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## Hospital futurescape: Schillenmethode, consumerism & virtual care



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The topic of the hospital of the future is garnering attention globally as hospital budgets shrink, aging populations increase and digital technology opens new avenues for treatment and establishes a new consumer mindset toward healthcare delivery.

Today's hospitals, as an aggregation of resources, are not well equipped to respond. Physicians, MRI's, operating rooms, intensive care beds, hospital beds and even labs reside in a campus of care to which patients must travel, wait and stay to receive treatment. Designed to consolidate and streamline acute care, hospitals are geared to the needs of care providers (not patients) and intended to maximize the use and efficacy of expensive physical and human resource assets.

This article postulates that the current hospital model must change, both for pragmatic reasons (the current model is financially unsustainable) and simply to enable more responsive and modern healthcare delivery. It also looks at some of the trailblazers – notably in Canada, the Netherlands and Norway – who are rethinking, redesigning and remaking hospitals for the future.

### The writing on the wall

A hospital built in 2016 looks similar in form and function to hospitals of the past 50 years. Yet, this infrastructure is unsustainable from a cost standpoint and can no longer meet the needs of today's society. Hospitals consume the bulk of healthcare resources: in Canada 29.5% of healthcare dollars are spent on hospitals<sup>i</sup> and in the US, hospital care accounts for 32.1% of national health expenditures.<sup>ii</sup>

Already strained budgets will be pushed beyond limits with essential infrastructure upgrades, such as hospital information systems that are in dire need of replacement across Canada. This is compounded by the increase of our aging population. In Canada alone, the population of those older than 65 is expected to increase to 10.4 million by 2036 – growing six times the rate of the under-65 age population.<sup>iii</sup>

At the same time, the ubiquity of digital technology has created a new consumer mindset; one that is now driving patient expectations of healthcare:

- 76% of Canadians say digital health can make accessing health care services easier and more convenient.<sup>iv</sup>
- Over 80% say they would take advantage of digital technology if it were available to view their own health information, such as lab test and prescriptions, or to access services, such as making appointments or requesting prescription renewals.<sup>v</sup>
- Internationally, over 75% of patients in Germany, the UK and Singapore indicate they would like to use digital healthcare services.<sup>vi</sup>

Economics and consumer demand have dictated the writing on the wall. The existing system needs to change, and change dramatically.

## What's next?

The organizing paradigm of hospitals is now poised to change dramatically as digital technology shifts healthcare to become consumer-centric, bridging the gaps between acute and primary care, health and wellness.

### Shift from 'hospital resources' to 'community resources'

Other changes to hospital care have already taken place and hasten this shift. The number of hospital beds per population has reduced dramatically as length of stay has been shortened. Day surgery has become the norm rather than the exception. And many surgeries have been replaced entirely by non-surgical care. All of this translates into patients recovering less in hospital and more at home or in community settings.

The difference between the past and the future will be that what takes place in the community and at home will not be isolated from specialist care.

The response is to bring care out into the community, closer to home; essentially disaggregating hospital resources and redefining them, perhaps more rightfully, as community resources.



Over the next few years we will see acceleration in the trends that have decreased the number of beds per population and resulted in more care delivered at home. The difference between the past and the future will be that what takes place in the community and at home will not be isolated from specialist care. Virtual care will allow the remote monitoring, assessment and follow up that has to-date generally involved moving the patient physically to access the care provider.

### Using information to deliver 'care by algorithm'

The same information that can flow between acute care providers and those in-community can also flow to powerful learning algorithms that will augment and improve care. Information from all aspects of a patient's life will be utilized to build custom care plans, personalized for their own genetic, social, environmental and clinical needs.

One can envision a future, where a patient's frailty status will be updated in real time, dependant on clinical information as well as smart sensors in the home, clothing and general environment. Coupled with a limited set of social and socio-economic data, preventive algorithms could alert care-givers of concerns before a tragic fall occurs. The potential for these predictive analytic algorithms in specific populations cannot be overstated: in BC, for example, the frail elderly make up less than 1% of the population but generate 21% of the health care costs.

## Global trailblazers

### The Netherlands' Schillenmethode

The Netherlands is home to some of the world's most advanced hospital designs. For the past decade they have embraced *schillenmethode*, or 'functional zoning model', which observes that a hospital contains four different zones with different functions. These functions are evolving independently, in different ways, subject to the 6 D's of digital health\*.

\*see sidebar, "The 6 D's of digital health".

The four functional zones in the Dutch model are:

- 1 The 'hotfloor', which provides advanced monitoring technologies for the sickest patients. It includes medical imaging facilities and operating rooms.
- 2 The 'hotel' is where patients stay while in the hospital.
- 3 The 'office' houses facilities for administration and management as well as patient clinics.
- 4 The 'factory' accommodates support functions, such as laundry, meal preparation and so on.



Hospitals like the Gelre Hospital in Zutphen have been built based on the model of four functional zones.

Source: Lucien Engelen, Roy Pype and Robert Muijsers, How to plan a hospital in 2016 to be built in 2020

Lucien Engelen, Director REshape Center for Innovation at Radboud University Medical Center (one of the leading hospital and digital health centres in the world), has outlined how converging digital health technology will completely reshape how these zones evolve. His view is that the home environment will become the hospital's new layer. Indeed, Radboud UMC has set a goal of eliminating 70% of current hospital functions within seven years and is planning to close half of its beds (500 beds) by 2025. They will achieve this by leveraging technology for telemonitoring through digital health.

## Digital dynamics: healthcare's quiet transformation

Understanding what the hospital of the future will look like requires a step back to consider the dynamics of digital technologies and the process that has been quietly transforming healthcare for over 30 years. For the past three decades, paper has been steadily converted from analog health records into digital "1's and 0's". The process has been slow and often painful. Politicians, physicians and the public have all, at times, questioned the value and the progress. This long period of (at times doubted) progress is actually a hallmark of the exponential curve that follows any digital transformation.

New York Times best-selling authors, Stephen Kotler and Peter Diamandis, have examined the cycles of advancing technologies. They have characterized a framework called the Six Ds of Exponentials, which is a chain reaction of technological progression; a road map of rapid development that always leads to enormous upheaval and opportunity. The Six D's apply to healthcare and will ultimately inform the hospital of the future. They are:

**Digitization** - a technology becomes exponential once it is information enabled. In health care, we are now seeing the convergence of multiple digital technologies: electronic medical records, digital medical imaging, sensors, genomics, big data, artificial intelligence, and robotics. Compounding the digitization challenge in health is the ability for these divergent digital streams to interoperate.

**Deception** - as these technologies develop they attract attention and hype that cannot be sustained on the basis of initial outcomes. Interest fades and the technologies are questioned and dismissed. In healthcare, as the digitization phase has continued to grind, for some the hope has faded.

**Disruption** - once information is digital and interoperable, it can flow in unexpected patterns creating new value and disrupting old ways of value delivery. In healthcare, we see the potential for apps and virtual care replacing many hospital encounters.

**Demonetization** – once value is being created digitally, the marginal cost for delivering more value approaches zero. This effect pulls huge amounts of money out of industries (e.g. newspapers, music). Any service provided completely via an app or algorithm will have a minimal marginal cost to scale. As these apps become widely used, we will see some healthcare costs decrease.

**Dematerialization** – as digital information can be exchanged between parties globally and in real-time, location and physical assets matter less. Structures designed to provide physical presence to deliver value are dematerialized. Hospitals of the future are no different.

**Democratization** – digital services become ubiquitous at low cost, delivering huge value (e.g. smartphones). This wave will reach healthcare as well.



In terms of *schillenmethode*, Engelen predicts that:

- The 'hotfloor' will get smaller as monitoring capabilities advance and are applied earlier in the course of disease, become predictive in nature, and treatment becomes ever more precise. Imaging will evolve as sensors become smaller and cheaper and hand-held diagnostic devices enable diagnosis in the community.
- The 'hotel' will become more focused with monitoring previously reserved for ICU beds now being part of a 'normal' room. Full rooming-in for patient's partners, who are the active care-givers at home, will be embraced and supported. Individual care plans will be loaded into the remote monitoring system at the patient's home and the role of care-givers will be incorporated more formally into this planning.
- The 'office' will change as the shift from acute care to outpatient treatment is matched by an increase of virtual visits that decrease the number of physical visits between patients and providers. Physical encounters will be reserved for examinations where physical attendance is absolutely necessary or for multi-disciplinary meetings to set care plans, educate or innovate.
- The 'factory' will be redirected. Many functions, like meal preparations or laundry will be outsourced offsite. Clinical functions like laboratories will themselves be disrupted and transformed by changes to lab medicine. Many tests will be performed in simple handheld devices in the community.

While the Netherlands is widely regarded for its progressive approach to reimagining the hospital environment, Ontario's Humber River hospital is also at the forefront.

### Canada's Humber River Hospital

The new Humber River Hospital in Toronto referred to Akershus University Hospital in Oslo, a fully digital hospital since 2008, as a model for their new operations.

In efforts to reduce "sneaker time" – the amount of time nurses and doctors spend walking to different parts of the hospital to deliver care – the fully digital 656-bed hospital equips patients to control and participate in their own environment and care. This encompasses changing temperature and light settings and communicating with their nurse via video link and health devices that will automatically record and transmit blood pressure and vital sign data.

**A look at the south side of the new Humber River Hospital showing the Portals of Care.**





The results are impressive<sup>vii</sup>:

- Workflow was redesigned using simulation and Lean methodologies which resulted in reducing nursing travel time by 20% and reducing care activity delays by 30%.
- To accommodate a 30% projected growth in patient volume, optimization of ED workflow, layout and processes using computer simulation modeling have reduced patient length of stay in the new ED by 35–62% and freed up more than 7,000 square feet of ED space.

In addition to creating a more patient-friendly quiet and restful environment, the interlinking of high-tech systems makes the hospital safer and more efficient. Medication errors are expected to be reduced due to wristbands with a barcode that will be scanned to confirm the patient is receiving the right medication and will record who administered it and when in the patient's chart.<sup>viii</sup>

### Oslo's Akershus Hospital

Oslo's Akershus Hospital, completed in 2008, won the coveted Better Building Healthcare Award for Best International Design in 2009 and is widely recognized as an excellent example of modern health-promoting architecture. Using principles of light, space and nature, sky views through glass ceiling, wood decor as well as calming piano music played through embedded speakers, the environment is the antithesis of more commonly found florescent, noisy and disruptive ones.

Wards are located on one side of the hospital and treatment buildings on the other. A central glass-covered atrium runs through the middle with shops, cafés and a hairdresser. The central 'street' is a principle copied from other Scandinavian hospitals and allows more normal social interaction in a central fluid space.<sup>ix</sup>

Digital technology is also a fundamental enabler of the Akershus Hospital experience. Highlights include<sup>x</sup>:

- **Wired and wireless backbone.** The whole hospital has a cabling backbone supporting 1700 wireless access points permitting voice communications, location information, and patient entertainment. Tablets and smartphones can connect to access all of the electronic patient files.

- **IP-Enabled Telephony.** The hospital has distributed 700 wireless IP phones to the staff, allowing for reliable and instantaneous communications between staff and between patients and staff.
- **Smart Cards.** Identification and log-in cards serve as a high security all-in-one solution for staff to access any of the hospital's facilities including parking lots, retail stores, robots, workstations, computers, patient's electronic journals, and printers.
- **Automated Transportation Systems** – Two systems were installed in order to maximize efficiency: a pneumatic tube system can carry objects less than 5 kilograms to most rooms in the hospital. For larger objects, automated guided vehicles (AGVs) transport food, laundry, sterile items, medical equipment, waste, and other items around the facility using laser scanners to navigate their way down corridors, onto elevators, and around people.

## Building empathy into tomorrow's hospitals

The role of digital health technology is transforming the shape and function of hospitals around the world and along with it the economics and patient-centricity of care. Where will this lead? The net result will be people remaining in their own home setting, receiving excellent care and needing to spend less time in hospital. The challenge for institutions contemplating major hospital builds in the next decade will be to embrace a digital health paradigm at its infancy. When hospital administrators, government and health care providers are able to maximize the flexibility of the physical infrastructure they build, they can create hospitals that embrace humanity in their very design.

What's next for Canada in the years ahead? How can we learn from Humber River and other hospitals that follow the future-forward path?





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