



Healthcare 4.6



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Healthcare 4.6

I am delighted to be taking over the editorial helm at HealthManagement.org from the very capable hands of Christian Lovis and happier still that this, my first issue as Editor-In-Chief – IT, is focussed on Healthcare 4.6 – the way to the future of healthcare 5.0? – a topic of extreme importance and interest to me.

If the recent pandemic has shown us anything, it is how critical it is to evolve in the way we offer care and build and develop the infrastructure that surrounds it. Practically overnight, patients and healthcare providers from across the world were forced to adapt to utilising technology in healthcare, and many lessons were learned. Jan-Philipp Beck makes a convincing argument for keeping the momentum around what he calls the “Digital Health Boom” going long after the pandemic subsides.

In their article Healthcare Worker 4.0: Redesigning Jobs for the Future, Dr Eugene Fidelis Soh and colleagues shine a light on the human resources aspect of evolution in healthcare as they take us through their hospitals’ journey in transforming the workforce for the next generation.

Prof Florencio Travieso urges you to put your preconceptions aside, and for a moment, consider how blockchain (not to be confused with the controversial bitcoin), could empower patients concerning their data and revolutionise global digital health with its unique ability to increase the speed, security and traceability of the information shared.

Mina Makary and Carol Vitellas take us inside the futuristic world of AI in radiology. From disease detection and characterisation to monitoring, this article details the latest research and discusses how AI has the potential to completely transform the field.

How do communities at large support the evolution of technology in healthcare? Supportive frameworks from policy and regulation to investment and education are essential. To that end, Dr Lena Otto from TU Dresden teams up with Diane Whitehouse from EHTEL in Brussels to

describe a telemedicine readiness tool that has been supporting communities internationally in their mission towards expanded telemedicine use.

In traditional medicine, much has been made of the human condition and our propensity to prefer face-to-face and hand-to-hand contact over the more ‘impersonal’ digital communication. In his article, Dr Rafael Vidal-Perez describes a telecardiology project that shows that in-person clinical care is not always necessary to provide a positive experience for both patients and clinicians.

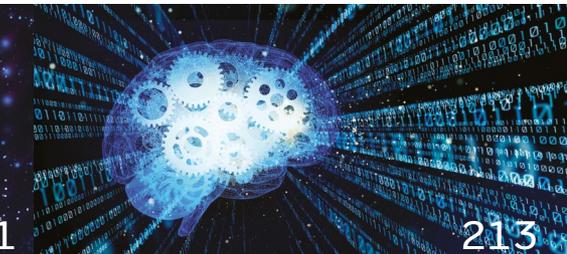
Mis- and disinformation, aka “fake news,” has become a serious health threat during the past couple of years, and this phenomenon has been coined an “infodemic” by the WHO with the obvious “pandemic” connection implied. Prof Henrique Martins proposes a solution to the issue in Europe, with the creation of a social network for health, dubbed “the EU health place”.

In the Winning Practices section, Sara Coelho and colleagues explore H360 Health Analysis, a national pioneer project that aims to paint a comprehensive picture of breast cancer management in Portugal, and Rebecca Morton Doherty highlights key challenges and enablers for bridging the “Policy to Practice” gap for quality, equitable cancer care based on experience in cities across Africa, Asia, Eastern Europe and Latin America.

How are you supporting evolving technology in your institution and/or country? We welcome your thoughts and success stories.

Meanwhile, enjoy this latest issue of HealthManagement!

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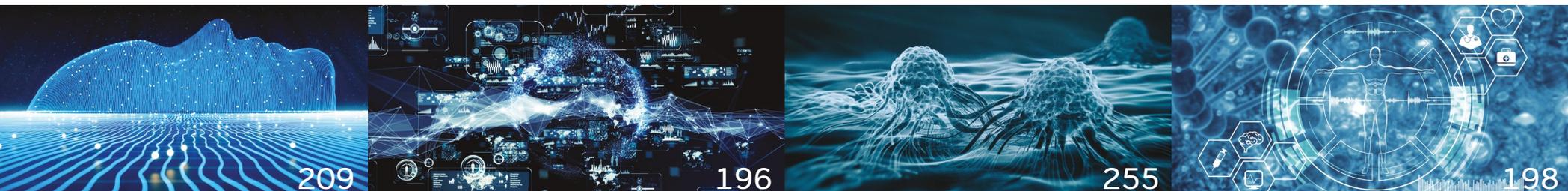


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Have your say. Engage!

COVID-19 has taught us that the healthcare business model needs to improve. In this issue, our contributors discuss virtual care, digital health, artificial intelligence, data analysis, data management, blockchain, telemedicine, telecardiology, teleradiology, new and improved diagnostic tools, home-based care, skills, leadership and hospital management.

To contribute, contact us on Interested@HealthManagement.org

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STORIES

“Rather than competing with radiologists as once suspected, AI can actually augment radiologists in providing optimal patient care”, *page 212*

COVID-19 Sparked a Digital Health Boom – But Will it Last?

 Author: [Jan-Philipp Beck](#) | CEO | EIT Health | Munich/Berlin | Germany

Digital health has experienced a boom during the pandemic, with solutions such as AI and telemedicine being adopted with speed across Europe. However, as many instances of such adoption have been the result of temporary or emergency measures, there is a question mark over whether solutions will continue to be leveraged after the pandemic, or whether the boom will be short lived.

Key Points

- The healthcare sector has been called upon to find solutions to many of the challenges raised by the pandemic – from diagnostics, to vaccinations, and digital healthcare.
- Healthcare innovation, including digital health, has significant potential to overcome the challenges that exist within our healthcare systems and make them more sustainable.
- Artificial intelligence and telemedicine can offer relief to overburdened healthcare systems, yet barriers have historically existed preventing large scale uptake, such as regulatory challenges and low chances of reimbursement.
- The pandemic has seen the sector waking up to the possibilities of digital healthcare, and this has been seen all over Europe. A number of solutions developed and launched by the EIT Health community have demonstrated strong impact.
- To enable technology in healthcare, supportive frameworks from policy and regulation, investment, reimbursement to education, are needed and it is crucial that we do not find ourselves in a similar situation in future, either due to another pandemic or by rising chronic diseases and ageing populations.



The COVID-19 pandemic has brought with it many challenges – across all sectors, however healthcare is the one that has been thrust into the spotlight. The healthcare sector has been called upon to find solutions to many of the challenges raised by the pandemic – from diagnostics, to vaccinations and digital healthcare.

Digital healthcare is not a term that is new to any of us – we have had the technology to provide many aspects of healthcare digitally for many years. But it was the pandemic that led to this well-established, yet under-utilised, area of healthcare to have its day in the sun.

Healthcare innovation, including digital health, has significant potential to overcome the challenges that exist within our healthcare systems and make them more sustainable. It has the potential to drive the paradigm shift in healthcare towards more prevention and prediction. Artificial intelligence and telemedicine can also offer relief to overburdened healthcare systems, yet barriers have historically existed preventing large scale uptake, such as regulatory challenges and low chances of reimbursement. ‘Necessity is the mother of invention’; and as such, the sheer urgency of demand created by COVID-19 has broken down many of these barriers. We see that when need, motivation and collaboration are combined, we are indeed in the position to overcome the inertia that has existed. However, such ‘broken down barriers’ have largely been ad hoc and/or temporary such as accelerated regulatory reviews or reimbursement decisions, and this puts the future of digital healthcare somewhat in question.

Once the pandemic is over, will we go back to our old ways? I hope not, I hope we recognise the learnings that come from the pandemic, the value that has been seen from digital health, and the very real and tangible fragility of our healthcare systems, harnessing the momentum created by COVID-19 to make lasting changes that will modernise our healthcare systems and make them more resilient.

We should also not forget the tremendous market opportunity. Europe has an opportunity to invest in digital and become an attractive market for investors and innovative companies from around the globe. For this we need excellent regulation that not only provides access to data but also a defragmentation of the market and a European fast track for regulatory assessment digital health solutions.

The pandemic has certainly seen the sector waking up to the possibilities of digital healthcare, and this has been seen all over Europe. A number of solutions developed and launched by the EIT Health community have demonstrated strong impact throughout the pandemic, and the technology can be applied to many other challenges facing our healthcare systems such as non-communicable diseases. Telemedicine, for example, could revolutionise the way healthcare is structured around such diseases, allowing for patients to be constantly monitored outside of the clinic (which could aid effective management and prevent complications), have access to online consultations, and receive in-person care only when needed, as opposed to routinely. The pandemic demonstrated the need for such solutions as two related challenges emerged:

1. In person care was strictly limited to emergency only due to the threat of virus transmission
2. Hospitals were overwhelmed and beds needed to be reserved for those with severe COVID-19 complications

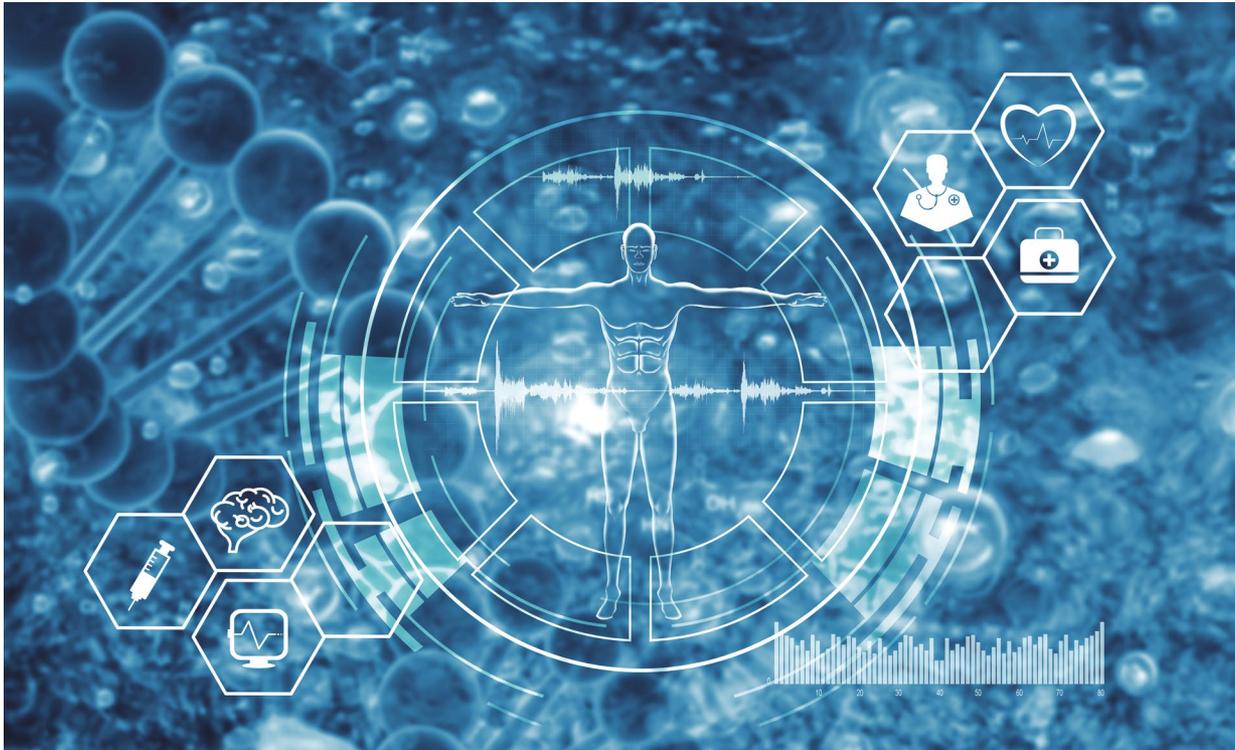
Covidom Community was one such project. Launched at the height of the pandemic, it provided home monitoring of patients with mild or moderate COVID-19 symptoms, allowing for effective intervention if symptoms worsen, while preserving already limited bed space for patients with severe symptoms. It is a web and mobile application which allows patients to fill in short daily questionnaires about their symptoms until they have recovered. The answers are analysed by algorithms and an alert is raised if the data indicates an issue via the control centre, which can then arrange

a consultation, refer them to hospital or send emergency services directly to the patient.

The project is led by Assistance Publique – Hôpitaux de Paris and Inria and is currently available in France and Guadeloupe, with discussions taking place about introducing it in other countries. The solution has been used by more than 2,000 healthcare professionals and more than 1.2 million patients, and satisfaction has been extremely high. Most impressively, the solution has saved 210,000 emergency room visits.

One of the challenges faced by this project was the inertia of governments and healthcare authorities who were focusing on hospitals beds, which was a catch 22, as here was a solution to avoid overcrowding and keep patients who can safely recover at home, out of the hospital. This indicates a lesson that digital systems need to be in place at all times, even if running in the background, so that they can be drawn upon when needed. A pandemic is not the time to introduce new technologies, train healthcare professionals on how to use them, and familiarise patients with changes in the delivery of their care. Solutions such as Covidom Community could also help with other emergency room peaks in demand, such as flu season or for chronic disease patients. Project managers are already in discussions with health authorities in France to discuss implementation beyond COVID-19.

Another example of a digital solution that made significant impact during the pandemic was the EIT Health project Digital Control Centre for COVID-19. The main cause of death for patients with COVID-19 has been respiratory failure, however many patients experiencing respiratory symptoms can be effectively treated if adequate care is provided at the right timepoint. Digital Control Centre for COVID-19 uses AI to analyse the data of hospitalised patients who are experiencing respiratory symptoms, and defining three distinct clinical pattern stratifications which reflect differing symptom complications – inflammation, co-infection



and thrombosis. Early knowledge of these symptomatic patterns conferring various clinical complications can lead to differing therapeutic approaches and subsequent personalised treatment decisions. Researchers at Hospital Clinic Barcelona-IDIBAPS created the artificial intelligence solution capable of analysing, in real time, more than a trillion anonymised data points of COVID-19 patients, identifying clinical patterns and suggesting personalised treatments. This provides a real-time control centre for all COVID-19 patients admitted to hospital, under the supervision of an expert in infectious diseases. Initially implemented in Barcelona, the tool demonstrated a 50% reduction in mortality, and has since been scaled out to hospitals in Belgium and the Netherlands.

Finally, other solutions not directly linked to COVID-19 have also been accelerated during the pandemic as a result of public consciousness around healthcare being raised. There is a visible recognition that our healthcare systems require and deserve modernisation. EIT Health-supported start-up Clinomic has developed a solution to address many of the challenges with delivering care in the intensive care unit (ICU). Co-founded by two ICU doctors, they had direct knowledge of the significant and growing issues facing ICU doctors.

Firstly, the enormous amounts and exponential growth of data points that must be monitored - doctors in the ICU have a minimum of six screens to monitor at any given time, and the majority of their time is spent in analysing data. This problem is only set to increase and

Clinomic believes the system is immediately unsustainable, giving it around 2-3 years before it breaks down.

Secondly, top specialists are often confined to larger hospitals or centres of excellence, meaning that knowledge is not easily shared with other consultants or nurses. Clinomic has built an AI-enabled telemedicine solution that removes both challenges. Specifically built for the ICU, it has specialised technology such as voice control, so that clinicians do not need to remove their gloves in order to interact, as well as mobile 5G which means the doctor doesn't even need to be in the same country as the patient, and it can be used even where there is no Wi-Fi – the opportunities to allow equal access to specialist care is increased across hospitals, regions, and countries which could offer significant support to developing countries. Before the pandemic, ICUs were using systems mostly from the 90s, the need for innovation was there and the pandemic has accelerated uptake with a long list of countries now discussing implementation of the solution.

We have many examples of where digital technology has stepped in during the pandemic to offer solutions to challenges that do not only exist within a crisis, but within our everyday practice.

Our healthcare systems cannot physically grow in line with the demand, and we have to get smart about how we address this rather than sleepwalking into the inevitable. I hope that now is the time for some serious conversations about how we can enable technology in the long-term. This requires supportive frameworks from policy and regulation, investment, reimbursement to education, and it is crucial that we do not find ourselves in a similar situation in future, either due to another pandemic or by rising chronic diseases and ageing populations eventually becoming too much to bear. We need to make lasting change, now.

Conflict of Interest

None. ■

Healthcare Worker 4.0: Redesigning Jobs for the Future

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Healthcare needs to change to meet demographic shifts, increasing demand and rising costs. To change healthcare, success lies in its transformation of the healthcare worker for tomorrow. In the face of these disruptions and increasing adoption of automation and digitalisation, healthcare workers must be equipped to redesign their jobs and upskill themselves to drive innovation and productivity.

The Centre for Healthcare Innovation's (CHI) systems approach to innovation called the "innovation cycle" is an iterative cycle that starts with redesigning care and processes, then leveraging technologies, and sustaining the change by redesigning jobs to deliver better care and job value. This article chronicles Tan Tock Seng Hospital's learning journey using the innovation cycle to redesign jobs for the Healthcare Worker 1.0 to 4.0.

Key Points

- Healthcare Worker 1.0 (Individual Job Redesign) – With job redesign tools, staff can redesign their jobs and upskill themselves to perform higher value-added roles.
- Healthcare Worker 2.0 (Team Job Redesign) - Applying job redesign beyond an individual level to the team level, allowing every staff to practise at the top of their license.
- Healthcare Worker 3.0 (Transdisciplinary Job Redesign)- Increasingly, as care moves from a care facility into the community, different mental models in workforce transformation need to be explored, where one caregiver is able to provide care for a multitude of related conditions as opposed to many caregivers to one patient in a hospital.
- Healthcare Worker 4.0 (Digitally Enabled Job Redesign) - Delivering care anytime and anywhere aided by digitalisation and employing technology that would move care beyond the walls of the hospital.

Healthcare Innovation & Workforce Transformation

Healthcare systems are ramping up to meet the needs of an ageing population, growing healthcare demands and rising costs. More of the same may not be better. To redesign healthcare with new models of care, healthcare jobs need to be redesigned. In the face of disruptive change and digital transformation, there are added pressures for healthcare systems to be agile in driving innovation and renewing their workforce to sustain large-scale change. Healthcare workers want better jobs and new capabilities to redesign their jobs for the future.

The Centre for Healthcare Innovation (CHI) drives thought leadership in healthcare innovation, digitalisation and workforce transformation. A big part of transforming the workforce was to change the way we redesign, train and enable our workforce for the future. Hosted by Tan Tock Seng Hospital (TTSH), CHI serves as an open co-learning platform that encourages ideas and translates these ideas through Communities of Practice. CHI adopts a systems approach to healthcare innovation called the “innovation cycle”, an iterative cycle that starts with redesigning care and processes, then leveraging technologies, and sustaining the change by redesigning jobs to deliver better care and value.

This article chronicles TTSH’s journey in using the innovation cycle to redesign jobs for the Healthcare Worker 1.0 to 4.0.

- Healthcare Worker 1.0 (Individual Job Redesign) – With job redesign tools, staff can redesign their jobs and upskill themselves to perform higher value-added roles.
- Healthcare Worker 2.0 (Team Job Redesign) – Applying job redesign beyond an individual level to the team level, allowing every staff to practise at the top of their license.
- Healthcare Worker 3.0 (Transdisciplinary Job Redesign) – Increasingly, as care moves from a care facility into the community, different mental models in workforce transformation need to be explored, where one caregiver is able to provide care for a multitude of related conditions as

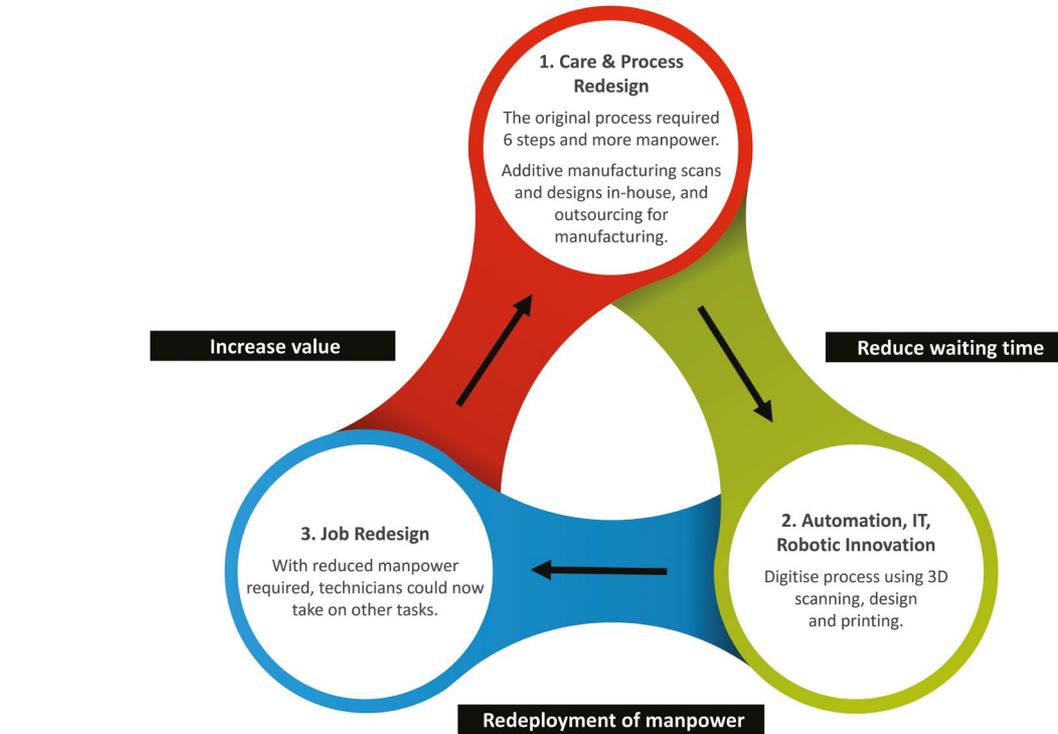


Figure 1: The Innovation Cycle

opposed to many caregivers to one patient in a hospital.

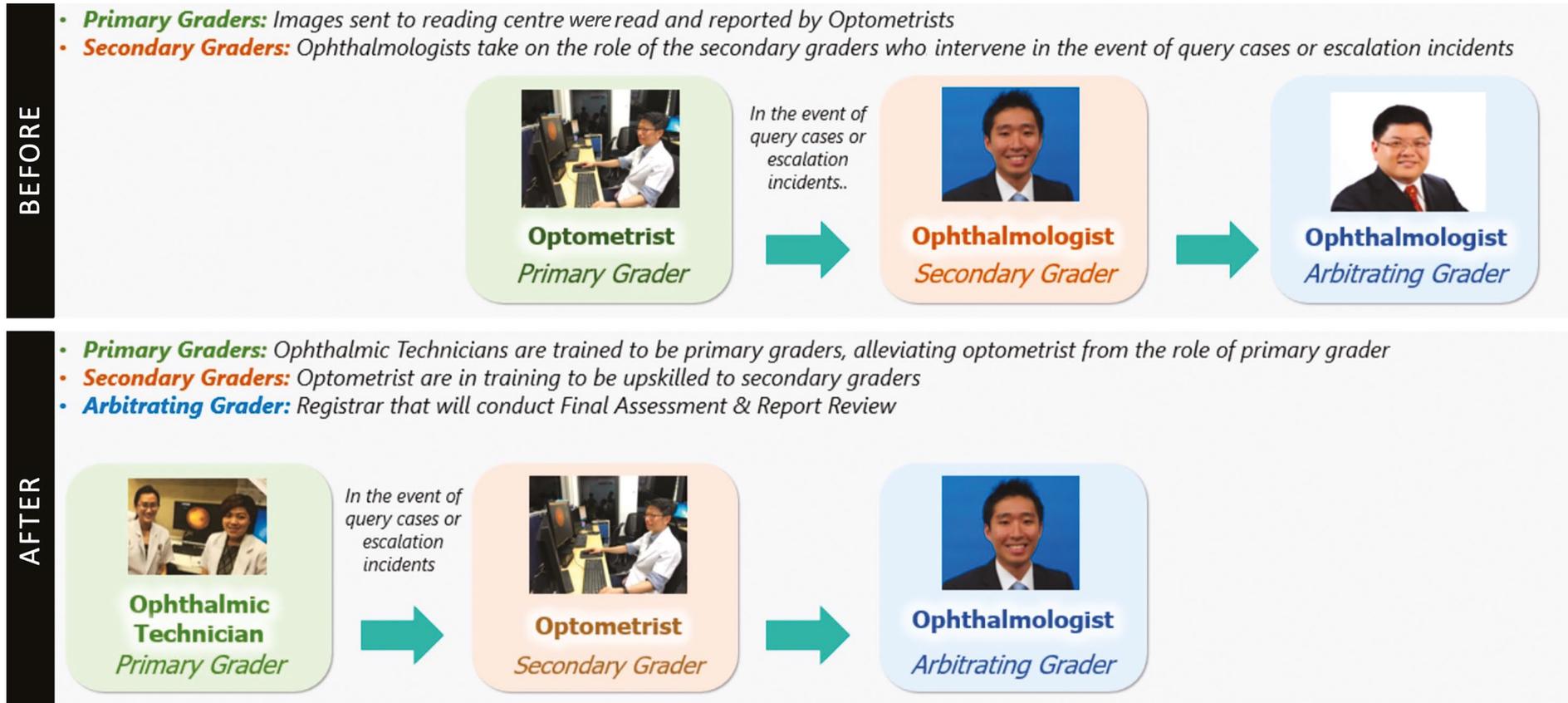
- Healthcare Worker 4.0 (Digitally-Enabled Job Redesign) – Delivering care anytime and anywhere aided by digitalisation and employing technology that would move care beyond the walls of the hospital.

The four levels for job redesign allow for the stacking of capabilities from Healthcare Worker 1.0 right through 4.0 in a systematic, scalable fashion. This is illustrated by the four case studies below that demonstrate how job redesign can help to anchor innovations and sustain change in transforming the healthcare workforce for the future.

Healthcare Worker 1.0: The Evolution of the Patient Service Associate

At the very heart of delivering value and quality care for patients and community, is the individual healthcare worker. At Healthcare Worker 1.0, transformation focused on the individual level by redesigning better value jobs in healthcare.

TTSH redesigned the jobs for our frontline Patient Service Associates (PSA). PSAs are administrative staff who are tasked to attend to and manage patient administration from handling enquiries, performing registration, making appointments, coordinating care and



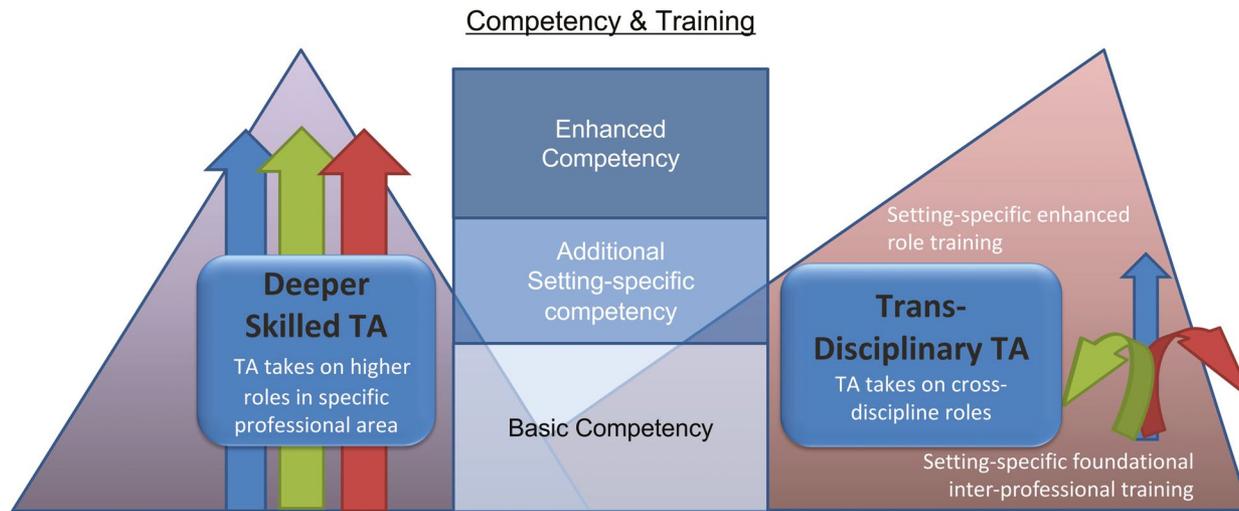


Figure 3: Deeper-Skilling and Multi-Skilling Therapy Assistant Competency Framework

services. PSAs were trained and certified to perform up to 21 Value-Added-Services (VAS) such as phlebotomy, electrocardiograms and basic eye tests, tasks that were previously performed only by nurses.

With the redesigned jobs for PSA, the committee recognised that PSAs are professionals with new capabilities and career development aspirations. The hospital developed three distinct career development pathways for its PSAs:

- (i) Management and Administration
- (ii) Training and Development, and
- (iii) Clinical

The suite of Value-Added-Service (VAS) were differentiated into the three career development pathways. Initially offered to only high-performing PSAs, these VAS have been integrated into the PSA's staff competency framework, aligned with opportunities to develop focus in one of the three career pathways. The competency framework also recognises that PSAs need to be equipped with interpersonal skills in addition to technical skills, to do their job well.

Opportunities are also provided for PSAs to participate in other hospital-level committees, to develop and hone their leadership skills. They undertake roles and responsibilities that involve the various professional groups within the hospital and span across the hospital's various settings. Job rotations for PSAs within the organisation have also been introduced.

Since implementation, the attrition rate of PSAs has dropped by 50 percent with increased job satisfaction. Through the PSA job-redesign and upskilling efforts, productivity has increased with reduced headcount growth for both PSAs and nurses and freed up as PSAs take on higher VAS.

Healthcare Worker 2.0: Team-Based Job Redesign

An example of team-based job redesign towards Healthcare Worker 2.0 would be the workforce transformation undertaken by the Singapore Integrated Diabetic Retinopathy Programme (SiDRP).

Before the programme was launched, the reading of retinal images was done by doctors during lunchtime or after working hours, and the results would be communicated to the patients within two to four weeks. However, there were no harmonised grading criteria and guidelines at the national level.

To improve the efficiency of DRP reporting and standardise grading standards, the National Healthcare Group Eye Institute (NHGEI) at Tan Tock Seng Hospital collaborated with the Singapore National Eye Centre (SNEC) and Integrated Health Information Services (IHIS) to set up SiDRP in December 2013. The objectives were to improve the level of screening standards and turnaround time; provide uniform assessment and referral guidelines for DRP reporting at the national level, and standardise training and audit governance for DRP reporting.

To empower the clinical programme and leverage the introduction of teleophthalmology in the reading of retinal images, the NHGEI undertook a team-based job redesign of its workforce. This workforce transformation was key to optimise resources, improve turnaround time, and enable staff to perform at the top of their license.

The SiDRP reporting process required three levels of graders:

- The primary grader to assess and provide report
- A secondary grader to re-assess and provide a report when the primary grader is in doubt
- An arbitrating grader would arbitrate both reports and do the overall assessment, if reports by both the primary and secondary grader differed.

At the beginning of the programme, the role of the primary grader was taken on by either the ophthalmic Technician or the optometrist, who would then send the graded images to the ophthalmologist who acts as the secondary grader, intervening when there were query cases or escalation incidents. Then, if the reports differed from each other, another ophthalmologist was brought in to act as the arbitrating grader.

Ward Without Walls (WoW)

Transformation Roadmap

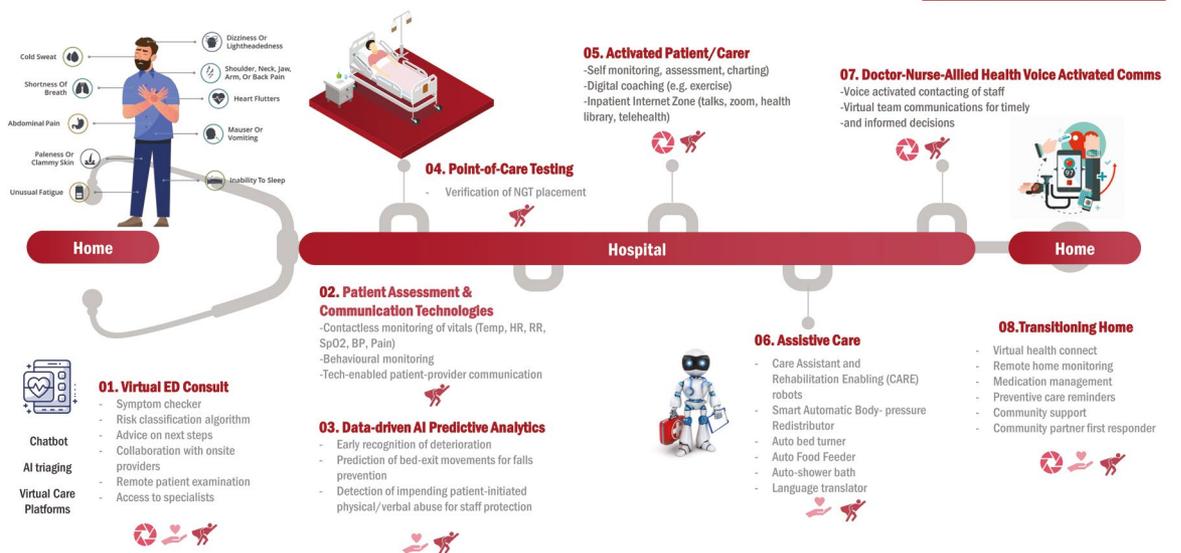


Figure 4: The WoW Transformation Roadmap

Through team-based job redesign, ophthalmic technicians were trained to grade images as primary graders, while optometrists were upskilled to become secondary graders. Ophthalmologists then focused primarily as arbitrating graders and treating complex cases. This disruptive innovation across the team was enabled by job substitutions bottom-up. For ophthalmic technicians to free up their existing workload to take on the role as primary graders, PSAs were trained to take over the visual field tests from the ophthalmic technicians as a VAS using individual job redesign. This was how team-based job redesign for Healthcare Worker 2.0 can stack up on the individual job redesign for Healthcare Worker 1.0.

Healthcare Worker 3.0: Therapy Assistants Job Redesign in the Community Space

In Singapore, Therapy Assistants (TA) generally work within the confines of the professional group they are employed in. TAs work in physiotherapy, occupational therapy and other allied health professional groups. The advantage of this is that they can develop deeper skills to deliver highly specific care and this serves well in settings of team-based interprofessional and multi-disciplinary hospital settings. In the community space where patients' medical conditions are more stable and care needs more multi-dimensional, TAs with transdisciplinary competencies would be able to maximise each contact and opportunity with the patient. Patient's

needs could be provided in a more holistic way and in a timely manner, avoiding excessive hand-offs or multiple visits. From a system's perspective, manpower deployment becomes more efficient and resilient, and costs of care more sustainable.

The TTSH Allied Health and Pharmacy Division developed a stacked job redesign approach that comprises deeper-skilling for the individual as Healthcare Worker 1.0 and multi-skilling for transdisciplinary care as Healthcare Worker 3.0. This dual approach enabled Allied Health TAs to practice independently in the clinical areas of higher acuity and holistically in the community. This is illustrated in Figure 3 above.

With multi-skilling, TAs are trained to practise as broad-based transdisciplinary therapy assistants to support patient care in the community. Having such trained staff providing care in the community is important because they provide greater ease and flexibility of deployment, enhanced training, ability to perform higher functions and the potential to conduct independent casework. This is a transformative shift from Many to One in the hospital setting to One to Many in the community.

To enable transdisciplinary job redesign, the division first looked into common physical care needs of the patients across allied health professionals. The team aligned the TA competencies across three different therapy departments – physiotherapy (PT), occupational therapy (OT), speech therapy (ST) – and three different settings (hospital, rehabilitation and community). Based on this, a concerted training programme that focused on the teaching of ten identified common competencies that span across the three professional groups was developed. Following the development of training materials, the departments started to train all new TA recruits with the aligned training syllabus.

Two interesting pilots are ongoing to further build upon the job redesign for TAs. First, in the sub-acute and rehabilitation setting, where a small team of

transdisciplinary TAs conduct group circuit classes for inpatients. Second, in the acute hospital setting, where an integrated transdisciplinary approach has been adopted by physiotherapists and occupational therapists to assess and perform common basic therapy for patients whose medical conditions have largely stabilised and present with generic care needs. Further discussions are ongoing with Nursing to enable more transdisciplinary job redesign opportunities.

Healthcare Worker 4.0: Digitally Enabled Job Redesign that empowers Wards Without Walls

Patients transit from home to the hospital when hospital care is needed and returning home thereafter. This is the model of building a relationship-based model of care for the population to enable an H3 journey of Home-Hospital-Home. TTSH's inpatient transformation journey began in 2010 with the redesign of nursing care in the Wards of the Future (WoF). This decentralised the central nursing counter and embedded nurses in patient cubicles to be more proximal to their care needs. It also sought to reduce non-value-added tasks in order to increase the time spent with patients. This is further augmented by the adoption of technologies such as RFID-tagging of patients, wireless vital signs monitoring, electronic discharge tracking system, inpatient pharmacy automation system to improve safety and reduce manual tasks. Further innovations with nurse-led ward rounds and ward resource nurses were critical to best coordinate and anchor inpatient and post-discharge care.

Ward without Walls (WoW) is the next phase and an extension of WoF to enable a full H3 journey for patients. WoW adopts 3 principles: Patients are Carers; Care Transformation; and Care is a Transition. The focus is on ensuring seamless care delivery beyond the hospital and providing patients and their caregivers the necessary tools to take charge of their

care journey. Digitalisation is a key enabler for the H3 journey, supported by a spectrum of technologies from Artificial Intelligence (AI) and analytics, digital applications, virtual care platforms, robotics etc., coming together as a coordinated system. It would reduce our reliance on manpower, yet level up the quality of care and value that we would be able to deliver to our patients, enabled by a digitally enabled workforce i.e. Healthcare Worker 4.0.

Inpatient falls were common yet complex challenges that influenced hospital care, particularly in elderly patients. More than one-third of inpatient falls cause injuries such as fractures and head trauma, which could be a heavy burden in terms of medical, financial and social outcomes. Falls that do not result in injury may consequently cause distress and anxiety to patients, next-of-kin and healthcare teams. It may lead to restriction of future activity, further losses of strength and lastly, independence. Traditional solutions such as bed-exit sensor mats or motion detectors could be inaccurate and were cumbersome to deploy with no automation or smart features. Nurses usually suffer from alarm fatigue and end up shelving such technologies.

Through an innovation project, TTSH co-developed the PreSAGE Falls Prevention System - a smart bed-exit prediction and prevention system based on thermal sensing. Trained on 12,000 hours of real patient thermal data, PreSAGE provided accurate early warning based on machine learning models that predict bed exit. An alarm was triggered whenever a positive bed-exit was predicted and provided more response time (as compared to current sensor mat system) for nurses.

The alarm would be automatically disarmed whenever a nurse was detected near the patient's bedside, and armed automatically when patient was alone. This feature removed the burden of remembering to arm/disarm the system alarm, which was required in a number of traditional surveillance systems, making it a user-friendly smart system.

PreSAGE could operate continuously regardless of lighting and environmental conditions, was non-contact and most importantly, non-intrusive. Thermal data provided crisp and clear silhouettes of objects detected, but do not show sensitive information such as facial or body features. The system has been deployed in TTSH's general wards, with studies that show 97 percent sensitivity and 100 percent specificity. The system requires minimal maintenance, easy setup and projects to save up to 30 percent Nursing FTE for falls prevention surveillance.

"Transforming Care Beyond Boundaries" is the next phase of TTSH's inpatient care transformation journey. The WoW Transformation Roadmap provides a structured way to move through the many initiatives and manage the WoW transformation efforts needed to realise success in creating a digitally-enabled workforce. Patient's journey will be connected as one, where there will be a smooth and timely flow of information between home, hospital, and the community. This ensures that the care follows the patient regardless of care setting.

Redesigning Healthcare Jobs for the Future

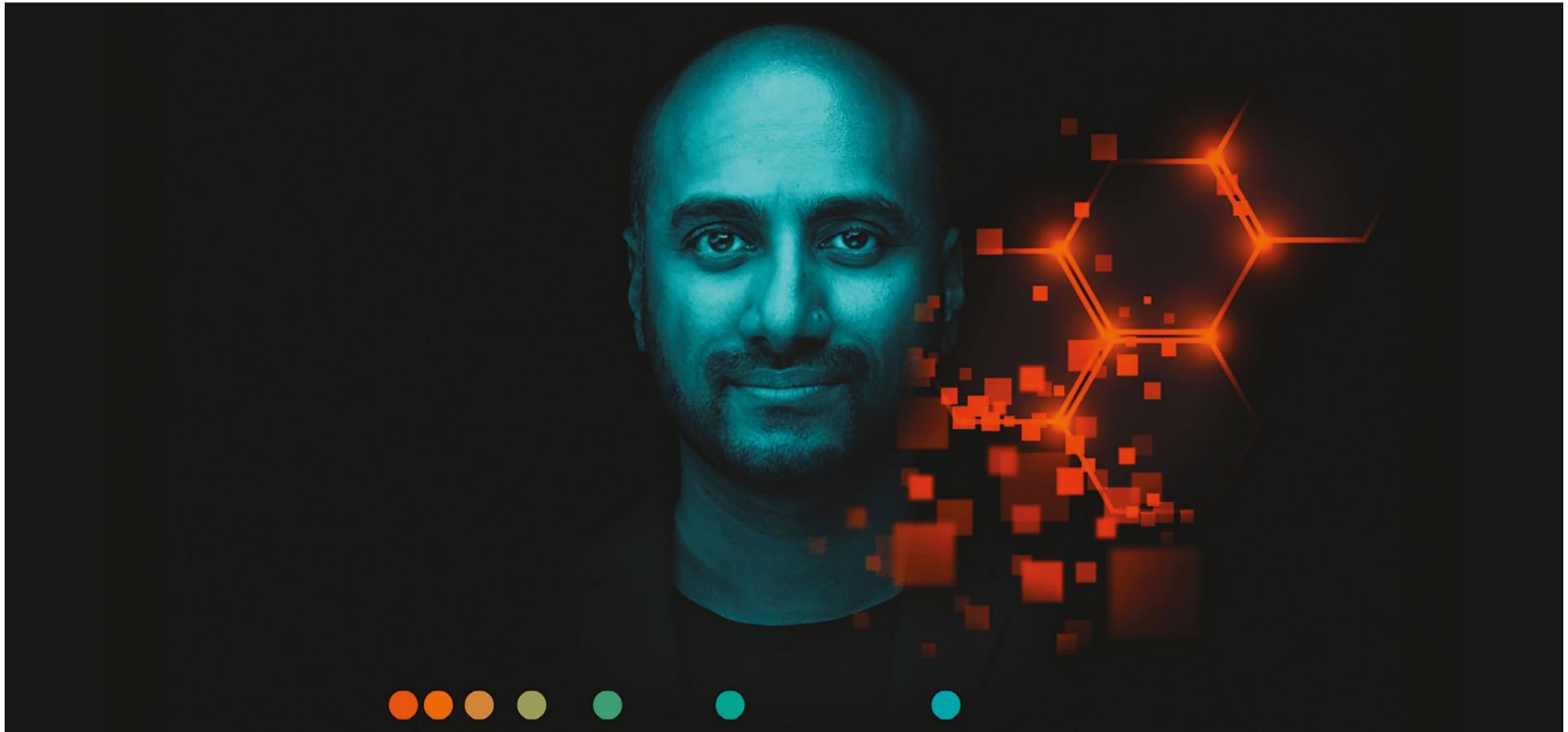
The Innovation Cycle enables a systems approach to Healthcare Innovation – Care Redesign, Enabling Technologies and Job Redesign. Through job redesign, we can sustain and scale the change by empowering our Healthcare Worker with better jobs. The four levels of job redesign for Healthcare Worker 1.0 to 4.0 illustrate the ability to stack up job redesigns from individuals to teams to transdisciplinary to digitally enabled healthcare workers. This is the future of healthcare, where every healthcare worker owns his job and can change his job to deliver better care and better value.

Conflicts of Interest

None. ■

Data Integration and Decision Support Along the Patient Pathway

An overview of a decision support platform that offers holistic decision support along the continuum of care, bringing together a wide variety of healthcare data from diverse IT systems with a vendor-neutral design and user-friendly solutions.





Key Points

- As healthcare processes become more digital, there has been tremendous growth in health data from electronic medical records, image databases, and other fragmented IT systems.
- Clinicians could benefit from data integration from various sources, including clinical, radiological, laboratory, genetic and pathological findings, and an overview of behavioural and social conditions.
- Siemens Healthineers' Teampay digital health platform offers features and applications that support operational decision-making, improved workflow and more informed diagnostic and therapeutic decisions for optimal outcomes.
- Siemens Healthineers' AI-Pathway Companion integrates clinical guidelines, individual risk stratification and patient preferences.

In a healthcare system that is rapidly turning digital, smart integration of data has now become increasingly important. However, there are several barriers along the patient pathway that make this task challenging. Often, data is inaccessible or too extensive to evaluate or analyse. There are also instances when information is overlooked and guidelines are ignored. This results in inefficient management of data that could otherwise be utilised more effectively for more informed and improved clinical decisions.

What is needed is a unifying approach that utilises digital applications powered by Artificial Intelligence (AI). This model could better support operational decisions, optimise care processes, and improve diagnostic and therapeutic decisions. Also, a more holistic approach would enable greater interaction and coordination between care teams and patients and help healthcare systems realise the goal of patient-centred care.

Healthcare has been, and will always remain, a process of healing that is not only dependent on data but also a strong patient-doctor interaction. However, as healthcare processes become more digital, there has been tremendous growth in health data from electronic medical records, image databases, and other fragmented IT systems. This data can play a critical role in facilitating complex healthcare decisions when clinicians are faced with multiple conditions, complicated symptoms and difficult diagnostic and treatment options. During such times, clinicians could benefit from data integration from various sources, including clinical, radiological, laboratory, genetic and pathological findings, and an overview of behavioural and social conditions.

This can be achieved by using digital technologies that can help improve decision-making and provide healthcare providers with the decision support they need along the patient pathway. This data should ideally be delivered in a user-friendly manner through a platform that is simple and flexible to use, and that can bring together patient information from diverse IT systems and data sources. The goal of such a platform would be to provide clinicians with a more comprehensive picture of the patient so that they can make decisions more holistically.

Challenges of Data Integration

While this concept seems easy to implement in theory, there are several challenges and barriers to overcome. First, there are often situations where relevant patient data is not available, or it is too labourious to retrieve it when needed. Studies show that doctors in intensive care units often have to sift through thousands of individual data points to extract the information they need (Herasvich et al. 2018). There is also sufficient evidence to show that a large proportion of electronically stored patient data is never used in the inpatient or the outpatient setting (Pickering et al. 2013; Hirbar et al. 2018).

There are several reasons why patient data is still underutilised. There is a lack of analytics expertise. Also, clinicians have to deal with a large volume of data. This can be difficult to handle and can lead to distraction, dissatisfaction and burnout (Ruppel et al. 2020). Healthcare is more or less facing an information overload, making the data integration and digitalisation process more complex. There is also inefficient filtering of the data that is available (Shirky 2008). Therefore, what healthcare needs are advanced digital solutions that can improve the analysis of patient data and present this data in a user-friendly and clinically meaningful way.

Using Smart Data Integration and Decision Support

Digital decision support can help overcome these barriers. Advanced clinical support systems have the ability to encompass clinical guidelines, patient data summaries, condition-specific order sets, diagnostic support and relevant reference information. An efficient and advanced decision support system would provide both general and person-specific information while filtering and organising valuable data. This can help improve diagnoses, treatment decisions and patient outcomes.

There is significant clinical evidence to demonstrate the value of advanced decision support systems. Studies show that machine learning algorithms can help avoid unnecessary CT scans in children with minor head injuries (Bertsimas et al. 2019); also, advanced decision support in oncological care can increase adherence to guidelines, reduce treatment costs and ease physician workload (Klarenbeek et al. 2020).

Siemens Teampay Digital Health Platform

Siemens Healthineers has developed a comprehensive decision support solution. The Teampay digital health platform offers features and applications that support

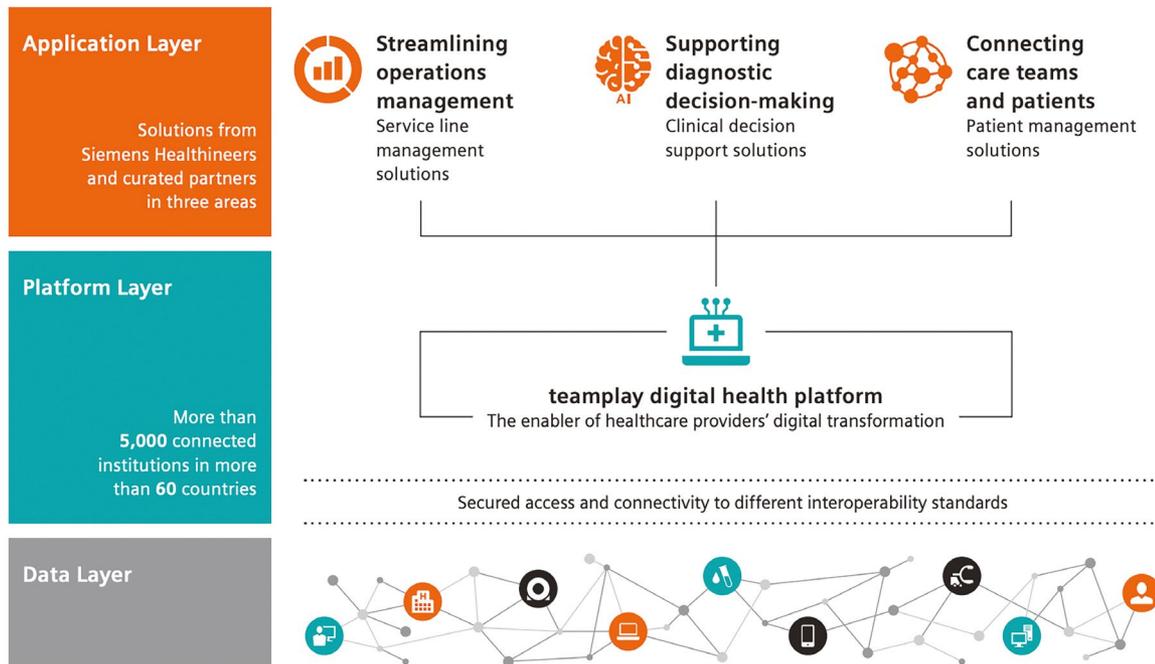


Figure 1: Basic principle of the "teampay digital health platform"

Data from a wide variety of IT systems can be integrated and then used by individual applications to improve the care process in its various dimensions.
Image Credit: Siemens Healthineers

operational decision-making, improved workflow and more informed diagnostic and therapeutic decision-making for optimal outcomes. Teampay also enables doctors, nurses and patients to connect more easily, thus providing a basis for patient-centred care and shared decision-making (Figure 1).

The Teampay digital health platform operates system- and vendor-neutral through various interoperability standards. It allows data from existing IT systems within an organisation to be integrated and shared across institutional boundaries such as hospitals, outpatient practices and pharmacies. The core philosophy behind the platform is to support decision-making along the patient pathway by providing a flexible

and uniform IT solution. This is done through various individual applications and extensions, which are available via an integrated digital marketplace. Siemens Healthineers' Teampay solution addresses multiple problems in various clinical fields, including radiology, oncology and cardiology.

Siemens Healthineers also offers the AI-Pathway Companion, a software system for data-driven decision support. The AI-Pathway Companion integrates clinical guidelines, individual risk stratification (CMS 2014) and patient preferences. This helps clinicians make evidence-based and transparent recommendations for different treatment options. It also helps clinicians map out where a patient is in the treatment pathway and

facilitates discussion between patient and doctor. Similarly, Siemens Healthineers' eHealth solutions include various software packages that allow patient-specific data exchange across institutions and better communication between care teams and patients.

Digitalisation - The Future of Healthcare

According to an international survey, three out of four healthcare executives believe digital platforms that connect things and people and foster innovation will enable their organisation's business strategy (Elliott et al. 2018). Siemens Healthineers offers solutions that can make this possible. Its digital health platform is a flexible tool that understands the importance of data for healthcare. Siemens Healthineers provides more than 40 apps, a third of which are AI-powered, for six different specialties. These apps enable advanced and customised digitalisation for a wide range of healthcare providers and healthcare situations.

Siemens Healthineers Teampay digital health platform does not require any major investment or restructuring. It is an interoperable system with a vendor-neutral design. It can integrate existing and different IT components and enable a step-by-step approach. It is the ultimate solution to ensure smart data integration, holistic decision making and improved patient outcomes. ■

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Blockchain: A Revolution in Digital Health

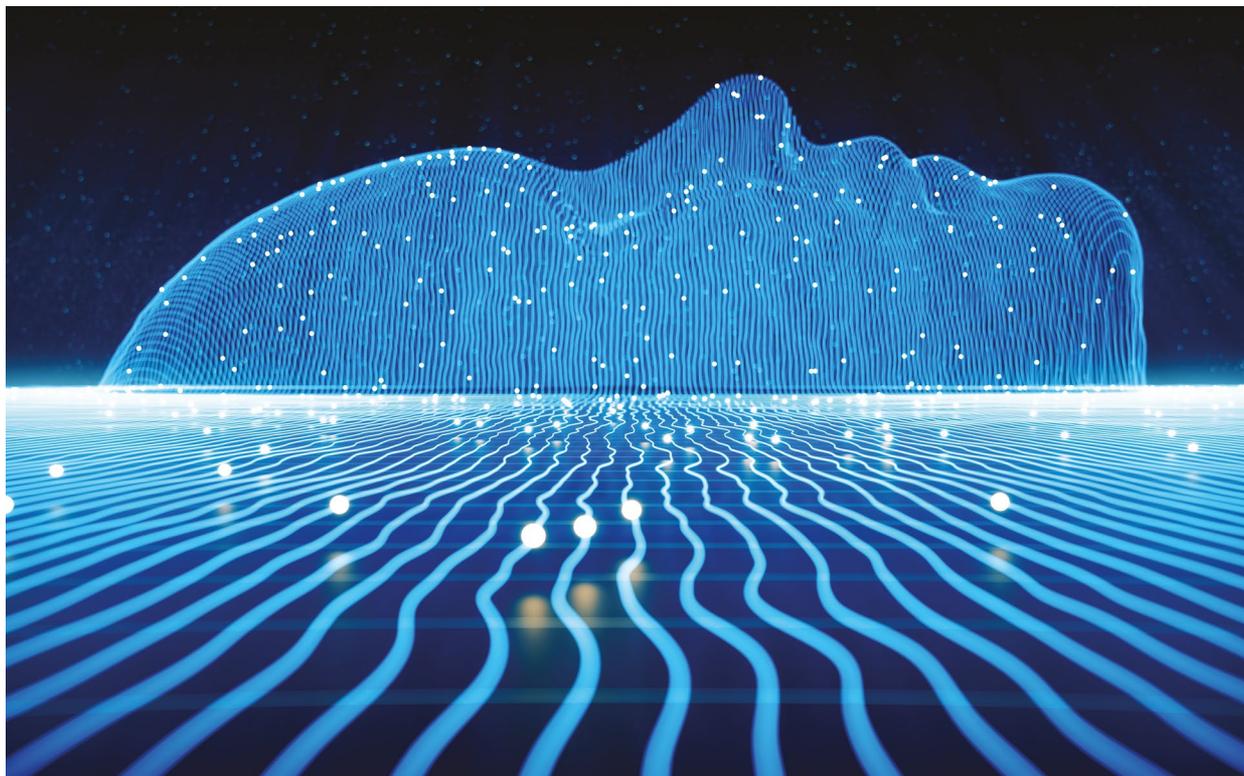
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Blockchain is presented today as a mirage of solutions that for many specialists might seem limited. The future challenge will be to build trust in users in a system that will process personal patients' data via the blockchain system. This may imply, in the end, the creation of a new personalised medicine business thanks to the information's accuracy and the predictive algorithms that will be used in this context.

Key Points

- Blockchain technology consists of a chain of digital records that are incorporated into an immutable structure that is verified by members who share the information.
- Since there is no centralised storage of information and it cannot be deleted or copied, increasing security and traceability of the information contained in the chain would make it a useful system for the digital health sector.
- Currently blockchain is limited by its novelty, but the use of cryptocurrencies will allow us to learn the dangers and eventual limitations of the system and the ways to foresee solutions.
- Blockchain offers an enormous technological hope of maintaining a single, unalterable and longitudinal record that each patient can demand at any time, securely and privately.
- Greater trust and transparency amongst stakeholders (patients, insurers, health providers, pharmaceutical companies) must be built into health data management through steps such as the GDPR (General Data Protection Regulation, 2018) in the European Union.
- For patients, blockchain offers the increase in the volume of health data that will make it possible to obtain better, faster diagnoses and more appropriate therapies and treatment regimes.





Background

Since its inception, blockchain has proven that it has the potential to unleash a technical and economic revolution. It all began with big data's holy trifacta: high volume, access and speed of information processing, which in turn increased the value of collecting and processing personal data. The next step was to place services in the cloud (cloud computing), making it possible to access all of this information from big data and process it more efficiently. And then, one day, blockchain appeared.

For those less familiar with the notion of blockchain, this technology consists of a chain of digital transactions (chained digital records) that are incorporated

into an immutable structure that is confirmed and verified by the members who share the information. There is no centralised storage of information and it cannot be deleted or copied. Much of the fundamental characteristics of the blockchain reside in its ability to increase the security and traceability of the information contained in the chain, which makes it essential for the digital health sector.

Blockchain includes the potential to revolutionise the health sector, since it places the patient (user) in the centre of the scene, allowing her or him to directly control the information protocol at all times, as well as being able to customise the distribution of the personal data on the shared network.

The companies that are in charge of exploiting this technology will have to find a way to adapt to the current operating conditions that the use of blockchain entails in the sector, but notably they will have to provide trust and transparency to users. A similar example can be a pedagogical step that has been taken in the European Union with the GDPR (General Data Protection Regulation 2018), which has created awareness among users about the importance of managing personal data.

In blockchain, we host the enormous technological hope of maintaining a single, unalterable and longitudinal record that each patient can demand at any time, securely and privately. This respect is appropriate between the patient and the doctor and the insurance company, as well as any other actor in the health ecosystem.

Applications and Benefits

Blockchain has the vocation to be present in most layers of the health ecosystem. The benefits that exist are multiple. The system will make it possible to unify the multiple identities of the patient through different health platforms, giving the user the possibility to decide and control (consent) the access and processing of information by any actor (Despotou et al. 2020).

By unifying the information, registers can be made compatible throughout the different platforms, thus facilitating the interoperability between the systems, a situation that is currently a real obstacle. Faced with user concerns about the way their data is processed, the blockchain system allows for the removal of certain intermediaries, and the user maintains direct access to the distribution list.

Transaction costs can be reduced as a consequence of the reduction in intermediation. Blockchain allows an update of the patient's information through the different networks where the information has been hosted.

Thanks to blockchain, the use of smart contracts can be extended in a generalised way by different service providers in a consistent manner.

Other applications of blockchain consist of being able to ensure the validity of drug supply chain, notably in developing countries, in order to avoid the circulation of counterfeit products. This can also help to guarantee the quality of the product and the respect for the cold chain, for example.

Consent, Control and Access

This giant step could be revolutionary for the patient. Blockchain will allow for patient identification and authentication and will store their personal information (eventually potentially sensitive genetic content) (Zhang et al. 2018) on a large number of health platforms. Annotations, certifications, exam results as well as a registry of medical prescriptions will also be stored on the blockchain. The system can also ensure the monitoring of patient treatments, reminders and, of course, payments for services (transactions through smart contracts). Blockchain access will come with one important caveat: Consent. Patients may give (or deny) access to different borrowers, or allow limited access to certain information, in relation to particular treatments or pathologies.

Some Limitations

Currently the blockchain system presents some limitations, however it is likely that, over time, market players will learn how to circumvent these specific limits.

One of these limitations is linked to the novelty of technology. The system will most likely still have to operate for about ten years in order to fully adapt to the specific characteristics of the market. The use of cryptocurrencies (and, for instance, NFTs - non-fungible tokens - more recently) will allow us to learn in detail the dangers and eventual limitations of the system and the ways to foresee solutions.

An important obstacle that blockchain finds in the digital health sector is linked to the mistrust that large pharmaceutical companies generate in a large population of patients. Not only as a consequence of the great benefits of these companies, but also because of their dominant positions in the drug market and, little by little, their access to personal data (Campillo 2020). Added to this is the lack of transparency in their processes and the monopoly that they naturally exercise in the management of pathologies.

It should also be noted that the mere use of the blockchain does not free operators from cybersecurity compliance. Risks persist, especially at the level of user terminals and providers. Complementary protocols should be established, especially since the current databases will remain in force for a longer time, and it will be necessary to guarantee a certain level of compatibility and security between both systems (Evangelatos 2020).

Conclusions

Blockchain may allow democratisation of the circulation of patients' personal information, as well as increasing the user's power over the consent and ultimate control of such information. At the same time, it is likely that by increasing the level of data in circulation, this could lead to fairer and more dynamic health services. An example to consider will be the next rollout of vaccine passports, which may serve as both a balanced opportunity for all citizens to re-engage in society, but also a restriction on some people's individual freedoms (Murphy 2021).

Blockchain could also provide an opportunity for greater trust and transparency in health data management. Companies must create solutions that acknowledge the importance of respecting personal data, while also being able to be utilised properly by patients. The greater the trust in the system, the more value will be created from the multiplication

of data units shared by users via blockchain. For patients, the increase in the volume of health data will make it possible to obtain better, faster diagnoses and more appropriate therapies and treatment regimes.

The key to true revolutionary success of blockchain will be for healthcare professionals and technology developers to reconcile the technological potential with the need for security and privacy of patients' personal data.

Conflict of Interest

None. ■

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Artificial Intelligence in Radiology: Current Applications and Future Technologies

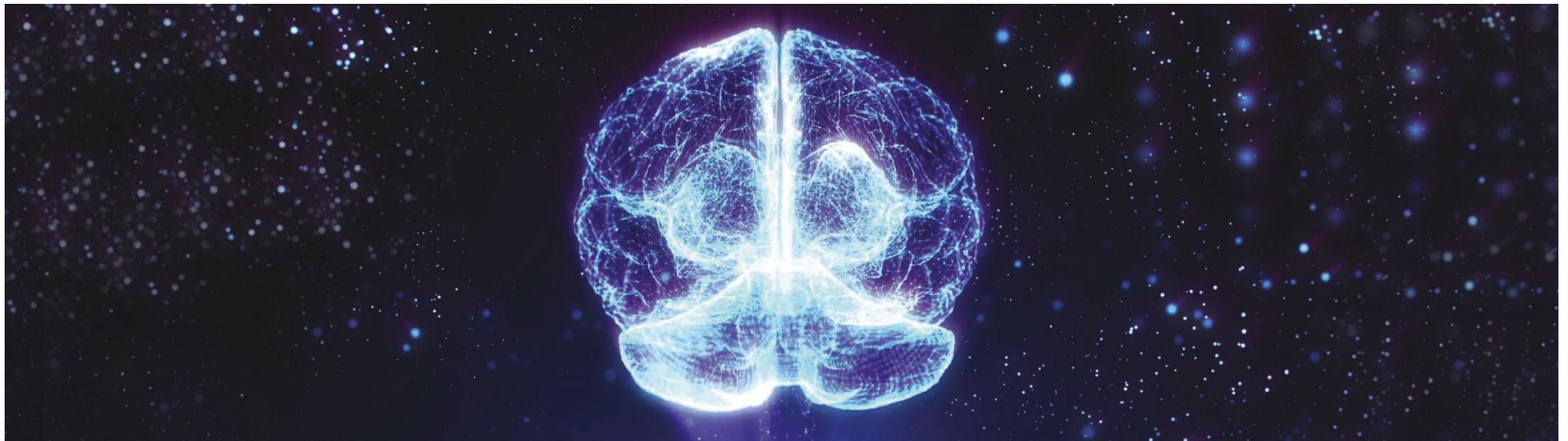
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An overview of the latest research regarding artificial intelligence in radiology and how these findings can transform the future of the field.

Key Points

- AI disease detection can help radiologists identify pathologies using subtle features not visible to the human eye and help prioritise images with positive findings in the read queue.
- AI disease characterisation can help differentiate between benign and malignant tumours which appear very similarly to radiologists, as well as help identify specific tumour mutations and subtypes without the need for invasive biopsy.
- AI disease monitoring can help predict the likelihood of tumour recurrence, as well as help radiologists distinguish tumour evolution from treatment-related tissue changes.



For the past five years, research into the use of artificial intelligence (AI) in radiology has been growing at an incredible rate. A PubMed search reveals that before 2018, less than 500 annual manuscripts included the terms “artificial intelligence” and “radiology”. However, in 2018, this rate doubled to ~1000 articles, and in 2019 and 2020, this number reached ~2000. It is clear that the use of AI in radiology is gaining momentum, primarily due to its potential to enhance the field. Many studies have shown that AI has the ability to increase radiologist efficiency, highlight urgent cases, increase diagnostic confidence, reduce workload, and help inform patient prognosis and treatment strate-

gies. Thus, rather than competing with radiologists as once suspected, AI can actually augment radiologists in providing optimal patient care. AI has the potential to transform the work of a radiologist through three major steps in image analysis: detection, characterisation, and monitoring. This article will review the status of current AI research in each of these categories, as well as highlight the potential impact of these findings on future radiology practice.

labour requirements, as each flag necessitates assessment by radiologists. In addition, each CADe algorithm is task-specific, and not generalisable across diseases and imaging modalities. Some studies on mammogram interpretation highlight these limitations, reporting that radiologists “rarely altered their diagnostic decisions after viewing results from predefined, feature based CADe systems” and that the use of these systems had “no statistical significance on the radiologist’s performance” (Hosny et al. 2018).

Artificially Intelligent CADe systems have been proposed as a solution to the limitations of current detection technologies. AI-based detection tools

high sensitivities (Jung et al. 2018; Ribili et al. 2018). In addition, an AI CADe system was shown to have similar performance compared to human mammogram readers (Kooi et al. 2016). In a 2020 study involving Coronary Computed Tomography Angiography imaging, AI applications were able to accurately detect coronary artery disease in under two minutes, which could help future radiologists prioritise CCTA images with positive results for a more detailed report (Van Assen et al. 2020). AI CADe systems have also been used in neurology to identify intracranial LVOs with excellent sensitivity (82%) and specificity (94%); implementation of these systems can also aid task prioritisation by

Rather than competing with radiologists as once suspected, AI can actually augment radiologists in providing optimal patient care

gies. Thus, rather than competing with radiologists as once suspected, AI can actually augment radiologists in providing optimal patient care. AI has the potential to transform the work of a radiologist through three major steps in image analysis: detection, characterisation, and monitoring. This article will review the status of current AI research in each of these categories, as well as highlight the potential impact of these findings on future radiology practice.

Detection

Detection refers to the process of flagging and bounding a specific subregion in an image that is likely to contain a lesion or anomaly (Montagnon et al. 2020). Current technologies that help radiologists detect areas of interest are known as Computer Aided Detection (CADe). However, current CADe systems are limited by a high rate of false-positives and by high

utilise pattern-recognition to evaluate large volumes of images in a timely manner (Hosny et al. 2018). Subtly suspicious areas that otherwise may have been missed by the human eye are quickly highlighted and presented to the reader (Bi et al. 2019). In addition to improving radiologist sensitivity, deep-learning based CADe systems can also aid with task prioritisation, as the highlighted images can be escalated to the top of the read queue (Mouridsen et al. 2020).

The potential advantages of artificially intelligent CADe systems can already be seen through preliminary research in several areas of image screening. Recent studies have highlighted the ability of deep-learning-based CADe systems to detect pulmonary nodules on CT (Rauschecker et al. 2020). In mammography, convolutional neural networks (CNN) have been shown to outperform traditional CADe systems at low sensitivities, while showing similar performance at

alerting senior physicians to the case (Mouridsen et al. 2020). All of these findings highlight the utility of using AI in developing future high-performing CADe systems.

Characterisation

Characterisation refers to identifying specific qualities of a pathologic finding, such as size, extent, and internal texture. These qualities can be used to classify lesions into different diagnostic categories (benign vs malignant, pathologic subtypes). Current technologies for characterisation include Computer Aided Diagnosis (CADx) systems that, similar to the CADe systems, are based on predefined discriminative features that lack generalisability (Montagnon et al. 2020). This can limit their utility, as qualitative descriptions are often difficult to quantitatively define and measure (Hosny et al. 2018). This limitation is magnified by the fact that humans are limited in the number of qualitative



features they are able to identify by visual exam alone, leading to lack of standardisation and significant variability among readers (Montagnon et al. 2020). For example, it is often difficult for human readers to accurately identify high-risk lung nodules because malignant and benign lesions appear very similarly. Furthermore, for any pathology, radiologists usually need to manually define the borders of regions of interest, risking omission of subclinical disease from analysis (Bi et al. 2019).

AI has the potential to overcome these limitations through its ability to consider a large amount of qualitative features in a reproducible and timely manner.

Deep learning-based algorithms are especially promising due to their ability to learn from patient populations without need for pre-definition of discriminative features. In addition, AI algorithms can account for the degree of relevance of each qualitative feature they detect (Hosny et al. 2018). Most impressively, AI CADx systems have been shown to predict tumour response to different treatment options, as they are able to detect subtle qualities that indicate different mutations and subtypes. These tools can help inform providers on which treatment strategy they should try first without the need for invasive biopsy that may not yield a representative sample tissue.

For lung nodules, CNN have been shown to distinguish between benign and malignant classifications at a higher performance than traditional CADx systems due to their ability to function at higher degrees of noise tolerance (Hosny et al. 2018; Nasrullah et al. 2019). Furthermore, in a study done on patients with non-small cell lung cancer, AI CADx algorithms were able to use CT images to significantly predict which cancers contained EGFR mutations, informing on potential treatment with Gefitinib (Bi et al. 2019). Deep learning algorithms have also been trained to accurately classify prostate cancer on Magnetic Resonance Imaging (MRI), which can promote early treatment as well as

decrease the number of unnecessary prostate biopsies and prostatectomy procedures performed (Bi et al. 2019). An additional study reported an AI system that was able to use MRI imaging to accurately generate brain tumour classification differentials at a level that exceeded human performance. The algorithm generated the correct diagnosis in one of its top three differentials 91% of the time, outperforming academic neuroradiologists (86%), fellows (77%), general radiologists (57%), and radiology residents (56%) (Rauschecker et al. 2020). Brain MRI AI algorithms have also been able to classify gliomas into molecular subtypes by identifying imaging features associated with alterations in IDH1/IDH2, EGFR, MGMT, and/or chromosomes 1p and 19q (80% sensitivity and 95% specificity) (Bi et al. 2019). This degree of characterisation is significant as it provides a phenotype of the entire tumour, rather than the core of the tumour alone from biopsy, which can more accurately inform treatment. It is clear from these studies that implementation of AI CADx systems in radiology can lead to vast improvements in accuracy, subclassification, and treatment strategies.

Monitoring

Monitoring refers to the longitudinal follow-up of an identified pathology over time to assess for changes, either in natural history or response to treatment. In solid tumour monitoring, radiologists currently use protocols such as Response Evaluation Criteria in Solid Tumors (RECIST) or World Health Organization (WHO) criteria (Hosny et al. 2018). Although these criteria have been validated over the years, they have been criticised for their oversimplified approach that can allow more subtle features of change to be missed (Bi et al. 2019). These features could include slight variations in texture or heterogeneity (Hosny et al. 2018).

AI-based monitoring could supplement these protocols by capturing a large number of discriminative features that are undetectable by the human

eye. The ability to identify these subtle characteristics allows AI-based monitoring systems to provide a clearer picture of tumour evolution. One of the most significant studies demonstrating the usefulness of AI in lesion monitoring described an algorithm that was able to distinguish brain tumour progression from treatment-related changes (Bi et al. 2019). Radiation and chemotherapy can cause enlargement of contrast-enhancing lesions, known as “pseudoprogression”. It is difficult for radiologists to distinguish the appearance of pseudoprogression from actual tumour extension. Machine-learning algorithms have been shown to successfully discriminate between therapy-related changes and pathologic tumour (Bi et al. 2019). These algorithms achieve this ability by combining a large number of qualitative image features that are difficult for radiologists to assess.

Not only can AI-based monitoring technologies accurately detect progression in active tumours, they can also predict areas of future recurrence after tumour resection. One MRI study demonstrated that an AI algorithm was able to identify new margins of tumour cell infiltration that were undetectable to the human eye on post-contrast images (Liu et al. 2019). Using this information, the algorithm then created a predictive spatial map on the surrounding tissues, plotting the likelihood of tumour recurrence in each region (Liu et al. 2019). This algorithm can help physicians decide upon extending the area of tissue resection to improve post-operative remission rates. In addition, this technology can help radiologists more carefully monitor follow-up imaging, as they pay special attention to areas marked with a high recurrence probability.

In conclusion, the opportunities for AI implementation in radiology are vast and exciting. Current research highlights the ways in which AI has the potential to enhance diagnostic imaging care. Advancements in pathology detection, characterisation, and

monitoring are just a few avenues by which AI is predicted to revolutionise the specialty in the coming years. Improved imaging analysis will lead to more timely and targeted diagnosis and therapies, which ultimately will improve patient outcomes. In the near future, the partnership between radiologists and AI technology will begin to redefine imaging care for years to come.

Conflict of Interest

None. ■

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Enterprise Imaging VNA - Enriching Patient Imaging Records

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Agfa HealthCare's Enterprise Imaging VNA solution is a modern, standards-based platform purpose-built on the latest technology. Health Management.org spoke to Christien Lefebvre, Global Program Manager, Enterprise Imaging VNA for Agfa HealthCare to discuss the VNA solution, what benefits it offers and why healthcare organisations and clinicians should transition to it.

Key Points

- Agfa HealthCare Enterprise Imaging VNA is the next generation cloud-enabled enterprise workflow and data management solution that can store native and non-native medical images and documents, allowing geographic boundaries to be removed.
- The focus is on extensive data management, collaboration, indexing to make data available when needed.
- The data consumption and distribution model helps with patient diagnostic times and reduces patient reimaging requirements when a patient moves from facility to facility.
- Agfa HealthCare VNA's data protection focus is to have all its data stored on the VNA system both encrypted at rest and in transit.





Can you tell us something about the Enterprise Imaging VNA solution from Agfa HealthCare?

The Agfa VNA is the next generation cloud-enabled enterprise workflow and data management solution that can store native and non-native medical images and documents, allowing geographic boundaries to be removed. The VNA solution has been innovated over the last 12 years to bring a collaborative model for data management that increases the availability of patient data while helping improve the timeliness of care by reducing the requirement to reimage patients. The focus of the Agfa VNA solution is based on extensive data management, collaboration, and indexing to make data available when needed.

When you say vendor neutral, what do you mean exactly?

The Agfa VNA offers true neutrality built on a state-of-the-art cloud-enabled solution, allowing clinical users to query for a complete patient timeline. The Agfa VNA has been deployed globally in over twenty countries now for over a decade. Agfa's focus on neutrality is towards connected image sources, format independence and consumer independence. With the help of the Agfa VNA Dicom tag morphing ability, applying Image Object Change Management "IOCM" and preservation mapper, allows its users to define a common taxonomy for data growth, significantly when expanding in non-Dicom imaging and document areas.

Is VNA limited to unifying imaging data in one central location, or is there more that can be done?

I immediately think of federation, compatibility, interoperability, and potentially endless integration options; for example, with the proper Agfa VNA workflow, the Agfa VNA can acquire any patient data, regardless of the Original Equipment Manufacturer (OEM) or datatype

(image or document). The Agfa VNA can then categorise and store this newly acquired data based on the available dataset from the HIS or a clinical console. There are additional data nominalisation offerings that clinical users can use to enrich this newly acquired dataset.

How does Agfa's Enterprise Imaging VNA solution ensure patient data is protected?

The Agfa VNA works with best-of-breed standards to ensure patient data is protected, starting with an aggressive patch management process following National Institute of Technology (NIST) guidelines. The patching process ensures our deployed "golden images" pass Nessus vulnerable scans before being installed. We also use a combination of DIMSE-C, IPV6 and HTTPS services depending on the dataflow requirements. We integrate user access via industry standardised login modules to ensure integration with our customer policies around accessibility and encrypted SSL user authentication. Understanding the concern around patient data from an unwanted security access point, we also use data segregation rules based on external system Application Entity Titles (AETs) defined within the Agfa VNA Access Control List (ACLs) Application Programming Interface "API." On top of these layers of patient data protection, we have detailed ATNA logging exported to an external repository. Agfa VNA's data protection focus is to have all its data stored on the VNA system both encrypted at rest and in transit.

How does the VNA solution benefit radiologists and clinicians with their everyday tasks?

The Agfa VNA solution allows all clinical users to access all the relevant patient data regardless of the treatment area or diagnostic areas. This data availability and collaboration-centric enable model provides clinician users with all the available patient data to help determine the best possible treatment plan. The ability to share information, study comments and the extensive patient data historical timelines allows for cross

treatment plans. The Agfa VNA can even unlock medical advances by enabling clinicians to link illness across service areas. The Agfa VNA enriches patient imaging records with data previously inaccessible to a diagnostician from enterprise modalities and service areas.

What makes your VNA solution different from that of your competitors?

The Agfa VNA solution differentiates itself by enabling an organisation to go beyond a consolidated archive. Most VNA systems connect a few PACS systems to a centralised archive and offer the ability to ingest from modalities. With the Agfa VNA solution, service areas that create imaging content can go onboard to the solution quickly with little effort through clinical acquisition and normalisation tools. Agfa HealthCare has worldwide experience, and we have expertise in integration with over fifty clinical service areas, hundreds of PACS and thousands of imaging devices and systems. Our extensive integration experience drives the VNA solution for hospitals, health networks, and regional or national imaging collaboratives, knowing that they will not have their data left on an island when planning their long-term digital care strategy.

Is this a costly solution for healthcare organisations? Or is it likely to result in long-term savings if implemented properly?

VNA investments vary widely based on desired VNA workflows, XDS, FHIR enablement, and BCDR strategy within the Agfa VNA solution. The Agfa VNA offers an immediate soft Return on Investment (ROI) concerning infrastructure and resource power and better long-term Total Cost of Ownership (TCO). The Agfa VNA solution can reduce resources and hardware by consolidating PACS and archives, enhancing data management efficiency by reducing redundant configuration, and allowing care facilities to capture revenue with crucial evidence from hospital service areas that have previously lost or missed billing opportunities. This broad



Scalable, vendor-neutral image storage



With over 1000 PACS and VNA deployments worldwide, Agfa HealthCare has connected with every major vendor in the world.



The Enterprise Imaging VNA integrates with hundreds, if not thousands, of products and acquisition systems from different vendors.



One of Agfa HealthCare's largest Enterprise Imaging VNA installations connects 60 hospitals.

approach to consolidation of imaging systems and increasing collaboration across service areas allows for improved data sharing, modelling, and capacity planning, resulting in a long-term cost-benefit model that healthcare leadership should not ignore.

How do you ensure healthcare organisations that adopt this platform use it effectively? Is there training for the people involved, or is this easy to use?

Within the Agfa VNA platform, there are advanced services that monitor and report on the overall system. We classify these services into two categories: "System reporting" and "Process reporting." The Agfa VNA services allow for clinical and operational insight into VNA system health, overall performance and reports on the institution's mission-critical KPI are being archived. Our VNA dashboards that handle our System and Process reporting are customisable, allowing the administrative user to alter the views based on any user's particular role and job function. Along with these VNA dashboards and monitoring

services that help ensure the system operates effectively, we offer advanced training paths to ensure all administration can manage their Agfa VNA environment. The focus of the Agfa VNA is to have all system tools configurable via our API so that it allows for ease of use and customisation. A simple search Agfa VNA Knowledge Base (KB) offers administrative and clinical users a step-by-step guide to make their desired changes.

The VNA & PACS market is projected to have healthy growth by 2023. Do you have any plans to improve/add on to this feature?

We are focused on three main areas that are already in development and prototyping;

1. We are expanding our non-Dicom native workflows leveraging lossless compression and reviewing the ontology of these studies; our API can leverage a proper taxonomy to ensure the clinical user experience is appropriate. There is very little value in acquiring non-Dicom data if there are limited tools to index this information for clinical end-user search and find properly.

2. We are expanding our VNA federation model to support multi-health systems and international level federation in the cloud. The focus around federation growth is our data accessibility to our streaming zero-footprint viewer (XERO) to offer more shared workflows. Shared workflows and collaboration are the future for sizeable multi-enterprise health networks and academic collaboration.

3. The final main focus is on AI and machine learning within the VNA environment. I feel that the poor uptake of AI within some aspects of healthcare is based on the dataset. There is a need to apply AI and machine learning to a small dataset while ideal in certain areas of medicine. I believe there are extensive options when applying machine learning to enormous datasets in trillions of objects. With proper anonymisation and correct AI-defined parameters, it is hard to imagine what we can learn around medical imaging. ■

For more information about Agfa Healthcare's VNA solution, please visit <https://global.agfahealthcare.com/vna/>

Telecardiology: What Could be Next?

The new way to monitor health

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With the COVID-19 pandemic and the lockdowns and restrictions of physical contact, many cardiovascular scientific associations and journals started to speak about telemedicine solutions, but many highlighted that no telecardiology programme could be created overnight. In cardiology, the branch of telecardiology is well developed and the COVID-19 pandemic showed us the potential of this tool, for example in the field of remote monitoring with TeleCheckAF. Telecardiology with the right improvements in the future can offer many benefits.

Key Points

- Telemedicine is not something new. It was well known from the beginning of the twentieth century. Cardiology has already covered all formats of telemedicine.
- The main lessons on telecardiology during the COVID-19 pandemic: unmasked many clinical visits as unnecessary, key for safety of patients and physicians, in some ways a return to the days of personal home visits, and big capacity for adaptation in the field of cardiology.
- TeleCheck-AF project during COVID-19 showed that mHealth experiences could be successful even during a pandemic period.
- Cardiovascular scientific societies have an important role in leading the telecardiology implementation.



Telecardiology - Something Unknown?

With the COVID-19 pandemic and its lockdowns and restrictions of physical contact, many cardiovascular scientific associations and journals started to speak about telemedicine solutions (Hollander 2020), but many highlighted that no telemedicine programme (also could be the same for telecardiology) could be created overnight. Due to this, only cardiology departments that have already implemented telemedical innovations can leverage them for the response to COVID-19.

We knew that telecardiology was not something new. It was well known from the beginning of the twentieth century. One of the first examples was elec-

tracardiography, when, in the early 1900s, Einthoven transmitted heart tracing via telephone lines from the local hospital to the laboratory where his string galvanometer was located (Einthoven 1906). However, the importance of this tool started to grow in 1960s with some initial experiences.

trocardiography, when, in the early 1900s, Einthoven transmitted heart tracing via telephone lines from the local hospital to the laboratory where his string galvanometer was located (Einthoven 1906). However, the importance of this tool started to grow in 1960s with some initial experiences.

We knew that telecardiology could be defined as “cardiology at distance”. Another way to define this could be “the practice of cardiology without the usual cardiologist-patient physical confrontation, via an interactive audio-video communications system”. But unfortunately for us, before the pandemic, telecardiology did not have a history of success. Problems mentioned in 1984 by Higgins (Higgins 1984) were still present in 2020: 1) The initial expense in setting up telecardiology systems is high and it is difficult to justify the costs. 2) There is resistance from

Telecardiology Before COVID-19

many cardiologists who feel threatened by alternative approaches to the practice of medicine. 3) Cardiologists’ reimbursement and legal implications need to be resolved.

Cardiology has clearly covered all formats of telemedicine and we could talk of telecardiology as something real in daily practice but not properly implemented. The current formats of telemedicine used in cardiology are:

- Synchronous (live): remote consults or teleconsultation, live video/audio
- Asynchronous (store & forward): e-consultation, imaging documents, patient remote monitoring

intervention participants, with concurrent reductions in systolic blood pressure and body mass index, significant increases in physical activity, and a significant reduction in smoking. The majority reported the text messages to be useful, easy to understand, and appropriate in frequency.

Lessons From COVID-19 in Telecardiology

The first lesson: COVID-19 has unmasked many clinical visits as unnecessary and likely unwise. Telemedicine has surged, as we suspected, that social proximity is possible without physical proximity. Progress over the past two decades has been painfully slow toward regularising virtual care, self-care at home, and other

Teleconsultation is not the Holy Grail and its advantages, disadvantages and limitations have been well described

In the field of cardiology, there have been multiple experiences in telecardiology. Probably, the main target was establishing a link with primary care through teleconsultation or e-consultation tools with different results. However, teleconsultation is not the Holy Grail and its advantages, disadvantages and limitations have been well described (Barrios 2020).

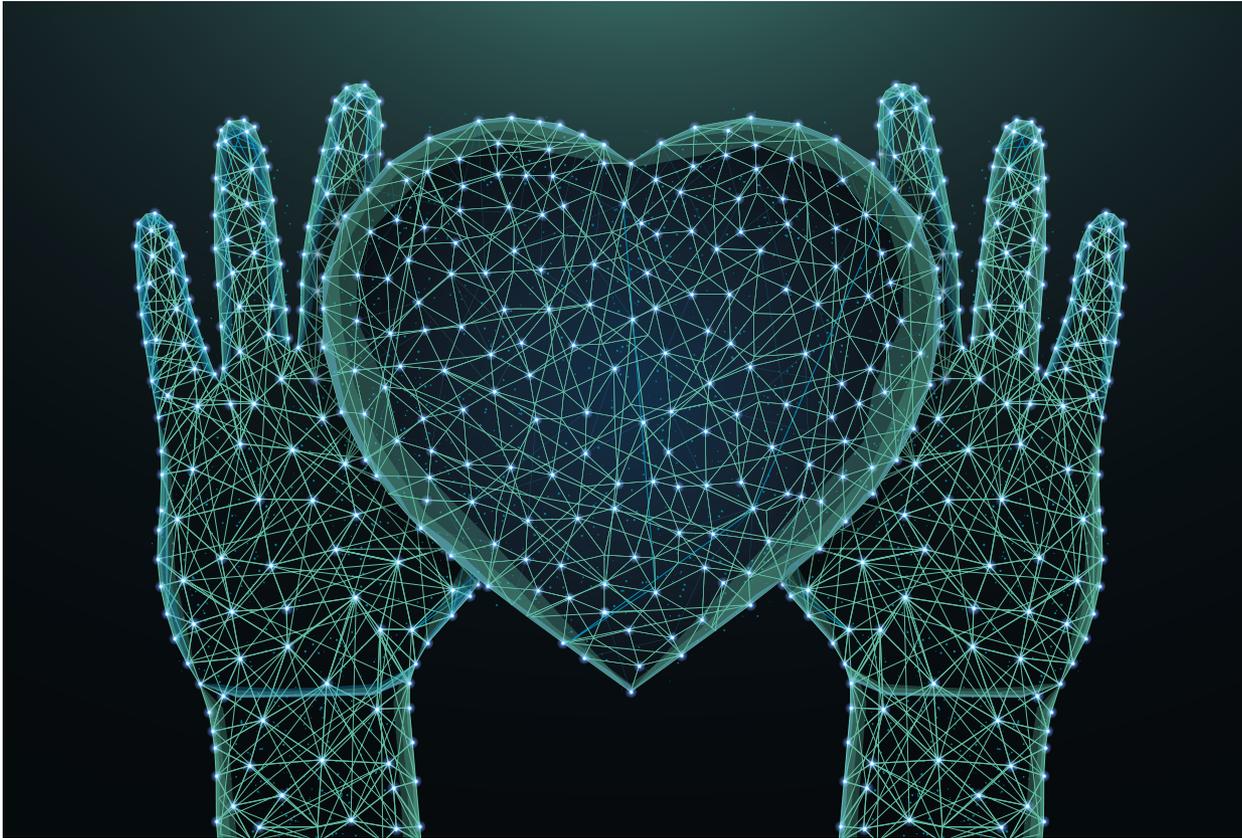
We must not forget that sometimes very complex strategies are not needed from telecardiology to offer improvements in cardiovascular outcomes. One of the best examples in scientific literature was the Tobacco, Exercise and Diet Messages (TEXT ME) trial, which based its strategy merely on reminder messages of healthy habits via short message service (SMS) in patients with proven coronary heart disease after discharge from hospital (Chow 2015). At six months, levels of LDL-cholesterol were significantly lower in

web-based assets in payment, regulation, and training. The arrival of COVID-19 has changed that in weeks. Virtual care, well scaled, would release face-to-face time in clinical practice to be used for patients who truly benefit from it (Berwick 2020).

The second lesson is security in both ways (patient and physician). All the scientific societies in cardiology (Driggin 2020) went in the same direction as Hollander proposed in New England and adapted for this review: “the central strategy for surge control is “forward triage” — the sorting of patients before they arrive in the hospital. Direct-to consumer (or on-demand) telemedicine, a 21st-century approach to forward triage that allows patients to be efficiently screened, is both patient-centred and conducive to self-quarantine, and it protects patients, clinicians, and the community from exposure. It can allow physicians

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and patients to communicate 24/7, using smartphones or webcam-enabled computers. Automated screening algorithms can be built into the intake process, and local epidemiologic information can be used to standardise screening and practice patterns across providers” (Hollander 2020).

The third lesson: telecardiology is in some ways a return to the days of personal home visits. Elderly patients, those who have limited access to technology, or those with low health literacy can be provided tools and teaching to adapt. For sure, this will be a tactic to help eliminate barriers and

increase access. Telemedicine has the potential to make healthcare more personalised, efficient, and coordinated; it has the potential to improve efficiency, patient and clinician satisfaction, and health outcomes (Poppas 2020).

The four lessons reveal the big capacity for adaptation in the cardiovascular field. Many recommendations have been created in less than one or two months to help in the management of the pandemic. The cardiology aspects specially focused on telecardiology in many cases. A good example are the dynamic web pages created by the principal

cardiovascular societies related with COVID-19 like European Society of Cardiology (<https://www.escardio.org/Education/COVID-19-and-Cardiology>).

Remote Monitoring – A Great Opportunity in Telecardiology

COVID-19 has changed the conversation about the value of remote monitoring, with increased focus on the benefits that come with less travel and inconvenience for patients and less social interaction. Perhaps achieving the same results as usual care is sufficient (Cowie 2020).

One great example of implementation of remote monitoring during COVID-19 in the telecardiology field is the TeleCheck-AF project (<https://www.fibrichck.com/telecheck-af/>). To guarantee the continuity of comprehensive Atrial Fibrillation (AF) management through teleconsultation, during the pandemic the Maastricht Medical University Centre developed a mobile health (mHealth) intervention to support AF teleconsultations.

The TeleCheck-AF incorporated three important components: (i) a structured teleconsultation (‘Tele’); (ii) an app-based on-demand heart rate and rhythm monitoring infrastructure (‘Check’); and (iii) comprehensive AF management (‘AF’). The on-demand heart rate and rhythm monitoring infrastructure is based on a CE-marked mobile phone app (www.fibrichck.com) using photoplethysmography (PPG) technology through a built-in camera allowing semi-continuous heart rate and rhythm monitoring of AF patients prior to and during the teleconsultation (Linz 2020).

This strategy was extended to different European countries during the pandemic with great satisfaction for physicians and patients as a recent publication has shown (Gawalko 2021). The majority (>80%) of centres reported no problems during the implementation of the TeleCheck-AF approach and recruited patients agreed that the app was easy to use (94%).

First one-stop clinic	Have the echocardiograph available in the consultation: it can be used by the clinician or the imaging specialist who will centralise various consultations. The possibility to perform other tests such as the stress ultrasound should be available
Test results	Once the pertinent answers are received in the initial consultation, test results can be given over the telephone. Reports or images could be sent by email
Telephone follow-up	A face-to face consultation should be considered if there is any indication that a physical examination or complementary tests are necessary. This is an attractive option for conditions such as chronic coronary syndrome
Echo-consultation	Consultation after an echocardiogram especially directed to the follow-up of patients with valvular disease
Follow-up of heart failure	Promotion of self-monitoring, teleconsultations, video consultations, and sending of tables and spreadsheets via email or cloud-shared folders
Link with the primary care physician	A multidisciplinary consultation can finally be carried out through simultaneous contact between the family physician and specialists in a conference call (with or without video) with the patient

Table 1. Possible ways to reorganise cardiology consultations. Adapted from Rev Esp Cardiol (Barrios 2020)

This approach showed that despite different healthcare settings and mobile health experiences, an mHealth approach could be set up within an extremely short time and easily used in different European centres during COVID-19.

What Could be the Next Improvements in Telecardiology?

Professional medical societies have pivotal roles in promoting digital literacy, including the implementation of evidence-based digital redesign and innovation

and should act as conduits to meaningful engagement with other key stakeholders (Cowie 2020).

Recently the Spanish Society of Cardiology proposed what could be better strategies to be implemented for cardiology consultations based on the telemedicine tools after COVID-19 (Table 1) (Barrios 2020).

Conclusion

Telecardiology had been with us for a long time but was not implemented properly. Telecardiology provides excellent opportunities. It allows patients to take a more

active role in the healthcare system, facilitates patient-physician collaboration/communication, has the potential to make smart use of every byte of data and shows promising results in cardiovascular prevention.

Obviously, the organisation of telecardiology is a challenge for the health system especially in times of a pandemic, but it is also an opportunity for new solutions like the TeleCheck-AF project. We need to constantly evaluate usability, data accuracy and validation of the results obtained.

Scientific societies have an important role in leading telecardiology, and we must be ready to overcome the resistance to change to a new cardiology practice with many potential benefits.

Conflict of Interest

None. ■

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For full references, please email edito@healthmanagement.org or visit <https://jhm/19si>



Gaia-X Federated Data Infrastructure: The Future of Data Management

An overview of Gaia-X, a cross-centre initiative that aims to create the next generation of data infrastructure by providing a secure, federated system based on the highest standards of digital sovereignty and innovation.

Key Points

- Gaia-X creates the foundation for a sovereign, federated, open data infrastructure based on European values.
- It connects centralised and decentralised infrastructures into homogenous and user-friendly system.
- It creates an open, transparent, federated catalogue of data sources and data services where stakeholders can access data in a consistent, secure and trustworthy manner.
- Gaia-X provides a solid legal and technical foundation to better manage data across European Member States.





Gaia-X creates the foundation for a sovereign, federated, open data infrastructure based on European values. It is a strategy that can facilitate a collaboration between different stakeholders to build a data space using the framework.

In particular, health data space includes a set of shared capabilities and federated health data spaces, where data is granularly and selectively accessible. These federated data spaces will exist on regional, national and European level. The goal is to ensure the data space contributes to the care delivery processes for patients as well as allows the secondary use of data on a cohort or population scale. This will create a data value chain between data holders and data users across the broad and complicated health domain ecosystem.

Mission and Goals of the Data Space

Gaia-X's mission is to allow access and sharing of data securely and confidently. Our primary goals include:

- Providing the means to link currently isolated data and disparate applications, between citizens, care providers and other stakeholders, within countries and across borders, in a transparent manner, adhering to international interoperability standards.
- Providing a framework to implement the data spaces at scale in a compliant, secure, and trustable manner.
- Enabling the storage and access of personal and non-personal information in trusted and collaborative cloud infrastructures, with elasticity to scale and with a proper legal basis (consent, anonymisation, etc.).
- Implementing clear governance for the use of data on personal, regional, national and European level and for delivery of care, for research, for commercial and governmental use.

Key Challenges

Healthcare is facing many challenges including the increasing burden of chronic disease, an ageing

population, significant lag in digitisation and a lack of integrated and longitudinal views when managing a single patient or a patient population. The health ecosystem is fairly complex with many stakeholders, regulated processes and multiple sources of funding. This has slowed down the innovation and transformation process in healthcare. The COVID-19 pandemic has further exposed these issues and has clearly demonstrated the fragility of global healthcare systems.

When it comes to patient data, it is collected and stored by disparate systems with low interoperability. Clinicians have difficulty accessing this data as well as share/exchange it. Therefore, they are unable to benefit from it. Data is distributed between many stakeholders, including healthcare providers, insurance companies, companies in the secondary health market and individual patients. For healthcare to progress and innovate, it is important to ensure data from various sources is easily available while meeting the highest standards of privacy, security, transparency and control.

Gaia-X data space should contribute to the care delivery processes (primary use of data) for the individual patient or resident (for healthy living, prevention, diagnosis, treatment and home care, leading towards value-based healthcare) as well as to secondary use of data on a cohort or population scale (for research, innovation, crisis preparedness and crisis management, public and population health). At present, there is significant duplication of effort in the management of healthcare data. Achieving interoperability among these systems is critical for clinical care as well as clinical research. This can also facilitate virtual healthcare services (e.g., e-consultations, e-interventions, telehealth, teleradiology, remote care management, and other aspects of telemedicine), as well as promote digital health science using both trial- and real-world-data.

Data Space – A Holistic Solution

The health domain comprises four essential contributors: data holders & data users, application and service providers, data space governance and operating entities, and cloud service providers. All these stakeholders can benefit from data-driven applications and services built on a trusted, safe and secure cloud infrastructure. Gaia-X data space also enables an equal playing field for application and service developers. Small, medium and large companies, together with governmental and non-governmental institutes, can take the lead in developing agile and innovative solutions that can transform healthcare.

The future landscape for innovative applications is incredibly rich and may include lifestyle improvement using various tracking devices and (non-) human coaching, symptom and vital sign tracking, continuous outcomes measurement, real-world-data trending and analysis, decision and referral guides, appointment scheduling, clinical data trial management, advanced image and genomic data analysis, health resource and capacity optimisation, emergency and triage management, and many more.

Data applications and services require common standards and common components. This will require participation from both data governance and operating entities. The data space initiative will co-create the framework with Member States and the European Commission. The data space will also work in collaboration with operating entities as they are the connectors that link isolated data in a transparent, secure and audited manner.

Finally, the data space is created on a foundation of cloud services and edge components. Gaia-X will create an ecosystem of trusted, safe and secure cloud and edge infrastructures in Europe to allow health data to flow securely and in line with Europe's privacy provisions and values.



Gaia-X Components

Core Gaia-X infrastructural components include:

- Identity & Trust: federated identity management for individuals and organisations
- Federated Catalogue: to publish the registration, consent and query services
- Sovereign Data Exchange: to manage registration, consent, cloud/edge services and data query and access services
- Compliance: rights management, onboarding and certification

Benefits of Data Space

The data space offers the following benefits to healthcare:

- It provides the required technical infrastructure that enables secure storage of large data sets and powerful computing architecture and methods for the complex analysis of data at petabyte scale.
- It ensures data access is secure and GDPR compliant, with datasets, analytics pipelines, and compute provided by different actors in the health care and research sectors.
- It provides extensive and published datasets through secured interfaces.
- It offers automated deployment and roll-out capability of the interoperable and virtualised methods of other secure top locations in the healthcare sector.
- With its ability to integrate data across individual domains (e.g., image data, clinical information), the Gaia-X network offers the potential to realise more complex integrative analyses within personalised medicine for the benefit of patients.
- It enables sharing of documents between different departments, private physicians, clinics, long-term care, acute care with different clinical IT systems.
- It provides a unified approach to support patient rights, clinical care and research.
- It enables secure, and GDPR-compliant access to patient data through compliance with Gaia-X provided policies.

Recommendations

The following are recommendations for the health-care industry:

- Converge the ongoing or projected initiatives towards the common Gaia-X framework.
- Improve transparency of the existing initiatives and deploy a process and tooling to maintain this transparency.
- Build the federated data and services catalogues to improve the availability of and access to data.
- Commit to privacy and security and to the principles of data sovereignty by design.

Recommendations for policymakers and society include:

- Align the EU initiatives with Gaia-X: European Health Data Space development and roadmap for cross-border data exchange, the TEHDAS Joint Action, the European Alliance for industrial data, cloud and edge, and the EU Cloud Rulebook with the Gaia-X initiative.
- Obtain buy-in and support from the Health Ministries of the European Member States with the Gaia-X framework and architecture.
- Solve electronic identity management across Europe: continue and accelerate the deployment of federated eID solutions (eIDAS) for natural and legal persons.
- Agree on data trust and data governance: where/who defines the standards and the guidelines for ethical use of personal health data. Harmonise these principles and guidelines across the EU Member States.
- Provide adequate level of funding, while keeping limited local variations where required (national healthcare sovereignty) to stimulate adoption of the Gaia-X framework and to kick start the deployment of a Gaia-X compliant data space.
- Encourage the European Data Protection Board to provide clear and updated guidelines on the concepts of personal data and non-personal data and on anonymisation techniques.

- Reduce fragmentation of local conditions on data processing for scientific research purposes. Reduce fragmentation of local data protection/healthcare rules applicable to health data, in particular in the field of cross-border transfers of health data within the EU.

Future Outlook

It is evident that the healthcare sector is multi-faceted, with a complex interplay between patients, care providers, insurers, governments and various other stakeholders. There is an increasing demand for better care delivery processes, efficient use of data and overall improvement in prevention, diagnosis, and treatment. There is also a demand for better utilisation of secondary data for purposes of research, innovation, vigilance, public health and population health.

A health data space creates an open, transparent, federated catalogue of data sources and data services, where demanding stakeholders can obtain access to select data in a consistent, secure and trustworthy manner. It is a compliant data management solution with a strict and open set of policies, rules and standards, giving full control to the respective data holders and creating an essential environment of trust.

The growth speed of global healthcare data is stunning. The application areas of big data in healthcare are developing at a massive speed and have further accelerated because of the pandemic. The current state of data collection, exchange and processing in Europe is limited by scale, gaps in standardisation and by legal challenges and national boundaries. Gaia-X provides a solid legal and technical foundation to better manage healthcare data and to ensure European Member States innovate at the required pace to sustain their healthcare systems and compete with the other large-population countries. ■

Empowering Communities to Support Telemedicine and its Business Model

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 Author: [Diane Whitehouse](#) | Principal eHealth analyst | EHTEL | Brussels | Belgium

The Telemedicine Community Readiness Tool proves its worth in supporting communities internationally on their journey towards expanded telemedicine use.

Key Points

- Empowering communities, while preparing for long-term telemedicine implementation and use, is vital. It can encourage telemedicine deployment during ongoing waves of the COVID-19 pandemic.
- The Telemedicine Community Readiness Model (TCRM) gives communities a tool to create a favourable environment for telemedicine.
- The TCRM been tested internationally and is available free of charge.
- Personas are a useful change management tool. Further focus on professional personas is needed to consider the professional perspectives in health, care, and management when working on improving telemedicine.

Supporting Telemedicine Implementation During COVID-19

Use of telemedicine has increased rapidly in 2020/2021 due to the special situation created by the COVID-19 pandemic. To enable this increase, various barriers have been lowered temporarily e.g. the removal of blockages to financing and inter-jurisdictional use (Bokolo 2020). To sustain the use of telemedicine, however, longer lasting business models that are not based simply on exceptional circumstances are needed. These are business models which can operate at the level of individual telemedicine solutions and can, in turn, be more widely supported by communities. Hence, communities can be empowered, thereby helping them to prepare for long-term telemedicine implementation and use. To this end, a [telemedicine community readiness model \(TCRM\)](#),



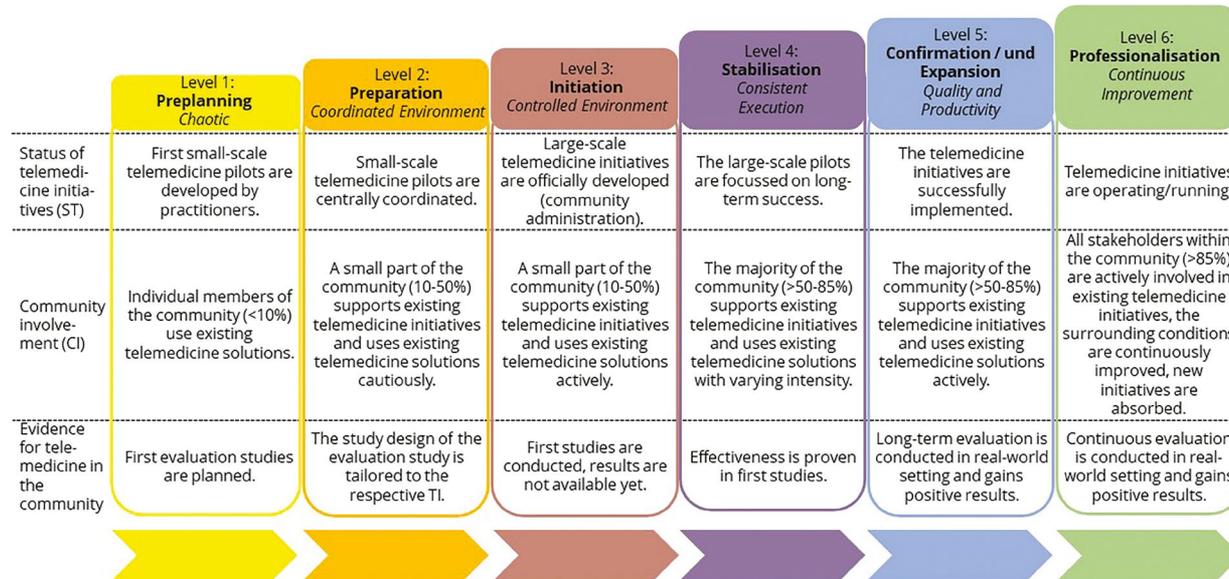


Figure 1: The assessment part of the TCRM

based on earlier Momentum Blueprint work (Jensen et al. 2015), has been developed and is available for use free of charge. Using the steps of the model will help to encourage the scaling-up of telemedicine innovations. This model has already assisted several communities – in Australia, Croatia, and Scotland – to identify key aspects of their own telemedicine success stories. Further experimentation, and development of tools, is now taking place in the context of other scaling-up exercises. Implementing the TCRM could really help to encourage telemedicine implementation in the future, including during any ongoing waves of the COVID-19 pandemic.

Telemedicine in 2021 and Beyond

During 2020, there were many telemedicine innovations. Internationally, increasing numbers of

telemedicine solutions were put in place, including in the field of mental health (Folker et al. 2021), and they were utilised for many reasons outside of social distancing and the special circumstances posed by the COVID-19 pandemic. Innovations began seemingly overnight. Barriers that had previously been assumed to exist were suddenly overcome, because COVID-19 did not leave citizens and organisations with many other alternatives. What can, however, be perceived from former pandemic or epidemic situations based on other respiratory conditions like SARS or MERS, is that an increase in innovation and continued use of telemedicine is rarely sustained after the special situation ends (Reifegerste et al. 2021).

The COVID-19 situation has taught us three main lessons. First, we have learned that there is a continuing

need to focus on telemedicine use, including how it can be integrated together with real-life (physical) appointments and treatments. Second, we should empower stakeholders – as well as communities – to develop long-term strategies to implement telemedicine initiatives successfully. Third, we should create environments which make it easier to scale-up telemedicine initiatives in scope and number. Most likely, ‘hybrid care’ will become a core endeavour – bringing together virtual and physical health and care encounters. Tools that can help communities engage will be essential in ensuring a smooth implementation.

The Telemedicine Community Readiness Model (TCRM)

The Telemedicine Community Readiness Model (TCRM) underpins telemedicine development by communities and stakeholders. The TCRM was developed to support communities – and stakeholders in those communities e.g. community representatives, legislative institutions, and payers – to create a favourable environment for implementing and scaling-up telemedicine. It is a valuable tool that helps to assess and improve the status quo for telemedicine in communities that can be connected locally (e.g. regions or health networks) or through a shared concern (e.g. a common disease). The model consolidates research on telemedicine barriers, and success factors for telemedicine implementation, e.g. by incorporating the findings of the Momentum Blueprint (Jensen et al. 2015; Whitehouse and Lange 2017).

How to Use the TCRM?

There are three main steps to using the TCRM. First, the TCRM guides users through a series of questions that help them to assess the status of telemedicine initiatives, the involvement of users in the community, and the level of evidence generated on



BLUEPRINT

DIGITAL TRANSFORMATION OF HEALTHCARE FOR THE AGING SOCIETY

Web: https://ec.europa.eu/eip/ageing/blueprint_en
 Contact: WE4AHA@empirica.com

Meet Ella



Name: Ella **Country:** Germany
Age: 27 **Area:** Rural
Life course: Working Age Adult
Need: To improve care delivery in her community
Connectivity: Broadband, smart phone

Internet usage	Low <input type="range" value="80"/> High
Mobile device skills	Low <input type="range" value="80"/> High
Affinity to new tech	Low <input type="range" value="80"/> High
Digital Health Literacy	Low <input type="range" value="80"/> High
Assistance (ICT use)	No <input type="range" value="80"/> Yes

Figure 2: The Blueprint persona Ella

what kinds of telemedicine projects already exist in the community. These questions help people to rate their community according to a particular level, in terms of their telemedicine adoption “as is” (today) (see Figure 1).

Second, based on the rating, the TCRM proposes specific improvement aspects that help the community to be better prepared to implement telemedicine successfully. Third, community stakeholders work together to develop a specific strategy for how to put the proposed improvement aspects into practice. These community stakeholders can include a wide range of people e.g. representatives from communities, payers, healthcare professionals, technicians, or others using telemedicine.

Who Can Use the TCRM?

The TCRM aims to empower representatives in communities to get their community ready for the successful implementation and scaling-up of telemedicine initiatives. The TCRM can be used together with the appropriate personas.

Ella is one of the [Blueprint personas](#) which were designed to help understand the profiles of people focusing on improved health and care, often by using digital technologies (Blueprint personas 2021). Ella can serve as a supporting persona for other communities, initiatives, and projects that want to include a professional perspective in their work.

As head of digital healthcare innovations in a rural community in Eastern Saxony, Germany, Ella is a good

example of a community representative. The community she works and lives in is characterised by its long distances from the clinics or hospitals where patients must visit medical specialists. As part of her work, Ella aims to introduce telemedicine solutions into her community to lower the burden of the effects created by the decreasing number of clinical specialists working in Saxony. Even though it is sometimes challenging for Ella to work with the health professionals in her community – especially as the older ones remain reluctant to change – she is thrilled to be able to build an environment in which professionals and users are involved and are motivated to use telemedicine. Ella uses the TCRM to get inspired as to what she can do specifically to reach her aim of improved care delivery in her community (Figure 2).

International Use of the TCRM and its Success Factors

The TCRM has now existed for over two years. It has been evaluated at several stages during its development in differing communities in Australia and Germany by healthcare professionals, representatives of health insurance companies and network organisations in healthcare. Now, it is available free of charge as a web tool. It is accessible to anyone who is searching for support on telemedicine deployment in his/her community.

During the winter of 2020-2021, sites in Australia, Croatia, and Scotland tested the model. The communities in these three countries were all at level 4 ('stabilisation') of the TCRM, meaning that they were consistently employing telemedicine, and had already implemented several telemedicine initiatives in which more than half of the people within the community are now involved. Challenges around confirmation, expansion, and professionalisation remain for these test sites, denoting the shift needed to levels 5 and 6. All three sites are highly interested in generating evidence that their telemedicine initiatives serve the communities as intended. They have conducted at least some first evaluation studies. Based on an initial assessment of their status quo, various actions have been identified that can help further improve the telemedicine implementation in all of these communities. The three countries' best practices and successes in reaching a level of stabilisation in their work (level 4 of the TCRM) follow.

Australia: The Australian community involved people with an Aboriginal background and racial diversity. Australia is a country with several states. The community benefitted from the following five practices, among others:

1. Stakeholders designed the layout and settings on mobile devices based on citizens' needs.
2. Aboriginal team members were involved to ensure culturally appropriate communication with users.
3. Focus was placed on partnerships with state-wide services.

4. The infrastructure used was interoperable.
5. Technical needs were very much driven by the clinical use case described by the community, and not by the available technology.

Croatia: Croatia focused primarily on cooperation and involvement. Among other activities, it conducted co-development workshops with relevant stakeholders (including software developers, doctors, nurses, patients, and policy makers). Implementation was supported thanks to a pre-existing framework for telemedicine reimbursement, which meant that adequate financial resources were available for telemedicine initiatives.

Scotland: The Scottish community experienced provision of adequate financial resources, with developments occurring at the national level and in a national context. Government Funding and Local Health Board resources were helpful in implementing telemedicine initiatives. A [Scottish government programme](#) exists which defines a sustainable scaling-up strategy necessary to implement and scale-up telemedicine initiatives in the long-run.

Other sites continue to download and use the TCRM.

Next Steps With the Use of the TCRM

In addition to the success factors presented, the TCRM helps mainly in identifying aspects for improvement which consist of hard and soft factors. Specific 'hard factors' (e.g. infrastructure, resources) and 'soft factors' (e.g. vision, awareness) are proposed by the model, which help each community to mature towards a state where it is easy to implement telemedicine initiatives.

Communication is also important. The TCRM supports communication among all of the stakeholders involved in a community by providing a unified understanding of their situation in order for them to work together seamlessly.

Since the TCRM is now in active use and freely available, it will serve as a knowledge base for sharing best practices in capacity building among communities

regarding telemedicine initiatives. By offering such support to communities, an implicit aim of the model is to help in sustaining the increased use of telemedicine throughout ongoing waves of the 2021 COVID-19 pandemic and in the years beyond. The Helict team of TU Dresden, as part of the reference site of Saxony, is always happy to assist other regions that need support with using the TCRM. For more information on the work of Helict, please visit [their webpage](#).

The TCRM is one of several tools that are undergoing revision and expansion, with a view to their extended use in the future. Two others are the SCIROCCO Exchange tool and the Momentum framework (Jensen et al. 2015). EHTEL and its members – including people from the region of Saxony in Germany – are keen to support digital health advances. For more information on the work that EHTEL has been conducting, in this time of opportunity and challenge, visit its [Imagining 2029 webpage](#) dedicated to digital health and its COVID-19 webpage. Hybrid care is one of EHTEL's current work streams.

Conflict of Interest

None. ■

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EU Health Place - Social Network for Health

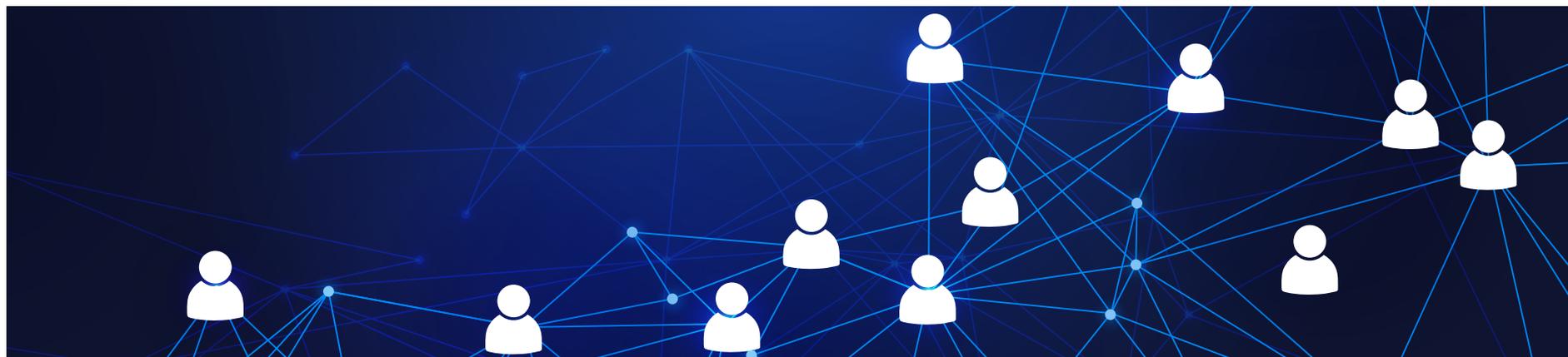
Balancing Human Rights Online Through “Action” Regulation

Author: [Prof Henrique Martins](#) | Editorial Board member – IT | Associate Professor - ISCTE – University Institute of Lisbon | Portugal

If we are to effectively modulate the benefits and harms from social networks and misinformation, there is an inherent value in the “audacious” idea of creating a publicly owned social network at the EU level. A balance between freedom of speech and dangers of misinformation has to be found. I would call this “action” regulation by means of digital infrastructural action. The European Health Data Space Regulation would benefit from social thinking. The EU needs to act now.

Key Points

- There is currently an overabundance of information, available both online and offline, much of which is health related mis- and disinformation. The WHO have coined this phenomenon an “infodemic” with the obvious “pandemic-like” connection implied.
- Human rights may be in conflict: the right to Freedom of speech, “anonymity and hiding” and the Right to health (protection), misinformation and infodemics.
- The “regulation in action” concept is presented through a realistic proposition: the creation of a social network for health, the EU health place, within the European Health Data Space (EHDS).
- The EU health place would provide a safe space for citizens and patients to securely talk about health wellness and their concerns, whilst being protected from misinformation and fake news by public health authorities and patient associations who participate equally in moderating activities.



Introduction

European Commission President Ursula van der Leiden has alluded to the need to have an EU action on social networks, misinformation, disinformation or “fake news”, and its’ risks to public health (EC Twitter post 2021). Yet most of this activity transpires within US-based, privately-owned social networks where Europeans (among others) connect and express their freedom of speech. In utilising these social networks, they also submit voluntarily to US companies’ terms-of-use and to speech moderation (human or via artificial intelligence or other algorithms) and expose themselves to significant and raising levels of mis- and disinformation. In health, the WHO have coined this phenomenon an “infodemic” with the obvious “pandemic-like” connection implied (WHO 2021). The term infodemic can be addressed in regards to literacy, however, some experts caution that it might be better to more clearly link infodemic with communication.

One way to deal with such issues is looking at it from a “regulation in action” perspective. This means, the State, or in this case the Union, endures the cost of creating a public space with “democratically enacted rules” as an effective guardian of human rights, particularly when these are at conflict and dynamic balances have to be found.

In health, there is an inherent value in the “audacious” idea of creating a publicly owned social network at the EU level, under the umbrella of the European Health Data Space, an action currently being discussed (Figure 1). This could provide a safe space for citizens and patients to securely talk about health wellness and their concerns, while remaining protected from misinformation and fake news by public health authorities and patient associations who participate equally in moderating activities.

Human Rights at Stake

Right to Freedom of Speech, “Anonymity and Hiding”

The right to freedom of speech is generally present in most liberal democracies. While in open public spaces,

The European health data space will:

- 1) promote safe exchange of patients’ data (including when they travel abroad) and citizens’ control over their health data;
- 2) support research on treatments, medicines, medical devices and outcomes;
- 3) encourage the access to and use of health data for research, policy-making and regulation, with a trusted governance framework and upholding data-protection rules
- 4) support digital health services;
- 5) clarify the safety and liability of artificial intelligence in health.

Source: European Commission (2021) Digital health data and services – the European health data space (europa.eu)

Figure 1. European Health Data Space

such as streets, parks, or a beach, in its oral form this is generally not legally problematic. Personal insult or directly damaging speech are generally quite well covered by civil law in most jurisdictions. The plaintiff can exert a right of protection from defamatory speech, highly abusive, aggressive, or threatening speech. The fact that the speech does not “sustain in time” significantly reduces damage, and since spread is naturally limited, the damage potentially caused due to a large number of people being made aware of this information (or mis-information) is also limited. The anonymity of the emitter is very difficult (albeit possible), which means the accountability and, hence, liability is very high.

In classic printed forms: papers, magazines, books etc, the reach enlarges, the spread, although faster, is somehow limited to copies available, and the anonymity is possible (pseudonyms) as well as traceability, although quite dependent on editors and their rules. Hence, direct responsibility for speech could be asked from author or from the editor in case the author’s identity could not be found. This means there is generally someone to be called in to step in front of a judge or jury.

Finally, in online social networks, in platforms like Facebook®, Twitter® or YouTube®, for example, the level of impact and speed of dissemination of false information is very high and fast. Persistence over time is almost unavoidable, and control, in this case by private companies, is somehow dependent on existing terms of contract and on the arbitrary decisions of these companies to take down, block or somehow filter, mostly a posteriori content. Anonymity is possible (this is less so now than in the past, as registration processes are increasingly requiring mobile phones numbers, or “real” emails, which somehow ensures a link to personal data of a “real legal subject”). Traceability is difficult, although its possibilities are increasing due to the same trends in registration.

This means people can quite easily create fake news, disseminate false healthcare suggestions, counter-inform, for example against COVID-19 vaccination, thus creating misunderstandings in less informed, capable and literate or people who are likely to be more easily influenced. This can place the person, or, more widely, a population at risk of an adverse health outcome as a result of incorrect behaviours such as drug intake,

Balancing Rights and Conceptualising Online Public Space

While doubts will remain, as we balance the two rights put forward, the fact that most of this “public speech” is happening on private media suggests two possible routes of action. Both relevant for the Union:

One would be to conceptualise that, although private entities own social networks, and most of them are non-EU companies; they are in effect bound to follow EU law, applicable to EU citizens, data and expressed opinions, posts, video uploads etc. In this case, a directly applicable Regulation, such as the GDPR would need to be enacted, with severe restrictions to the element of informed consent, and possibly infringing on “the general right to liberty.”

The other would be to conceptualise that any space where a significant number of people meet to exchange their views, share and do things “together”, although virtual in nature and digitally supported, even if by a private company, is de facto a public space. This means public space “rules” could be enacted in similar ways, making no distinctions.

If one accepts the second view, an additional question arises. Should not public health authorities participate in such spaces? Not just as “citizens” as they are now considered by most social network companies – with the same terms and rules, but as “true” public health authorities, with the prerogatives that derive from that. For example, this would provide the capacity to limit an activity economically or just its’ advisement, solemnly based on health protection grounds. This equally would mean they would need to participate in any “due process” of speech moderation online. It is quite difficult to foresee that EU level or national level public authorities are likely to gain such prerogatives, particularly in US-based companies. Prerogatives, which seem to me, to be quasi-essential for effectively influencing speech moderation online.

An Orthodox Solution – “Action” Regulation

An alternative option, admittedly counterintuitive is for the EU to work up its digital sovereignty, by creating a “Public Space” about health wellness and healthcare. This would be a space for patients, citizens and their associations, to interact with each other as well as with public entities, trusted health information providers and health promotion agents. Such space can be part of the EHDS. Through public funding and public law rules, the role of public “democratic” authorities could be ensured; “due processes” for dealing with whatever needs to be defined as inadequate content, through a mechanism of “action” regulation would equally become possible.

In summary, under proposal is a public social network for patients/citizens and public health agents, where true identification (hence traceability) is possible as well as mechanisms of data altruism. Anonymous and non-anonymous sharing of health issues, peer support, interactions in general are both possible at a person-to-person level if solid (block-chained, or other cybersecure) pseudo anonymisation mechanisms are made available.

Next Steps

The contributions on the European Health Data Space Regulation presently under consultation benefit from social thinking. Sociologists, social psychologists and as well as other social science experts can be involved in thinking the European Health Data Space as a socio-technical project and not just as a digital health project. Such a narrow-minded approach may miss out on important factors such as motivation, engagement, and emotional distancing. Perhaps more importantly, regarding the infodemic problem, it may miss out on potential evolutionary and somewhat “revolutionary” solutions. One such solution is to brand this platform, as a “health place”; that is, a social networking place for all professionals, patients, citizens and health promotion authorities.

The EU does not need to be passive in this regard. It can act by including the concept of a “EU Health Place” within the set of digital services to be contained within the EHDS currently under discussion and conceptualisation. Instruments such as Coordination and Support Actions, or other EU funding instruments can be utilised to create the relevant community and concepts. Also some of these instruments are equally suited to fund the actual creation the “EU Health Place” to foster health multi-professionalism and patient literacy, empowerment and enlightenment.

Conclusion

It is proposed that a “publicly owned” social network be part of the EDHS as a mechanism to balance the right to freedom of speech and the right to health protection in the EU, from misinformation and infodemics.

What is the alternative? The status quo means allowing the flow of information to continue to occur in unregulated, unsafe and to a certain extent, unethical and unjust ways in privately-owned social networks, which are mostly regulated by non-EU law. It is clear that general regulatory approaches regarding the health domain are ineffective in curbing the current infodemic.

The EU should not remain passive with regards to health topics in non-EU social media. There is a global infodemic underway and as such, misinformation and fake news are a considerable threat to the health of EU citizens. As outlined succinctly in this paper, the time to act is now: a pilot project to create an EU Health Space should be initiated through Horizon Europe funds.

Conflict of Interest

None. ■

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For full references, please email edito@healthmanagement.org or visit <https://jhm.19sj>



Long COVID and Autonomic Dysfunction

Continuous non-invasive monitoring to detect autonomic dysfunction in long COVID

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Long COVID patients suffer from autonomic dysfunction with persistent long-term symptoms. CNSystems' non-invasive technology significantly contributes to a well-founded cardiovascular diagnosis of COVID-19 survivors and enables a quick check of treatment efficacy.

Key Points

- Many patients who survive acute COVID-19 infection suffer from ongoing symptoms including breathlessness, palpitation, headache, chest pain, fatigue, pain, cognitive impairment, sweating, anxiety and depression.
- For COVID-19 long-haulers, symptoms can have a severe impact on their social life.
- Autonomic dysfunction is the trigger for many symptoms that can still be present months after a COVID-19 infection has been overcome.
- Easy autonomic function tests, such as the Active Standing Test, enable quick diagnosis and are essential for effective treatment.

Recent studies have revealed that in long COVID, patients suffer from autonomic dysfunction with persistent symptoms such as breathlessness, chest pain, palpitations and orthostatic intolerance long after post-acute infections. Easy diagnostic procedures and supporting management to patients will be required to handle the rapid increase in primary and secondary care consultations.

Diagnosing Long COVID

A recent study by the Mayo Clinic reported autonomic dysfunction in up to 63% of patients presenting with

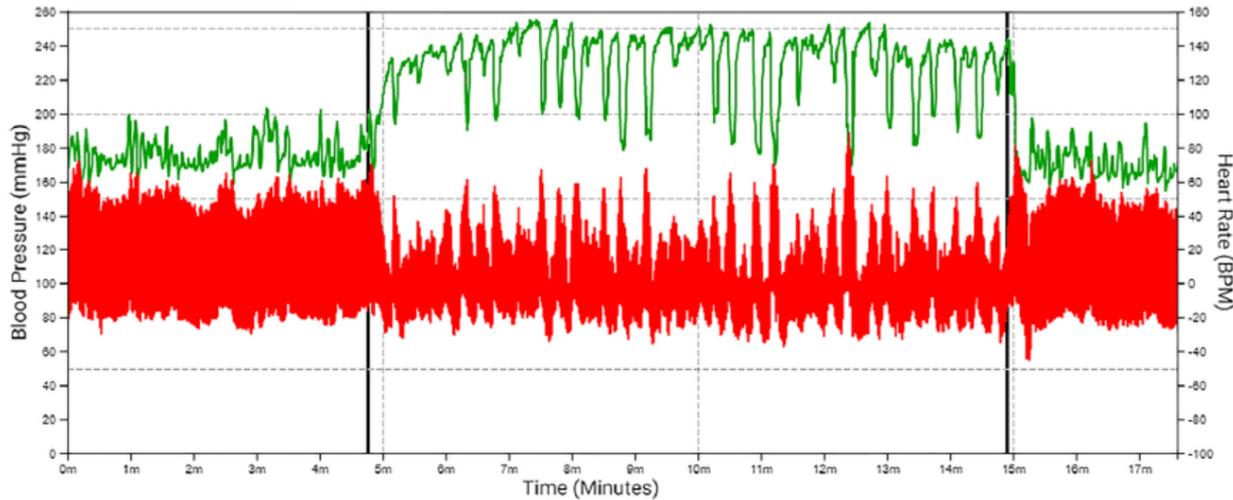
specific symptoms, after having survived a corona infection. Diagnosis was revealed by recording and evaluating beat-to-beat blood pressure and heart rate during head-up tilt tests.¹

Experts from the Imperial College/London UK also confirm that active standing tests and tilt testing, with the help of continuous blood pressure and heart rate measurement, are essential tools for diagnosing autonomic dysfunction in long COVID patients,² which is essential for appropriate treatment and recovery.

Basic research studies investigating the complex mechanisms of a COVID-19 infection also count on

the continuous, non-invasive monitoring of blood pressure and hemodynamics, such as provided by the CNAP technology, in order to apply a multidisciplinary analysis of the cardiovascular status of the COVID-19 patient.³

However, although easy diagnosis and therapy control tools are available on the market, the current infrastructure is insufficient to cope with the existing long COVID patient population. More physicians familiar with the care of postural orthostatic tachycardia syndrome (POTS) and related autonomic diseases are definitely needed. As long as the waiting



Hemodynamic profile on head-up tilt study in long-COVID patient:

- > Prominent orthostatic tachycardia (green) 129-42 bpm
- > Labile orthostatic hypotension (red) with systolic BP between -14 to -34 mmHg

Adapted from Shouman et al., 2021

lists in tertiary care clinics with this expertise can be 6–12 months or longer, appropriate and timely diagnosis and treatment are impossible.⁴

Patients are Desperate and Need Encouragement

Many patients who have survived the acute COVID-19 infections suffer from ongoing symptoms resulting in a combination of breathlessness, palpitation, headache, chest pain, fatigue, pain, cognitive impairment, sweating, anxiety and depression.^{4,1} Studies report that 93% of these patients complain of lightheadedness.¹ Many symptoms indicate orthostatic hypotension, POTS or even vasovagal syncope,² caused by a dysfunction of the autonomic nervous system.

Well-known American newspapers such as the New York Times, the Wall Street Journal or the Atlantic

have already addressed the fears of the so-called “COVID long-haulers” and give them a voice. Thousands of patients and their doctors are establishing support groups on the Internet or on social media channels (e.g. #longcovid on Twitter) to share experiences, find quick solutions² or simply cry for help.

These patients are desperate, as symptoms have a severe impact on their social life. A recent study reports that six to eight months after having recovered from COVID-19, patients still suffer from residual autonomic symptoms. 60% are unable to return to work, only 15% have completely recovered.⁵

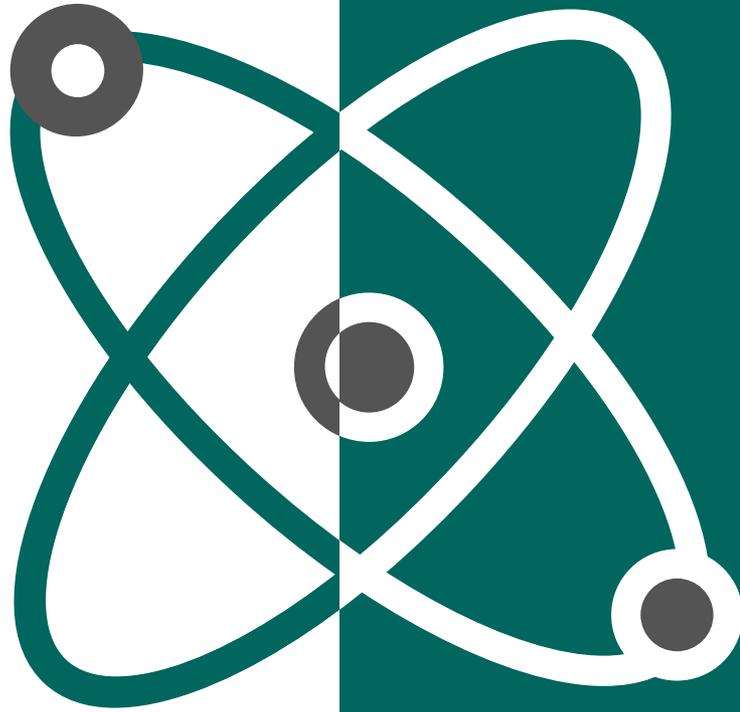
Quick Help Through Easy to Use Tools

Autonomic Dysfunction is the trigger for many symptoms that can still be present months after a COVID-19 infection has been overcome. This severely

affects the quality of life of thousands of “COVID-19 veterans”. Easy autonomic function tests, such as a 10-minute ACTIVE STANDING TEST^{4,5} or a short tilt table test², enable quick diagnosis and are essential for effective treatment. Established and easy-to-use methods and medical devices such as the Task Force® Touch platform by CNSystems for cardiovascular and autonomic assessment help to support these requirements to enable recovery from long COVID and a return to normal life. Integrating autonomic testing might be the key for managing long COVID as the American Autonomic Society makes it very clear: “It will not be possible to address the needs of this population without a commitment not just from providers, but also hospitals and medical center administration.”⁴ ■

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**WINNING
PRACTICES**

360 Health Analysis - Breast Cancer Management in Portugal: Patient Journey

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An overview of H360 Phase 2 study that analysed hospital organisation and performance on breast cancer management from the perspective of patients, health care professionals and hospital decision-makers.

Introduction

360 Health Analysis (H360) was started in 2018 with the aim of providing a comprehensive picture of breast cancer management in Portugal by retrieving real-world data from Portuguese hospitals. Phase 1 of this project consisted in a comprehensive review of the state of the art regarding clinical practice, management, and quality of care in breast cancer in Portugal (Coelho et al. 2020).

H360 Phase 2 intends to document how the Portuguese health system currently performs regarding breast cancer management, from screening and diagnosis to treatment and follow-up. It also aims to identify the main difficulties experienced by the health system in this endeavour and put forward an integrated multi-institutional action plan on how to improve breast cancer management in Portugal. To do so, the present study analysed hospital organisation and performance regarding breast cancer management from the perspective of patients, health care professionals (HCPs; clinicians and non-clinicians), and hospital decision-makers. The study aim was to analyse how patients perceive their journey within the health system, from breast cancer diagnosis to treatment and follow-up, and also how HCPs and hospital decision-makers perceive the journey of these patients within their institutions. Data regarding both these aspects represents an unmet need in Portugal, as there is a clear lack of literature and studies on the subject. European and international studies published in this area are scarce and usually related to the process of breast cancer diagnosis (Heisey et al. 2011; Burgess et al. 1998; Arndt et al. 2003).

Methodology

This study was approved by the Administration Boards of participating hospitals following approval by the respective Ethics Committees and its design

and conception were of the strict responsibility of study investigators. Voluntary surveys were carried out to breast cancer patients and face-to-face interviews to HCPs and hospital decision-makers in Portuguese hospitals. Of 10 initially selected hospitals, three were excluded due to successive bureaucratic and Ethic and Data Protection Commission response delays and seven were included, comprising general university hospitals (n=1), district hospitals (n=3), oncology institutes (n=2), and private hospitals (n=1). Hospital institutions were anonymised to ensure data privacy.

1. Patient surveys

Patient inclusion criteria for participating in the survey included women (i) with breast cancer diagnosis, (ii) aged ≥ 18 years old, (iii) with a first cancer diagnosis, (iv) with breast cancer diagnosis ≥ 6 months and ≤ 5 years ago, and (v) able to provide written informed consent. No exclusion criteria were set. Sampling was done by convenience for patients attending the Oncology consultation, meeting study inclusion criteria, and accepting to participate in the study. The intention was to select a 3:4 proportion of patients with early and advanced stage disease.

Based on the initial hospital sample of 10 hospitals and in the 1.72% prevalence of breast cancer in Western Europe (Bray et al. 2013), the estimated sample size was between 263 and 332 patients. Sample estimation was set for a bilateral test, with 0.05 probability of type I error and 0.95 potency. G*Power® Software was used for calculations. Based on these considerations, sample size was 300 patients. After exclusion of three hospitals and considering the number of patients answering the survey (n=98), study potency was set at 0.84.

Patients received the survey either by email or telephone between 1 and 23 of June 2020. Online interviews were carried out with Computer Assisted

Web Interview (CAWI) system and phone interviews with Computer Assisted Telephone Interview (CATI) system. Quantitative study using descriptive and comparative statistics was subsequently performed using SPSS® software.

2. Health care professional (HCP) interviews

To gain insights from HCPs on patients' journey within the health system, including main barriers and facilitators, a qualitative methodology was used, through implementation of semi-structured interviews with presentation of a standardised case vignette.

Inclusion criteria comprised professionals (i) with direct intervention in breast cancer care in the study hospitals (ii) belonging to one of the following professional categories: diagnostic technician, nurse, nutritionist, operational assistant, pharmacist, psychologist, physician, physiotherapist, social worker, or technical assistant.

HCPs meeting inclusion criteria were randomly invited to participate in the study on the day of study interview until the pre-defined sample size for each hospital was reached. Considering the number of professional categories established in inclusion criteria, the prespecified sample size was three HCPs *per* hospital, in a total of 30 HCPs. Qualitative analysis of interview contents was subsequently performed based on breast cancer patient journey.

3. Hospital decision-maker interviews

To retrieve the perspective of hospital decision-makers regarding hospital procedures and performance in breast cancer management, a qualitative methodology was used, through implementation of semi-structured interviews.

Inclusion criteria comprised professionals (i) performing hospital decision-maker functions (ii) in one of the following settings: Administration Board, Management Support Unit, Department direction,

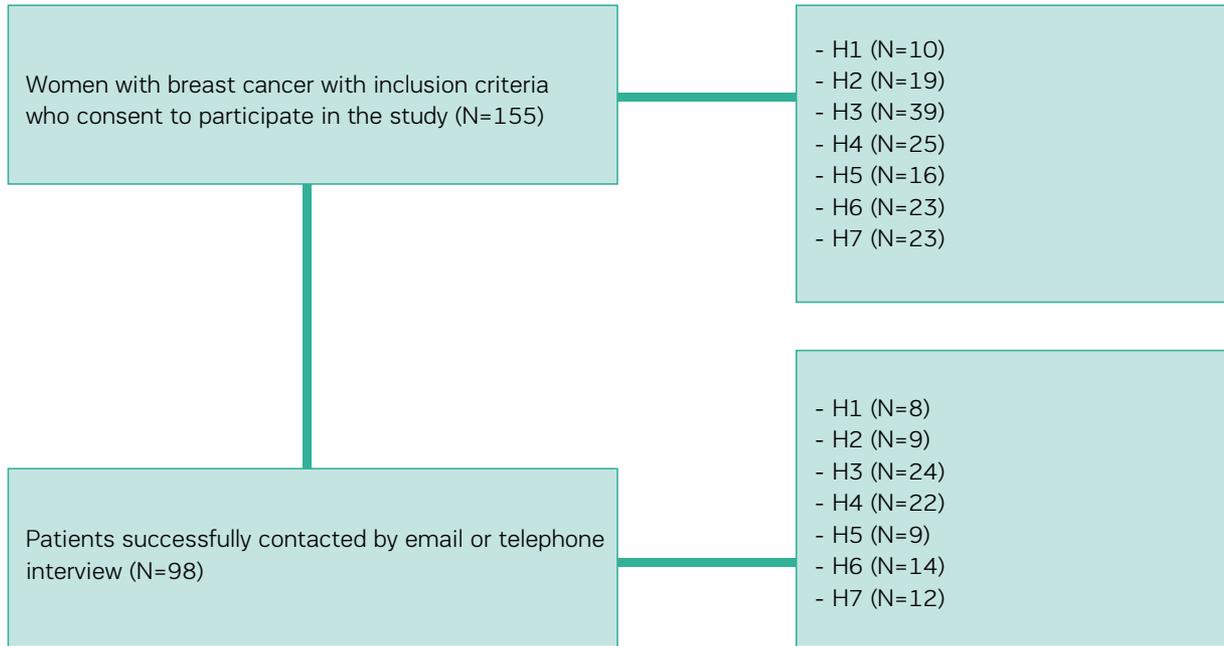


Figure 1. Flowchart of breast cancer patients included in the study.

or Clinical management/direction. Sample was prespecified at one hospital decision-makers *per* hospital, in a total of 10. Qualitative analysis of interviews' contents was subsequently carried out.

Results

1. Patient surveys

1.1 Hospital selection and patient interviews

A total of 155 patients accepted to participate and were enrolled in the study. Of these, 98 patients were successfully contacted, either by email or telephone. The flowchart of patient enrollment is depicted in Figure 1.

1.2 Patient socio-demographic characterisation

The median age of women included in this study was 59 (range 35–85) years old and most lived in the north of Portugal (33%) or Lisbon (32%; Table 1). Regarding household, 44% of women lived in households of two people, 23% of three, 13% of four or more, and 20% of patients lived alone. A significant proportion of women (58%) were married or lived with a partner, 16% were single, 13% were divorced, and 13% were widows. The predominant household net monthly income was ≤800€ (30%), followed by 800–1200€ (23%). Most women (81%) had descendants (two descendants in 41% of cases and one descendant in 40% of cases). Most women (53%) had their breast cancer diagnosed <4 years ago and

42% ≥4 years ago. Regarding disease stage, 68% of women had localised breast cancer, 5% locally advanced disease, 22% metastatic disease, and 5% were not aware of their disease stage. Socio-demographic characterisation and disease stage of the study population is further detailed in Table 1.

1.3 Commuting and hospital waiting times

The main mode of transportation to and from the hospital for treatment purposes was patients' own vehicle (42%), with 21% of patients depending on ambulance transportation and 15% on public transports (Table 2). The total commuting time to and from the hospital was highly variable, with patients spending between 10 minutes to 2 hours in the process (Figure 2). Within the hospital, time spent waiting for treatment start was also variable, with 56% of patients reporting waiting less than 60 minutes and 26% less than 20 minutes (Figure 2). Time spent on treatment was the most variable parameter, in agreement with the high diversity of treatments used in breast cancer (Figure 2). Patient commuting times and hospital waiting times are presented in Table 3.

Most women (63%) were accompanied while going to treatment, 47% by their partners (Table 4). About 1 in every 3 women went to treatment alone.

The number of monthly treatments was highly variable, ranging between less than 1 to 60, presumably due to diversity of breast cancer treatments. Thirty percent of women took medication on a daily basis (Table 5). Women ≥60 years old were those receiving the greatest number of monthly treatments, possibly due to the great incidence of hormone therapy treatments in the elderly, which can be performed orally and at home.

1.4 Last day of hospital treatment and number of hospital desks visited

Patients were also asked about their experience in the last day of treatment in the hospital. The number

Age – median (range)	59 years (35–85)	Age – median (range)	59 years (35–85)
Socio-demographic characterisation		Socio-demographic characterisation	
Geographic area of residency – N (%)		Net household monthly income – N (%)	
North	32 (33)	≤800€	19 (30)
Center	10 (10)	800–1200€	15 (23)
Lisbon	31 (32)	1201–1600€	9 (14)
Alentejo	12 (12)	1601–2000€	3 (5)
Algarve	13 (13)	2001–2400€	6 (9)
		≥2401€	12 (19)
		NR	34
Hospital – N (%)		Descendants – N (%)	
Hospital 1	8 (8)	Yes	79 (81)
Hospital 2	9 (9)	No	19 (19)
Hospital 3	22 (23)		
Hospital 4	24 (25)		
Hospital 5	9 (9)		
Hospital 6	14 (14)		
Hospital 7	12 (12)		
Household – N (%)		Number of descendants – N (%)	
1	20 (20)	1	32 (40)
2	43 (44)	2	32 (40)
3	22 (23)	3	9 (12)
≥4	13 (13)	≥4	6 (8)
Marital Status – N (%)		Disease Stage – N (%)	
Single	15 (16)	Localised	67 (68)
Married or living with partner	57 (58)	Locally advanced	5 (5)
Divorced	13 (13)	Metastatic	21 (22)
Widow	13 (13)	NR	5 (5)

Table 1. Study population socio-demographics, risk factors, and disease characteristics IUD, intrauterine device; NR, no response

and type of hospital desks visited during the last day of treatment was variable, with most patients referring having visited 1 (44%) or 2 (36%) desks (Table 6).

The type of desks visited varied according to hospital (Figure 3). For most patients, the first desk visited was the front desk (88%) and the second was predominantly either the nurse station (33%) or the clinical analysis (28%) desk. For women who visited a third desk, this was the medical oncologist desk or the Day Hospital treatment facility desk (28% each). Thirty-three percent of women visited a fourth desk, mainly the front desk, the nurse station desk, or the medical oncologist desk (33% each). Desk waiting times were generally low (less than 10 minutes), except in the fourth desk, in which 10 to 40 minutes of waiting time were reported (Figure 4).

1.5 Impact of treatment on professional life

A total of 18% of women with breast cancer continued to work while receiving treatment for their disease, particularly those with less than 60 years of age (HR 7.25, 95% CI 1.4–38.3, $p=0.020$), with 40% of working women reporting having never missed work (Table 7). Most of these women had less than 60 years of age and considered that keeping an occupation was positive for their health. Of note, a significant proportion of women (44%, $n=43$) resorted to medical leave during breast cancer treatment, particularly women less than 60 years old (HR 0.21, 95% CI 0.09–0.52, $p=0.001$), and 7% ($n=3$) continued working despite being on medical leave.

2. HCP interviews

A total of 22 HCPs were interviewed (four from one hospital and three from the remaining six hospitals), mostly women (86.4%) and with a mean age of 40.7 years (range 27–60). Half (50%) of participants were married and 21 (95.5%) lived in urban

Way of commuting to and from the hospital	Total N=98	H1 N=8	H2 N=9	H3 N=24	H4 N=22	H5 N=9	H6 N=14	H7 N=12
Own vehicle	42	25	11	33	50	22	57	75
Ambulance	21	13	33	38	5	56	14	---
Public transport	15	13	22	13	27	11	14	---
Vehicle from a family member or friend	9	38	---	4	18	---	---	8
On foot	5	---	11	4	---	11	14	---
Home treatment	4	13	11	4	---	---	---	8
Taxi	2	---	---	4	---	---	---	8
NR	1	---	11	---	---	---	---	---

Table 2. Commute to and from the hospital according to age group and hospital H, hospital; NR, no response

areas. Regarding educational level, 4.5% (n=1) had 7–9 school years, 18.2% (n=4) had 10–12 school years, 31.8% (n=7) had a bachelor degree, 40.9% (n=9) had a master degree, and 4.5% (n=1) had a doctoral degree. Regarding professional categories, 7 (31.8%) HCPs were physicians, 5 (22.7%) were nurses, 3 (13.6%) were operational assistants, 3 (13.6%) were pharmacists, 2 (9.1%) were technical assistants, 1 (4.5%) was a social worker, and 1 (4.5%) was a psychologist. Twenty (90.9%) respondents worked as HCPs and the remaining (n=2; 9.1%) mainly performed management functions. Regarding the type of contract with the employer, 10 (47.6%) had an unfixed-term employment contract, 7 (33.3%) had a permanent contract, and 4 (19.0%)

had a fixed-term employment contract. Concerning working schedule, 6 (84.2%) had fixed working hours and 3 (15.8%) had rotating working hours. Six (27.3%) respondents worked elsewhere.

2.1 Breast cancer patient journey in the health system

HCPs were asked their perception about breast cancer patients’ journey within their institutions, from disease clinical suspicion to confirmatory diagnosis, treatment, and follow-up. For most hospitals, primary health care is the main source of patient referral to the hospital. Patients receive information about their diagnosis mostly from the surgeon and occasionally from the medical oncologist. Most

hospitals have a multidisciplinary team working in collaboration in treatment decisions. Some hospitals accept and refer patients for medical appointments after an initial multidisciplinary or Oncology meeting, while others undertake the medical appointment with the surgeon or medical oncologist first and the multidisciplinary group meeting afterwards. One hospital has a dedicated Breast Cancer Clinic, where surgeons, medical oncologists, radiotherapists, and nurses work in coordination. In another hospital, patients are referred, not only to designated breast cancer treatment specialties, but also to Psychology and Nutrition support after diagnosis. Breast cancer patient journey according to hospitals from HCP perspective is detailed in Table 8.

2.2 Main barriers and facilitators in breast cancer patient journey

The main barriers identified by HCPs from National Health Service (NHS) hospitals regarding breast cancer patient journey were an excessive number of patients to the availability of technical and human resources and lack of adequate work facilities. Long waiting times for Imaging scheduling and respective results, analytic and pathology results, and surgery scheduling were also commonly acknowledged barriers. Insufficient treatment seats in Day Hospital for chemotherapy and other oncology treatments was a common concern. Shortage of human and technical resources and proper working facilities were pointed out as main reasons for HCP’s overwork and exhaustion and for lack of adequate response regarding imaging, pathology, other complementary diagnostic exams, surgery times, and cancer treatments.

The main facilitators in breast cancer patient journey varied according to hospital. One hospital acknowledged the presence of a multidisciplinary structure focused on breast cancer treatment, as well as the availability of all necessary patient

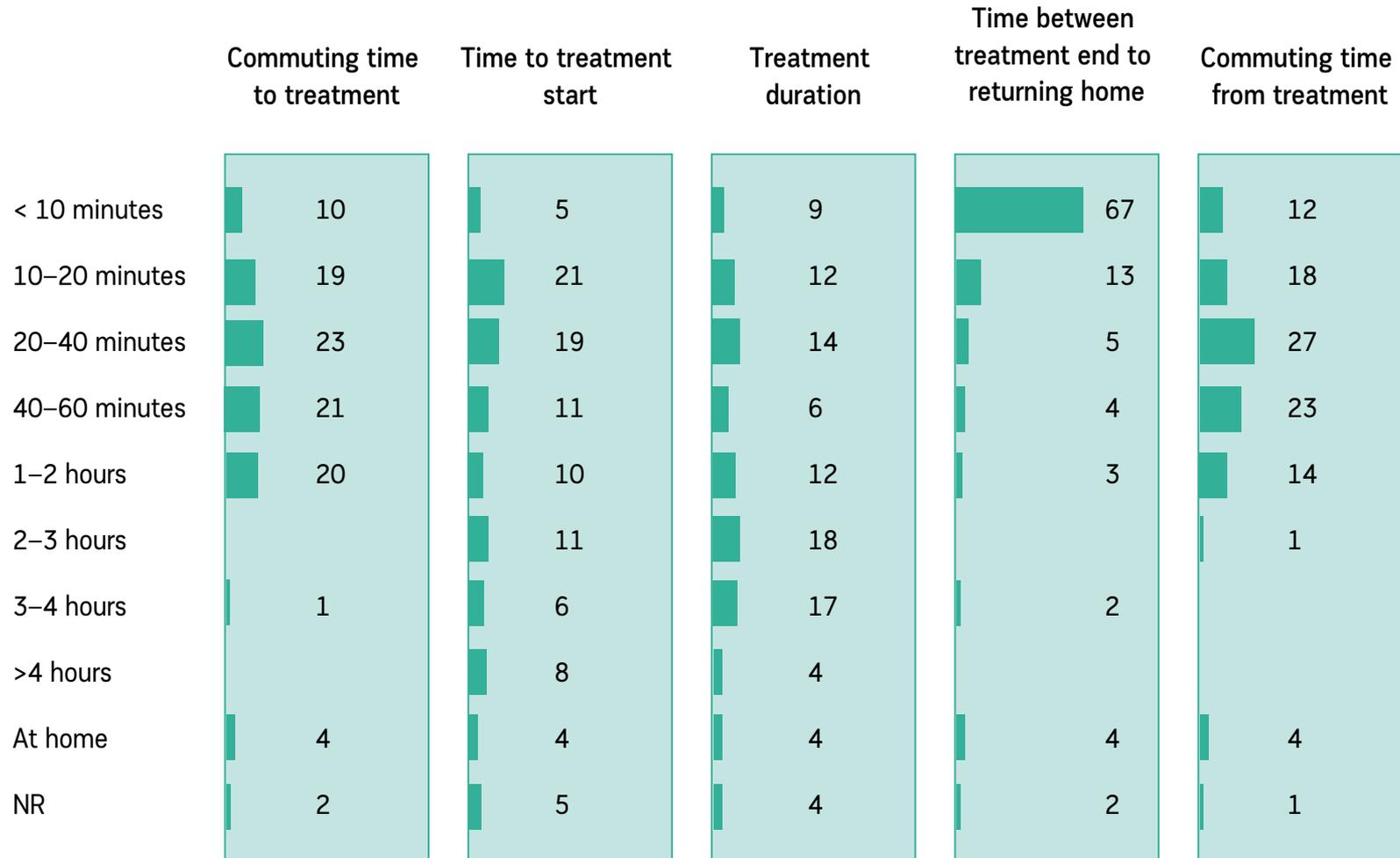


Figure 2. Commuting times and in-hospital waiting times (%)

resources in all stages of the disease. Another hospital denoted the good Day Hospital functioning and the availability of a software for optimising waiting times since the first breast cancer appointment to treatment start. HCPs at one hospital acknowledged a functional system for treatment and appointment scheduling and

a convenient and patient-friendly outpatient pharmaceutical system. HCPs at another hospital acknowledged the availability of plenty of room in their facilities and the benefit of double-checking analytic results. One hospital acknowledged the importance of multidisciplinary team discussions and efficient

inter-specialty communication and the good relationship between professional team and patients. Another hospital referred its highly motivated professionals and good working relationship, existence of a functional Day Hospital and Nursing consultation, and the possibility of performing non-scheduled consultations. Finally,



In-hospital waiting times and commuting times	Total	H1	H2	H3	H4	H5	H6	H7
	N=98	N=8	N=9	N=24	N=22	N=9	N=14	N=12
Commuting time to treatment								
< 10 minutes	10	---	11	8	9	11	21	8
10-20 minutes	19	---	---	13	27	33	29	25
20-40 minutes	23	25	11	17	27	44	7	33
40-60 minutes	21	38	33	21	14	11	21	17
1-2 hours	20	25	22	38	18	---	14	8
2-3 hours	---	---	---	---	---	---	---	---
3-4 hours	1	---	---	---	5	---	---	---
>4 hours	---	---	---	---	---	---	---	---
NR	2	---	11	---	---	---	7	---
Time to treatment start								
< 10 minutes	5	---	---	4	9	---	---	17
10-20 minutes	21	13	---	33	18	22	---	42
20-40 minutes	19	25	67	8	18	---	21	8
40-60 minutes	11	25	11	8	14	---	14	8
1-2 hours	10	---	---	8	14	22	14	8
2-3 hours	11	---	---	4	14	33	21	8
3-4 hours	6	---	---	17	5	---	7	---

>4 hours	8	13	---	8	9	11	14	---
NR	5	13	11	4	---	11	7	---
Treatment duration								
< 10 minutes	9	13	22	8	9	22	---	---
10–20 minutes	12	---	11	25	9	---	14	8
20–40 minutes	14	38	11	---	18	---	14	33
40–60 minutes	6	---	---	4	9	---	14	8
1–2 hours	12	25	---	13	---	11	36	8
2–3 hours	18	---	11	13	18	44	7	33
3–4 hours	17	13	11	29	27	11	---	---
>4 hours	4	---	---	---	5	11	14	---
NR	4	---	22	4	5	---	---	---
Time between treatment end and returning home								
< 10 minutes	67	88	44	63	68	56	86	58
10–20 minutes	13	---	---	13	18	11	14	25
20–40 minutes	5	---	11	---	5	22	---	8
40–60 minutes	4	---	11	8	---	11	---	---
1–2 hours	3	---	---	8	5	---	---	---
2–3 hours	---	---	---	---	---	---	---	---



3-4 hours	2	---	---	4	5	---	---	---
>4 hours	---	---	---	---	---	---	---	---
NR	2	---	22	---	---	---	---	---
Commuting time from treatment								
< 10 minutes	9	13	22	8	9	22	---	---
10-20 minutes	12	---	11	25	9	---	14	8
20-40 minutes	14	38	11	---	18	---	14	33
40-60 minutes	6	---	---	4	9	---	14	8
1-2 hours	12	25	---	13	---	11	36	8
2-3 hours	18	---	11	13	18	44	7	33
3-4 hours	17	13	11	29	27	11	---	---
>4 hours	4	---	---	---	5	11	14	---
NR	4	---	22	4	5	---	---	---

Table 3. Patients' commuting and hospital waiting times, by hospital H, hospital; NR, no response

Accompaniment to treatment	Total N=98	H1 N=8	H2 N=9	H3 N=24	H4 N=22	H5 N=9	H6 N=14	H7 N=12
No accompaniment	37	25	22	50	32	78	21	25
Significant other	31	13	33	21	36	22	29	58
Son/daughter	18	13	22	21	18	---	29	17
Father/mother	9	---	11	4	9	11	29	---
Sibling/ sibling-in-law	9	25	---	4	14	---	14	8
Friend	7	13	---	4	18	---	7	---
Home treatment	4	13	11	4	---	---	---	8
Other family members	1	---	---	4	---	---	---	---
NR	1	---	11	---	---	---	---	---

Table 4. Accompaniment to breast cancer treatment according to age group and hospital H, hospital; NR, no response

Number of monthly treatments	Total N=98	H1 N=8	H2 N=9	H3 N=24	H4 N=22	H5 N=9	H6 N=14	H7 N=12
<1	5	---	11	4	5	---	---	17
1	19	50	11	17	9	44	29	---
2	19	13	11	21	23	---	36	17
3	2	---	11	---	5	---	---	---
4	11	---	---	4	27	11	7	17
5-22	12	---	---	25	5	11	7	25
Daily	27	25	44	29	18	33	21	25
Twice a day	2	13	---	---	5	---	---	---
NR	2	---	11	---	5	---	---	---

Table 5. Number of monthly treatments according to age group and hospital H, hospital; NR, no response

diagnostic test results. Time until treatment start, particularly surgery, was pointed out as an aspect to improve, as well as time until radiotherapy start. One hospital acknowledged survivor follow-up and referral as aspects requiring improvement, while another hospital stressed the need to incorporate patient-reported outcomes in clinical assessment.

3.3 Aspects to modify

The main aspects requiring adjustments and improvement varied according to hospital. In one hospital, decision-makers considered that there should have a better and easier access to medical specialties not available at the center and stressed the need to implement oncofertility evaluation. In another hospital,

waiting times for magnetic resonance imaging (MRI), namely breast MRI, were a relevant concern requiring improvement. One hospital pointed out the need for timely complementary diagnostic method results, better and larger infrastructures, and more HCPs, and private sector hospital referred insufficient insurance coverage as main aspect requiring improvement.

Number of desks	Total	H1	H2	H3	H4	H5	H6	H7
	N=98	N=8	N=9	N=24	N=22	N=9	N=14	N=12
1 desk	44	38	33	54	36	44	50	42
2 desks	36	50	33	29	45	44	21	33
3 desks	15	13	22	13	9	11	29	17
4 desks	2	---	---	---	5	---	---	8
5 desks	1	---	---	---	5	---	---	---
NR	2	---	11	4	---	---	---	---

Table 6. Number of desks visited in the last hospital treatment H, hospital; NR, no response

3.4 Resource availability

Resource shortage was mentioned by all public hospitals, in contrast with the private sector where lack of resources was not referred.

Hospital decision-makers generally referred a lack of human, technical, economic, and financial resources. Specifically, the need for more nurses, non-HCPs (particularly statisticians), and investigator study coordinators was mentioned by representatives of one hospital, who nevertheless referred having sufficient technical equipment at

the institution. In this hospital, lack of economic and financial resources, as well as need for better working facilities and for improved and restructured budgetary allocation to improve drug policy were also stressed.

Additionally, shortage of human and financial resources, need for better working facilities and equipment, and need for more human and technical resources were also emphasised by participating hospitals.

Discussion

H360 Health Analysis is a pioneer project at national level that intends to comprehensively address aspects involved in breast cancer management in Portugal. As far as the authors are aware, no such study has been conducted in Portugal to date, particularly focusing hospital logistics and accessibility by breast cancer patients, and studies conducted in Europe and high-income countries are infrequent and mostly centered in primary care setting (Heisey et al. 2011; Burgess et al. 1998; Arndt et al., 2003).



Figure 3. Number and type of hospital desks visited by patients during the last hospital treatment [%]

In low- and middle-income countries, several initiatives are in place to improve accessibility of breast cancer patients to primary health care and hospitals, with the aim of reducing disparities between these countries and high-income counterparts, and ultimately impact breast cancer incidence and improve survival (Anderson et al. 2008). The Breast Health

Global Initiative is a program directed at low- and middle-income countries involving the synergic work of breast cancer experts together with that of epidemiologists, health care administrators and politics, and clinical and translation researchers. (Anderson et al. 2008; Hortobagyi 2010). Understanding implementation and following the example of this type of program

can be an example of how to improve health care delivery to breast cancer patients, particularly those with difficulties in hospital/health care system access (Anderson 2010). To do so, H360 was designed as a multiphase study involving patients and stakeholders (health care professionals and hospital decision-makers) participating in breast cancer management.

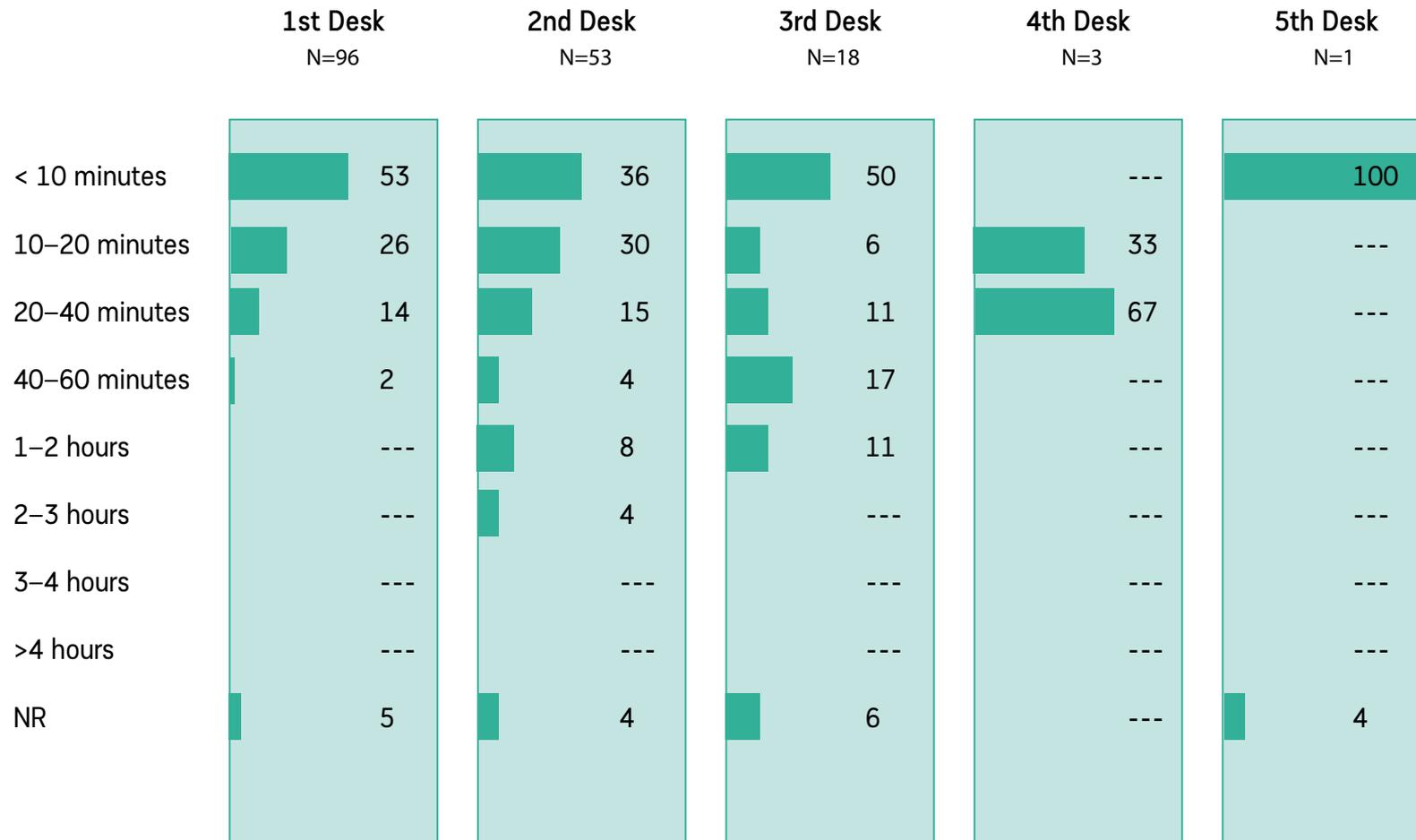


Figure 4 – Patient-reported waiting times in hospital desks during the last hospital treatment (%)

By providing a patient- and multi-stakeholder approach, this study retrieved relevant data for the future optimisation of breast cancer care in Portugal.

Patient accessibility to the hospital appears to be a relevant issue that should be improved. For instance, more than half of women used their own vehicle or public transport as main mode of commuting to and

from the hospital, with 21% of patients depending on ambulance transportation. Commuting times to and from the hospital and waiting times until treatment start, although widely variable, were frequently longer than one hour. The need to reduce commuting and waiting times to treatment start is manifestly important, as the number of monthly treatments

ranged between less than 1 to 60 for some women (even considering that some were performed orally and at home).

Training and humanisation of the staff involved in the care of these patients is of uttermost importance and should be a priority, as approximately one in every three women reported going to treatment

	Total	Patients <60 years old	Patients ≥60 years old	p-value
	N=98 (%)	N=57 (%)	N=40 (%)	
Medical leave				
Yes	43 (44)	33 (58)	9 (23)	0.001
No	55 (56)	24 (42)	31 (78)	
Kept working during treatment				
Yes	10 (18)	8 (33)	2 (7)	0.02
No	45 (82)	16 (67)	29 (93)	
Work absenteeism				
Never missed work	4 (40)	2 (25)	2 (100)	0.20
Missed work a few times	3 (30)	3 (38)	---	
Missed work several times	3 (30)	3 (38)	---	
Working while on medical leave				
Yes	3 (7)	2 (6)	1 (11)	0.56
No	40 (93)	31 (94)	8 (89)	
Reasons for working during treatment				
Financial reasons	3 (23)	2 (20)	1 (33)	

Personal choice for health reasons	5 (46)	4 (40)	1 (33)	0.54
Absence of work backup/substitute	4 (31)	4 (40)	---	
No access to medical leave	1 (8)	---	1 (33)	

Table 7. Impact of treatment on professional life according to age group

Hospital	Origin of hospital referral	Diagnosis	Hospital HCP receiving the referral	HCPs giving information to the patient and type of information given	In-hospital patient referral	Follow-up and surveillance
H1	- Primary health care	- Oncology surgeon	- Early-stage clinic physician and nurse	- Physician: clinical information - Nurse: doubt clarification, explanations and preparation for diagnostic and staging exams, and explanation of hospital functioning -Multidisciplinary team	- Breast Neoplasm Clinic - Day hospital - Radiotherapy Department	- Regular medical appointments according to undergoing treatment and patient's condition. - Follow-up based on alternate Oncology, Surgery, and Radiology consultations
H2	- Primary health care -Multidisciplinary meeting	- Assistant physician - Surgeon	- Physician - Surgeon	- Surgeon: diagnosis information - Physician: therapeutic decision	- Multidisciplinary team - Oncology consultation - Surgery consultation - Day hospital	- Biopsy - Regular medical appointments and diagnostic tests in different medical specialties



H3	<ul style="list-style-type: none"> - Primary health care - Oncology decision meeting 	<ul style="list-style-type: none"> - Medical oncologist - Surgeon 	<ul style="list-style-type: none"> - Medical oncologist - Surgeon 	<ul style="list-style-type: none"> - Medical oncologist: clinical information and treatment plan - Surgeon 	<ul style="list-style-type: none"> - Day hospital or hospital pharmacy (depending on the treatment plan) - Nursing consultation 	<ul style="list-style-type: none"> - Guided by the Day Hospital with all treatment sessions scheduled, including radiotherapy
H4	<ul style="list-style-type: none"> - Primary health care - Surgeon - Private medicine - Multidisciplinary meeting 	<ul style="list-style-type: none"> - Medical oncologist - Surgeon 	<ul style="list-style-type: none"> - Medical oncologist - Surgeon 	<ul style="list-style-type: none"> - Physician and Nurse 	<ul style="list-style-type: none"> - Oncology consultation - Surgery consultation - Radiotherapy 	<ul style="list-style-type: none"> - Staging - Clinical analytics and biomarkers
H5	<ul style="list-style-type: none"> - Primary health care 	<ul style="list-style-type: none"> - Pathology - Surgeon 	<ul style="list-style-type: none"> - Surgeon 	<ul style="list-style-type: none"> - Family doctor: clinical information about the need for medical exams - Surgeon: diagnostic information and probable treatment options 	<ul style="list-style-type: none"> - Oncology consultation 	<ul style="list-style-type: none"> - Regular medical appointments with evaluation of patient's symptoms, physical examination and diagnostic and follow-up tests
H6	<ul style="list-style-type: none"> - Community screening - Senology - Primary health care 	<ul style="list-style-type: none"> - Senology Department (pre-biopsy) - Specialist doctor 	<ul style="list-style-type: none"> - Physician and Nurse (Senology Department) - Medical oncologist (Day Hospital) 	<ul style="list-style-type: none"> - Physician: diagnosis, treatment plan, and guidance within the Oncology department - Psychologist and nurse: collaborate in diagnostic information 	<ul style="list-style-type: none"> - Medical oncologist: diagnosis, treatment - Surgery: external hospitals - Radiotherapy - Day hospital - Psychology - Nutrition support 	<ul style="list-style-type: none"> - Surveillance every 3 months or every 6 months (if hormone therapy) - Surveillance of toxicities and treatment response. - Multidisciplinary team communication, if therapeutic adjustments are needed
H7	<ul style="list-style-type: none"> - Health care professionals - Surgeons - Multidisciplinary meeting 	<ul style="list-style-type: none"> - Family doctor - Radiologist - Surgeon 	<ul style="list-style-type: none"> - Multidisciplinary meeting - Medical oncologist - Surgeon 	<ul style="list-style-type: none"> - Physician 	<ul style="list-style-type: none"> - Medical oncologist - Surgeon - National Health Care System Hospital 	

Table 8. Breast cancer patient journey according to HCPs H, hospital; HCP, health care professional

Hospital	Barriers	Facilitators
H1	<ul style="list-style-type: none"> - Surgery and complementary exam results' waiting times - Disproportionate volume of patients to the availability of technical and human resources 	<ul style="list-style-type: none"> - Multidisciplinary structure based on the pathology on an organisational basis - All resources required to guide the patient at all stages of disease available
H2	<ul style="list-style-type: none"> - Difficulties in all stages of disease, from diagnosis to treatment, due to excessive bureaucracy, lack of human resources, and insufficient working facilities - Difficulty in transporting patients to the cancer center 	<ul style="list-style-type: none"> - Software in the final stage of development for optimisation of waiting times from the first appointment at the Oncology center to treatment start - Day Hospital treatments
H3	<ul style="list-style-type: none"> - Lack of human resources, namely pharmacists and other health care professionals, with consequent work overload for other professionals - Delays in treatment authorisation by the national regulatory authority - Disproportionate volume of patients to the availability of technical and human resources, with disproportionate geographic coverage - Long waiting times and insufficient treatment seats on Day Hospital - Delay in analytic results 	<ul style="list-style-type: none"> - Functional system for treatment and appointment scheduling - Practical outpatient pharmaceutical service - Collection of clinical analyzes the day before treatment
H4	<ul style="list-style-type: none"> - Long waiting times - Staff preparation 	<ul style="list-style-type: none"> - Plenty of space - Double-checked analytics
H5	<ul style="list-style-type: none"> - Different computer software with insufficient integration between primary care and hospital - Time spent by the doctor validating clinical processes and analytic results - Long drug preparation time in hospital pharmacy - Insufficient seats for all scheduled patients 	<ul style="list-style-type: none"> - Existence of a multidisciplinary team. Efficient inter-specialty communication - Good relationship between medical team and patients - Short waiting times
H6	<ul style="list-style-type: none"> - Radiology department with difficulty in responding to requests, with consequent postponement of consultations - Long waiting times to retrieve results of clinical analysis and Pathological Anatomy and to carry out treatments - Lack of human resources, namely health care professionals - Insufficient working facilities and non-functional physical distribution of departments within the hospital - Manual prescription of cancer treatments 	<ul style="list-style-type: none"> - Good working relationship between professionals and highly motivated professionals - Access to training (although mostly individually paid) - Functional nursing consultation to support patients and clarify their doubts - Availability of non-scheduled consultation - Easy access to Day Hospital treatment - Ongoing project to provide consultations and treatments by pathology
H7	<ul style="list-style-type: none"> - Difficulties in contacting the doctor 	<ul style="list-style-type: none"> - Functional insurance system - Promptness in diagnosis, staging, and required treatments

Table 9. Main barriers and facilitators in breast cancer patient journey according to HCPs H, hospital

alone. This is even more important regarding staff working in hospital front desks, as they frequently represent patients' first contact within health structures.

Concerning professional activity, studies about employment trends in women with breast cancer suggest that between 40% to 76% of women of working age have a job at the time of breast cancer diagnosis (Amir and Brocky 2009; Blinder et al. 2017; Jagsi et al. 2014; Jagsi et al. 2017), who will predictably experience difficulties in maintaining their jobs due to the disease (Blinder et al. 2017; Jagsi et al. 2017). According to a meta-analysis, 5.6% to 56.3% of women become unemployed after breast cancer surgery (Wang et al. 2018). Additionally, a significant proportion of women do not return to work after cancer (Jagsi et al. 2017; Bouknight et al. 2006). Substantial employment disruptions are particularly notorious for patients undergoing more aggressive treatments (Jagsi et al. 2017). Studies suggest that workplace accommodations and a non-discriminating work environment play a central role in returning to work (Bouknight et al. 2006). In the present study, 18% of women continued to work while undergoing breast cancer treatment and the Portuguese legislation falls short from protecting

these women in terms of working rights, flexibility in working hours, and adjustment of working functions.

Regarding the approach to breast cancer management of hospitals analysed in this study, HCPs acknowledge the benefit of multidisciplinary disease management, which was a reality in all institutions. However, HCPs and hospital decision-makers from the NHS clearly acknowledged issues to be addressed. One of the main is the disproportionate number of patients for their institutions' capacity, either regarding facilities as technical or human resources. The long waiting times for performing complementary diagnostic exams and obtaining results and for performing treatments referred by public hospitals are a major concern and significantly contrast to what is reported in the private sector. Difficulties in complementary diagnostic exams are an issue widely recognised both by HCPs and hospital decision-makers and should be tackled as a priority in the optimisation of breast cancer patients' care. On the other hand, medical health professionals reported difficulties in accessing innovative cancer therapies through the NHS. This is an important issue specifically addressed in the recently presented Europe's Beating Cancer Plan, which will hopefully help improve access to innovative cancer

diagnosis and treatments across Member States (https://ec.europa.eu/commission/presscorner/detail/en/ip_21_342).

This study has limitations that should be acknowledged. Of ten hospitals initially selected, three were excluded due to bureaucratic and Ethic and Data Protection Commission response delays, with subsequent decrease in sample size. Also, due the study's mainly descriptive and qualitative nature, some qualitative information, particularly provided by HCPs and hospital decision-makers, may have been lost.

Conclusion

Issues uncovered by this study regarding patient accessibility and journey within health institutions are relevant for the management of breast cancer patients and should be addressed. Hospital administrations have an important role in improving some of the aspects referred, which should also be addressed by national policies and legislation, with the aim of improving the quality of life and care of people living with breast cancer in Portugal.

Conflict of Interest

None. ■

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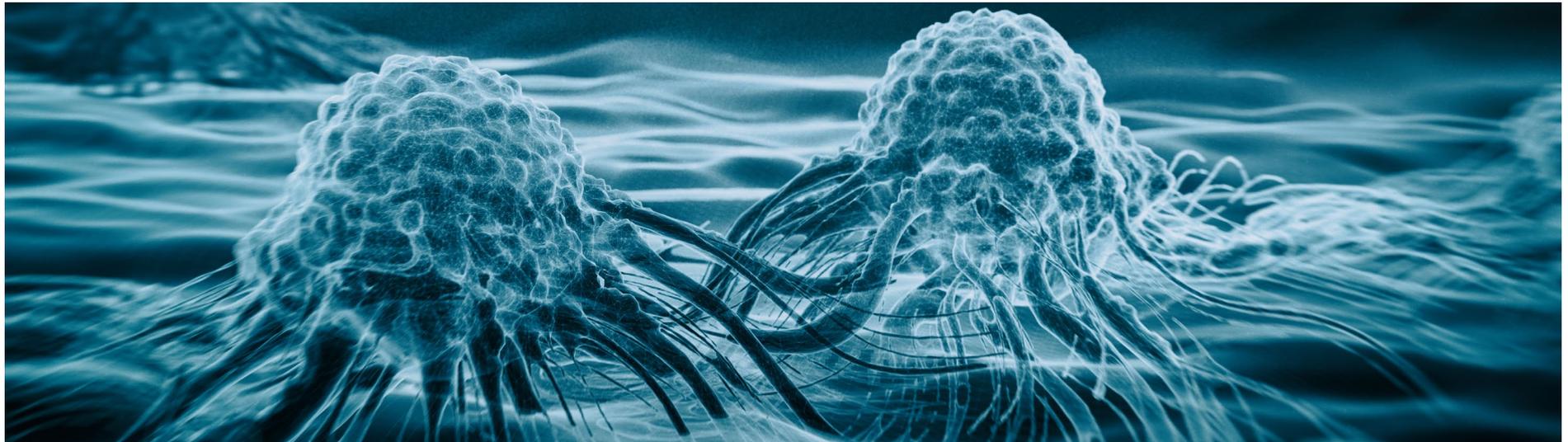
Bridging the “Policy To Practice” Gap In Cancer Care

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Based on experience in a first set of cities across Africa, Asia, Eastern Europe and Latin America, this article highlights key challenges and enablers for translating policy into practice for quality, equitable cancer care.

Key Points

- Programmatic strategies to address complex health challenges can be accelerated by enabling a policy environment.
- In the cancer care context, relevant policy including laws, regulations and legal frameworks are an important component in advancing innovative, sustainable solutions to improve access to quality care.
- Policy implementation can be limited by a number of barriers in the areas of resources, planning and coordination, leadership and ownership, measurement and accountability, and political economy.
- City Cancer Challenge’s experience in a first set of cities has demonstrated that fostering strong local leadership, ownership and engagement are key strategies in mitigating these barriers and ensuring translation of policy to practice.



Key Considerations for Policy Implementation	
Factor	Description
I. RESOURCES	
Budget	Funding to support policy implementation, including both capital and operational expenditures
Human resources	Sufficient staff with the necessary technical and nontechnical knowledge, expertise, and skills in key roles and levels of authority
Infrastructure and physical resources	Public assets needed to carry out a given policy, including infrastructure, vehicles, buildings, and physical resources
II. PLANNING AND COORDINATION	
Targeting	Policy focus on intended beneficiaries, products, and locations where it can have the biggest impact
Guidelines and documentation	Guidelines and planning documents that specify roles, responsibilities, and procedures, including clarifying which units “own” elements of implementation
Management and coordination	Capacity of implementing agencies to support effective planning and performance management
Policy alignment and sequencing	Fit or conflict between the policy and other domestic laws and policies and external commitments
III. LEADERSHIP AND OWNERSHIP	
Public sector champions	Leaders at multiple levels to drive momentum and “own” implementation

Introduction

The planning and implementation of programmatic strategies to address health challenges is often viewed in isolation, but equally important is ensuring an enabling policy environment. The [US] Centers for Disease Control and Prevention’s list of “Ten Great Public Health Achievements”—including motor vehicle safety, tobacco control, and maternal and infant health—all involved policy change (Porter 2018).

A holistic view of what is needed to drive successful health programme implementation, including policy change, political commitment, and multisectoral partnerships (Frieden 2014) is consistent with a health systems approach that considers all six health systems pillars (WHO 2007) and their interconnectedness. Similarly, tackling the global cancer burden, which totalled 19.3 million new cases and 9.96 deaths in 2020 (Ferlay et al. 2020), from a systems perspective, requires consideration of policy change that can support programmatic actions to address gaps in cancer care services and infrastructure.

Now operational in nine cities across Africa, Asia, Eastern Europe, and Latin America, the [City Cancer Challenge \(C/Can\) Foundation](#) supports cities to identify, design and implement local cancer care solutions that improve access to quality cancer care. C/Can’s “test, learn, adapt” approach has generated early learnings on the barriers and enablers of implementing programmatic and policy solutions for cancer care in low-and middle-income (LMI) cities. Based on experience in a first set of cities, this article highlights some of the barriers and enablers to translating policy solutions into practice for improved access to quality cancer care, with a focus on the need for local engagement, leadership, and ownership.

Policy Failure: Barriers to Implementation for Cancer Care

Health policy has been defined as an agreement on the health issues, goals, and objectives to be addressed at the international, national, or local level, the priorities

Inclusive stakeholder engagement	The landscape of actors in the policy ecosystem whose actions can facilitate or undermine implementation progress and policy design and implementation processes that are inclusive of diverse stakeholders
Education, messaging, and awareness	Education and awareness of key groups (e.g., designated implementers, private and civil society actors, and the public) regarding a policy’s purpose, implementation requirements, and potential impacts
IV. MEASUREMENT AND ACCOUNTABILITY	
Monitoring systems	Data systems and processes to track implementation, provide evidence to inform modifications, and to benchmark against measures of progress and success
Transparency and public access to information	Systems and protocols that enable transparent access to information, as a necessary condition for accountability, and empower public scrutiny
Institutional accountability	Administrative and political oversight mechanisms to ensure accountability for results by discovering and addressing poor implementation because of incompetence, fraud, or negligence
V. POLITICAL ECONOMY	
Power, incentives, and institutional norms	Implications of stakeholder incentives, power relationships, and institutional norms for implementation; ensuring policies take account of distributional impacts by identifying “winners” and “losers” and address potential barriers through design or follow-on activities
Political priorities	Assessment of the relative importance and urgency of a given policy on the political agenda of leaders across levels of government

among those objectives, and the main directions for achieving them (WHO Regional Office for Europe 1999). In the cancer control context, policy (in the form of laws, legal frameworks, and domestic regulations) can have a powerful influence on the exposure of individuals and communities to risk factors, such as tobacco and alcohol; equitable access to core cancer care services; collection and use of health information; and experiences of people affected by cancer (McCabe Centre 2021).

During a recent forum on the opportunities to accelerate cancer care using digital health solutions, thought leaders from across regions and sectors agreed on the need for new or updated regulations and legislative frameworks to facilitate the uptake of digital health interventions. Such policies can be enablers for innovative solutions by creating a common acceptance of digital technologies and by supporting decision-makers with guidance, particularly regarding data governance and privacy. [C/Can’s Digital Health Discovery Forum](#), also underscored that whilst in some contexts, the COVID-19 pandemic had triggered the development of new policies such as broadened criteria for telemedicine (Brazil) or expanded insurance coverage for telehealth consultations (Australia), in other contexts, legislation is not strongly developed or implemented.

Literature documenting the challenges of developing and implementing effective healthcare policies has emphasised that “policies do not succeed or fail on their own merits; rather their progress is dependent upon the process of implementation” (Hudson 2019). Underestimation of the delivery challenges including lack of human and financial resources; insufficient evidence base; misalignment of stakeholder views and conflicting interests; and accountability challenges are often cited as key barriers to translating policy to action. Table 1 summarises five areas of consideration for policy implementation that are frequently observed as barriers/enablers.

Table 1. Key considerations for policy implementation - Adapted from the Framework to Facilitate Implementation of Agricultural Policies in Africa

In a recent dialogue convened by C/Can on “[the Future of National Cancer Law in Latin America](#)” legislators, academics and analysts from [Argentina](#), [Chile](#), [Peru](#) and [Uruguay](#), where national cancer laws are at different stages of development, identified several of these barriers in the cancer context. In Chile for example, where a new cancer law has recently been adopted, one of the key barriers to its development and implementation has been the misconception that cancer can only be addressed at the Ministry of Health level. Engagement of all key stakeholders, and particularly local civil society has been an important success factor.

Bridging the Policy Implementation Gap for Cancer Care: Local Leadership and Ownership

Locally led development and health policies that place value on listening to local actors, understanding local systems, and supporting local leadership are being increasingly recognised as critical for achieving long-term, sustainable impact (USAID 2019). This principle has been validated by early experience in developing and implementing policies that support improved access to quality cancer care in C/Can’s cities.

Spotlight on Implementing Guidelines for Invasive Breast and Cervical Cancers

Implementing clinical guidelines for the management of invasive breast and cervical cancers is key to ensuring

that patients receive the best quality care within the particular context of the city. This has been identified as a gap across many of the cities with which C/Can works and is being addressed through city-led projects to develop and implement locally appropriate guidelines. [C/Can’s technical cooperation support](#) for these projects has focused on creating multidisciplinary, multisectoral city-wide expert networks that share knowledge and expertise through hands-on workshops, expert consultations, and mentoring. A web-based initiative launched in 2020 with [Project ECHO](#) has also facilitated city-to-city discussions on this topic and sharing of best practices among 85+ cancer care professionals from nine cities. Common success factors identified for the uptake and implementation of clinical guidelines for invasive breast and cervical cancers included:

- Development of guidelines should be informed by robust local data gathered in a comprehensive situation assessment.
- Establishing a broad and inclusive guidelines development team from the outset is critical even if it delays the drafting process.
- Review and adaptation of guidelines is a multistep process that should be done using a participatory, multidisciplinary, and multi-institutional approach.
- It is important to involve not only the most relevant cancer care experts but also patient representatives and local decision makers and payers early on.

In C/Can’s first city - Cali, Colombia - guidelines for the management of invasive breast and cervical cancers have been developed through locally led project teams with support from the American Society of Clinical Oncology (ASCO) and the Oncology Nursing Society (ONS).

“The five guidelines that have been developed in Cali with the multidisciplinary work of health professionals are timely and very useful. When they are finalised, we should think about regulating them through the departmental cancer committee so that they can be implemented in a generalised manner and have the greatest impact on improving the quality of care for cancer patients” (Dr María Cristina Lesmes, Secretary of Health, Valle del Cauca).

What Next? Test, Learn, Adapt

As C/Can’s network of cities continues to expand and city projects mature, so too does the opportunity to better understand key drivers and barriers to effective implementation - and critically, how to sustain implementation over time. By committing to a rigorous cycle of monitoring and evaluation C/Can aims to systematically capture learning and best practices that can be shared and adapted among cities, and ultimately contribute to an evidence-base for locally led policy solutions for cancer care.

Conflict of Interest

None. ■

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