New Standards of Care

Editorial

Prof Tienush Rassaf
Editor-in-Chief
Cardiology

Department Head and
Chair of Cardiology and
Vascular Medicine
Westgerman Heart
and Vascular Center
University of Essen, Germany

New Standards of Care

The healthcare industry is one of the most regulated sectors in the world. That is primarily because the quality and level of care provided to patients could determine the course of their lives. We need standards because, in healthcare, the patient is always the top priority. Standards in healthcare promote transparency, accountability, governance, leadership, disease prevention and control, improved and early diagnosis, optimum treatment strategies and an overall direction and focus on providing quality services to patients.

In this issue, our contributors discuss **New Standards of Care**, the role these standards play in ensuring the delivery of high-quality patient care and the improvements that are needed to further ensure optimal patient outcomes.

Veli Strohmann and Strahil Birov talk about the digital health transformation in Europe and discuss the importance of data-driven decision support tools for better care delivery and policy-making. Arnaldo Stanzione, Vincenzo D'Ambrosio and Renato Cuocolo discuss biparametric MRI and explore whether it may be the new standard for prostate cancer imaging.

Henrique Martins and Luís Lino introduce the concept of Digital Anamnesis, a process of medical history taking using digital means and discuss how a systematic approach can improve clinician productivity and efficiency.

In their case study, Miroslav Mađarić and Vesna Nesek-Mađarić touch upon a very timely issue about standards related to medical information on the Internet and how it is important to make online health information more secure and useful for both patients and healthcare providers.

Stefan Heinemann explores the role of ethics in the digital transformation of cardiology and argues that in the future, the presence of a physician will continue to be necessitated in order to ensure value-driven care for patients. Carla Riera Segura and co-authors talk about how Telestroke 2.0, an innovative approach to optimise timing and automate workflow facilitates early detection and treatment of stroke for optimal patient recovery.

Wong Hon Tym provides insights on Singapore's healthcare system and how the pandemic has driven progress within the system and enabled it to adjust to the new normal. Sam Maiden discusses integrated care systems and how they can help deliver long-term benefits to patients and clinicians and help overcome challenges presented by the pandemic.

Standards are critical in every aspect of healthcare – from diagnosis to treatment. Continuously adapting our standards is the only way to deliver value-driven, patient-centred care.

We hope you will enjoy this issue. As always, your feedback is welcome.

Happy Reading!

Contents

Contents

Have your say.
Engage!

To contribute, contact us on
Interested@HealthManagement.org

Contributors

Strahil Birov,
Germany

Strahil Birov is a research consultant at empirica Communication and Technology Research. He holds an MA in Innovation and Information Management. He has been active in many European-funded projects. He currently leads the work undertaken in DigitalHealthEurope.

Renato Cuocolo,
Italy

Renato Cuocolo is a research fellow at the Department of Clinical Medicine and Surgery, University of Naples Federico II. His research interests include musculoskeletal radiology, genitourinary radiology, radiomics and machine learning applications in medical imaging.

Vincenzo D'Ambrosio,
Italy

Vincenzo Ambrosio is a resident in Radiology at the Department of Advanced Biomedical Sciences of the University of Naples Federico II, with particular interest in radiomics and artificial intelligence.

Stefan Heinemann,
Germany

With his work focussed on ethics and business of digital medicine and AI, Stefan Heinemann is a Professor of Business Ethics (FOM), spokesman of the Ethics Ellipse Smart Hospital (UH Essen) and part of multiple professional and educational organisations in the healthcare sector.

Luís Lino,
Portugal

Luis is a 6th year medical student at the University of Beira Interior - Health Sciences Faculty. Research interests include Digital Health, particularly Electronic Health Records, Medical History Taking and the intersection between Technology and Medical Education. He is working on a master degree in medicine with a research thesis on Classic and Digital Anamnesis.

Miroslav Mađarić,
Croatia

Miroslav has had an illustrious career, holding all IT positions in leading Croatian and Austrian hospitals. He has experience in implementing integrated hospital and business information systems (including Hospital Information Systems and SAP). Holds the chair "Innovation management" in Zagreb High School Algebra. He retired in 2016.

Sam Maiden,
UK

Sam Maiden is a healthcare transformation consultant at PA Consulting, and specialises in developing new operating models, helping organisations achieve their strategic goals by improving their structures and processes. His consulting experience includes projects in the NHS with public sector commissioners, providers, national bodies and private sector organisations.

Henrique Martins,
Portugal

An Internist MD and Management PhD, Henrique Martins headed SPMS (Portugal) leading numerous nation-wide eHealth projects and co-chaired the EU eHealth Network. He is an Associate Professor at ISCTE – University Institute of Lisbon in Portugal, where he teaches and consults on Digital Health, health transformation, management and leadership. Henrique Martins is an Editorial Board member for Health Management – IT.

Vesna Nesek-Mađarić,
Croatia

Dr Vesna Nesek-Mađarić graduated from medicine and was employed in the University hospital centre Zagreb in 1976. She obtained her M.Sc. in 1986 and became Head of the Neurophysiological lab in the Neurology department in 1987 and the Neurology day-hospital in 2010, with training in several renowned European university hospitals. She retired in 2015.

Natàlia Pérez de la Ossa,
Spain

Natalia is a specialist in Neurology. Currently she is coordinator of the Stroke Unit of the Germans Trias i Pujol Hospital, accredited by the Spanish Neurology Society, as well as Director of the Master Plan for Cerebral Vascular Diseases of the Generalitat de Catalunya.

Tienush Rassaf,
Germany

Prof Rassaf is the Department Head and Chair at the Westgerman Heart- and Vascular Center at the University of Essen, Germany. He is also the Editor-in-Chief for Cardiology at HealthManagement.org.

Carla Riera Segura,
Spain

Carla has a degree in biomedical engineering from the Universitat Politècnica de Catalunya, and she just finished a Master's degree in Bioinformatics and Biostatistics. She has been working at IdoniaHealth since 2020.

Arnaldo Stanzione,
Italy

Arnaldo Stanzione is a PhD student in Biomorphological and Surgical Sciences at the Department of Advanced Biomedical Sciences, University of Naples Federico II. His main research field is oncologic imaging, with a focus on genitourinary radiology and radiomics.

Veli Stroetmann,
Germany

Veli Stroetmann is a Director of empirica Communication and Technology Research and head of Health Policy and Research. A medical doctor, she has a PhD in Medical Informatics. She has been coordinator / principal investigator of many European-funded projects like DigitalHealthEurope.

Laura Valenzuela López,
Spain

Laura has a degree in biomedical engineering from the Universidad Politécnica de Madrid, and is currently completing her Master's degree in the same discipline. Now she is working at IdoniaHealth as a presales engineer and community manager on an international project.

Wong Hon Tym,
Singapore

Clinical Associate Professor Wong Hon Tym is the Medical Director of Singapore's National Healthcare Group Eye Institute and the Clinical Director of the Centre for Healthcare Innovation. His other appointments as Critical Incident Manager and Open Communication instructor reflect his interest in patient communication.

Editorial Board

Alexandre Lourenço
Editor-in-Chief EXEC
Centro Hospitalar e Universitário de Coimbra, Portugal
al@healthmanagement.org

Prof. Lluis Donoso Bach
Editor-in-Chief Imaging
Hospital Clinic – University of Barcelona, Spain
ld@healthmanagement.org

Prof. Tienush Rassaf
Editor-in-Chief Cardiology
Westgerman Heart- and Vascular Center, University of Essen, Germany
tr@healthmanagement.org

MANAGEMENT MATTERS

Leveraging the Lessons of COVID-19 to Maximise the Benefits of Integrating Care

Author: Sam Maiden I Healthcare Transformation Consultant I PA Consulting I England, U.K

An overview of the Integrated Care System (ICS), how it can help deliver significant long-term benefits to citizens and member organisations and steps that can be taken to overcome implementation challenges.

Key Points

- A truly integrated approach will help target resources towards key population health needs and address inequalities.

- Most systems are struggling with the scale of the ICS design and transformation challenge.

- Embedding capabilities that are key to integrated care, such as population health management, will require new skills and fundamental changes to how teams work together.

- The long sought-after benefits of integrated care are possible to achieve despite the significant challenges ahead.

Introduction

Over the next few months, healthcare leaders need to come together to implement local blueprints to deliver the government's integrated care agenda – a radical plan with the potential to deliver significant long-term benefits to both citizens and member organisations.

A truly integrated approach will help target resources towards key population health needs and address inequalities. End-to-end pathway approaches will create a more seamless user experience, underpinned by digital tools that enable greater choice and self-management and allowing an increased focus on prevention and wellbeing, thus keeping people healthier for longer.

The Challenge of System-Wide Change

For wider NHS commissioners and providers, local authorities, and other organisations, becoming part of an Integrated Care System (ICS) offers the prospect of greater sustainability and efficiency through shared investment in the delivery of clinical and corporate services. For their workforce, it will also facilitate a more collaborative culture and create new opportunities for employees to develop their careers and learn new skills.

But it comes with challenges, and most systems are struggling with the scale of the ICS design and transformation challenge. This includes pandemic fatigue in the workforce, capacity and capability restraints, existing structural and cultural barriers, and a complex landscape encompassing diverse systems, places and neighbourhoods.

But, having worked with systems throughout the pandemic, and seen local responses to COVID-19, we believe these can provide a model for integrating teams effectively and delivering change at pace. We believe ICSs can harness four lessons from the pandemic response when designing and mobilising their programmes:

Lesson 1: Unite stakeholders around an idea they're all passionate about

The pandemic created a focal point that all stakeholders could unite around, regardless of which organisation they worked for. This sense of common cause enabled levels of cross-organisational collaboration which many had previously thought impossible.

While the underlying logic of integrated care is similar across the country, each system should define its own unifying vision that goes beyond generic ambitions to 'improve health outcomes' or 'reduce health inequalities'. The vision must stem from a specific system idea that everyone will recognise and care about.

From a practical perspective, this means combining strong

evidence-based insights into the local health and care landscape with cross-system stakeholder engagement to identify the key challenges integrated care can address. In our experience, asking open questions such as "If there's one thing you could change within the next two years, what would it be?" helps get to the heart of people's true motivations and concerns.

Lesson 2: Challenge conventional wisdom about how and where to best deliver services

One of the more remarkable aspects of the COVID-19 response has been the rapid development of organisational capabilities to deliver services in new ways. For example, virtual consultations – which many had previously thought would take years to implement – became routine for millions within a matter of weeks. According to NHS Digital, the percentage of GP appointments delivered remotely rose from 14.5% in February 2020 to 40.9% in February 2021.

When designing ICS operating models, system leaders should ask themselves three questions:

- What are the core organisational capabilities we need to be successful and grow, such as population health management and outcome-based contracting?

to focus on the right things. System- or place-based support needs to help frontline workers identify priority areas and clear evidence for action, and to provide easy access to wider system, regional or national assets and resources where needed. For example, this means providing clear insights supported by evidence, rather than detailed reports which teams need to wade through and interpret themselves.

We also know that, as clinician time is extremely limited, initiatives need to allow clinicians to maximise their ability to shape solutions and minimise time spent attending governance meetings or providing progress updates.

Lesson 4: Provide the right support to enable people to work in new way

COVID-19 has shown that, with the right support, people can rapidly adopt new ways of working. For example, many community providers applied their expertise in infection prevention and control to help staff in care homes and primary care to embed improved practices.

Embedding capabilities that are key to integrated care, such as population health management, will require new skills and fundamental changes to how teams work together. While we're seeing several systems already planning organisational devel-

One of the more remarkable aspects of the COVID-19 response has been the rapid development of organisational capabilities to deliver services in new ways

- At what layer should these capabilities sit? Will a system or place approach deliver them more efficiently at scale, or will a neighbourhood approach take advantage of local knowledge, insight and relationships?
- Will current functional teams still make sense in the new world, or should we combine capabilities differently? Asking these challenging questions will ensure that ICSs are genuinely re-designed to deliver their local vision, rather than just adaptions of legacy organisations.

Lesson 3: Empower frontline teams to deliver practical changes that will make a difference

Throughout the pandemic, teams have had greater freedom to cut across traditional organisational and financial boundaries to solve problems. For example, many NHS providers collaborated by sharing supplies of PPE to ensure sufficient availability across their systems, and primary, community and social care teams have worked more closely together to support vulnerable patients. In a recent survey of NHS trust leaders, 92% reported that collaboration and partnership working in local systems had accelerated during the pandemic.

We know that frontline teams have a great ability to solve practical problems, but they also need clarity and direction

opment programmes to support these changes – particularly around building analytical and digital skills - it will be important to base them on practical interventions wherever possible. For example, by defining a practical set of solutions that will improve health outcomes then mapping the skills required to deliver them.

Mechanisms that enable peer learning, such as action learning sets and collaborative improvement events, will be key to systems learning from each other, establishing best practice and building capabilities.

Unlocking the Benefits of Integrated Care Systems

The long sought-after benefits of integrated care are possible to achieve despite the significant challenges ahead. The response to the pandemic provides a great example of how to drive collaboration and major change at pace. Leaders now have a great opportunity to capture and apply these learnings as they plan the longer-term future of their systems.

Conflict of Interest

None. ■

SPOTLIGHT

"As a concept, telemedicine was struggling to fully take off in Singapore.… Now increasing numbers of medical departments, doctors (and) nurses are getting involved with telemedicine and virtual visits in some form or other", *page 275*

What COVID-19 Has Taught Us: Insights on Singapore's Healthcare System and the New Normal

Author: **Wong Hon Tym | Clinical Director | Centre for Healthcare Innovation |** Singapore

Singapore is world-renowned for being a unique and technologically advanced hub, and has proved to be one of the global leaders in fighting the COVID-19 pandemic. HealthManagement.org talks with Associate Professor Wong Hon Tym, Clinical Director at the Centre for Healthcare Innovation, about the pandemic-driven progress in Singapore's healthcare.

What is your background and how did you get involved in healthcare innovation?

I'm an ophthalmologist and I previously headed the eye department at Tan Tock Seng Hospital for 10 years, during which I started dabbling in changing the way things were. Changing the way you work is innovation, and that's how I ended up in the Centre for Healthcare Innovation which goes beyond medical technology itself, and focuses on changing jobs and the way we deliver care.

I've been with CHI for about five years now. COVID-19 forced us to transform many care models into a digital or virtual format in about two or three months. The medical world has never been completely comfortable with online transactions or dialogues, although now, out of sheer necessity, we've increasingly become more accustomed to it. It's quite symbolic of how healthcare has changed – or evolved as well. Working online has become more normalised now, and as such, we're starting to recognise the pros and cons of this new normal. It's all about grappling with our own insecurities or presumptions about something that we've never tried before, jumping in and then discovering that it also has its benefits over the traditional mode of practice.

What has Singapore learned from other countries, with regard to innovation in the era of COVID-19?

It's strange because we're based in Singapore and it is a completely different world from Europe, for better or worse. We designed our annual CHI conference with a global audience in mind, incorporating a deeper understanding of where we are and where the rest of the world is, and ensuring that the content speaks to all parts of the spectrum.

Over the past year, we have liaised with our colleagues from around the world – learning about the diverse responses to COVID-19 from our Swedish, British and European colleagues has really put things in perspective for us. We have also learned much from health leaders in Hong Kong, which has just weathered a very tumultuous year - politically, societally and medically.

Sharing experiences from this past year has really provided a better picture of how others have coped with the pandemic. You never know if you're going to find yourself in similar circumstances later on, so opening this line of communication allows us to learn leadership and personal decision-making strategies and lessons that may help participants make an important future call.

For example, a year ago, Sweden was holding firm with their herd immunity strategy. More recently, the Swedish government started having second thoughts about their strategy. It is very interesting to look back and revisit that decision-making now. Last year, our U.K. colleague discussed the push to set up the Dragon's Heart makeshift hospital in Cardiff, Wales. Since then, it has already been decommissioned – what kind of a journey is that, in less than a year, to set up and take down a field hospital!

Reflecting on the past year, what were the strengths and weaknesses of Singapore's healthcare response?

From Singapore's perspective, at this point in time last year we were still recovering from the surge in our migrant worker COVID-19 cases. We learnt many important lessons as we struggled to manage during that phase. Now there's a huge understanding that everyone must be, in a sense, taken care of in the same way as much as possible, so that the country can progress together, with every sector of our society on board. Of course, we're not right there yet, but there is good introspection and a strong affirmation for that. On a personal level, I think many Singaporeans had a real evolution in our

perspectives too, clearly realising that we have to think about every person involved in society when it comes to healthcare.

For me, a turning point – and it just crystallises everything I believe about this whole pandemic – was realising that healthcare was not the first line of defence. I distinctly recall watching a doctor on YouTube, early on in the pandemic, turning that concept on its head. She said "healthcare is not the frontline – you (referring to the layman viewer) are the first line, we are the last line, so please make sure that you do your job". That really made it clear for us that health services are so dependent on how well society can flatten the curve, before too many patients overwhelm the hospitals.

So the reason why Singapore was and is doing well is because society (the real frontline) in general played its part: everyone listened and thought about each other. We've never been a highly individualistic society, and I think that strength

What has changed over the last year in terms of innovation in healthcare in Singapore?

More speed! Singapore can move fast when we want to, but there's also the necessary tension to be safe and do the right thing, do multiple checks and go through many layers of approval. Innovation sometimes falls victim to this very high level of rigour, and ends up evolving much slower than it could have. Many good ideas have arrived at the pilot stage, but struggled to find a bigger platform and lacked the timely momentum to spread.

Telemedicine is a telling example of this phenomenon. As a concept, it was struggling to fully take off in Singapore because, we're small and healthcare access is quite easy and quick, so there was never a strong impetus to develop it. But, as they say, COVID-19 is the best Chief Innovation Officer ever in the history of mankind. Within the pandemic, tele-

As a concept, telemedicine was struggling to fully take off in Singapore…. Now increasing numbers of medical departments, doctors (and) nurses are getting involved with telemedicine and virtual visits in some form or other

or weakness came into play, for the better mostly. Everyone joined in and started doing the right thing. Our successes are a result of the fact that society in general behaved and listened to the experts.

As such, the Singapore healthcare system was not pushed past the brink. Unlike in other countries, we experienced an almost surreal calm by comparison. We were of course inundated in our screening centres and containment facilities as a result of the migrant worker situation. Our wards and ICUs were also under strain from this prolonged status of alert, preparing for the worst. But that disastrous storm never really happened.

Healthcare workers were also pushed out of our comfort zones professionally and psychologically. We were re-deployed all over the system. I wasn't doing my regular job and stopped seeing non-urgent eye patients for several months. Along with many others, I was rostered to support the National Centre for Infectious Diseases, fearing that the worst would happen, but it luckily it didn't. It's clear to see now that that was due to how well-managed the "outside" was.

The unfortunate situation that the U.S., Italy and Spain, for example, found themselves in was in great part due to COVID-19 just overwhelming societies which were unable to completely transform the way they lived, worked and behaved fast enough or cohesively enough, whatever the reason; thus their last line of defence was tragically breached as well.

medicine approvals were sped up, projects got fast-tracked, and as we approach a critical mass of telemedicine projects, we can do better evaluations because there is more data. And with more data, there's more confidence. That is a good snowball effect.

Now increasing numbers of medical departments, doctors, nurses in Singapore are getting involved with telemedicine and virtual visits in some form or other. From speaking remotely to a patient or looking at a patient's images through a screen, it has been a huge paradigm shift for us and our patients.

The other thing that we have recognised over the past year is the need to actively ensure that sectors of the population are not left behind. The elderly, for the most part, are not digitally savvy, yet we are continuously inundating them with digital apps. We've got to make sure that each technological advance includes more humanistic design and development. There is, as well, a need to include the economically, socially and physically disadvantaged people from our society in these innovations. I'm an ophthalmologist, so I do know that many of my patients are struggling, now even more than ever, because there's greater dependence on technology. If you are requiring a smartphone for people to organise their life and their medical appointments, there are big sectors of the community that may not be able to participate.

What are your overall expectations for the future of innovation in healthcare?

I feel like the goal and theme of the coming years should be 'Creating a better normal for healthcare'. The idea is that we are already creating a new normal, but true innovation implies that a new normal can't simply be new and the same or worse; it must be improved – thus, a better normal. In order for this true innovation to really materialise, we must challenge ourselves to go beyond the near future and imagine progress much higher than what we have ever experienced. Can telemedicine be even better in some respects than regular medicine? Can home care beyond the brick-and-mortar hospitals be actually better than the care that we're delivering now to our patients? That's the challenge that we must set, and I

behind. We all move together, and when we design healthcare, when we innovate for healthcare, it's not just about the average Joe or Jill, it is about society as a whole. That's what I hope for, that sort of new realisation.

We must retain some elements of the old normal, like the human contact that many of us miss terribly, not just with our patients, but also each other. Some services and care pathways cannot do without face-to-face contact, so I hope that they can regain as much of that old normal as possible, while the rest of us will make newer methods like telemedicine more mainstream.

Finally, I hope that by this time next year we will see even more of healthcare focusing on care becoming even more accessible to patients within their communities and homes,

---

We all move together, and when we design healthcare, when we innovate for healthcare, it's not just about the average Joe or Jill, it is about society as a whole

---

hope that this idea resonates and results in breaking a lot of old presumptions that we've been holding on to.

One clear way we can innovate in healthcare is to reach outside of our field and collaborate with innovators from completely different areas of industry. For example, how might a clothing company designer approach personal protective equipment design? Or what if the head of a transport company were in charge of the vaccination programme? How would they run it differently from us? How about inviting a video game designer who started moving into the augmented reality field to use all the equipment they have – their headphones, goggles – to see if they can design a better experience for our patients?

In the future, we need to challenge ourselves to look outside of the box and bring imagination and new mindsets into healthcare, allowing us to break free of some traditions and improve our overall care. I think that would be a good thing.

Has COVID-19 improved (or will it improve) Singapore's healthcare delivery or made the system worse?

That's a question for the minister, not for me! But I hope that through this pandemic we have learned to be more versatile as a healthcare system and as such, are able to utilise the best of the new normal while retaining some of the best of the old normal. This pandemic has thrown a spotlight on the cracks in our system and hopefully, in the new normal, there will be more appreciation for healthcare workers and a society that's more considerate of all sectors, ensuring that we don't just look after our own immediate community, but also those who are on the fringes, and those likely to be left

so that we can remain connected, wherever and whoever we are.

Conflict of Interest

None. ■

COVER STORIES

"Digitisation can support the reform of health systems and their transition to new care models, centred on people's needs", *page 281*

Digital Health Transformation in Europe – Recommendations are on the Horizon

Author: **Veli Stroetmann | Director | empirica |** Bonn, Germany
Author: **Strahil Birov | Research Consultant | empirica |** Bonn, Germany

DigitalHealthEurope's work indicates the importance of the development and uptake of data-driven decision-support tools for better health and care delivery and policy-making. While European funding should further support and reinforce better collaboration in times of pandemics, plenty of non-communicable diseases will need to be supported by 'digital' and data.

Key Points

- COVID-19 has acted as a real force for scaling-up use of digital health.

- Today, Europe is advancing its vision of digital health and care proactively.

- DigitalHealthEurope, a coordination and support action, has played an active role in supporting thinking and acting to facilitate digital transformation in health and care.

- Exciting developments include active twinning schemes between Europe regions and sites.

- Important current impacts include the way in which DigitalHealthEurope can act as an important platform for communication among people working towards the digital transformation of health and care.

- A set of potential recommendations is on the horizon: Areas already exist in outline.

COVID-19 and Digital Health

The COVID-19 pandemic, with its many variants, continues to threaten people around the globe. Yet one key benefit is that countries' responses to the pandemic have enabled a faster transformation of health and care systems through the use of digital technologies: this can be seen in Europe especially. There are many European digital tools increasingly used to fight the pandemic: at least six can be listed.

1. automatic testing and diagnosis;

2. a pan-European approach to the use of mobile applications and mobility data;

3. the use of Artificial Intelligence to speed up diagnosis of the virus;

4. the use of AI to improve the future treatment of patients;

5. the use of supercomputing technologies to analyse billions of combinations of the structure of the virus; and

6. the introduction of robotics in clinical settings to enable medical staff to minimise the risk of contagion.

By summer 2020, at least

65 DIGITAL SOLUTIONS

had been identified that support the fight against COVID-19.

European Vision of Digital Transformation

The digital transformation of health and care has the capacity to act as a key enabler to enhance health and care. It can help drive health and care systems to become more resilient, accessible, and effective in providing quality care for European citizens.

Well before the emergence of the threat of COVID-19, the European Commission and Member States identified three high-level policy priorities to advance the digital transformation of health and care in the European Union (European Commission 2018):

- Enabling citizens' secure access to and sharing of health data across borders,
- Providing better data to advance research, disease prevention and personalised health and care,
- Using digital tools for citizen empowerment and person-centred care.

These three trends led to a major European focus on the use of digital solutions as well as data.

Digital Solutions

Digital solutions can help tackle key challenges in the healthcare sector. Besides the very obvious difficulties in 2020-2021 emerging from the effects of a major pandemic, many other clinical and organisational examples have been flagged up. Illustrations include ageing; multi-morbidities; the rising burden of preventable non-communicable diseases; challenges related to neuro-degenerative and rare diseases; and health workforce shortages.

Digitisation can support the reform of health systems and their transition to new care models, centred on people's needs. It can also enable a shift from hospital-centred systems to more community-based and integrated care structures. New business models, in particular, are likely to be among the expected results.

Data

Health and care data could be used in new ways to help improve the functioning of Europe's healthcare sector. Currently, however, the use of health data is handicapped by many limitations. Among the several shortcomings, data is available in many forms which are not managed the same way in all European Member States or in national health systems. Data is often not available to public authorities, medical professionals, and researchers (to help them develop and deliver better diagnoses, treatments, or personalised care) or even to patients themselves. Its use is often dependent on technologies that are far from being interoperable. Many challenges arise from these difficulties with digital solutions and data.

Right now, European health systems lack key information to optimise their services. Health providers find it hard to ensure economies of scale that would lead to efficient digital health and care solutions and support cross-border use of health services. Market fragmentation and a lack of interoperability across health systems stand in the way of an integrated approach to disease prevention, care, and cure. European patients and citizens are not yet able to benefit from the operation of a digital single market in this area.

Despite this obvious fragmentation, many of the difficulties and challenges facing Member States in terms of their health and care systems are common to them all. If the problems were to be analysed and faced together, they could be addressed jointly. Certainly, Europe experiences common safety concerns in matters of public health where the competences are shared between the European Commission and the Member States (European Union 2012).

The European Commission is currently supporting cooperation among the Member States, for example, to improve the complementarity of their health services across borders, for example, in relation to the use of electronic health records (European Commission 2019). In close collaboration with the Member States, it could also, take action to stimulate innovation, economic growth, and the further development of the Digital Single Market in directions supportive of health and care.

DigitalHealthEurope's Support for Digital Transformation

DigitalHealthEurope is a coordination and support action. It is an initiative funded by the European Commission to facilitate concrete progress in the three chief policy priorities. They are the secure sharing of health data, health data use for secondary purposes like research, but also basically for citizen and patient empowerment.

The action provides comprehensive support to European digital health and care stakeholders on two levels. First, it delivers practical, on-the-ground support to large scale deployment of digital solutions for person-centred care. Second, it supports collaboration and knowledge exchange among stakeholders in order to elaborate and define policy recommendations and actions that can contribute to the priorities' further adoption.

Support for Large-scale Deployment of Digital Solutions for Person-centred Integrated Care

DigitalHealthEurope assessment has identified, analysed, and selected a number of successful initiatives which are highly impactful and replicable. Structured advice has been offered on European funding instruments and financing sources for advancing digital health topics. The project's activities are especially focused on a dedicated funding instrument called a twinning.

Support for Innovation Through Collaboration in Multi-stakeholder Communities

DigitalHealthEurope has facilitated the creation of a shared platform for multi-stakeholder communities. These communities have addressed the three European policy priorities, and

taken these priorities further in very concrete ways. With the help of associated experts and contributors, white papers, guidelines, and policy recommendations are all under development: digitalhealtheurope.eu/results-and-publications.

Together, these two DigitalHealthEurope activities are contributing to the development of a vision for the digital transformation of health and care, which will include solid advice and recommended actions. DigitalHealthEurope's activities are organised in a clear, structured way as illustrated in Figure 1.

DigitalHealthEurope's 25 Twinning Schemes

In total, 25 twinning schemes have been financed by Digital-HealthEurope. Their overall aim has been to spread the adoption of concrete solutions and digital approaches. Twinning is a mechanism that has been used to facilitate the further adoption and spread of successful digital health initiatives, thereby advancing the three policy priorities for the digital transformation of health and care. The DigitalHealthEurope twinnings

have involved more than 75 organisations from 20 countries committed to adopting digital health and care practices practices: digitalhealtheurope.eu/twinnings/dhe-twinning-results.

Descriptions of two twinning examples follow. One twinning was organised on a region-to-region basis. Another has been managed between a single institution in one country and adopters in several other countries. Each of the two originators is from a country holding the present or a soon-to-be upcoming presidency of the European Union. This implies that their progress is likely to see widespread public coverage across the continent.

AppSaludable – An Approach to Ensuring Safety and Quality in Mobile Health Apps

AppSaludable: (digitalhealtheurope.eu/twinnings/dhe-twinning-results/appsaludable) is a twinning scheme that addresses the challenges that arise from an ever-growing number of health applications being available to patients and citizens, often without vetting or quality
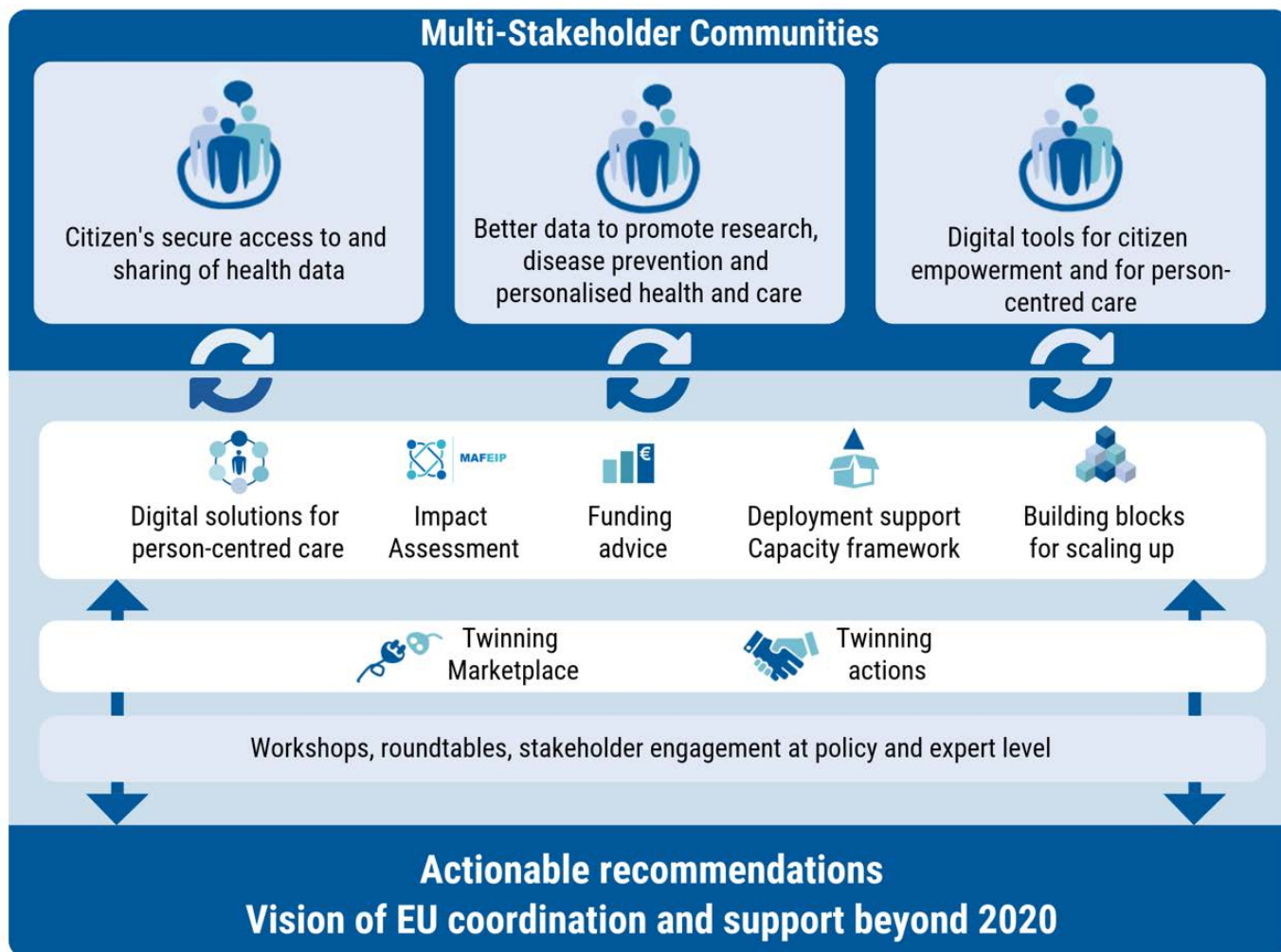
Figure 1 – DigitalHealthEurope's focus: Towards actionable recommendations digitalhealtheurope.eu/overview

control. As a result, governments and healthcare authorities need to ensure that their citizens can choose applications that are safe, secure, effective, and provide added value. The AppSaludable twinning has brought Andalusia in Spain together with Portugal.

The two partners have developed common requirements for mHealth app design, use, and assessment: (Digital Health Europe 2021a). Their approach has been based on the experience of the Andalusian Agency for Healthcare Quality (ACSA) and the Andalusian Public Health System. ACSA has taught the Serviços Partilhados do Ministério da Saúde (SPMS) of the Ministry of Health in Portugal about the AppSaludable model ("Safety and Quality Strategy in Mobile Health Apps").

DigitalHealthEurope's Outcomes From 2019 Onwards

DigitalHealthEurope has been extremely busy during the project's two years of operation. Many summaries of the policy directions followed by the project players can be read here (digitalhealtheurope.eu/results-and-publications). Examples include:

- Health data spaces and their future directions.
- Citizen and/or patient empowerment in digital health.
- The governance of digital health.
- The support for demand and supply in digital health.
- The role(s) of digital infrastructure.
- The role of industry in digital health and care.

Digitisation can support the reform of health systems and their transition to new care models, centred on people's needs

Developed by originator, ACSA, a decade ago, the model has been used as the basis for improving adopter, SPMS's own model, MySNS Selecção.

The recommendations resulting from the twinning are to be included in an updated version of MySNS Selecção's in order to ensure better value for the citizens and health professionals who will use the certified health apps. Today, the originator, adopter, and additional collaborators, are all interested in continuing their partnership around the use of mHealth apps.

REHAB-LAB-4ALL – Self-designed 3D printed assistive devices in Europe

The REHAB-LAB-4ALL (digitalhealtheurope.eu/twinnings/dhe-twinning-results/rehab-lab-4all) twinning scheme has focused on empowering patients with disabilities. It has encouraged people who are disabled to take part in developing everyday objects that take their disabilities into direct account. The twinning originator is the Centre Mutualiste de Rééducation et de Réadaptation Fonctionnelles de Kerpape (France). It has developed a 'first of its kind' fabrication laboratory ('fab lab'). The lab is based around the concept of enabling healthcare providers to work collaboratively with patients, producing three-dimensional printed assistive devices together. Kerpape has shared this participative approach with adopters from six countries: Belgium, Denmark, Italy, Romania, Spain, and Switzerland. A video discussing the scheme can be found here.

Many further twinnings funded by DigitalHealthEurope can be browsed online here.

These specific COVID-19 resources are also available:

- A catalogue of digital solutions for fighting COVID-19.
- Sixty-five good digital solutions selected practices on health and care.
- Support offered by the sequencing of 1+million genomes to preventative medicine.

DigitalHealthEurope's Practical Impacts

DigitalHealthEurope's has had important impacts as a platform for people and patients interested in health data spaces. DigitalHealthEurope has established itself as the go-to platform for stakeholders who want to share information, receive support, and learn about the digital transformation of health and care in Europe. Its website (digitalhealtheurope.eu) has had 18,000+ individual visits from people from almost 80 countries. There have been more than 3,700 unique downloads of DigitalHealthEurope resources. The initiative's Twitter account (@DHE_2020) has over 1,000 followers. Indeed, more than 500 subscribers receive regular updates of the DigitalHealthEurope Digest, a bi-monthly newsletter (Digital Health Europe 2020). In terms of sustainability, the plan is to maintain the project website beyond the project end, and to continue to offer a forum for the exchange of information about the digital transformation of health and care. Yet DigitalHealthEurope has even more to offer – Recommendations are next on the horizon.

DigitalHealthEurope's Future Recommendations

By September 2021, DigitalHealthEurope will lay out a set of potential recommendations for policy directions in the field of the digital transformation of health and care. A number of possible directions can already be foreseen, based around

discussions held in a series of expert workshops and round tables. Broadly, they relate to European Health Data Space(s); legal challenges in health data use; the use of health data by patients and citizens; and, last but not least, funding mechanisms to ensure better health and care.

European Health Data Space(s): The governance of a common European Health Data Space (or spaces) would enable safe and secure data sharing that empowers citizens, health authorities, and companies to share insights that follow the highest ethical and technical standards. Health-related industry

collaboration in times of pandemics. This may have many aspects. For example, it could include supporting digital preparedness; strengthening a coordinated approach among all stakeholders for the uptake and integration of digital solutions along the continuum of health and care; consolidating achievements in the fields of interoperability, telemedicine, and remote monitoring; and focusing on a common approach to mHealth quality and safety. Directions are likely to focus on the development and uptake of data-driven decision-support tools for better health and care delivery and policy-making.

Directions are likely to focus on the development and uptake of data-driven decision-support tools for better health and care delivery and policy-making

experts were consulted on this topic by DigitalHealthEurope: they called for such spaces to act as a centralised access point to data coming from multiple European Union countries. They suggested that the spaces could expand the market for the use of data for innovation, especially for small and medium-sized enterprises. Ensuring recommendations may well go in the direction of data governance rules, common principles, access agreements, and technical standards.

Legal challenges in health data use: In a DigitalHealthEurope focus group concentrating on the views of European and international lawyers, opinions indicated that legislation should focus on 'citizen protection' and not only on data protection. Laws should act as 'enablers'. The demand side in health and care has a right and a responsibility to request interoperability-friendly regulation(s) that would ensure 'bottom-up' conditions for data flow(s). Opinions expressed indicated that, in relation to interoperability and health data standards, an incentive structure is needed that would stimulate the use of data by the demand side.

Citizens' use of data: A DigitalHealthEurope focus group concentrating on the views of patients and citizens indicated that they want to combine the data in their electronic health records with their own self-management and lifestyle data. Participants emphasised the need for greater investment in digital and data health literacy to empower people and patients. They supported the use of people's health data to improve the quality of health services, for both public health and research purposes whether funded from public sources or industry.

Future Funding Mechanisms in Health and Care in Europe

DigitalHealthEurope's current work indicates that European funding should further support and reinforce better

While currently infectious diseases are the most urgent on the agenda, it is easy to see how there will be a build-up of the need to investigate and treat all those conditions and diseases which have lain untreated for several years. Cancer and mental health are potential areas of future focus.

Conflict of Interest

None. ◼

REFERENCES

Digital Health Europe (2021a) Common requirements for mHealth app design, use and assessment in Andalusia and Portugal thanks to DigitalHealthEurope twinnings. Available at: digitalhealtheurope.eu/news/common-requirements-for-mhealth-app-design-use-and-assessment-in-andalusia-and-portugal-thanks-to-digitalhealtheurope-twinnings/

Digital Health Europe (2020) The DHE Digest #1 is OUT! Available at: digitalhealtheurope.eu/news/the-dhe-digest-1-is-out/

Digital Health Europe (2021b) The REHAB-LAB innovative concept for designed 3D printed assistive devices successfully transferred to three adopters. Available at: digitalhealtheurope.eu/news/the-rehab-lab-innovative-concept-for-designed-3d-printed-assistive-devices-successfully-transferred-to-three-adopters/

European Commission (2018) Communication on enabling the digital transformation of health and care in the Digital Single Market; empowering citizens and building a healthier society. Brussels: European Commission: **digital-strategy.ec.europa.eu/en/library/communication-enabling-digital-transformation-health-and-care-digital-single-market-empowering**

European Commission (2019) Commission Recommendation on a European Electronic Health record exchange format (C(2019)800) of 6 February 2019: digital-strategy.ec.europa.eu/en/library/recommendation-european-electronic-health-record-exchange-format

European Union (2012) Consolidated version of the Treaty on the Functioning of the European Union. Brussels: Official Journal of the European Union: C326/47-385 eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:12012E/TXT.

The Cost of Keeping the Imaging Status Quo

As demand for diagnostic imaging continues to increase, it is important for hospitals and radiology departments to trade in the imaging status quo of the isolated silo for a consolidated approach such as Enterprise Imaging.

✓ Key Points

- Hospitals today have to deal with an assortment of disparate, standalone systems that have different capabilities and functions and are often inefficient, fragmented and costly.

- Diagnostic and clinical users could benefit from a complete patient imaging system such as Enterprise Imaging.

- Economic, operational and clinical forces are pushing healthcare systems to switch from traditional imaging systems to a unified Enterprise Imaging ecosystem.

- A converged Enterprise imaging approach offers several benefits, including reduced complexity, lower cost, increased efficiency, and enhanced care and satisfaction.

Imaging and Imaging IT are fundamental components of modern healthcare. Their increasing application and use for clinical diagnosis and treatment decisions have resulted in the use of a variety of systems and technologies across departments, specialties and healthcare facilities. That is why many hospitals today have to deal with an assortment of disparate, standalone systems that have different capabilities and functions and are often inefficient, fragmented and costly.

Diagnostic and clinical users could benefit from a complete patient imaging record. However, in such a fragmented environment, this could be quite a challenge. But this challenge must be overcome if healthcare organisations want to trade in the imaging status quo of the individual, isolated silo for a consolidated approach. One such solution is Enterprise Imaging.

Why Do Imaging Systems Need to Change?

Three primary forces are pushing healthcare providers to switch from traditional imaging systems to a unified Enterprise Imaging ecosystem. These include:

Economic Drivers

Buying, implementing, deploying, integrating and supporting multiple imaging systems across multiple departments is an inefficient and costly solution. The time and money spent on managing and updating these siloed systems and on duplicate storage could easily be put to better use by investing in more efficient and value-driven solutions.

Operational Drivers

When healthcare organisations use siloed systems, each system requires separate staff trained in its maintenance and interface. Again, the time and money spent on training staff on multiple user interfaces can be more efficiently utilised
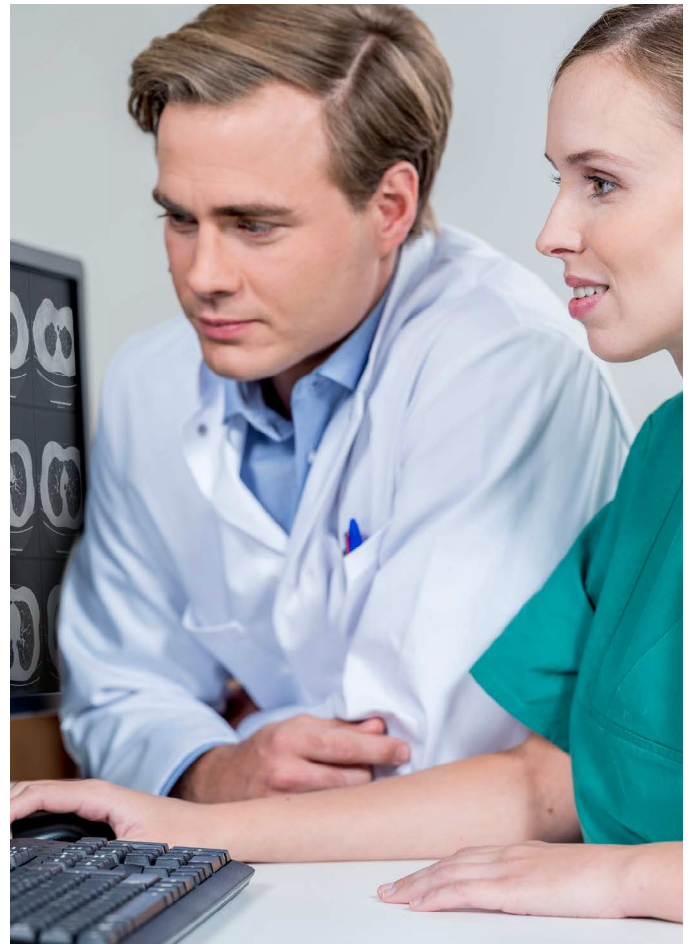
to develop skills that enhance patient care. Also, synchronising different systems with varied capabilities can be very difficult, and auditing can also be quite complex.

Clinical Drivers

Physicians and clinicians are ultimately the ones who need patient imaging records. Switching from system to system to find, compare and diagnose images and then make treatment decisions based on those images can be time-consuming, cumbersome and extremely inefficient. The goal of an imaging record system should be to provide easier access to all images so that clinicians can focus on adding value rather than spending their time browsing through different systems.

Advantages of Converged Image Management

Image management systems have one basic purpose: to acquire, store and display images. A consolidated system such as Enterprise Imaging converges image collection, storage, management and sharing. This is delivered through a scalable and

of both staff and patients. Longitudinal patient imaging records also eliminate redundancies and enrich the strength and impact of multi-disciplinary teams. Enterprise Imaging also offers an intuitive and powerful viewer for image-enabling the EHR.

Building a Tailored and Robust Strategy with Enterprise Imaging

While each hospital has its unique needs, Enterprise Imaging allows healthcare organisations to build a robust imaging strategy, step-by-step:

Step 1: Converging radiology imaging ecosystem through PACs, advanced image processing, reporting, clinical applications, collaboration tools, analytics and more.

Step 2: Converging cardiology imaging into a single system through the use of third-party solutions, thus optimising the use of services such as Cath lab, CT, MRI, ultrasound, nuclear medicine and ECG.

Step 3: Offering a consolidated platform with an enterprise-level

---

A consolidated system such as Enterprise Imaging converges image collection, storage, management and sharing

---

centralised platform, reducing the technical complexity, IT footprint and cost of the imaging ecosystem while increasing efficiency. At the end of the day, the ultimate goal is to enhance physician satisfaction and patient care.

Here are a few advantages of a converged Enterprise Imaging approach:

Reduced complexity and total cost of ownership

Enterprise Imaging allows the use of lower-cost storage alternatives such as tiered or cloud models. It also optimises storage utilisation and eliminates duplicate storage. In addition, a centralised system is less costly and takes less time to manage and run. Security and data privacy is also much easier on a centralised platform, and data recovery is simpler and faster. Finally, Enterprise Imaging supports non-orders based workflows. Therefore, integrating these into the billing system and workflow improves the payment and reimbursement process.

Increased operational efficiency

Using a standardised approach for image capture, storage and quality across an enterprise increases the long-term value of these images and reduces the risk of duplicate exams. Also, Enterprise Imaging supports the latest industry standards, thus simplifying the integration of current and future applications. This not only makes the system more efficient, but it also reduces staff and training costs while optimising resources.

Enhanced clinical care and satisfaction

The Enterprise Imaging platform harmonises workflows and helps build a patient-centric approach to care delivery. It facilitates information sharing, multi-disciplinary cooperation and patient engagement and improves the overall experience

VNA combined with a universal viewer providing care providers access to multimedia patient information they need, anywhere, anytime – including at the point of care.

Step 4: Driving imaging workflows of other departments and service lines, making them standardised and stored centrally in the VNA.

Step 5: Allowing cross-enterprise imaging sharing within a hospital network and routing and sharing workflow support to better manage data.

Overall, Enterprise Imaging offers a new strategic pathway to hospitals. It can be applied based on the hospital's immediate economic, technical, operational and clinical priorities and their objectives and current situation. Whether it's overstressed IT resources, low clinical productivity, missed financial reimbursements, declining referrer loyalty or staff or patient dissatisfaction, Enterprise Imaging offers the path to achieve organisational goals smoothly and efficiently. ■

Biparametric MRI: A New Standard for Prostate Cancer Imaging?

🔹 **Author:** **Arnaldo Stanzione ❙ Department of Advanced Biomedical Sciences ❙ University of Naples Federico II ❙** Naples, Italy

🔹 **Author:** **Vincenzo D'Ambrosio, MD ❙ Department of Advanced Biomedical Sciences ❙ University of Naples Federico II ❙** Naples, Italy

🔹 **Author:** **Renato Cuocolo ❙ Department of Clinical Medicine and Surgery ❙ University of Naples Federico II ❙** Naples, Italy

A lone and discordant voice supported by few at first, biparametric prostate magnetic resonance imaging has been gradually gaining attention and visibility as a reliable, faster, and cheaper alternative to conventional multiparametric magnetic resonance imaging and could become a new standard of care in the near future.

☑ Key Points

- The role of magnetic resonance imaging has grown over the years for detection and characterisation of prostate cancer.

- An imaging protocol without the need for contrast agent administration could lower the costs and time requirements, aiding wide scale adoption.

- Recent studies support the use of biparametric magnetic resonance imaging for prostate cancer screening and active surveillance.

- Implementation of biparametric MRI could improve availability of the exam to the public and ease workload organisation as demand continues to rise.

Introduction

Magnetic resonance imaging (MRI) has long-established its valuable role as the imaging cornerstone in prostate cancer management, with the main current application being lesion detection for biopsy guidance (EAU Guidelines 2019). However, MRI could also play a role in other settings, ranging from prostate cancer local staging to diagnosis of disease recurrence after treatment. Overall, its recognition and reliability have led to the development of new diagnostic pathways which are favourably considered by both patients and physicians. This is at least partly due to the efforts made towards the standardisation of the imaging acquisition protocol and interpretation culminated in the release of the Prostate Imaging Reporting and Data System (PI-RADS) guidelines (Turkbey et al. 2019). These have undergone several revisions over the years, and the current proposed standard of care is represented by multiparametric magnetic

resonance imaging (MRI). This consists of a protocol based on three sequences (T2, diffusion and perfusion-weighted imaging). Unfortunately, this approach requires a relatively long scan time on average as well as the administration of a gadolinium-based contrast agent, with a consequent impact on exam cost and safety. To overcome these downsides of multiparametric MRI, the use of alternative protocols without the use of contrast agents has been proposed, broadly referred to as biparametric MRI. Embracing this approach could have advantageous financial implications and increase the accessibility of prostate MRI exams without sacrificing overall diagnostic accuracy (Porter et al. 2019; van der Leest et al. 2019).

Prostate Cancer Screening and Lesion Detection

The adoption of multiparametric MRI for prostate cancer detection has become widespread since its use is recommended

both before the first biopsy and in case of persisting clinical suspicion before a re-biopsy (EAU Guidelines 2019). Evidence suggesting that biparametric MRI could replace multiparametric MRI in this setting has been piling up, with recent meta-analyses confirming that there is no significant difference in terms of diagnostic accuracy between these two strategies (Cuocolo et al. 2021; Alabousi et al. 2019). It has also been highlighted that pre-biopsy biparametric MRI can adapt well to clinical practice and aid in the stratification of risk (Choi et al. 2020). A prospective clinical trial confirmed that biparametric MRI is a superior screening test compared to prostate-specific agent or ultrasound (Eldred-Evans et al. 2021). Nevertheless, current guidelines still underscore that multiparametric MRI should be preferred in a wide range of clinical scenarios (Turkbey et al. 2019). This is in contrast with the findings of a work specifically focused on the PI-RADS v2.1 scoring system, reporting that the interobserver reliability and diagnostic performance of biparametric MRI was comparable with those of multiparametric MRI for prostate cancer detection (Tamada et al. 2021; Perez et al. 2020).

Prostate Cancer Staging and Detection of Local Recurrence

While prostate MRI has the ability to assess the local extension of prostate cancer, its accuracy is not as high as desirable. A recently proposed scoring system (EPE grade) could help standardise and increase the value of MRI in this setting, just like PI-RADS did for cancer detection. As for biparametric MRI, it appears that the lack of contrast enhanced images does not negatively impact the accuracy of the exam (Christophe et al. 2020; Stanzione et al. 2019). This is probably related to the fact that most signs of local invasiveness are better evaluated on T2 weighted images.

There is an overall lack of studies assessing the role of biparametric MRI for patient treated with either radical prostatectomy or radiation therapy and at risk of local recurrence. The main reason behind this is that the sensitivity of T2 weighted images for detection of recurrence is rather low, as fibrous scar tissue can mimic recurrence. Similarly, diffusion weighted imaging is not as reliable for the detection of tumoural tissue after treatment. On the other hand, dynamic contrast enhanced images are considered the most accurate for the detection of local recurrence (Panebianco et al. 2021).

Active Surveillance

Given the biological behaviour of prostate cancer, there is a significant proportion of low-grade lesions that may be managed with an active surveillance approach. These patients traditionally underwent periodical systematic biopsies of the prostate to identify eventual disease progression. Recent trials have shown that the MRI-targeted biopsies provide an added value during active surveillance, improving patient management (Klotz et al. 2019). The increased workload due to this practice, however, may be challenging to manage and biparametric MRI may prove a valuable optimisation in terms of acquisition time and exam scheduling in busy radiology departments. A study conducted in the United Kingdom reported a 55% reduction in scan time, significantly increasing the number of scans performed weekly (Sushentsev et al. 2020).

Conclusions

The increased demand for MRI is supported by current evidence in literature for a wide range of applications in prostate cancer patients. While current imaging guidelines advocate for the administration of contrast agents, biparametric MRI has also gained attention and recognition as a viable alternative in selected patients. This implementation of MRI could improve availability of the exam to the public and ease workload organisation as demand continues to rise.

Conflict of Interest

None. ∎

REFERENCES

Alabousi M, Salameh JP, Gusenbauer K et al. (2019) Biparametric vs multiparametric prostate magnetic resonance imaging for the detection of prostate cancer in treatment-naïve patients: a diagnostic test accuracy systematic review and meta-analysis, BJU Int, 124:209-220.

Choi MH, Lee YJ, Jung SE (2020) Tracking Changes in Clinical Practice Patterns Following Prebiopsy Biparametric Prostate MRI, Acad. Radiol, 27:1255–1260.

Christophe C, Montagne S, Bourrelier S et al. (2020) Prostate cancer local staging using biparametric MRI: assessment and comparison with multiparametric MRI, Eur. J. Radiol,. 132: 109350.

Cuocolo R, Verde F, Ponsiglione A et al. (2021) Clinically Significant Prostate Cancer Detection With Biparametric MRI: A Systematic Review and Meta-Analysis, Am. J. Roentgenol, 1–14.

Eldred-Evans D, Burak P, Connor MJ et al. (2021) Population-Based Prostate Cancer Screening With Magnetic Resonance Imaging or Ultrasonography, JAMA Oncol, 7: 395.

EAU Guidelines. Edn. presented at the EAU Annual Congress Barcelona 2019. Available from https://uroweb.org/guideline/prostate-cancer

Klotz L, Loblaw A, Sugar L et al. (2019) Active Surveillance Magnetic Resonance Imaging Study (ASIST): Results of a Randomized Multicenter Prospective Trial, Eur. Urol, 75:300–309.

Panebianco V, Villeirs G, Weinreb JC et al. (2021) Prostate Magnetic Resonance Imaging for Local Recurrence Reporting (PI-RR): International Consensus -based Guidelines on Multiparametric Magnetic Resonance Imaging for Prostate Cancer Recurrence after Radiation Therapy and Radical Prostatectomy, Eur. Urol. Oncol.

Perez IM, Jambor I, Kauko T et al. (2020) Qualitative and Quantitative Reporting of a Unique Biparametric MRI: Towards Biparametric MRI-Based Nomograms for Prediction of Prostate Biopsy Outcome in Men With a Clinical Suspicion of Prostate Cancer (IMPROD and MULTI-IMPROD Trials), J. Magn. Reson. Imaging, 51:1556–1567.

Porter KK, King A, Galgano SJ et al. (2019) Financial implications of biparametric prostate MRI, Prostate Cancer Prostatic Dis.

Stanzione A, Ponsiglione A, Cuocolo R et al. (2019) Abbreviated Protocols versus Multiparametric MRI for Assessment of Extraprostatic Extension in Prostatic Carcinoma: A Multireader Study, Anticancer Res, 39:4449–4454.

How Consistent is Medical Information on the Internet?
Case Study: Amyloidosis on Portal of Mayo Clinic et al.

◆ Author: **Miroslav Mađarić | Member of Management Board | Croatian Society for Medical Informatics | **Zagreb, Croatia

◆ Author: **Vesna Nesek-Mađarić | Member | Croatian Chamber of Physicians |** Zagreb, Croatia

In the age of constantly accessible Internet, would-be patients and healthcare professionals often "Google it" when faced with an ailment or an unusual symptom or condition. In order to test how reliable and consistent the information is that is found there, we conducted a review of several Internet-based information sources which combine symptoms and underlying causes (diagnoses, diseases). As our findings show serious inconsistencies in symptoms/diseases mapping, we propose solutions for how to remedy this issue and suggest ways to make medical information on the Internet more secure and useful for both patients and healthcare providers.

✓ Key Points

There is obvious lack of consistency in medical information presented on Internet, therefore:

- Integral symptoms/diagnoses database must be established.

- Wordings of all terms must be checked and corrected (synchronised), preferably by using some standard classification or nomenclature.

- Both views should "look" at the same information source,

where appropriate IT solutions are to be implemented aimed at ensuring information quality and security.

- "Symptoms' view" has priority to be corrected, due to its prevailing importance over "diagnosis/condition view".

- Symptoms feed directly from patients after they have a confirmed diagnosis is operationally advantageous.

- All portals must establish the feedback feature where users can report deficiencies experienced.

Introduction

This research was induced by a medical case which began when the patient reported severe unexplained weight loss. This was followed by a long diagnostic process, conducted in very different directions, including colonoscopies and major surgery on the patient's bowels after suspicion of cancer. This final procedure and following histopathology finding turned out to be negative. After the patient experienced renal failure, a kidney biopsy was performed with subsequent complications. This specimen revealed amyloidosis as the diagnoses

and because of the known association to multiple myeloma, the patient was quickly forwarded to haematology. Multiple myeloma was subsequently diagnosed, which was the underlying cause of secondary amyloidosis. As a result of the belated diagnosis and delayed start of treatment of the patient (nearly 8 months after detecting symptoms), there was severe and partially non recoverable damage to multiple organs.

The delay in diagnosis and treatment was due in large part to the lack of association of the initial symptom and the condition. We searched possible causes of unexplained

weight loss, consulting many online sources. The base for the review was our experience with the Mayo Clinic portal for patients (MayoClinic.org 2021). When we searched specifically for causes of unexplained weight loss, 23 possible causes of this symptom were listed; unfortunately amyloidosis was NOT mentioned at all (Figure 1.)

Causes

By Mayo Clinic Staff

Unexplained weight loss has many causes, medical and nonmedical. Often, a combination of things results in a general decline in your health and a related weight loss. Sometimes a specific cause isn't found.

Usually, an unrecognized cancer will have other symptoms or abnormalities of laboratory tests, in addition to unexplained weight loss.

Potential causes of unexplained weight loss include:

- Addison's disease (adrenal insufficiency)
- Cancer
- Celiac disease
- Changes in diet or appetite
- Changes in sense of smell
- Changes in sense of taste
- COPD (chronic obstructive pulmonary disease) exacerbation — worsening of symptoms
- Crohn's disease (a type of inflammatory bowel disease)
- Dementia
- Dental problems
- Depression (major depressive disorder)
- Diabetes
- Heart failure
- HIV/AIDS
- Hypercalcemia
- Hyperthyroidism (overactive thyroid)
- Hypothyroidism (underactive thyroid)
- Medications
- Parkinson's disease

Figure 1. Screenshot from Mayo Clinic "Symptoms A-Z" chapter for the entry: "Amyloidosis"

It was quickly found that the way to view to this information via symptoms is not consistent with that of the information found via disease and conditions, where in one symptom description page all related diseases (diagnoses) should be listed. In order to illustrate the inconsistencies, this paper is focused on the association between: diagnosis "Amyloidosis" and symptom "Unexpected weight loss".

The symptom mentioned can be seen in "diseases view"

(diagnosis "Amyloidosis"). The opposite "symptoms view" for "weight loss" does not yield diagnosis "amyloidosis" in the list of dozens of diagnoses listed. In the Mayo Clinic portal, this inconsistency is common practice: the same applies for "amyloidosis" also for the symptom "leg swelling" etc. In addition, inconsistency in naming the symptoms (as well as other entities) was detected. "Symptom Checker" page on the Mayo Clinic website offers very poor information with only 28 symptoms listed in total.

It is understandable that all symptoms cannot be mapped completely with all associated diagnoses, especially if a rare disease is concerned, such as secondary amyloidosis. However, after obtaining the respective diagnosis, the Mayo Clinic source was consulted again, with the result depicted in Figure 2.

Symptoms

You may not experience signs and symptoms of amyloidosis until the condition is advanced. When signs and symptoms are evident, they depend on which of your organs are affected.

Signs and symptoms of amyloidosis may include:

- Swelling of your ankles and legs
- Severe fatigue and weakness
- Shortness of breath with minimal exertion
- Unable to lie flat in bed due to shortness of breath
- Numbness, tingling or pain in your hands or feet, especially pain in your wrist (carpal tunnel syndrome)
- Diarrhea, possibly with blood, or constipation
- Unintentional weight loss of more than 10 pounds (4.5 kilograms)
- An enlarged tongue, which sometimes looks rippled around its edge
- Skin changes, such as thickening or easy bruising, and purplish patches around the eyes
- An irregular heartbeat
- Difficulty swallowing

Purpura around the eyes
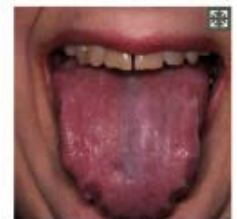
Enlarged tongue

Figure 2. Screenshot from Mayo Clinic "Diseases & Conditions A-Z" chapter for the entry: "Amyloidosis"

The search for "Amyloidosis" yielded the article "What is amyloidosis and 10 signs you might have it" published on the Mayo Clinic website (Sparks 2019), where "unintentional weight loss", is listed as the third most frequent/important symptom:

"***Unintentional, significant weight loss***. *If you're losing protein from your blood, you may lose your appetite and, as a result, lose weight without trying. If amyloidosis affects your digestive system, it can also affect your ability to digest your food and absorb nutrients. It's common to lose 20 to 25 pounds.*" In the article, the author Dr Dana Sparks rightfully directs patients as follows: "Many of these signs and symptoms may be caused by other conditions. But if you experience any of

them, talk with your healthcare provider about whether they might be caused by amyloidosis."

Materials and Methods

Based on the patient case presented in the introduction, research was made on the following internet portals/sites/platforms which render the "symptoms checker" service or similar:

- Mayo Clinic
- WebMD
- NHS
- PatientsLikeMe

Material mentioned was analysed according to the aim of this paper to map between symptoms and diagnoses. This analysis was made in both directions: First the symptoms were found in the diagnosis (disease) description, and subsequently these symptoms descriptions were checked against diagnoses. This "test" resulted in "passed" if the same diagnosis was found in both searches. Analysis process is shown in Figure 3.

While the main focus of the analysis was on the symptom and final diagnosis of the case in discussion (unintentional weight loss and amyloidosis), some lateral symptom/diagnosis pairs were also examined, with the aim to find evidence of other general inconsistencies.
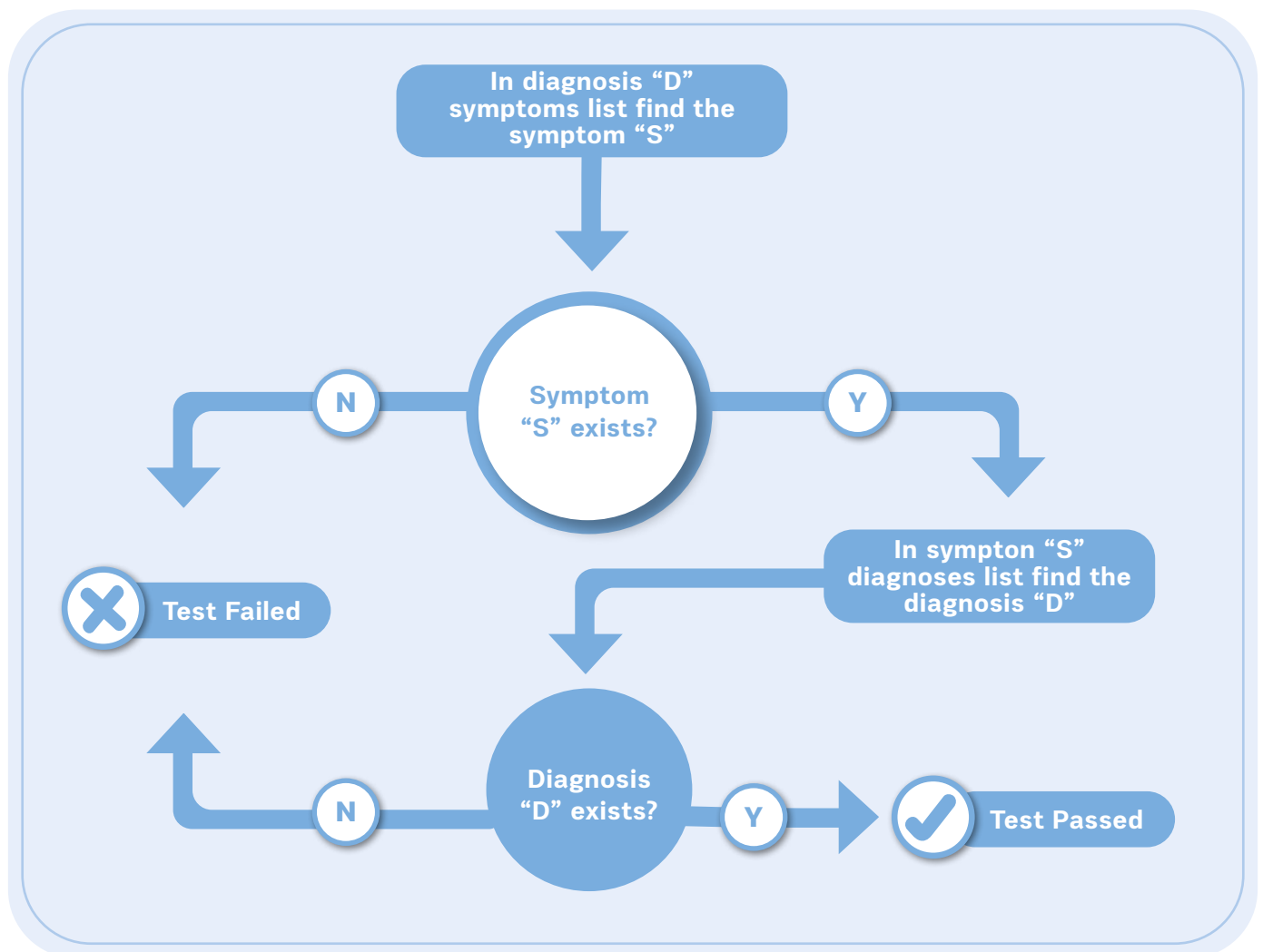
Figure 3. Symptoms/diagnoses mapping testing process

Results

According to the materials and methods described, here the results are presented, for each and every web page examined and tested against consistency of symptoms/diagnoses mapping. From Table 1, we see that there are several types of inconsistencies. Either the diagnosis is not mentioned in the symptom's description page, or the symptom mentioned in the diagnosis page is not existent in the symptoms list. The wording of symptoms is also inconsistent. Here we observe not less than five different wordings:

- "Unintentional weight loss" (in amyloidosis chapter)
- "Unexpected weight loss" (in symptoms list entry)
- "Unintentional, significant weight loss" (in Dana Sparks' paper)
- "Weight loss" (in sarcoidosis chapter, even directing on "Obesity")
- "Losing weight without trying" (Lung cancer chapter)

SYMPTOMS MENTIONED ON MayoClinic.org	RESPONSES
Swelling of ankles and legs	- Amyloidosis not mentioned - Ankle swelling symptom not listed
Severe fatigue and weakness	- Amyloidosis not mentioned - Weakness symptom not listed
Shortness of breath with minimal exertion	- Amyloidosis not mentioned - Symptom not listed
Unable to lie flat in bed due to shortness of breath	- Symptom not listed
Numbness, tingling or pain in hands or feet, especially pain in wrist (carpal tunnel syndrome)	- Correct mention of amyloidosis - Symptoms not listed
Diarrhoea, possibly with blood, or constipation	- Correct mention of amyloidosis - Constipation symptom not listed
Unintentional weight loss of more than 10 pounds (4.5 kilograms)	- Amyloidosis not mentioned as a cause
An enlarged tongue, which sometimes looks rippled around its edge	- Enlarged tongue symptom not listed
Skin changes, such as thickening or easy bruising, and purplish patches around the eyes	- None of these symptoms are listed
An irregular heartbeat	- Symptom not listed
Difficulty swallowing	- Symptom not listed

Table 1. Symptoms mentioned in "amyloidosis" chapter of Mayo Clinic website and their appearance in its symptoms chapter (causes list for specific symptom)

Of course, neither "weight loss" nor "losing weight without trying" can be found in the symptoms list on Mayo Clinic portal. This means that sarcoidosis and lung cancer also cannot be added to the differential diagnoses list searching with such wording via symptoms. In addition, when we look for "weight loss" in the Mayo Clinic symptoms list, we also obtain a misleading result: "Weight loss (See: Obesity)". Given these numerous issues, it is unclear why the Mayo Clinic has not implemented systematic quality control of their health and medical information intended for the broader public.

Proposed Solutions

In this situation, best practice would be to adhere to some standard, for instance ICD-10, R-classification. There are more than 700 hundred symptoms presented in a scrutinised manner. Focussing on the instance researched – "weight loss" – ICD-10-R uses standard wording "abnormal weight loss". It is up to medical experts to evaluate whether the naming in Mayo Clinic portal for this instance corresponds fully to this standard symptom wording, but the final aim is to have it appear consistently in different parts of website.

Here we want to mention one more deficiency of Mayo Clinic symptoms presentation. It relates to the "See also" caption, which we can see in the "Causes" table, as depicted in Figure 4.

See also

6 tips to manage rheumatoid arthritis symptoms

Acanthosis nigricans

Addison's disease

Adjuvant therapy for cancer

Adrenal fatigue: What causes it?

Alcoholic hepatitis

Alternative cancer treatments: 10 options to consider

Amputation and diabetes

Amyloidosis

Angina

Anorexia nervosa

Antidepressant withdrawal: Is there such a thing?

Antidepressants and alcohol: What's the concern?

Antidepressants and weight gain: What causes it?

Antidepressants: Can they stop working?

Figure 4. Caption "See also" first page in Mayo Clinic symptoms webpage

As we can see, amyloidosis is listed here, but is among 300 other different symptoms, diagnoses, laboratory tests, conditions and other medical terms. Finding "amyloidosis" on the first page of this list is pure luck, because it begins with the letter "A". This list is very questionable because of the example "Acanthosis nigricus", which has, according to its description in the Mayo Clinic portal, only one symptom is mentioned and it has nothing to do with "Unintentional weight loss". The same applies also for "angina" and a majority of the other terms listed here. Opposite inconsistency is observed for "sarcoidosis": despite the fact that in the disease description "weight loss" is mentioned, in the symptom "unexpected weight loss" lists for "Causes" and "See also" this diagnosis does not appear. This "See also" list is huge and irrelevant and represents a kind of "information noise" that can only confuse the reader.

Amyloidosis is not the only diagnosis which demonstrates inconsistency in searching it through the symptoms list. The same is observed also in the case of very common diseases, such as GERD (Gastroesophageal reflux disease). One of the symptoms mentioned here is "Regurgitation of food or sour liquid", however neither symptom nor any of its keywords was mentioned in the symptoms list.

There are also numerous instances of such inconsistencies in symptom/diagnosis "intersections". As an example, the field of neurology was also examined, for a common disease such as multiple sclerosis. In the disease chapter, the symptom "tremor" was mentioned, while in the symptoms chapter, such symptom is not listed at all. Another manifestation of inconsistency for the diagnosis "multiple sclerosis" is the symptom "dizziness". This common symptom was mentioned in the diagnosis chapter, but in the list of diagnoses stated as the cause of this symptom, it is not noted at all.

On the Mayo Clinic website, we also found the service called "Symptom checker". Unfortunately, the content of this service is extremely poor. It consists out of only 28 different symptoms for adults, as can be seen on Figure 5. On the other hand, in the general symptoms table, there are some 300 different symptoms, whereas there are about 700 in ICD-10.

Similar inconsistencies were observed in another health information source – the NHS. On the amyloidosis webpage we examined the symptom "weight loss". In the disease description, the symptom "loss of appetite" was mentioned, but when looking backwards in this symptom page, amyloidosis was not mentioned. In addition, this symptom naming is not recognised by ICD-10 at all.

On this portal similar inconsistency was observed related to "Carpal tunnel syndrome", which was mentioned among "other symptoms" of amyloidosis. But if one goes to the symptoms page, there is no mentioning of amyloidosis.

Another source examined on the issue of consistency of medical information is the portal PatientsLikeMe. A platform with a data feed (also) from patients can be very useful for building a proper database of symptom/diagnosis associations. On the PatientsLikeMe portal, this could be implemented rather than the current one depicted in Figure 6. The PatientsLikeMe symptoms' page presented in Figure 7. is very questionable, as it can direct the patient to take some

1
CHOOSE A SYMPTOM

2
SELECT RELATED FACTORS

3
VIEW POSSIBLE CAUSES

Adult Symptoms

Abdominal pain in adults
Blood in stool in adults
Chest pain in adults
Constipation in adults
Cough in adults

Diarrhea in adults
Difficulty swallowing in adults
Dizziness in adults
Eye discomfort and redness in adults
Eye problems in adults

Foot pain or ankle pain in adults
Foot swelling or leg swelling in adults
Headaches in adults
Heart palpitations in adults
Hip pain in adults

Knee pain in adults
Low back pain in adults
Nasal congestion in adults
Nausea or vomiting in adults
Neck pain in adults

Child Symptoms

Abdominal pain in children
Constipation in children
Cough in children
Diarrhea in children
Ear problems in children

Earache in children
Eye discomfort and redness in children
Eye problems in children
Fever in children
Headaches in children

Joint pain or muscle pain in children
Nasal congestion in children
Nausea or vomiting in children
Skin rashes in children
Sore throat in children

Urinary problems in children
Wheezing in children

Figure 5. Screenshot of Mayo Clinic symptom checker

Figure 6. Symptoms' presentation in the disease page in PatientsLikeMe
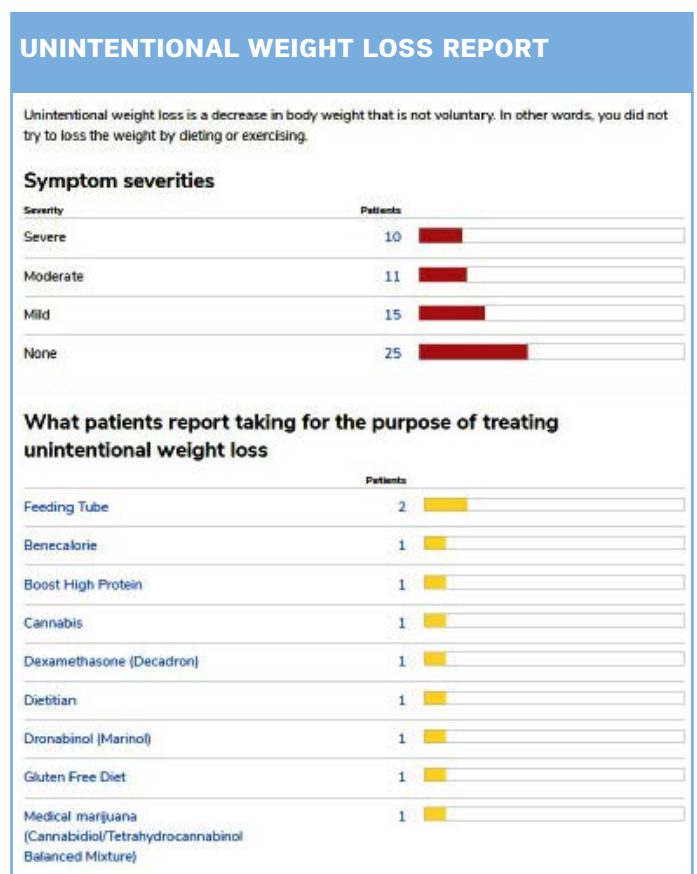
Figure 7. Symptoms' representation in the symptom page in PatientsLikeMe

steps by him/herself, instead of offering information about possible causes of this symptom. This page neglects a very straightforward diagnostic process, where first two steps are as follows:

1. Gather all information about the patient and create a symptoms list. The list can be in writing or in the clinician's head.
2. List all possible causes (candidate conditions) for the symptoms.

This "list of all possible causes" or "candidate conditions" is what is missing in all of the internet services researched. Furthermore, after these first two steps, clinicians must then prioritise what should happen and then eliminate or confirm diagnosis, mostly based on laboratory tests and imaging procedures. The fifth and sixth steps are finally the diagnosis and therapy. (en.wikipedia.org 2021)

On portals such as PatientsLikeMe, the middle steps are neglected, and the patient gets information about how some other patient treated, without experiencing their own actual diagnosis.

The architecture of PatientsLikeMe is deficient despite the fact that this website has complete symptoms and diagnoses information from patients, as shown in Figure 8.

Unlike the Mayo Clinic portal, PatientsLikeMe does not have a "symptoms view", which could support medical doctors in a differential diagnosis search. This is despite the availability of such information in their database and the best practice of presenting information in a reliable way, meaning with integrity and transparency.

Discussion

Authors tried to get feedback about the main points set out in this paper from the medical sources mentioned. Reaction was poor. In addition, several medical experts and end users representing patients were consulted concerning the issue of inconsistencies observed. Within the Croatian Society for

unintentional weight loss" symptom in PatientsLikeMe

Medical Informatics all issues will be discussed further in a forum and these round table conclusions will be presented in separate paper.

In concluding this discussion about the issue researched, medical doctors should answer one very simple question related to the purpose of this research: "Is there any medical reason to mention a symptom in disease description and NOT to mention this very disease in this symptom's causes list?"

A negative answer denotes the evidence that this issue was worth being researched. A positive answer must also give arguments as to why the information about the symptom in

- Links between symptoms and diseases should be presented as a quantitative measure of the "association strength" (in the next improvement phase)

Of course, such long list of suggested actions should be prioritised, "low hanging fruit" principle can be taken into account. In the case we analysed here, elementary information "cell" is the intersection of diagnosis and symptom. It would be a great advantage to state the strength of such an association as in Table 2. e.g. what is the percentage of detected weight loss symptom in diagnosed amyloidosis?

If the online list of diagnoses associated with "unintentional weight loss" was complete, the pathologist may have considered amyloidosis much sooner

disease webpage is of some value, but the opposite is not.

The success of the diagnostic procedure relies heavily on the importance of clinicians obtaining as much information about the patients' symptoms as possible, as well as the availability of a complete diagnostic hypothesis list.

Conclusion and Recommendations

There are obvious deficiencies in numerous medical portals which deal with symptoms/diagnoses mapping. In the case study noted, these shortcomings led to a kind of "malpractice" wherein the tissue from biopsy was not tested with Congo red stain for amyloidosis. While this is somewhat understandable because amyloidosis is a really rare disease and the working diagnosis was cancer. However, if the online list of diagnoses associated with "unintentional weight loss" was complete, the pathologist may have considered amyloidosis much sooner, after not finding another diagnosis.

Therefore, all subjects responsible for medical portals are strongly recommended to remove this architectural shortcoming by implementing improvements as follows:

- Integral symptoms/diagnoses database must be established
- Wordings of all terms must be checked and corrected (synchronised), preferably by using some standard classification or nomenclature
- Both views should "look" at the same information source, where appropriate IT solutions are to be implemented aimed at ensuring information quality and security
- "Symptoms' view" type webpages corrections should be prioritised, as they are highly accessed by patients and more important than other views
- Symptoms feed directly from patients after they have a confirmed diagnosis is advantageous
- All portals must establish the feedback feature where users can report deficiencies experienced

Diseases > Symptoms V	Amyloidosis
Unintentional weight loss	1,23 % / 3,21 %

Table 2. Example depicting data association in table diagnosis/symptom (percentages are exemplary)

In this exemplary (fiction) case, the symptom/diagnosis can be indicated as follows:

- By the onset of the symptom "unintentional weight loss", there are 1,23 % cases with diagnosis "amyloidosis" and vice versa.
- By the diagnosis "amyloidosis", 3,21 % patients reported the symptom "unintentional weight loss".

Of course, there is considerable work ahead to obtain these figures. Here, we return to the importance of information coding and standard medical terms wording. In the digital era, more information is entered by clicking on the screen rather than by writing free text on white paper. Without dictating how medical doctors will enter data in medical records, another possibility is to promote standard "free text" wording, which can be a posteriori analysed by algorithmic or AI based solutions. This can lead to obtaining a database with data structure, to which a simple model is depicted in Table 2.

The process of gathering data and preparing informat should be designed as follows:

- MDs are asked about symptoms observed in diseases from their fields of expertise
- Previous symptom/disease data can be supplemented with patients' personal experience
- This data is gathered and table diseases/symptoms is formed

- Diagnoses and symptoms have to be structured and named according to some official classification/nomenclature, preferably ICD-10

This process is substantially simpler compared to the one obviously used until now, yielding correct information for all groups of stakeholders (patients, medical doctors, students). The lack of values indicating the strength of symptom/diagnosis association should not hinder the efforts for immediate improvement of the systems mentioned. Until such figures will be available, instead of percentage only some kind of "X" in the crossing cell can be checked. This is nothing new, all these data exist in Mayo Clinic portal or other medical resources on the Internet. An example of such service can be seen in this prototype, developed with partial Mayo Clinic data available, and seen in screenshots in Figure 9.

Conflicts of Interest

None. ◼
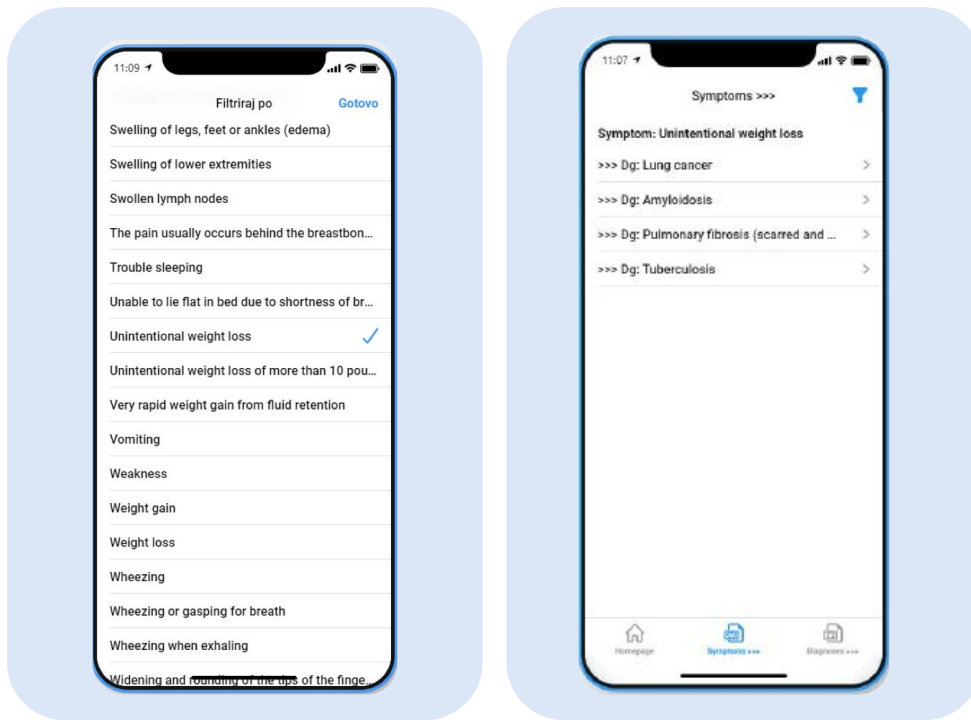
Figure 9. App prototype for symptom/diagnosis check (based on Mayo Clinic data – partial)

REFERENCES

Balogh EP, Miller BT, Ball JR (editors) (2015) Improving Diagnosis in Health Care. Committee on Diagnostic Error in Health Care; Board on Health Care Services; Institute of Medicine; The National Academies of Sciences, Engineering, and Medicine; Washington (DC): National Academies Press (US); 2015 Dec 29. 2, The Diagnostic Process. Available at: ncbi.nlm.nih.gov/books/NBK338593/ (accessed 5.5.2021)

CDC ICD-10 Index. Chapter: Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified (R00–R99). Available at: icdlist.com/icd-10/index/symptoms-signs-abnormal-clinical-laboratory-findings-not-elsewhere-classified (accessed 5.5.2021)

Kern J, et al. (2021) 'Declaration on eHealth. 1st Revision', Bilten Hrvatskog društva za medicinsku informatiku (Online), 27(1), pp. 1-9. Available at: hrcak.srce.hr/253259 (Accessed 5.5.2021)

Mayo Clinic, Amyloidosis description in HEALTH A-Z page. Available at: mayoclinic.org/diseases-conditions/amyloidosis/symptoms-causes/syc-20353178 (accessed 2.5.2021)

Mayo Clinic Lung cancer description in HEALTH A-Z page. Available at: mayoclinic.org/diseases-conditions/lung-cancer/symptoms-causes/syc-20374620 (accessed 7.5.2021)

Mayo Clinic Oesophageal cancer disease symptom page. Available at: mayoclinic.org/diseases-conditions/esophageal-cancer/multimedia/esophageal-cancer-infographic/ifg-20442996 (accessed 2.5.2021)

Mayo Clinic Sarcoidosis description in HEALTH A-Z page. Available at: mayoclinic.org/diseases-conditions/sarcoidosis/symptoms-causes/syc-20350358 (accessed 7.5.2021)

Mayo Clinic Symptoms chapter in HEALTH A-Z page. Available at: mayoclinic.org/symptoms (accessed 5.5.2021)

Mayo Clinic Unexplained weight loss symptoms page. Available at: mayoclinic.org/symptoms/unexplained-weight-loss/basics/definition/sym-20050700 (accessed 2.5.2021)

NHS Unintentional weight loss symptom page. Available at: nhs.uk/conditions/unintentional-weight-loss/ (accessed 5.5.2021)

PatientsLikeMe. Available at: patientslikeme.com (accessed 5.5.2021)

Sparks D (2019) What is amyloidosis and 10 signs you might have it. Mayo Clinic; newsnetwork.mayoclinic.org/discussion/what-is-amyloidosis-and-10-signs-you-might-have-it/ (accessed 2.5.2021)

WebMD Symptoms list. Available at: symptoms.webmd.com/ (accessed 5.5.2021)

Wiki Differential diagnosis description. Available at: en.wikipedia.org/wiki/Differential_diagnosis (accessed 2.5.2021)

Digital Anamnesis: Integrating Classic History Taking with Digital Health

🔹 Author: **Henrique Martins | Editorial Board member – IT | Associate Professor | ISCTE – University Institute of Lisbon |** Portugal

🔹 Author: **Luís Lino | Medical student | Faculty of Health Sciences | University of Beira Interior |** Portugal

The "Digital Anamnesis" concept and the proposed model may have useful implications for medical education, in a medical practice and for conceptualisation of modern Electronic Health Records.

✓ Key Points

- Medical history taking is a historically, and key part of clinical practice and provides a correct diagnosis 76% of the time, when performed correctly by a doctor.

- History taking is reliant on information provided by the patient and/or the next of kin. Aging populations may suffer from memory loss, which may cause issues with information recall.

- As anamnesis means a patient's account of a medical history, the process of medical history taking using digital means would be designated ***Digital Anamnesis***.

- Data management is fundamental in a physician's practice of digital anamnesis. A systematic and oriented data extraction is directly related with increased productivity and efficiency.

- Physicians' training is a necessary step when implementing and using digital health tools and systems such as EHR. When utilised properly, it may be possible to reduce "click fatigue" and physicians' workload.

Introduction

Medical history taking has been a pillar of clinical practice for many centuries. Even now it is estimated to provide a correct diagnosis 76% of the time, when performed by a doctor with adequate communication skills (Seitz T et al. 2019). But history taking has remained mostly reliant on information provided by the patient and/or the next of kin. With the increase in life-expectancy, populations have more complex and chronic diseases which are often are associated with conditions such as dementia or age-associated progressive memory loss, which may significantly hamper the capacity for information recall and reporting (Prince et al. 2013; European Commission 2021).

Digital tools in clinical practice mean new tools for physicians to provide care. One such is the possibility to gather and store information related with care giving in online, interoperable systems. This, however, has brought changes in workflow and occasionally with risk for increased workload and fatigue (Martins 2007). Table 1 summarises findings in current literature reviews regarding use of digital tools in medical history taking (Lino and Martins 2021; Hedian et al. 2018).

Digital Anamnesis

As highly variable workflow adaptations have been found, we propose that the existence of a common referential could promote more harmonised medical history taking when exploring digitally stored information. As anamnesis means a patient's account of a medical history, the process of medical history taking using digital means would be designated ***Digital Anamnesis***. Having a clear concept and a basic model for this is very important as this can of course be

Chronology and Context of Care Giving	Different styles on e-chart review were found to be used by physicians with implications in time and efficiency.
	Increased screen time and click fatigue.
	Improved quality of care.
	Chart review prior to first face-to-face contact.
Data Management and Tools	Horizontal and vertical integration amongst peers and care teams.
	Population health management.
	Excessive downstream documentation with defensive documentation.
	Oversized notes.
	Patient-derived portals for medical history.
Challenges In Use and Information Conflict	Systems interoperability.
	Physician burnout.
	Lack of common disease terminology.
	Variability in information sources.
	Copy and paste.
Doctor-Patient Relationship	Triadic relationship.
	Decline in bedside medicine.
	Improved patient safety and overall engagement.
	Little to no empathetic impact on patient's perception.

Table 1 – Findings related with medical history taking through digital tools

further matured, but serves to guide current clinical practice and education. Establishing a framework to help harmonise digital tool use, caregiving and workflows, may improve patient safety, physician's satisfaction, and workload and productivity management. A preliminary model for Digital Anamnesis has been developed based on current classic medical history taking models (Evans et al. 1993; Kurtz et al. 2003). It stems from the interconnection of three major components:

The first is the **content of the medical history to be explored via digital tools**. As classic medical history relies on the patient's ability to recall information related with the chief complaint, history of the present complaint, past medical history, family, personal and social history, drug and allergy history, functional enquiry/systems review. Digital tools have the possibility to build a virtual construct of the patient based on this information – a sort of "iPatient". This allows for the data stored within the EHRs to be systematised and facilitate the interpretation of the background in which the patient is inserted.

The second component is **the skills set needed for the exploration of data.** As physicians are the main sources of data input and output, they are required to be competent in information gathering and introduction. Thus, computer skills and literacy, multitasking and documentation managing and data selection skills for note review and entry heavily impact physicians' relationship with digital tools.

Physicians' training is a necessary step when implementing and using digital health tools and systems such as EHR. Not only is it beneficial to include written and reference material to guide the provider, but also practical lessons and opportunities should be available. This should not happen only once, but rather continuous training may improve efficiency and productivity when updates or changes are introduced in the system.

Data management is fundamental in physician's practice of

digital anamnesis. A systematic and oriented data extraction is directly related with increased productivity and efficiency. Physicians need to be educated in data input and output. Utilising the right templates to introduce the adequate information leads to easier data extraction. When conducting chart reviews, it may be possible to reduce time consumption, also known as "click fatigue" and physicians' workload.

Basic computer skills are acquirable traits that influence physician's relationship with digital tools. As defined by UNESCO "Basic computer skills courses cover the most common usages of a computer, including a majority or all of the following: understanding the basic notions of computer manipulation; managing computer files, word processing, using spreadsheets and databases; creating presentations; finding information and communicating using computers; and being aware of social and ethical implications of Internet use." (UNESCO UIS 2021). When considering EHR usage, the provider must be able to interact with the system without the need for
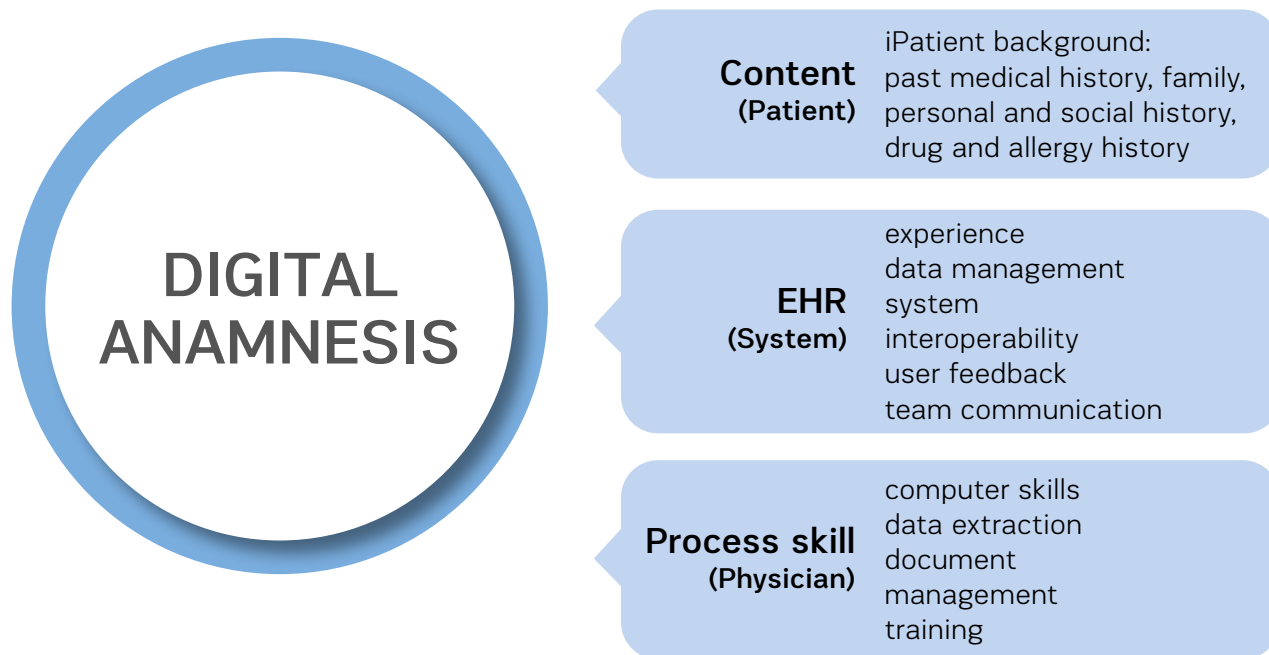
Figure 1 – Basic framework for Digital Anamnesis with interrelationship amongst content to be discovered, process skills for data exploration and digital tools

advance computer manipulation skills.

Lastly, **the interface and tools used also impact the possibility and methods for digital medical history taking**. User interface, system interoperability and data management are factors that influence efficiency when considering physicians' and digital tools relationship.

Discussion

User experience and interface influence physician's ability to quickly access information. Through user-friendly tools such as shortcut and search bars, information preview, and technical support, productivity can be increased, and fatigue decreased. It also allows data to be more readily accessible when conducting chart review. Physician's feedback should be a valuable tool when designing and reassessing EHR, contributing to system development directly.

Adequate template design can allow for intuitive data input and extraction. Medical specialty and setting of care should influence software design and architecture. As different necessities arise from urgent to inpatient to outpatient care.

Team communication and system interoperability increase information available and improve digital medical history accuracy. It also provides information from different types or care from nutritionist, to nursing, to medical information. Providers can then gather data to induce a holistic approach to care giving. Increasing patient safety and satisfaction and quality of care.Patient-derived information in EHR can also be found in some systems. This allows far greater data collection and accuracy. Nonetheless, perhaps even more fundamental than conceptualising a purely digital process of medical history taking is the consideration that doctors will need to be proficient in conducting Digital Anamnesis and hybridising it with Classic Anamnesis. As both sources can complement each other allowing for a meticulous medical history.

Conclusions

Future work is needed to evaluate possible models and templates of Digital and Classical Anamnesis hybridisation. Those can be implemented in clinical practice and medical education, such as the room used for simulations labs at UBI Medical School (Sa 2011). Medical educators should integrate this concept in students' curriculum. Future physicians' will most likely continue to rely on different digital tools to develop their practice. Furthermore, multiple associations such as the Association of American Medical Colleges (Obeso et al. 2017) have advocated that digital tool skills are necessary for junior interns. Digital tools developers may integrate this information during system development stages where priority to user friendliness and data management and security can be a point of focus.

Conflict of Interest

None. ■

REFERENCES

European Commission (2021) The 2021 Ageing Report. Economic & Budgetary Projections for the EU Member States (2019-2070). Vol. 148. 2021. 375 p.

Evans BJ, Sweet B, Coman GJ (1993) Behavioural assessment of the effectiveness of a communication programme for medical students. Med Educ. 1993;27(4):344–50.

Hedian HF, Greene JA, Niessen TM (2018) The Electronic Health Record and the Clinical Examination. Med Clin North Am. 2018;102(3):475–83.

Kurtz S, Silverman J, Benson J, Draper J (2003) Marrying content and process in clinical method teaching: Enhancing the Calgary-Cambridge guides. Acad Med. 2003;78(8):802–9.

Lino L, Martins H. (2021) Medical History Taking Using Electronic Medical Records: A Systematic Review. 2021;(X):1–11.

Martins HMG (2007) Caregiver-patient-information system triad: Conceptualising the workspace for mobile and ubiquitous computing in Health. Heal 2007 Ubiquitous Heal Aging Soc - 2007 9th Int Conf e-Health Networking, Appl Serv. 2007;299.

Obeso V, Brown D, Phillipi C, Aiyer M, Barron B, Bull J, et al. (2017) Core entrustable professional activities for entering residency Pilot Program. Toolkits for the 13 Core Entrustable Professional Activities for Entering Residency. 2017;20. Available from: aamc.org/download/484778/data/epa13toolkit.pdf

Prince M, Bryce R, Albanese E, Wimo A, Ribeiro W, Ferri CP (2013) The global prevalence of dementia: A systematic review and metaanalysis. Alzheimer's Dement [Internet]. 2013;9(1):63-75. e2. Available from: dx.doi.org/10.1016/j.jalz.2012.11.007

Sa J (2011) Teaching Non-technical Skills through Medical Simulation – Master Thesis, full text available at: ubibliorum.ubi.pt/bitstream/10400.6/1051/1/Tese%20Final.pdf

Seitz T, Raschauer B, Längle AS, Löffler-Stastka H (2019) Competency in medical history taking—the training physicians' view. Wien Klin Wochenschr. 2019;131(1–2):17–22.

UNESCO UIS [Internet] (2021) Basic computer skills [cited 2021 Jun 17]. Available from: uis.unesco.org/en/glossary-term/basic-computer-skills

Smart Circulator or Value-Driven Perspective for Patients?
Thoughts on the ethics of the digital transformation of cardiology

🔷 **Author:** **Stefan Heinemann | Professor of Business Ethics | FOM University of Applied Sciences | Spokesman | Ethics Ellipse Smart Hospital of the University Medicine |** Essen**,** Germany

Cardiology is a discipline with many opportunities; however, replacing the physician is ethically impermissible and machines must follow the measure of ethics. Only then can smart cardiology save and improve lives and make an important contribution in the world.

☑ Key Points

- Smart medicine, like all other technological innovations, must serve humanity.

- Ethical discourses and insights and corresponding consequences for action are necessary, as well as clear information for system professionals and patients alike.

- Smart cardiology is not charlatanry; it is an important step

towards a better, error-reduced, safer medicine; a medicine that draws its social license to heal from a critical-open assessment of digital technologies and their medical use.

- Cardiology is a discipline with many opportunities and a corresponding responsibility to contribute to a modern, digital, effective and ethical medicine.

Smart Medicine, Like all Other Technological Innovations, Must Serve Humanity

392 years ago, after more than 1,400 years, Galen's theory of the humors was replaced in an almost revolutionary way by a scientific treatise on the circulation of the blood - "Exercitatio anatomica de motu cordis et sanguinis in animalibus" (An Anatomical Exercise Concerning the Motion of the Heart and Blood in Animals) - by the English physician and anatomist William Harvey (although the first edition was published only 12 years after it was written, in poor quality and even with printing errors). Harvey was derided as a "circulator" (an ambiguous name that alludes to the circulation of the blood and to the Latin term of abuse "charlatan"), and his view of the heart as a central switchboard was not initially a success story, despite all the fact-oriented research geared to modern experimentation. For Galen's quasi one-way theory

of blood flow was a de facto 16th-century mindset that blood would be continuously produced in the liver, from which it would flow through the body and be consumed by the flesh. Valuable time passed before these new medical insights were ultimately accepted by patients, but also in the training of medical professionals. Of course, questions of medical ethics were also discussed during these days: Is it an unacceptable risk for patients to make these new approaches around the heart and the blood circulation in the concrete care, usable? Is this research, which is new in the Renaissance, a serious scientific procedure?

Diagnostics is constantly discovering new procedures, non-interventional methods are advancing the field, and cardiology is digital. Always technology-savvy, but now in the age of the digital transformation of medicine increasingly a digital parade discipline. Catheter techniques are being innovatively

developed, and the often difficult image situation in the operating room in particular is being improved with new hybrid forms. In this way, treatment for patients is developing in a thoroughly positive way overall. Common diseases affecting heart valves, cardiac rhythm, heart failure or coronary forms. Today, many clinical pictures benefit from digital innovations on the basis of evidence. In the Smart Hospital, Smart Cardio is a driver, so to speak. What is the perception and evaluation of this new revolution in postmodernity today?

To be sure, the research revolution of the 16th and 17th centuries is not simply identical with the data-driven, AI-oriented, and significantly accelerated opportunities - but also risks(?) - of today's further development of medicine. There is much to be said for seeing in digitisation a develop-

If the digital transformation of cardiology itself is accompanied ethically and critically, if humanity and patient outcomes are in the foreground, and if innovations are welcomed with appropriate care where they help, this development is legitimate. Digitisation is not an end in itself, but it has the inherent tendency to suggest precisely this end in itself to those who unquestioningly consider the accelerating infinitisimalism of the digitally economised world to be the first principle. Digitisation can, however - and medicine, with its professional breadth and human proximity, is perhaps the most important field of application - bring benefits where it serves legitimate purposes as a responsibly used means. Admittedly, these purposes may be in conflict with each other, and medical ethics will not be made

One of the essential challenges is to transform medicine in such a way that it can take advantage of the opportunities offered by digitisation without losing sight of the core of its own noble purpose

ment path that is less gradual than structural, one that makes the position of man in the cosmos as a whole questionable once again but more fundamentally and recommends it for reconceptualisation. After the Copernican turn, now it's AI's turn? And yet one thing is true of the discussions surrounding Harvey's old discoveries and the new digital developments: neither of them are self-propelling in the scientific community and certainly not in clinical and further care - even if today the eHealth community is certainly much broader and economically more agitated and moving. However, if it remains true that medicine as a subject between science, art and ethics secures its dignity through the primacy of ethics, this means that smart medicine, like all other technological innovations, must serve humanity. For this to happen, however, ethical discourses and insights and corresponding consequences for action are necessary, as well as clear information for system professionals and patients alike. Otherwise, even the most intelligent technology assessment will come to nothing.

Digitisation is Not an End in Itself

In this sense, the criticism of eHealth & Co. - one could subsequently speak as the older criticism of Harvey of "Smart Circulator" for the actors - can only be substantiated if ethical arguments put effect in the sense of healing and risks as well as further possible value violations into a proper relation. Where this does not happen, one must speak of a vapid, unpleasantly abstract moralism that itself forgoes its own ethical evaluation, and thus reduces opportunities for patients.

easier by digitisation, only richer in challenges. As long as humanity, closeness, warmth and care, healing and helping form the infungible primordial ground of medicine, digital innovations can only be dispensed with by arguments that are often not easy to win. How we, as finite beings on the threshold of the real digital age of autonomous systems, deal with our finiteness, whether we seek to overcome it or find ourselves in it, these questions are basic anthropological concerns which are themselves ethically oriented. Is therefore "finiteness" a "disease", "death" a "mistake" and "disease" itself mere not-yet-knowledge?

Smart cardiology is not charlatanry; it is an important step towards a better, error-reduced, safer medicine; a medicine that draws its social license to heal from a critical-open assessment of digital technologies and their medical use.

One of the essential challenges of jointly shaping a successful, healthy, equitable and sustainable future for all people is to transform medicine in particular in such a way that it can take advantage of the opportunities offered by digitisation without losing sight of the core of its own noble purpose. At the end of the day, at the very least, it will also depend on whether we domesticate the machine revolution, which is about to replace our thinking itself. If the first added values that can be generated legitimately, legally and efficiently for patients are already being talked down and hastily described as a risk, later developments that are socially hardly reversible will probably take the place of precisely these small but useful and also justifiable smart developments in medicine. In a certain sense, advocating a

smart new medicine today also helps strategically to ensure that market participants who do not attach any great importance to legitimate practices, but for whom the exploitation of legality is quite sufficient, do not gain a competitive advantage with strongly marketed offers of benefits that hardly seem to be catchable on free markets. Framework conditions that focus on central values such as dignity assume responsibility. The machines have to follow the measure of ethics, not the moral actor "man" the measure of the machines. If this central point is not lost sight of, developments such as those in cardiology can save and improve lives and ultimately make an important contribution to a world in which we are all allowed to be healthy and still human at the same time.

Replacing the moral actor "physician" is ethically impermissible since machines cannot (and probably should not) assume responsibility

and autonomy, without necessarily making innovations in medicine impossible, will form the basis in concert with good institutional activities so that those who are actually at stake, the patients (and the professionals around the system, who have a right to good work and respect), can derive at least as much benefit from these offers at a comparable price.

Ethics as a competitive advantage remains empty without concrete evidence that this idea carries in reality. Competitive advantages with at least a lesser degree of ethics remain blind, no matter how successful they may be. Therefore, the empowerment of the consumer, the customer, also has a central role to play, even if we may feel uneasy about calling the patient a customer. Because it may be today also in solidary health care systems at the end exactly so - not always and with it nothing is suspended over the employment and the quality of humans those in the system responsibility take over. But about the system itself. It would therefore be better to position oneself in such a way that the patients, who probably first have to be customers in order to be allowed to be human beings, also get this chance as enlightened good customers. And work together with doctors and nurses in a spirit of partnership - the doctor-patient-machine triangle is certainly not an entirely wrong description in this respect, but it is important that the actual priority of the doctor-patient relationship is not lost sight of in this picture, no matter how intelligent aids may be available to further shape it.

Cardiology is a discipline with many opportunities and a corresponding responsibility to contribute to a modern, digital, effective and ethical medicine. If it is reported in 2019 that artificial intelligence may detect myocardial infarctions in the ECG more reliably than cardiologists, this will be useful if it becomes clear that medicine will become better as a result and at the same time cardiologists will be prepared for this development and remain in the driver seat. Replacing the moral actor "physician" is ethically impermissible since machines cannot (and probably should not)

Conflict of Interest
The author states that no conflict of interest exists. For this article the author has not used any studies on humans or animals. ∎

Essentially literal translation but expanded of the author's paper in Heinemann S (2020) Ethische Aspekte der digitalen Kardiologie. Cardio News - Ausgabe # - 11. Dezember 2020, p. 17-18 into English by the author.

REFERENCES

Attia ZI, Kapa S, Lopez-Jimenez F et al. (2019) Screening for cardiac contractile dysfunction using an artificial intelligence-enabled electrocardiogram. Nat Med, 25:70-74.

Hannun AY, Rajpurkar P, Haghpanahi M et al. (2019) Cardiologistlevel arrhythmia detection and classification in ambulatory electrocardiograms using a deep neural network. Nat Med, 25:65-69.

Heinemann S (2020) Ethische Aspekte der digitalen Kardiologie. Cardio News, 11:17-18.

Heinemann S, Matusiewicz D (Hrsg.) (2020) Digitalisierung und Ethik in Medizin und Gesundheitswesen, MWV, Berlin.

Heinemann S (2019a): Nur noch KI kann uns heilen!(?) – Künstliche Intelligenz in der Medizin als Deus ex machina, Grands recits nouveaux oder Supertool? Der Urologe, 58(9): 1007–1015.

Heinemann S. (2019b) Grundlinien eines „Ethikatlas der digitalen Medizin und Gesundheitswirtschaft. BARMER Gesundheitswesen aktuell, 146–168.

Silvermann MD (1985) William Harvey and the Discovery of the Circulation of Blood. Clinical Cardiology, 8(4): 244-246.
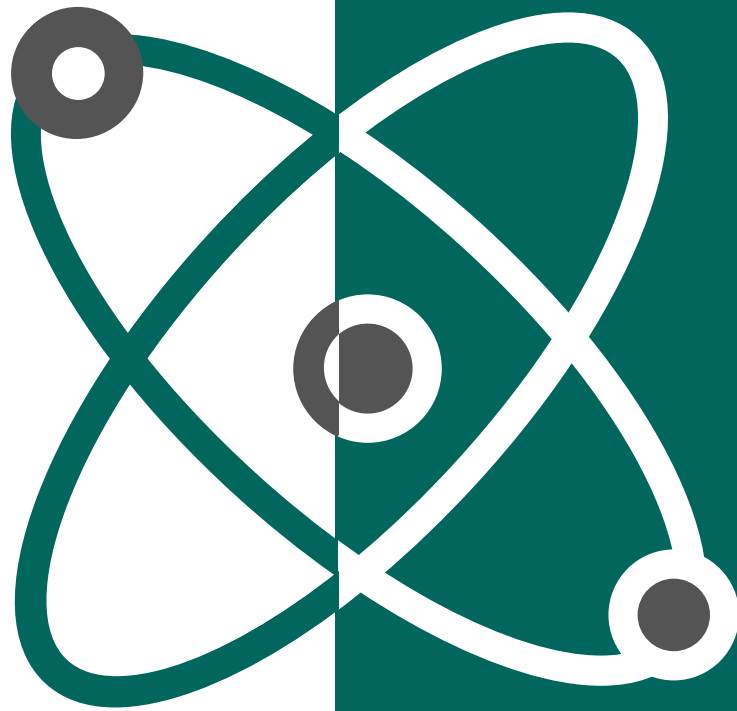
WINNING PRACTICES

Telestroke 2.0: Innovative Approach to Optimise Timing and Automate Workflow

⬡ Author: **Carla Riera Segura | Biomedical Engineer | Idonia |** Barcelona, Spain

⬡ Author: **Laura Valenzuela López | Biomedical Engineer | Idonia |** Madrid, Spain

⬡ Author: **Natàlia Pérez de la Ossa | Stroke Neurologist | Hospital Germans Trias i Pujol | Director of the Stroke Plan | Catalan Health Department |** Barcelona, Spain

Rapid stroke care that allows early detection and treatment is essential for optimal recovery and evolution of patients. For this reason, Catalonia has a telestroke network that connects regional hospitals with reference hospitals where emergency neurologists are located. Through telemedicine tools, they achieve a rapid response to possible cases of stroke occurring in the region.

✓ Key Points

- Stroke is a treatable emergency. Clinical recovery depends largely on early identification and specialised treatment, that must be initiated within the first hours from symptom onset.

- A very close coordination between different levels of care, including prehospital and hospital levels, as well as a planification and support from administrative health systems,

is crucial to achieve equitable and effective care for the population.

- Telestroke networks allow specialised care to be provided in remote locations, speeding up treatment.

- The efficacy and safety of thrombolytic treatment delivered via the telestroke connection has been shown to be similar to face-to-face care.

Introduction

Currently, stroke is the second most common cause of death in Europe and the world, and one of the leading causes of disability in adults (Allender et al. 2008; Feigin et al. 2014). According to recent statistics, approximately 1.1 million Europeans suffer a stroke each year (Béjot et al. 2016), and the incidence is estimated to increase by 34% by 2035 (Vivien 2021).

A stroke is a syndrome caused by a decrease in cerebral blood flow. This can be caused by the occlusion (partial or total) of a cerebral blood vessel caused by a blood thrombus, known as ischaemic stroke (Gutiérrez-Zúñiga et al.2019), or it can be caused by extravasation of blood to the cranial cavity as a result of the rupture of a cerebral blood vessel, the case being haemorrhagic stroke (Smith and Eskey 2011).

Diagnosis and Treatment

The diagnosis of stroke can be made clinically. The most characteristic symptoms are motor disturbances affecting facial, arm and leg (such as hemiparesis and hemiplegia), and speech disturbances (Gutiérrez-Zúñiga et al. 2019). However, these symptoms are usually present in both types of stroke, and it is imaging tests that can distinguish between cerebral ischaemia and cerebral haemorrhage.

Imaging tests (CT scans) are therefore of particular importance in the correct diagnosis of stroke, since the treatment of ischaemic stroke is different from that of haemorrhagic stroke. In the case of haemorrhagic stroke, the treatment consists of offering measures as strict control of blood pressure, giving drugs to reverse the anticoagulant effect in patients under anticoagulation treatment, and, in some cases, treating the lesion by evacuating the extravasated blood or

inserting ventricular drainages through surgical intervention (Fernández et al. 2018). However, in ischaemic strokes, treatment is based on restoring blood flow in the vessel that has been occluded through pharmacological treatment of fibrinolysis, or in cases of large vessel occlusion through mechanical thrombectomy (Henderson et al. 2018).

Challenges

After stroke stabilisation, it is very common for survivors to experience various types of sequelae, resulting in levels of disability that significantly alter their quality of life. The severity of the sequelae varies especially, in addition to the blood vessel affected, depending on the speed of detection and treatment. For example, in some cases, a 30-minute delay in treatment can mean a 20% increase in mortality (Vivien 2021). Evaluation of the patient by a neurologist within the first 6 hours from the onset of symptomatology is associated with a fivefold lower risk of poor outcome. In addition, some treatments can only be given hours after symptom onset, such as fibrinolysis, which must be administered within 4.5 hours after symptom onset, and mechanical thrombectomy, which can only be given within 24 hours after symptom onset and only in certain specialised healthcare centres, sometimes requiring a specialised diagnostic process using advances neuroimaging (Henderson et al. 2018). Therefore, early detection of acute stroke patients, a very close coordination between different levels of care, including prehospital and hospital levels, as well as a planification and support from administrative health systems, is crucial for the evolution and recovery of these patients.

The problem of delayed stroke detection is particularly exacerbated in cases of patients living in areas far from referral hospitals. In these cases, the problem lies in the fact that not all health centres have the necessary resources to allow evaluation by a neurologist specialised in stroke. Traditionally, when a patient with a high suspicion of stroke arrived at these centres, he or she was transferred to a specialised centre urgently, with the consequent loss of time in diagnosis

have emergency neurology services with the rest of the health centres in the area. Thus, in the event of a possible case of stroke in a healthcare centre, the neurologist on duty can diagnose the patient remotely, and therefore the patient can benefit from effective and specialised treatment during the acute phase of the stroke.

Catalonia's Telestroke Network

The Telestroke network in Catalonia connects 16 regional hospitals with a remote stroke neurologist network from reference hospitals for the sharing of medical tests through telemedicine tools, with the aim of providing the best service to the whole territory.
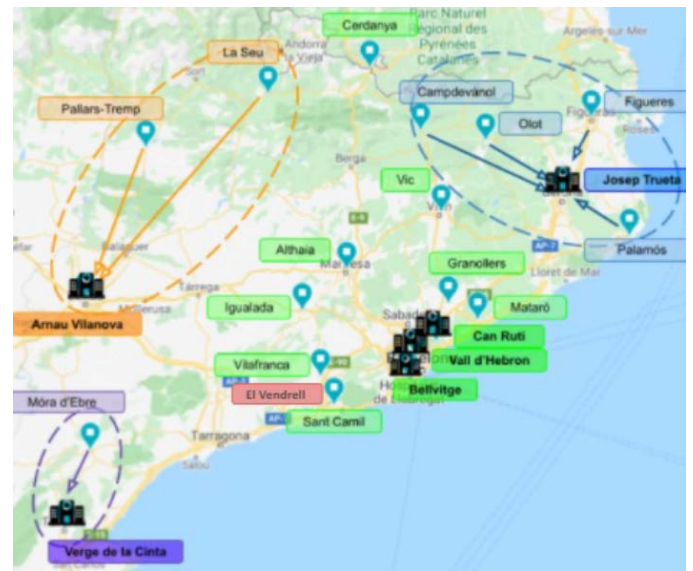

Figure 1. Catalonia telestroke network

The Telestroke system in Catalonia has an alarm system that immediately alerts the emergency neurologist. In this way, the neurologist connects to the web platform that allows

In some cases, a 30-minute delay in (post-stroke) treatment can mean a 20% increase in mortality

and treatment that this entailed.

This is why the telestroke code was created, with the aim of providing a rapid response to possible cases of stroke occurring in areas far from referral hospitals. The referral hospitals have a specialist team of neurologists who are organised to provide support 24 hours/365 days a year through a centralised on-call service.

In this way, the telestroke system connects hospitals which

him to visualise the patient's cranial CT scan as soon as it has been performed. The CT scan is further informed by a radiologist who issues a final report. In addition, the remote neurologist can establish a videoconference with the patient in real time to check his neurological status, which allows a better diagnosis to be made. Traditionally, the videoconferencing systems available in hospitals are not directly connected with the imaging visualisation platform and do

not allow connection between mobile devices or devices located outside the emergency room, requiring a dedicated room. However, recently, the telestroke network has undergone significant development and allows the emergency neurologist to make a video call to the regional centre via computer, cell phone or table, all integrated in the same platform, which allows the visualisation of the CT image and the patient in real time, thus facilitating the connection and agility in decision making without changing between applications or communication systems.

Thus, as soon as a case of suspected stroke occurs in the regional centres, the emergency neurologist service receives a notification by SMS, email and WhatsApp business (WABA) instantly to connect to the platform. This notification does not contain patient information, but allows the neurologist to connect to the platform immediately in order to treat the

Figure 3. Telestroke system operating circuit

Evaluation of the patient by a neurologist within the first 6 hours from the onset of symptomatology is associated with a fivefold lower risk of poor outcome

patient in real time, regardless of where the patient is located. As soon as the CT scan is performed on the patient at the health centre, it is shared via a cloud service with the on-call team of neurologists. Thus, the neurologist can access the image through any device and, thanks to the platform's online viewer, can visualise and interact with it, thus offering a better diagnosis.
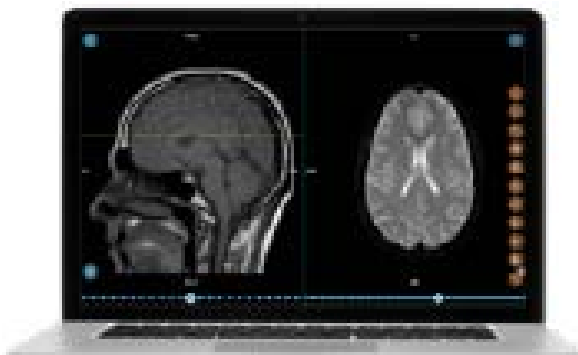

Figure 2. DICOM image viewer used in telestroke

This telestroke system in Catalonia has been supported by the Idonia.com platform since 2017. In 2020, Idonia enabled the sharing and storage of more than 2,500 CT scans of potential stroke cases in Catalonia, accessed by more than 150 different emergency neurologists. Idonia also centralises all communications, alerts and video communication.

Results

The regional telestroke centres serve as referral hospitals for acute stroke care for a population of 1.5 million inhabitants in Catalonia. The rest of the Catalan population (6 million) has a primary or tertiary referral centre with an on-site neurologist. Thanks to the deployment of the telestroke network, the population rate of thrombolytic treatment in remote areas could be equated to metropolitan areas covered by hospitals with on-site neurology teams (López-Cancio et al. 2018).

Activity in the telestroke centres in Catalonia is high, with 400 connections per year generated by patients with acute stroke, 26% of whom received treatment with intravenous thrombolysis. The close internal coordination in these hospitals and with the remote neurologist allows care and treatment to be provided very quickly, with a median of 33 minutes from the patient's arrival at the telestroke hospital and 125 minutes from the onset of stroke symptoms. The efficacy and safety of thrombolytic treatment delivered via the Telestroke connection has been shown to be similar to face-to-face care (Lopez-Cancio et al. 2018).

The assessment by the neurologist through the Telestroke system also makes it possible to optimise resources and patient transfers between hospitals, so that 40% of patients received remote specialised care that avoided the need for transfer to another centre of greater complexity, while the remaining 60% required a transfer to perform mechanical thrombectomy or admission to a more specialised unit.
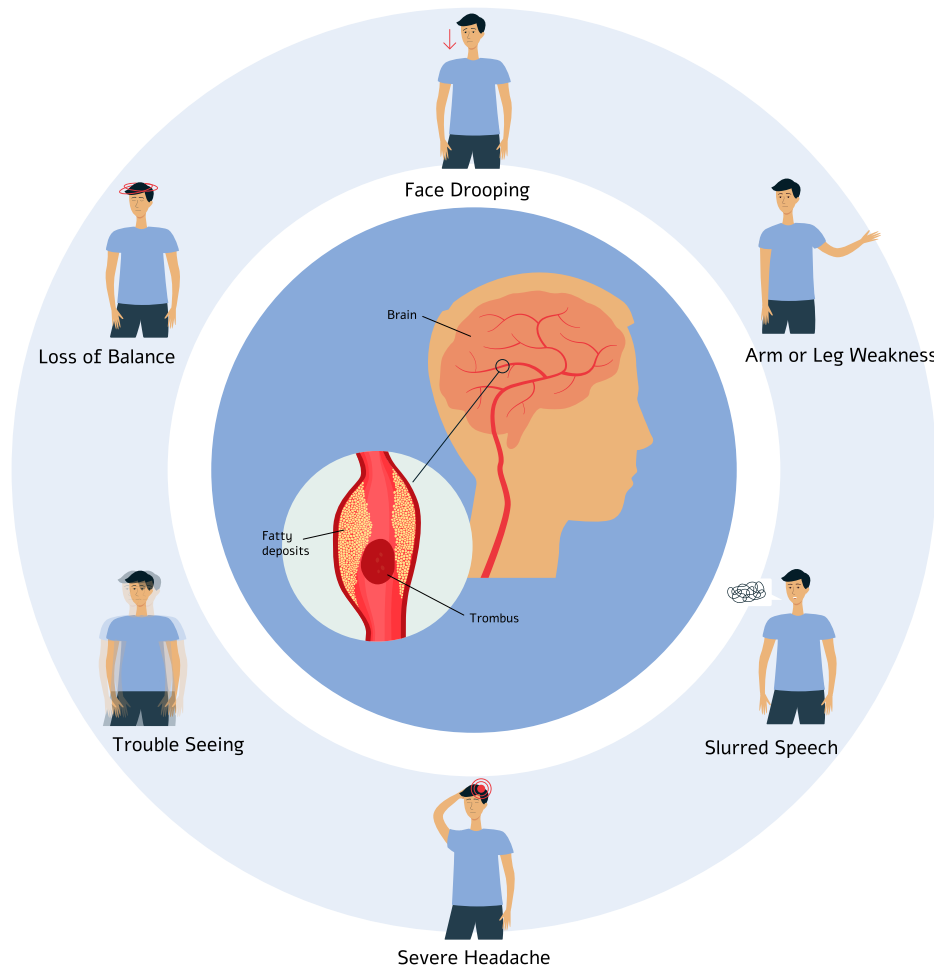
Conclusions

The development of telemedicine technologies in stroke care is in continuous development and is undergoing a rapid transformation, which must be adapted to the needs of the system. In this sense, the Telestroke platform that allows high quality image visualisation in real time may be integrated with artificial intelligence algorithms that support image diagnosis, with the aim of identifying the best treatment for each patient and making decisions as quickly as possible and in an integrated way. The integration of videoconferencing to visualise the patient, not only from a fixed point in a hospital but also during their transfer between hospitals for example,

from an ambulance with 5G connectivity, would allow better management of patient transfers and reception. Moreover, the platform will integrate all the necessary information and serve as an effective communication channel be tween users, including the collection (from different information systems) and transmission of structured clinical information and serve as a simultaneous alert system for all those involved in the care process.

Conflicts of Interest

None. ◼

REFERENCES

Allender S et al. (2008) European cardiovascular disease statistics 2008 edition. European Heart Network, 3, 11–35.

Béjot Y et al. (2016) Epidemiology of stroke in Europe and trends for the 21st century. Presse Medicale, Vol. 45, Issue 12, pp. e391–e398.

Fernández A et al. (2018) "Tratamiento para ictus." Clínic Barcelona.

Gutierrez-Zúñiga R et al. (2019) Ischaemic stroke. Cerebral infarction and transient ischaemic attack. Medicine (Spain),12(70), 4085–4096.

Henderson SJ, Weitz JI, Kim PY (2018) Fibrinolysis: strategies to enhance the treatment of acute ischaemic stroke. Journal of Thrombosis and Haemostasis, 16(10), 1932–1940. doi.org/10.1111/jth.14215

López-Cancio et al. (2018) Telestroke in Catalonia: Increasing Thrombolysis Rate and Avoiding Interhospital Transfers. Cerebrovasc Dis, 2018;46:66-71 doi.org/10.1159/000492124

Smith SD, Eskey CJ (2011) Haemorrhagic stroke. Radiologic Clinics, 49(1), 27-45.

Vivien D (2021) New Opportunities for Diagnosis and Prognosis of Stroke: The Benefits of across Border Approaches. Hämostaseologie, Vol. 41, Issue 1, pp. 22–24.

Upcoming Issue

Cover Story:
Health and the City

With urban populations increasingly growing worldwide and technology making smart cities a reality, there is great potential of improving healthcare services by expanding them beyond the hospital walls. Both immediate health emergencies, such as COVID-19, and long-term strategies can be addressed with new, tech-driven solutions supported by enhanced community care. In this issue we explore how healthcare operates in the wider urban context and analyse the challenges and opportunities of such interconnected systems.

Subscribe here for FREE

Decision Support Community