, medication management
- Support and counseling for managing long-term conditions and chronic pain
- Physical and occupational therapy
- Follow-up appointments after surgery or hospitalization
- Assess symptoms and identify risk factors with lifestyle and health habits
- Monitor chronic medical conditions without requiring visit to hospital or clinic
- In 2020: 80 additional services approved in the home due to COVID

The full suite of home-based hospital services is taken up (voluntarily) by ~130 hospitals in 30 states. Note – key criteria to participate: Must live 30 min from ER, must have good enough internet, and family caregiver support.

With this multi-year strategy, the results so far are profound:

- Overall results aligned with the quadruple aim: better health outcomes, lower costs of care, patients prefer it[xiii]
- Home care spending as a proportion of total Medicare expenditure is now higher than hospital care (as of 2013)[xiv]
- The # of hospitals in the US continues to decline (7100 in 1974, 6200 in 2017); 110 hospitals have closed in rural communities in the US since 2010. Further consolidation and rationalization of hospitals is expected as the country emerges from the pandemic[xv].



New US president President Joe Biden is doubling down on the government's focus on ending the "institutional bias" in healthcare by expanding access to home and community-based services with a recent $400 billion investment. Key focus areas[xvi]:

- ✓ Extend the current Money Follows the Person program that increases the use of home and community based care services, and reduces the use of institutionally-based services
- ✓ Supports better paying senior care jobs that include benefits and the ability to form unions.

The US government has also enacted another recent policy "Total cost of care" – incentivizing hospitals to also focus on upstream drivers of health, not just acute medical care (such as food security, poverty, housing, transportation, and digital literacy).

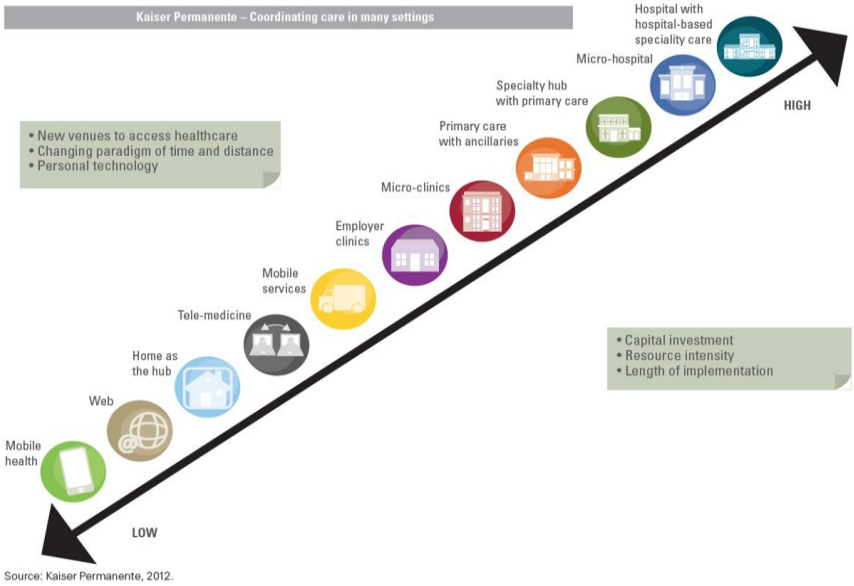
US example #1 – Kaiser Permanente health system is pursuing a "Focus Home" and "Care Anywhere" strategy

Kaiser Permanente (KP) is a large non-profit US health system with 13M members in 8 states and a ~$60MM budget. >15% of members are publicly insured via Medicare (elderly) or Medicaid (poor). KP has been on a 10+ year journey to modernize and ensure fiscal sustainability, while improving outcomes, access and equity. The health system consistently performs in the top 5 on nearly every quality indicator across US hospital systems.

As Medicare increasingly incentivizes care at home, as well as value based care (Accountable Care Organizations), KP reoriented its strategy and care models to embrace these shifts, and lead the country. KP made a strategic decision to no longer build any more health centers or beds, despite growing demand for services and a more complex patient mix[xvii]. The multi-year strategy has 2 main pillars:

I. **Care Anywhere –** KP created more than 12 channels for patients to get care that does not require patients to visit one of their health centers; half of the channels are home-based or virtual (see schematic).

II. **Focus Home** – KP is building a world class home healthcare system with the same level of quality, metrics, technology, and infrastructure as hospital or doctor office care have had for decades. As of 2020, KP is in process of shifting 750K home-based care providers to the Focus Home platform.



There are many enablers to this strategy. The two most notable ones are significant investment in IT (>10% of total budget, compared to <5% for most hospital systems), and creation of their own new medical school to train the next generation of physicians in a future-forward way.

As a result of this strategy, no new beds or health centers have been built or will be built. 65-90% of services are delivered virtually, mostly asynchronous via the Kaiser Connected Care App. Notably, KP was one of few health systems that was able to maintain service levels

(surgery, outpatient, specialty care, primary care) during the pandemic without canceling any visits or care (unlike most others who dropped volumes by 30-70%). Further, because there is a digital backbone across all touch points with patients, KP is able to gather real time data to support continuous improvement.

US Example #2 – Jefferson Health system is pivoting to a "healthcare with no address" strategy

Jefferson is a 12 hospital regional health system based in inner city Philadelphia, with 80k employees. The Board of directors recruited a new CEO (a physician) to transform the health system for the future due to four drivers:

1. Recent merger of many hospitals, including recent acquisition of a design school
2. Financial pressure – although Jefferson is non-profit, it was getting more difficult to make the books balance every year
3. Low socioeconomic population – inner city urban population with poverty, low education and literacy, food insecurity, racial and other inequities impacting access and health outcomes
4. Need to differentiate – Jefferson was not a well-known brand compared to the University of Pennsylvania Medical Center. The board of directors was recently updated and had an ambitious agenda for transformation which led to hiring of the new CEO to challenge all aspects of status quo hospital care.

""In our book on healthcare, we talk about the ridiculousness of the physical [exam]" – Dr. Stephen J Klasko, CEO

Under the leadership of the newly recruited physician CEO, Jefferson embraced a new strategy called "Healthcare with no address". This mantra became the overarching strategic framework for transforming the hospital system from a focus on place to a focus on the person[xviii]. They reframed the default pathway: the majority of healthcare delivery will start at – and occur -- at home. The core acute care hospitals' mandate was reduced to ICUs, for critically ill people and for coronary care. As part of the roll out of the strategy, Jefferson Health built a new specialty hub in downtown Philadelphia to serve as the "space station" between the home and the traditional healthcare ecosystem. A key enabler of the transformation was creative partnerships with technology companies. For example, with some tech solutions, they purchased the enabling technology "on risk" where they only pay the company if results are generated. They also used some of their own capital to make strategic venture capital-like investments in companies that they strategically work with – to align interests, and generate capital to help finance the transformation.

Key results to date[xix]:

- Access: Via investments to create the *JeffConnect* virtual care platform[xx], patients can reach a clinician in any channel, on demand or via scheduled appointments 24 hours a day, 7 days a week
- Shift to home setting: 50% of Emergency Dept ”visits” are no longer a visit to the hospital – they occur in the home
- New capital: Generated >$40Million profit from the IPO of one of the startups they invested in (in 2020) – this helped them avoid declaring bankruptcy during COVID when hospital services were in major decline

Common themes – hospital (dis)investment strategies

I. Central government set conditions for how and where funds for hospital services are used

- Use policy (budget) to force bold action
- Built capacity for people across the health system to embrace future models and new ways of thinking
- Build more flexibility and modularity into capital development processes
- Support sustained technology investment, use regulation and policy to remove barriers

II. Alignment of multiple stakeholders around a single narrative and vision of the future

- Set a long-term plan / vision that is based on principles that almost everyone can agree to
- Smartly use evidence and facts: the quality agenda and economic business case can help make a strong case for centralizing specialized procedures
- Set up to 3 (maximum) big dot strategies and concrete goals across the entire health system – tie the attainment of results to ability to be elected or retained in a position in the future
- Partner rationally with local providers, and payers/health insurance providers to align interests
- Align with economic development policy – local, regional, national. Hospitals can co-invest in tech companies that enable these models and share in the revenue upside while supporting the growth and jobs in the local health tech economy

III. Courage

- Courage to no longer build hospitals and be a leader for others to emulate
- COVID provides a once in a decade window to be bold, take advantage of the momentum
- Long term capital investments for redevelopment of a hospital campus are not fixed – have courage to change plans, even if impact will not be realized for many years

IV. Find like-minded smaller sites that want to lead

- Work with smaller sites that are “off the grid” to be early adapters – they are hungry to lead and differentiate
- Promote and rewarded early adapter sites – especially internationally giving them exposure; the world will notice you and come to learn if you are bold

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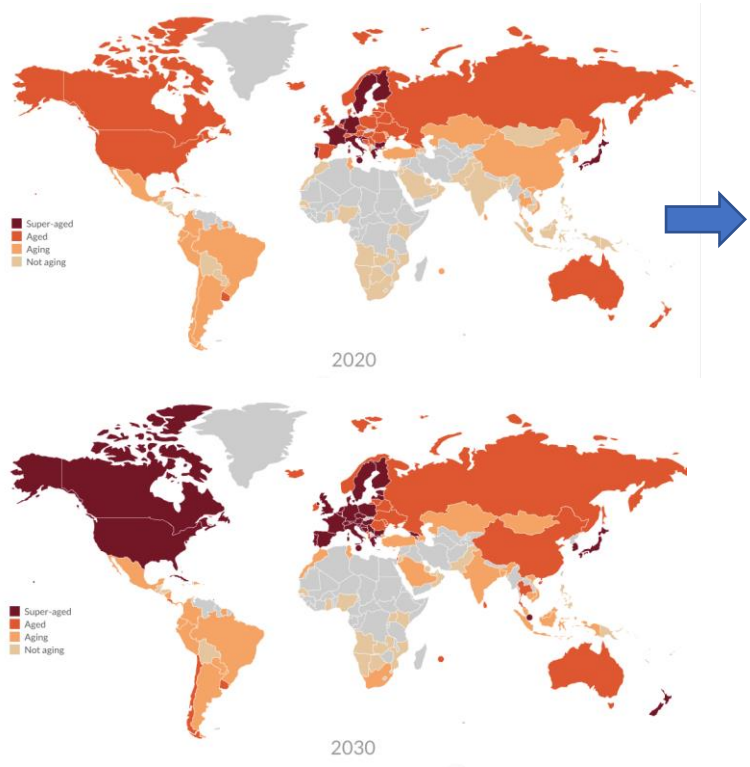
Case studies –long term care setting is shifting away from congregate residences

For the first time in the history of our species, by 2030 the majority of OECD countries will join Japan in being “super-aged”; that is, >20% of the population is older than 65 years[xxi].



The elderly account for ~20% of the population in the EU[xxii], and account for ~50% of publicly funded health and care services. the. The tax base growth of EU-27 countries cannot keep pace; it will not be possible to continue to meet the care needs of our aged society using today’s capital- and labor-intensive facility-based models of long term care. Further, >90% of elderly citizens do not wish to live in congregate settings, and >70% prefer to die in their own home. This scan of global headlines signals that citizens, policy makers and providers seek alternatives to multi-residential facility based supportive living for aging adults:

In this context, we use case studies from Japan, Australia, Netherlands, Denmark, Sweden, Germany, Canada and USA to highlight innovative alternatives to financing and delivery of residential care for seniors.

Integrated community-based systems of elderly care [Japan, Netherlands, Denmark]

Japan, Netherlands and Denmark have set bold, multi-year visions & strategies for integrated community-based systems of care & living for the elderly. The major driver for Japan was their aging society – they reached "super ager" status a decade before any other OECD country. For Denmark and Netherlands, the driver was future fiscal sustainability as well as a philosophy or ideology that values choice, power to citizens and a "community first" paradigm for aged care.

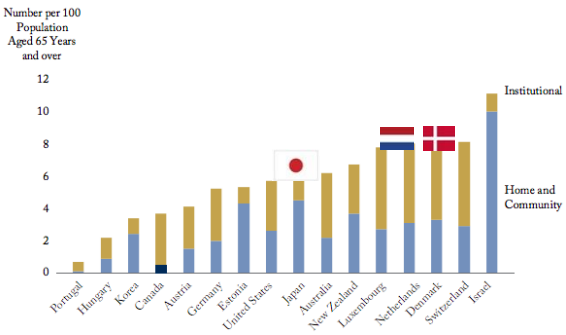
Japan put into place a coherent vision for every municipality to have an integrated system of elderly care over the long-term, by 2025. The focus is two-fold[xxiii]:

"If needed, there is nursing home care too, but people are kept in community as much as possible"

- The home setting - supporting older persons, caregivers and families.
- The community – infrastructure such as seniors clubs, volunteer groups, multidisciplinary teams in every community, including nurse practitioners and other allied health workers

Netherlands – after splitting the health ministry into two separate ministries (Cure for hospitals, Care for elderly care in community), the new lead of the *Care* ministry wrote a bold vision for the future of aged care in the Netherlands. The vision was profiled as world leading in international journals (see figure referencing how the AARP – Association for the Advancement of Retired Professionals – in the US profiled the Dutch vision in their quarterly journal)[xxiv].

Denmark's system calls for people to be cared for in their homes as long as possible, even if they lose functions for daily living. Choice is maximized and pre-ordained models are not imposed. Residents pay monthly fees for housing and food costs. Government pays most of the other costs. Also, workers are well paid, and don't rotate shifts so that they work with the same "family."[xxv] Delegations from around the world visit Denmark to learn about their home and community-based system of care for the elderly.



Taken together, these 3 countries have very high ratios of nurses and personal care workers in the home setting compared to institutional setting [source: CD Howe]. Denmark often describes how nursing home spaces have been closed over time resulting in a 30% drop in institutional spaces, with a shift of spending towards home care over institutional care. The Netherlands allocates >25% of healthcare spend for long term care of the elderly (2nd highest in OECD), of which ~50% is in home & community. The Dutch also pioneered the world renowned home care model (Buurtzorg[xxvi]) now spread to 28 countries including China, Sweden, Germany, the UK, and Kaiser Permanente in the USA.

Nursing Home @ Home [US & Canada]

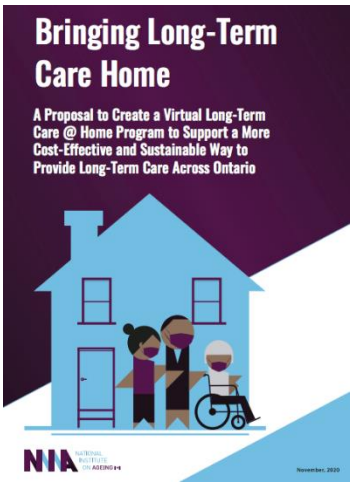
In the USA and Canada, there are increasingly formalized programs called "Nursing home @ home". The drivers for this shift are somewhat different, but the approaches are similar:

USA

The driver in the USA is Medicare (public health system for people aged >65) seeking to keep seniors out of nursing homes after they leave hospital. Also, the nursing home industry and senior living industry is in significant financial trouble due to COVID-19.

A new program called “Medicare Advantage” was put into law wherein the public insurance scheme for seniors pays for many more non-medical services to keep seniors at home. These include home meal delivery, transportation, home safety improvements and personal care. In response to COVID-related pressures, Medicare accelerated and funded a new program called “Skilled Nursing Facility @ Home” (2020)[xxvii]. In this model nursing home operators can now also be paid to take care of people in their homes – this opens up a second revenue stream for nursing home operators, without cannibalizing their core business model. This de-silo’d funding model also allows patients to easily go back and forth if needed (for example, day programs or respite programs for people with Alzheimer’s).

Canada



The driver of nursing home @ home in Canada is lack of capacity – the country historically funds institutional living as the default pathway when seniors can no longer manage in their homes, with one of the lowest levels of home care investment in the world. There is a waiting list for 99,000 longterm care beds today, which is expected to grow to 194,000 by 2035. There are currently ~75,000 beds in the country; it will be impossible to build enough beds to meet this level of demand. Further, during COVID-19 pandemic, nursing homes in Canada were among the worst in the world for morbidity and mortality of residents, causing citizens and providers across the country to actively seek out alternatives to congregate settings for seniors care and living. The home setting was significantly safer for seniors during COVID compared to institutional settings, and many residents and their families asked to be pulled out of nursing homes. Given that pandemics are likely here to stay, nursing home @ home policy is becoming a long term strategy in Canada.

Experiments are now underway in 3 key provinces (Ontario, Saskatchewan and Alberta) with different variations of a “virtual long-term care @ home program”. The cost is budgeted to be ~$123 a day per client, significantly less than nursing home ($190-250/day)[xxviii]. The program includes services such as food delivery, transportation, adult day programs, home care, primary care and the services of community ambulance drivers. Early data emerging in Ontario are promising. It is estimated that ~20% of people currently in a nursing home could reactivate in their home setting with the right supports in place. Further, it is now shown that residents have a 6X higher chance of ending up in an institutional setting if they start in a hospital[xxix] – this is leading to a need to embed standardized, objective assessments for who really needs

residential care and who does not. SE Health has been able to now demonstrate that the ~20% of nursing home residents are able to become fully or nearly fully independent at home on average within 37 days of transition to the home setting, at <1/10th the cost of institutional care over the same period.[xxx]

Overall a key success factor for these nursing home @ home models is having clear evidence-based criteria for what kinds of patients/residents are a good fit – not only based on medical criteria. Further, sophisticated segmentation is a new capability that health system planners often do not have natural competency with. In Ontario, the teams designing nursing home @ home have used data to create 6 discreet segments each with their own @ home care model and funding package, depending on several variables such as medical/functional/social/cognitive state, and the level of family support available.

Self-directed funding via vouchers / patient budgets [Australia, Germany, Sweden, Denmark]

"Here is your budget, what do you want to do with it?"

There is a global shift away from centralized, standardized, one-size-fits-all models for long term care support for frail seniors based on blunt assessments. Countries like Australia, Germany, Sweden and Denmark are ramping up self-directed funding models for older residents, caregivers & communities to disrupt the institutional waiting lists, give people choice & flexibility, and stimulate innovations for aging in place.

In this payment model innovation, the funding for older persons and their family caregivers is allocated based on assessed needs and goals, NOT where care is located, nor how much time of service providers is needed. Care is also agnostic to the setting. There are generally 3 flavors for self-directed funding[xxxi]:

1. Patient/family budgets [Australia, Germany]

Australia and Germany introduced different tiers of patient budgets to allow citizens to age in place. Germany mandatory old age insurance with 5 levels, ranging from $500-$4500 / week (USD)[xxxii]. Australia introduced four tiers of "Aged Care packages", ranging from $8,700 to $50,000 per year (USD)[xxxiii].

2. Caregiving allowances [Sweden]

25% of adults are now caregivers in OECD, and some 9% have financial hardship. The allowance targets helps family caregivers avoid loss of income if they need to take care of someone. Caregivers are reimbursed by the municipality at a salary equal to what a formal

home care worker is paid. This is taxed as income. In addition, if the caregiver is a family member, they are compensated in untaxed cash at a rate of ~$825/month (USD)[xxxiv].

3. Fund supports to stay home beyond medical, ADL and IADL services [Denmark]
Denmark's government provides funding for elderly citizens to stay at home. The funding envelope includes supports form non-traditional providers including neighbours, friends, community groups, local business, faith organizations, and cities for services such as mobility, home maintenance, snow removal, grocery shopping, banking, and social activities

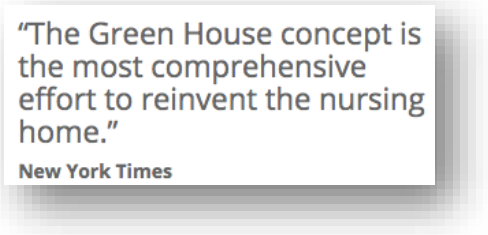
The key success factor for implementing this funding innovation is clarity and transparency over who gets what budget, and for what services. It requires a simple, transparent, evidence-based scheme that is easily understood by all parties. It also requires clarity about what is in scope, what is not in scope, and how a service provider is vetted to receive services using government funded vouchers.

Overall, there are many benefits of giving patients and families the budgets to direct their own long term care. This distributed approach opens up a lot of space for innovation from multiple players including people, families, communities, service providers, tech companies and government. However, it is a lot of change from the status quo and takes time to work. Australia has reported that clients find the system more complicated – it requires education, navigation and support. Also, care workers and agencies resist the model as it requires them to change to a more service and quality orientation.

Alternative community-based models for frail senior living & care

Although the ideal setting for long term care of an elderly citizen is to stay in their own home, this is not always possible due to several factors including lack of family caregiver support, physical built environment, and cost of housing on a fixed income. In parallel, 90% of people do not want to move into a congregate setting such as a nursing or multi-residential supportive living environment. This is mostly because they have an institutional 'feeling', and behave more like hospitals than homes. COVID has naturally made these settings even less desirable because of the severe restrictions imposed on residents and families, and the disproportionate morbidity and mortality that residents experienced in this setting. To fill the gap between the home as the ideal, and an institution as the last resort, several new models have emerged in a grassroots way that create the feeling of home and community, despite the need to relocate to a multi-resident setting:

i) Cluster living / Greenhouse Model [USA]



Cluster living broadly describes a model of housing where multiple renters live in a small (maximum 3 floors) building, and share common amenities such as laundry, kitchen and yard space[xxxv]. Dr. William Thomas, a world renowned geriatrician who is known for designing the Eden Model of nursing home care developed a new model of cluster living called the "Greenhouse" project[xxxvi]. Similar services to a nursing home are instead offered in a small building that looks and feels like a house in a community. The built environment resembles clusters of small residential group homes with 8 to 12 residents each, and a private bathroom.

Key design features of Greenhouse homes demonstrate their non-traditional approach to care[xxxvii]. They principles are similar to other clustered living models that are emerging such as the Butterfly Model or Montessori homes:

- Continuity of care – richer relationships with fewer care providers. Typically, two workers (certified nurse assistants) for every 10 residents
- Access to the amenities of home, including living room that invites socialization, and being able to go outdoors freely
- Central dining via an open kitchen where meals are prepared; access to food 24/7, including residents being allowed to prepare their own food
- Family dining table is key: there is no large dining hall. This design feature is critically important for people with dementia who fare better in familiar environments
- Laundry & chores are decentralized: they are done in the home, with residents contributing when they can

"Those caregivers are also doing the cooking; they're doing the cleaning. They're doing the laundry right along with the care."

The Greenhouse model is starting to get significant uptake. Currently there ~300 Greenhouse homes in the USA across 68 organizations, serving ~3,250 elders. Money follows the person: instead of funding being assigned to a bed, funding is assigned to an individual, who has the choice of how to use the money within certain parameters.

Publicly available results demonstrate the superior outcomes of this model compared to larger congregate settings like nursing homes[xxxviii]:

- Care workers spend more time directly caring for residents than in traditional nursing homes
- better health outcomes
- Better life satisfaction
- Lower healthcare spending on administration and avoided hospital care
- Significantly lower COVID infection rates

Key success factors of the Greenhouse model:

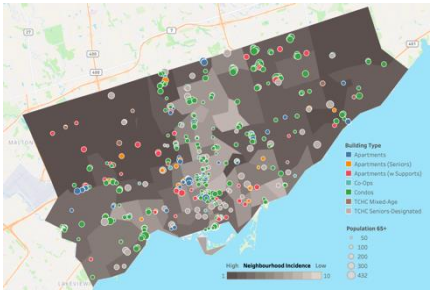
- Evidence based – they evaluate everything consistently, to make the business case
- More staff + more autonomy for the staff
- More attention to the social and the emotional rather than focusing on tasks and the medical. And comfortable physical environments
- Focus on standards and not standardization – adjust the care to fit the population and the individual, daily

The least feasible aspect of the model is the square footage provided to each resident – which is a significant barrier to implementation in urban centres where space is limited. Further, although direct costs for this model are more than traditional institutional care (i.e., for the staff), this direct cost structure is offset by lower admin costs, lower staff turnover, and reduced costs elsewhere in the system.

This model is now gaining international attention outside of the US, especially during the pandemic.

ii) Naturally Occurring Retirement Centers (NORCs) [Canada]

Also commonly called “vertical aging” NORCs are normal rented high rise apartment buildings in urban centers that were not originally built for seniors, that naturally evolved to have a large concentration of elderly people. Typically, a multi-unit apartment building that reaches >35% of residents over the aged of 65 qualifies as a NORC[xxxix]. NORCs tend to be affordably priced rental apartment buildings located near conveniences such as grocery stores and public transportation. Now governments at all levels in Ontario, Canada are trying to accelerate the formation of NORCs so that they are no longer only “naturally occurring”, as they seek out more more community-based models for aging in place in order to deal with the long waiting list for nursing homes. In parallel, NORCs are forming because communities are seeking out models to support seniors to age in place in a more grassroots, bottom-up way.



NORCs exploit the existing footprint of apartment buildings – there is no new investment in creating buildings; and there is no focus on medical models of service delivery. There are 3 critical components to the program:

1. Cooperative landlord - provides free space for a lounge and a large room for communal meals. Members can visit the lounge for morning coffee and conversation and could sign up for up to three subsidized catered dinners a week served by volunteers, as well as a variety of activities

2. Volunteer board of directors - Community leads, government supports – bottom up social innovation instead of top-down institutional models of senior living
3. Paid coordinator at each site - funded by the health system, or the municipality

The original program in Kingston, Ontario, Canada was studied extensively by government and academics. Evaluation of the 2014 pilot project revealed key outcomes[xl]:

- 11 residents were eligible for nursing home, but all preferred to remain where they were. While some people eventually needed to enter a nursing home, the benefits of socialization and exercise helped defer entry, resulting in significant savings
- Scalable and affordable: ~$10 per day per person (compared to >$200/day for nursing homes)
- Families of the residents shared that the program coordinator communicates proactively if problems surface
- While landlords provide space for gatherings, there are also benefits for the landlords because occupant turnover declines

"Some of the services are in the building for more hours of a day; individuals can tap into that resource as they need it; it's more flexible, and more reliable" - resident

Key success factors for NORCs as an alternative to institutionalized living and care for seniors:

- Designed by seniors for seniors – not led by government
- Government and other funders provide support to scale, and fill gaps in infrastructure when needed
- Evaluate extensively by partnering with a credible academic center
- Use storytelling, media and an effective spokesperson (such as 91 year old resident Christine McMillan) to tell the story and influence people

There is now infrastructure and government support to expand to sites across the province.

iii) Dementia Villages [Netherlands, Germany, France, Australia, Canada, USA]

A dementia village is a small city or village where 100% of the residents have dementia, yet the built and non-built environment is indistinguishable from a typical community. The Dutch were the first to create a dementia village in the small town of Hogeweyk[xlii] more than 25 years ago. It is funded by the Dutch social security system and run by a non-profit nursing home agency.

The Hogeweyk is the outcome of an innovative and disruptive vision on living, care and wellbeing for people living with severe dementia.

There is a major need for alternatives to facility-based paradigms for people with dementia. Given that more than 50% of residents of nursing homes have dementia or other forms of cognitive decline, and dementia rates are rising, the need is ever growing. The concept is now being replicated around the world including with groups in Tazmania (Australia), Germany (2),

San Francisco (USA), British Columbia (Canada), and France all recently announcing the opening of their own dementia villages.

The  **core design principles for dementia villages are:**

1. Favourable surroundings: normal house life, support of professionals as needed; streets, gardens
2. Life's pleasures and meaning: freedom to wander, social life (day trips, clubs, etc.)
3. Health: staff to help residents enjoy family and community, freedom, environment, culture; focus on well-being through social relationships rather than medical interventions
4. Lifestyle: people are supported to be the same person they were before they had dementia
5. Combined staff and volunteer resource model: they work as a team, and all understand and work toward the vision
6. Organizational innovation: all policies and structures, procedures in service of the resident. E.g., staff do not wear uniforms

Although there is little published, peer reviewed evidence of outcomes of dementia villages, there are many public case studies, presentations, and webinars. Notable results[xlii]:

- Primary outcome target: satisfaction with quality of life, despite progression of dementia – achieved
- Almost no bedridden residents; only occasionally is a resident bedridden for a long period of time
- Use of antipsychotic medication reduced for ~50% of residents by 12% (2019)
- Residents die at the village – with palliative care in the home

A key success factor for dementia villages is the ability to convene multiple partners to come together in a trusted coalition – the city, a care provider, academia, service providers, product providers and more. It usually requires donation or favorable lease price for a large parcel of land – as a result, non-profit charities (such as churches with surplus land) and municipalities are seeking out models like this. It takes a long time to get a project off the ground – which is why it is critical for the right partners to come together and be committed for the long term.

There has been lots of experience with this model given the Dutch site has had a 25 year runway. The model is being replicated globally[xliii], with many more projects in the pipeline. And the model also can also readily apply to people with disabilities (example - Het Dorp in Arnhem, Netherlands[xliv]).

iv) Multi-generational Living

There is growing attention on designing facilities for long term living of seniors with an "intergenerational" approach from the outset. This means that multiple generations (usually youth + seniors) live in the same physical space – either in the same building, or in the same unit. Key drivers are 3 fold:

1. Seniors have too much house, are often lonely and seek purpose
2. Young or vulnerable people can't afford market housing, have skills to offer, and seek wisdom of elders
3. Municipalities and universities are struggling to support housing and care needs of seniors and youth + families

This approach solves for social isolation of seniors, cost constraints for long term housing and care, and provides access to wisdom and a source of income for younger people, students and other vulnerable populations.

There are generally 3 segments of populations that are targeted for intergenerational living arrangements:[xlv]

Preschool children – e.g., Providence Mount St. Vincent nursing facility in Seattle with a preschool on the site

University students: Many examples:

- Deventer (Netherlands)[xlvi] –university students who seek affordable housing as roommates with seniors seeking companionship
- Trent University (Canada)[xlvii] + *peopleCare Communities* (a family-owned nursing home chain) are building a new 224-bed home that will be the anchor for an "integrated seniors village" on campus
- long-term land lease from the university means peopleCare doesn't have the upfront cost of buying land
- the home will have access to academic experts at the Trent Centre for Aging and Society
- students will have the benefit of interacting with the residents
- nursing students with placements in the home
- graduate students in music act as student musicians-in-residence

Foster kids / at risk young families – e.g., New Life Village (Florida), Bridge Meadows (Oregon): intergenerational community for kids who have come out of the foster care system

Program participants report key benefits of this living arrangement as an alternative to social housing or institutionalized living[xlviii]:

- Seniors gain 24/7 social engagement and neighbors who care about them – without additional state funding
- Students and other vulnerable groups access affordable housing, and wisdom of elders
- Scalable – Partnerships do not have any marginal cost to develop
- Very appropriate for diverse cultures where there are many newcomers from other countries who are used to multi-generational living (Asia, India, Middle East, South America, Africa)

To realize these benefits strong partnerships must be formed between senior living facilities and sources of children, youth or students. Often local zoning or other municipal policies have to be adjusted to enables these models to work at scale.

Though the concept of intentional, intergenerational living has been around for decades, it is quickly gaining steam. Multi-generational housing is now the fastest growing segment of the real estate market and many policymakers and municipalities are creating programs and initiatives to accelerate these developments.

Common themes – alternatives to centrally financed, multi-resident seniors care facilities

I. Philosophy / values alignment across multiple partners – health system, municipality, communities, agencies

- Although we think standardization and scale is the best way to control/regulate quality and minimize costs, it is often against values, and has risks. It requires time to test, learn and refine – often not successful at the beginning
- Shared reality of not needing to build expensive institutions (that no one wants to go to anyway)
- Design for flexibility, agility, modularizing, ability to pivot (i.e., if a pandemic hits!) - introducing patient and family choice for care setting is a more flexible and intuitive way to help people age on their terms, with government supports
- Wherever possible design solutions that solve the problems of other divisions of government – nationally, regionally, locally. For example, intergenerational living addresses student housing (Education department) while also addressing long term care of the elderly (Healthcare). Similarly, using local technology companies' solutions to support aging in place can help with Economic development strategies of all levels of government.
- Transforming a traditional senior's residence to these models requires vision and commitment from leadership to sustain changes over the long run

II. Policy / budget reform

Budget allocation to home/community and away from institutions – ideally with hard targets (>50%)

Create policy incentives to make non-facility care more attractive and viable than facility-based care – for citizens, for staff, and for system leaders

Invest in system-level evaluation in order to build a full business case at a system level – instead of focusing only on direct operational costs of alternatives compared to traditional institutional care

III. Holistic models

Wrap around services and supports are key to making alternative models work – it is not just about the care services or staff ratios. It includes transportation, food, social isolation, family caregiver supports, etc.

IV. Positioning and language matters

Because the institutional model of long term care is so dominant, these emerging alternatives benefit from a memorable brand and positioning e.g., “Greenhouse” “NORC”

- The founders of De Hogeweyk now prefer not to use the term “dementia village” and refer to the Hogeweyk Care Concept instead

V. Health workforce innovation

One cannot pursue these models without addressing health workforce gaps

VI. International Community of Practice

Look outside to learn from others who have already tried these models. It is timely to join the growing community of countries / cities actively exploring many of the models above.

Opportunity to put your country or a city on the global map – with the world wanting to come to you to learn about your approaches. This becomes valuable for generating revenue, and attracting talent and investment.

Case studies – exploiting technology to enable new care models & business models

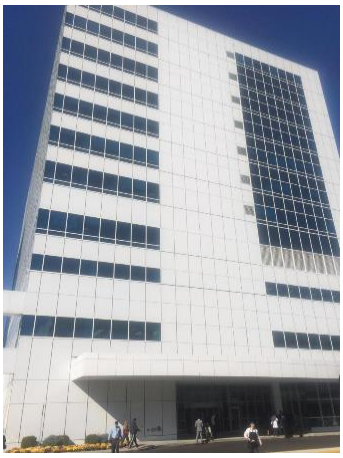
Historically, most people only had access to urgent healthcare services through house calls. Doctors or midwives made house calls to patients from their birth to their death. After the second World War a lot changed with the development of medical technologies and specialization; the hospital became the only place where patients could access specialists (hospitalists), and diagnostic technologies. Fast forward to today, when people are admitted to the hospital, this care setting not only uses up the fair share of constrained healthcare budgets, elderly people also decompensate, which leads to further downstream illness and burden on health systems. With the availability of emerging technologies, coupled to more empowered and engaged patients and families, it is now possible to avoid a growing portion of hospital-based service lines, and shift more (and more complex) healthcare services to one's home. This scan of global headlines captures the promise of current and next generation technologies in allowing many hospital-based services and procedures to no longer need to occur on site at a clinic or facility.

In this context, we examined case studies from the USA, Canada and Australia to highlight how health delivery organizations are leveraging digital and other emerging technologies to re-imagine the care model and business model for many hospital-based services and procedures.

Hospital with no beds [USA, Canada]

Hospitals are embracing a transformation strategy that shifts focus to outpatient care wherein no patient can stay overnight in their facilities, including for procedures that historically had lengths of stay of 2 or more days, such as post-surgical care. This is commonly termed the "*The Hospital without beds".* Two examples from North America highlight the approach, key success factors and results:

Example #1: Montefiore hospital (USA)



The Montefiore health system in Bronx, New York converted an abandoned hotel site into an 11 floor, 280k-square-foot 100% outpatient hospital. The hospital hosts 500 staff and runs 12 operating rooms, but has no overnight inpatient beds.[xlix] The health system moved many medical specialties that were previously housed at other inpatient hospitals into the new outpatient hospital site. *"Bringing them under one roof streamlines the experience for both patients and caregivers. Everything in health care is moving to an ambulatory environment".* As a result of the restructuring, the health system avoided going into bankruptcy (peer hospitals had to close down). They were even able to integrate failing hospitals into the network while continuing to do capital improvements to meet their community's needs.

Example #2: Women's College Hospital (Canada)

Women's College is an academic medical center in the downtown district of Toronto where four other independently owned and operated academic medical centers are within a few city blocks. To differentiate the hospital and position for the future, the board made a strategic decision to change the operating model to a fully outpatient hospital, "the hospital to keep you out of hospital". They divested services that require overnight stay (such as the Maternity/birthing unit), despite lost revenue and prestige. For the remaining services, they transformed care models including integrating digital and home monitoring into all care workflows so bring length of stay down to <24 hours[l]. To enable the transformation they recruited forward thinking clinician leaders and built an in-house innovation team[li] to drive the effort, and evaluate the changes in real time. Notable results from the transition:

- Length of stay for surgery decreased from 5 days to 12 hrs (without cancelling surgical procedures)
- Able to pivot quickly when COVID hit – offered "COVID care @ home" to other hospitals who were unable to offer it

- Significant revenue growth – new grants, new funding, new services. Example – in house transformation team grew from 5 to 45 people in 5 yrs; they became a consultancy to the rest of the system
- Able to attract top talent – physicians, nurses & researchers want to be part of the future
- Became a digital, evidence and policy shop for the Ontario Ministry of Health to support the broader hospital transformation agenda in the province

Hospital with no patients [Australia, USA]

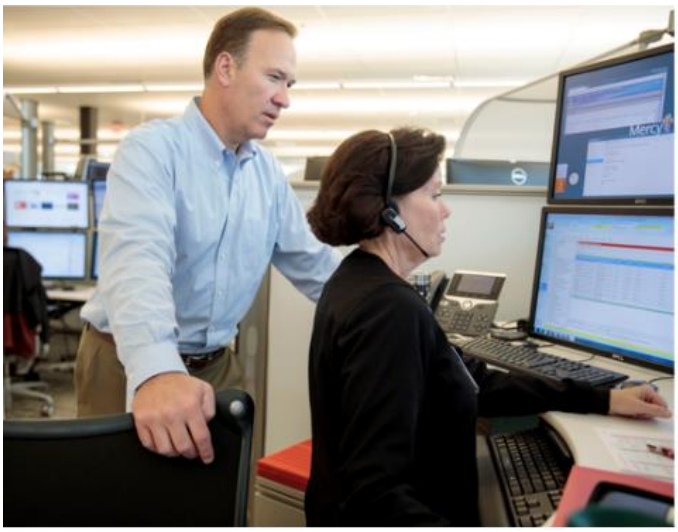
A new type of hospital model is emerging that exploits emerging technology and the ability of hospital to deliver almost all care @ home or at a smaller microsatellite site. These types of hospitals are called “virtual hospitals” or “Hospital without patients”[lii]. Three recent successful models highlight this approach for significantly leaning out bricks and mortar hospital infrastructure. Common success factors of all three case examples are:

- ✓ All leverage technology and care model innovation to challenge the definition and physical boundaries of a traditional “hospital”
- ✓ All open up hospital service access to people in regions that do not have consistent access e.g. Virtual ICUs deliver specialty (critical) care to remote health facilities who otherwise may not have access
- ✓ All can scale up the model quickly without the capital needed for more buildings or beds
- ✓ They partner with tech companies as a “test lab” for the companies to co-design the IT infrastructure that exploits the latest tech

Example #1 - Mercy Virtual Hospital in St. Louis [USA]

Mercy hospital in St. Louis, Missouri needed a more scalable hospital structure to support the changing and growing needs of patients in their community. They created *Mercy Virtual* in 2015, a four-story hospital with “no beds” and “no patients”. More than 300 staff care for patients remotely – either at home or at other local, smaller Mercy facilities, 24 hours a day, 7 days a week. They make use of key technologies such as video calls and remote monitoring of vital signs. They also operate a virtual ICU with an equivalent 30-bed ICU capacity. In the virtual ICU they deploy 2-way cameras to zoom in on patients. Staff at a command centre continuously analyze data to support clinicians at the patient’s bedside[liii]. The hospital has been able to reduce ICU length of stay by 20%. Overall, the hospital reports it can deliver care for less cost than the traditional model (at least 2% ie $98M vs $100M) while also generating better outcomes - fewer hospitalizations, fewer deaths and better patient and staff experience.

Delegations from around the world come to St Louis to learn about the model, effectively putting the small hospital and region on the global map.



Example #2 – University of Pennsylvania Medical Centre 3 new digital hospitals [USA]

UPMC needed to build new hospital capacity from scratch, at scale to meet the needs of specialty care populations in Pennsylvania. They invested $2B to build 3 new "100% digital hospitals", but "no new beds". The three specialty hospitals span cancer, heart & transplant, and rehab. A key enabler of the ambitious strategy was a strategic partnership with Microsoft Inc as a technology development partner.[liv] Results are not yet published, as UPMC began implementation of the 3 digital hospitals in 2020-2022.

Example #3 - Royal Prince Alfred (RPA) Virtual Hospital in Sydney [Australia]

RPA accelerated plans to virtualize their hospital services during the COVID-19 pandemic. They launched *"RPA Virtual*" – Australia's first digital hospital – in 2020. The goal was primarily to reduce the number of ER visits and reduce length of hospital stay for patients who are admitted. They use a blend of remote patient monitoring and real time patient engagement practices such as devices to measure vital signs at home, data surveillance 24/7 and video consults with clinicians 2 times per day. During COVID they were able to defer ~11% of patients from visiting the hospital when their health status deteriorated. Milestones that were planned for 5 year time frame were reached in 10 weeks during COVID (enabled by digital infrastructure), demonstrating how quickly a transformation like this could be achieved[lv].

Shifting specific hospital departments to the home setting [USA]

The above case studies describe strategies for an entire hospital to re-imagine their operating model so that the minimal amount of activity takes place in bricks and mortar hospital centers. For some hospitals or patient populations, it may be enough to just decentralized one

department or patient pathway in order to ensure access, fiscal sustainability or improve outcomes. Four relevant hospital based departments that now can deliver services in the home setting are showcased here:

Inpatient care @ home

Hospital-to-home care models were first developed by Mayo Clinic 15+ years go. They now are a fairly standard model to reduce length of in-patient hospital stays in North America[lvi]. In nearly all cases the driver of hospital-to-home programs is two-fold: Firstly, to reduce cost and free up bed capacity (or shut down beds). Secondly, to improve outcomes and reduce re-admissions to hospital after discharge (value-based care, Accountable Care). COVID accelerated the movement of in-patient care to the home setting due to the significant risk of physical contact.

In the US, most hospitals now offer a hospital-to-home program as a standard offering. The model has key features:

- Up to 70% of in-patient care can be managed at home
- Patients remain at home – care is managed using advanced remote monitoring, telemedicine + periodic home visits from physician, nurse, pharmacist, phlebotomist, etc.
- Often used for elderly patients who either refuse to go to hospital or are at risk of hospital infections or other decompensation in hospital
- Also used for risky or complex hospital discharges – wrap a lot of human care and tech around the patient to ensure they can stay safely at home for as long as possible

In Canada (Ontario) hospital to home programs are just starting to get off the ground because of new funding programs the Ministry of Health created. The first is “Bundled Payments” hospitals are required to discharge patients on the same day of a surgery and complete the post-surgery care in the home setting. The hospital typically partners with a home care provider and technology partner to enable the new care pathway – all three players get one envelope of funding for each patient episode (the “bundle”) and decide how they will split the funds among them. Key use cases for post-surgical bundles in Ontario are cardiac surgery, hip replacement surgery, total knee replacement surgery, post-stroke care, dialysis, COPD management, and palliative care[lvii]. In addition to the payment innovation (ie paying for one price regardless of activity or setting), providers in the bundle also need to deliver on stated, evidence-based outcomes targets (such as zero readmissions) in order to get full payment.

Results published[lviii]:

- Better clinical outcomes, lower length of stay, lower readmissions & fewer ER visits
- Cost savings of 19–30% compared to traditional inpatient hospital care (Cleveland Clinic reports saving $3,320 saved per patient care episode)

- Allows hospitals to diversify revenues & buffer capacity (e.g. free up beds for use with COVID patients

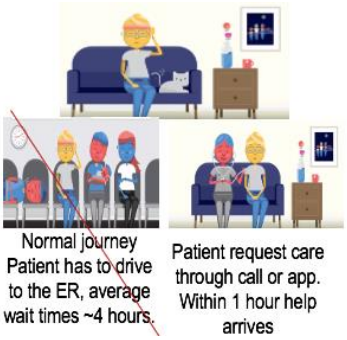
For these examples of hospital-to-home programs there are three key success factors:

- Abandoning the fee-for-service transactional payment model. Instead, outcomes based payment models are used.
- Technology in the home that extends capacity of care professionals - clinical grade, but inexpensive, intuitive, simple, easy to use, integrated with IT systems[lix].
- Strong, trusted relationship between hospital staff and home care staff – if hospital clinicians do not trust the home care partners to deliver high quality acute care in the home setting, the program cannot deliver on targets

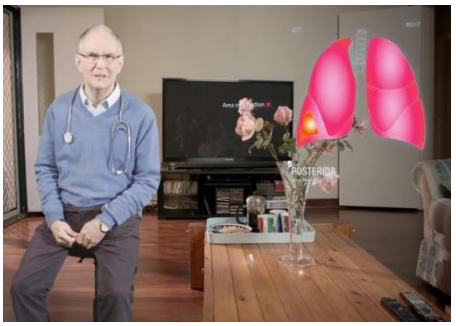
Emergency Department / Primary Care / ICU @ home

Technology coupled to new care and business models are enabling constraints of time, place and distance to be broken for urgent care situations like Emergency care, primary care and even critical care. When COVID hit, health systems tried to significantly reduce visits to the ER or to primary care, while also protecting ICU capacity for COVID positive patients. As a result, small experiments with ER/Primary Care/ICU @ home quickly accelerated and became usual care models.

ER @ Home: Key drivers for diverting ER visits to the home include: long wait times in the emergency room, poor access and outcomes for patients and an estimate that 40-65% of ER visits are inappropriate or unnecessary. In the ER @ home model patients are triaged virtually (phone, video or via app/text)[lx]. If an urgent situation requires some level of direct care, the hospital partners with a home-based agency to bring the ER service to the home. With Dispatch Health in the US, wait times were reduced from 4 hours to 1 hour, and 30-40% of ER visits were avoided or diverted[lxi]. Also, ER @ home allows hospitals to better plan and utilize capacity at the ER on site by diverting unnecessary visits to the home.



Primary care @ Home: Because the visit-based model of primary work does not work well for complex home bound seniors, leading primary care physicians extend their practice to house calls for home bound seniors and other complex patients. Often a nurse is the ”hands, eyes, ears” of the physician in the home, and the physician delegates via virtual presence (phone, video or even hologram). Programs report better continuity of care for complex, home-bound,



frail seniors[lxii]. And, programs such as Kaiser Permanente's "Primary Care Plus" report reducing hospital admissions and stays by 52%.

ICU @ Home: ICU @ home programs expanded during COVID in India. US sites report the model pays for itself within a year.[lxiii]

Key success factors for all three programs:

- Requires a good home-based care partner that is flexible, nimble and knows how to do house calls - rarely can a hospital do this themselves
- Requires good technology for the home setting, interoperable with the hospital's IT systems
- Financing innovation – reallocate the operating capital that would have been spent at the hospital to finance the @ home model
- Policy innovation – to allow traditional physician services to be delivered in the home setting via in person or virtual care

Surgery @ home

Hospitals globally have struggled with long wait times for surgery due to constrained operating room capacity. Reducing wait times for surgeries are under major political and societal pressure since they are very visible, and people often wait and suffer in pain. This need has amplified during COVID due to cancelled elective surgical procedures and a backlog that is currently estimated to be 3 years or more.

"Instead of bringing the patient to the operating room, the operating room is taken to the patient"

Building Operating Room capacity is a fixed capital investment and is an unrealistic and unsustainable way to deal with surges in surgery demand[lxiv]. Technology and process innovation is now allowing viable alternatives to hospital-based Operating theatres. These include mobile surgeries, temporary surgical suites[lxv] or even home-based surgery (where a truck pulls up to the patient's house – as shown in the figure to the right). Home surgery is both safe and cost-effective. It provides an efficient and effective use of capital and other resources to help hospitals clear a backlog or wait list, without investing in permanent capex. It can also extend care to patients and communities that are underserved by traditional hospital surgery centers.

Infusion services @ home

Infusion services such as chemotherapy, hemodialysis and other intravenous (IV) drips like antibiotics and pain medication can be done in the home for many patient and disease situations. Home chemotherapy has been around for more than 45 years, but it is still not the default pathway; instead, we ask patients with cancer to drive to hospitals to do chemo treatments several times a week or month. Home dialysis is known to be feasible for 40% of patients, yet <15% access it at home. The promise of home alternatives for these types of infusion services are both a better patient experience (convenience), and a lower cost of care given these are a high volume procedures that are currently mediated by high paid professionals in a hospital facility. Home chemotherapy is mediated by a skilled nurse; home dialysis is self-managed by the patient, usually in the evening while they are sleeping.

Technology is making home alternatives for infusion therapy easier and more cost effective than ever before. For example, legacy technology for home dialysis is difficult to use, expensive and is analog (data does not link to other systems); New technology (on the right in the image) seamlessly purifies the water, produces fluids that are used in dialysis in real-time, takes the patients blood pressure, communicates data to people in the circle of care, and also supports automatic ordering of supplies when they run low. *"It only needs water and an electrical outlet".*[lxvi]

Chemotherapy @ home results[lxvii]:

- Decreases hospital acquired infections
- Convenience for patient and family as they do not need to travel to the cancer center or infusion clinic
- Better care quality – nurse delivers chemo in the home and can assess the home environment
- Reduces hospital admissions and occupied beds (example AML patients reduced from 30 days to 10 days)

Dialysis at home results[lxviii]:

- Average rate in North America is <15% … however, leading sites with intentional home dialysis strategies are at the maximum (40%) of all dialysis care at home (e.g. UHN – Toronto)
- Less disruption to patient's daily life (can do it while sleeping)

Key success factors for implementing home-based infusion services as a routine care model:

- Really good user experience design –there are many barriers to technology use in the home that need to be considered and designed for (energy, water, stairs, user capacity, internet, managing consumables and other supplies)
- Payment models and incentives aligned – otherwise hospitals will want to keep the services in their walls as they are lucrative for revenue
- Behaviour change – clinicians at hospital like having the same patients every day. Some patients resist home alternatives because they like the feeling of being cared for by someone when they undergo the treatment in a facility.

With the rising prevalence of chronic disease and cancer, the demand for chronic dialysis and chemotherapy treatment is expected to grow; hospitals will not be able to meet the demand, nor do they need to, as home based alternatives that are becoming mainstream.

New entrants – Retailization of healthcare

All of the case studies described above came to life because hospitals or health systems chose to pursue an alternative model to facility-based care. However, in none of the above situations was it a mandatory requirement to make the change. The window where these models of de-institutionalization of hospital or senior care models are "voluntary" may be closing. Nearly every major tech giant, grocer and retailer has is finding ways to enter the healthcare market and capture share of the activity from incumbent traditional players (physician practices, hospitals, pharmacies, diagnostic labs, imaging centers, nursing homes, and home care). This includes major brands such as: Apple, Amazon, Google, Walmart, Microsoft, major banks, major telcos, and large grocery chains. These "new entrants" to healthcare may be outside firms, but they have a lot of patience and capital to invest, as well as new capabilities that traditional healthcare delivery organizations lack. For example – competency with technology, deep consumer insight, designing amazing client and staff experiences, at scale. These outside firms can disrupt the traditional hospital system very quickly.[lxix]

New entrant case study: Walmart Health [USA]

Major US retailer Walmart has had a long held ambition to be "the #1 healthcare delivery company in America". The company is now executing the strategy. Key moves in the last decade include[lxx]:

✓ Formed an in-house Healthcare team: Built a Walmart Health team with top advisors from Disney Institute (to create amazing experiences for staff and patients)

- ✓ Care Centers: Rolled out first set of health center s with full suite of services in 2019. Services include primary care, urgent care, dentistry, pharmacy, diagnostic labs (via partnership with Quest diagnostics), imaging, optometry, light surgical procedures. 35 health centers were built in 2020, with an ambition to open 4000 more in the coming years. “A Walmart within 12 miles of every American”
- ✓ Cost of services is 20% to 80% lower than currently available alternatives with incumbents (e.g. doctor visit for $4, dentist visit for $10)
- ✓ Financing: Built a health insurance division – influencing payment and reimbursement schemes
- ✓ Doctors: Acquired a telemedicine company to offer their own access to doctors on demand, 24/7, no matter where you are
- ✓ Health workforce: Created a University to train health workers to support their roll out - program for any Walmart staff to upskill to become a health professional – for $1/day of tuition
- ✓ Home care: Formed a preferred partnership with Humana health system, which just bough Kindred Home Care, one of the largest home care organizations in the USA.

Key success factors for Walmart and other new entrants exploit many gaps that traditional healthcare players possess:

- Ambitious vision with bold targets for cost savings and quality outcomes. For example, Walmart reports cost of services that are 20% to 80% lower than currently available alternatives with incumbents (e.g. doctor visit for $4 instead of $50-75, dentist visit for $10 instead of $70-100)
- Relentless focus on creating a superior customer experience and staff experience
- Systematic plan to scale to multiple sites, leveraging their reach and customer base
- Creative partnerships and acquisitions to bring capabilities in house

Common themes – technology enabled alternatives to centralized facility-based care

- Requires good technology and a digital backbone for data integration; work with local tech ecosystem to enable
- Requires sound financing / reimbursement schemes so the home alternative is more attractive to clinicians/hospitals AND patients/families than the facility based model
- Partnerships are key:
- Support from / partnership with the public health system and payers or insurers
- Academic partnerships to build evidence and credibility – translational science, evidence focused
- Partner with a local major tech company to bring in needed technology and expertise, and capital (example - UPMC partnered with Microsoft; in the Netherlands they partner with Philips)

- Hospital to home and virtual hospitals can be a major strategy for reducing need for bricks and mortar hospital buildings and beds
- For regions with low volumes, and/or where it is difficult to recruit physicians, and there is political risk of closing small hospitals, virtual hospitals are a viable option for keeping a hospital "open", even if there are limited operations on site. Example – the "uncloseable hospital" in a small island in Canada[lxxi]
- Once you get started with one program or service line (such as ER @ home or post-surgery bundles), hospitals can continue adding more services and use cases to the program … allowing you to ultimately reduce need for inpatient beds and other infrastructure
- Experiment with "off the grid" smaller hospitals or senior living / nursing homes

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