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# AI & Robotics Implementation and Pitfalls

THE JOURNAL 2023

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Health at a Glance Europe 2022: Addressing Legacies from the Pandemic

**Stephen Lieber**  
HCO's Using Digital Tools to Rebound from Pandemic, Supply Chain Issues

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**Danny Havenith**  
Healthcare Procurement in 2023: Let's Shape the Beginning from the End!





# Editorial



PROF LLUÍS  
DONOSO BACH

Head of Diagnostic Imaging Hospital Clínic  
Barcelona University of Barcelona, Spain  
HealthManagement.org Editor-in-Chief, Imaging

## AI & Robotics - Implementation and Pitfalls

Artificial Intelligence and Robotics are now being used everywhere in healthcare, whether its robotic surgery, genetic testing, data collection, cancer research or more. However, healthcare is still in an evolutionary stage when it comes to AI and Robotics and is in the process of testing and experimentation to ensure this technology becomes an integral part of the future. Both these technologies have the power to transform many aspects of healthcare as long as they are used effectively and efficiently.

In this issue, our contributors discuss **Artificial Intelligence and Robotics** and how it is changing the landscape of healthcare and quickly becoming an essential part of the healthcare ecosystem. They explore the transformation and the use and application of AI and Robotics in healthcare and how it affects our day to day operations and how its effective use could potentially benefit both patients and clinicians.

Raffaele Ascione and co-authors talk about radiomics in cardiovascular imaging and how it may lead to personalised management and treatment of cardiovascular diseases. Geraldine McGinty discusses the concept of integrative diagnostics as the pathway to more patient-centred care with improved outcomes and highlights the need to overcome hurdles in its implementation to achieve its true potential.

András Vargha explores what we have learnt from AI development and whether it can be a source of feedback in the daily routines of clinicians, radiologists and other stakeholders.

Peter Mildenerger highlights why radiologists need to care about IT standards and interoperability as radiology facilities are often completely digitised and the ability to use a wide variety of systems efficiently is very important. Elizabeth Cocklin and co-authors explore the use of artificial intelligence in screening and showcase its benefits, challenges and impact on patient pathways.

Steven Lieber, Editor-in-Chief IT, discusses the importance of using digital tools in healthcare to rebound from the pandemic and address issues such as infrastructure, security, administrative/ supply chain, analytics/data management, innovation and other clinical and business areas.

Antonio Cirino highlights the important task of managing hospital communication as it is a critical factor for implementing a strategic vision in hospitals. Danny Havenith discusses healthcare procurement in 2023 and giving decision makers the tools to bring objective, patient-centred and cost-oriented value to healthcare.

Jan Vekemans highlights the benefits of a unified information system for healthcare providers for easier access to a patient's medical records and

better coordination of care.

Francesca Colombo and co-authors glance back at 2022 and discuss challenges that must be addressed to develop more resilient health systems after the pandemic. Jens Declerck and co-authors talk about the complexity of health data and the importance of data quality for effective use and application.

Christodoulos Papadopoulos discusses the paradigm of cyber resilience as a defense strategy against cyberattacks to help organisations through challenging circumstances and quick recovery.

Rita Veloso talks about women leadership in healthcare and the glass ceiling which is a consistent invisible barrier preventing women from reaching the top positions.

Inga Shugalo talks about population health management software and how it can be used to improve healthcare services for different groups of people. Mario Damas talks about public-private collaboration and the importance of incorporating innovative procedures in contracting to achieve better solutions.

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

Happy Reading!

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### DISCLOSURE OF CONFLICT OF INTEREST:

Point-of-View articles are the sole opinion of the author(s) and they are part of the HealthManagement.org Corporate Engagement or Educational Community Programme supported by educational grants.

# Upcoming Issue

## Cover Story: Medical Device and AI Regulations

Artificial Intelligence has the potential to transform healthcare. It can help provide more efficient care and solve issues of access and quality. However, assessing the safety of medical devices with AI is equally important. What measures are needed for improved regulation of medical devices and healthcare tools that use AI? What are some ongoing regulatory reforms, and what can be expected in the future?

A laptop and a tablet are shown displaying the cover of the journal 'HealthManagement.org'. The laptop is in the foreground, and the tablet is positioned in front of it, slightly to the right. Both devices show the same cover design, which features a red background with a network of white lines and dots. The text on the cover includes the journal title, volume and issue information, and the main article title.

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**Medical Device  
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[edito@healthmanagement.org](mailto:edito@healthmanagement.org)

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# Contributors

**Herik Agrell,**  
Sweden



Henrik Agrell, the CEO of TMC, is an international healthcare entrepreneur and executive with 20 years of experience in e-health and telemedicine. He is at the forefront in finding new ways to solve some of the challenges that face many public healthcare systems. Specifically interested and skilled in developing and packaging solutions that could be understood, accepted and embraced by players in the healthcare area. Strong understanding of customer value creation and innovative service design.

Trends in Telemedicine

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**Elizabeth Cocklin,**  
United Kingdom



Elizabeth Cocklin is a software technical author at InHealth Intelligence, providing technical and user facing documentation as well as training materials. Elizabeth has previous experience in data management within clinical research and comes from a technical background with a PhD in physics.

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**Raffaele Ascione,**  
Italy



Raffaele Ascione is a radiologist at the Department of Diagnostic Imaging of Pineta Grande Hospital. His research interests include cardiovascular imaging, radiomics and machine learning applications in medical imaging, genitourinary and hepatobiliary imaging.

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**Francesca Colombo,**  
France



Francesca Colombo, M.Sc., is Head of the Health Division at the Organisation for Economic Co-operation and Development (OECD). Ms Colombo has over 25 years of experience leading international activities on health and health systems.

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**J. Antônio Cirino,**  
Brazil



J. Antonio Cirino is the Director of Education and Development at Agir (Brazil). He has a Master, PhD and postdoc in Communication and he is completing a new postdoc in Information and Communication at the Universitat de Barcelona (Spain). He is a Member of the International Hospital Federation - IHF YEL Alumni and a Member of the Center for Studies in Communication, History and Health (NECHS-UFRJ/Fiocruz).

Managing Hospital Communication

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**Jens Declerck,**  
Belgium



Jens Declerck is a Data Quality Manager at The European Institute for Innovation through Health Data (i~HD). He is responsible for coordinating data quality projects, including study design and preparation, data quality assessment, improvement strategies and reporting.

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**Lluís Donoso-Bach,**  
Spain



Prof Donoso-Bach is chairman of the diagnostic imaging department at the Hospital Clínic of Barcelona and a Professor of Radiology at the University of Barcelona. He has served the European Society of Radiology in various capacities, including as President in 2015–2016.

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**Dipak Kalra,**  
Belgium



Dipak Kalra is the President of the European institute for Innovation through Health Data (i~HD), a Professor of Health Informatics and a former London general practitioner.

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**Danny Havenith,**  
Belgium



Danny has worked in Company Management for 25 years. For the last 5 years, he has been General Manager of MercurHosp, the central purchase office of Wallonian & Brussels Hospitals Belgium and Board Member of several companies. Since 2021, he has been Chairman of EHPPA, the European Health Public Procurement Alliance, co-organiser of the 1st Pan European Healthcare Procurement Summit in Brussels. Since 2022, he has been a lecturer at University Paris-Cité - faculty of medicine - for Value Based Healthcare.

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**Gaetan Lafortune,**  
France



Gaetan Lafortune is a Senior Economist in the OECD Health Division. For over 10 years, Gaetan Lafortune has coordinated the preparation of various editions of "Health at a Glance". Before joining the OECD, Mr. Lafortune worked for over 10 years for the Government of Canada.

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**Sean Hickey,**  
United Kingdom



Sean Hickey is an experienced transformational CIO focused on delivering real strategic value through the use of IT and Digital capabilities. He has delivered measurable and sustainable change across multiple Industry sectors, partnering with senior level stakeholders.

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**Mario Ledesma,**  
Spain



Mario Ledesma is an expert lawyer, legal executive, judicial tribunals representative and head of departments in public sector organisations, health-care and national private entities, including legal boutiques management and enterprises of the facility sector.

New Public Procurement Specifications and New Public Procurement Flows. Public-Private Collaboration

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**Noémie Levy,**  
France



Noémie Levy is a Health Policy Researcher in the OECD Health Division where she has spent two years working on topics like antimicrobial resistance, one health, health workforce and health system resilience.

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**Peter Mildenerger,**  
Germany



Peter Mildenerger is Vice-Chair and Head of Radiology-IT, Department of Diagnostic and Interventional Radiology at the University Medical Center Mainz, Germany. He is a Member of ESR (European Society of Radiology) and EuSoMII (European Society for Medical Imaging Informatics) and Board Member IHE Catalyst since 2021.

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**Stephen Lieber,**  
USA



From 2000 until 2018, Stephen Lieber served as President and Chief Executive Officer of HIMSS. Since his retirement in 2018, he has worked as a consultant to healthcare companies and associations in the areas of strategic planning, digital media, and data analytics. He began work with CHIME in 2020 to create and launch CHIME's digital health leaders program and became Chief Analytics Officer in 2021.

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**Carmela Nappi,**  
Italy



Doctor Carmela Nappi, MD, PhD, is Researcher at Department of Advanced Biomedical Sciences, Federico II University of Naples, Italy. She also worked as research fellow at Department of Radiology, Massachusetts General Hospital and Harvard Medical School from 2012 to 2017 focusing on Cardiovascular Imaging. She is currently Cardiovascular Committee member of European Association of Nuclear Medicine (EANM) since January 2019.

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**Geraldine McGinty,**  
USA



Geraldine McGinty is an internationally recognised expert in health care strategy and imaging economics, a radiologist, and an unwavering advocate for patient-centered quality care. A faculty member at Weill Cornell Medicine in New York City, she serves several roles including Professor of Clinical Radiology as well as Senior Associate Dean for Clinical Affairs.

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**Christodoulos Papadopoulos,**  
Cyprus



Christodoulos is an innovative thinker and entrepreneur, with broad-based expertise in information security – InfoSec (incl. cybersecurity), data privacy, risk management, RegTech, FinTech, operations, and business development. He has been elected initially as Vice Chairman and later Chairman of the Cyprus Association of Information Protection and Privacy (CAIPP) as of February 2018 and April 2022 respectively. He founded CPBros Group in 2010, with the vision of becoming one of the leading firms in the region.

Shifting from Cybersecurity to Cyber Resilience

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**Vicki Prior,**  
United Kingdom



Vicki Prior is the Operational Head of Grading for InHealth Intelligence. With 18 years of experience within Diabetic Eye Screening, Vicki is responsible for performance and delivery of the Grading function across all IHIs Diabetic Eye Screening Programmes, providing assurance as to effectiveness and compliance with National, Local Grading Policies, Procedures and Guidance, as well as creating Internal Procedures and Guidance to further improve Grading Quality.

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**András Vargha,**  
Austria



András Vargha is a radiologist in general purpose hospitals since 1992. He is a former department leader in various Hungarian hospitals (2000-2012), leading activities in healthcare policy since 1996., and he was coordinator for clinical audit implementation in radiology (2013-2016) Hungary, Oberarzt in Austria 2012.

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**Inga Shugalo,**  
USA



Inga is a healthcare industry analyst at Itransition, a software development company headquartered in Denver, Colorado. She focuses on Healthcare IT, highlighting the industry challenges and technology solutions that tackle them. Inga's articles explore the diagnostic potential of healthcare IoT, opportunities of precision medicine, robotics and VR in healthcare and more.

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**Jan Vekemans,**  
Belgium



Jan Vekemans has 38 years of experience in delivering solutions in IT security, network infrastructure and heavy duty software solutions, for industries including Finance and Healthcare. His wealth of experience has led him to his mission with 1patient1record4Belgium; to open the debate on standardisation of patient records in healthcare in Belgium and work towards solutions together with all the players involved.

The Patient Is the DATA

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**Geert Thienpont,**  
Belgium



Geert Thienpont is the Managing Director of The European Institute for Innovation through Health Data (i~HD). Since 1992, Geert has been involved in over 30 national and international eHealth R&D projects.

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**Rita Veloso,**  
Portugal



Rita Veloso is currently an executive member of the Board of Directors of Centro Hospitalar Universitário de Santo António. Rita is an invited Professor of several executive programs and postgraduate courses. She is also a Member of the Advisory Board of the NGO "Health 4 Mozambican Children and Families," which is dedicated to supporting and promoting maternal and child health in Mozambique.

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Centro Hospitalar e Universitário de Coimbra, Portugal  
al@healthmanagement.org



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**Editor-in-Chief Imaging**

Hospital Clinic – University of Barcelona, Spain  
ld@healthmanagement.org



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**Stephen Lieber**  
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 Chief Analytics Officer,  
 College of Healthcare Information Management  
 Executives (CHIME), USA  
[sl@healthmanagement.org](mailto:sl@healthmanagement.org)



**Christian Marolt**  
**Executive Director**  
[HealthManagement.org](mailto:HealthManagement.org), Cyprus  
[cm@healthmanagement.org](mailto:cm@healthmanagement.org)

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National Centre for Patients' Rights, Hungary
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University of A Corunia, Spain

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Executive Director [cm@healthmanagement.org](mailto:cm@healthmanagement.org)
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- Iphigenia Papaioanou**  
VP Customer Experience [ip@healthmanagement.org](mailto:ip@healthmanagement.org)
- Katya Mitreva**  
VP Client Service [km@healthmanagement.org](mailto:km@healthmanagement.org)
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Senior Editor [hb@healthmanagement.org](mailto:hb@healthmanagement.org)

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Communications Assistant
- Sergey Chygrynets**  
Front-end Developer



**EU Office:**  
 Rue Villain XIV 53-55  
 B-1050 Brussels, Belgium  
 Tel: +32 2 286 85 00  
[brussels@mindbyte.eu](mailto:brussels@mindbyte.eu)

**EMEA & ROW Office:**  
 166, Agias Filaxeos  
 CY-3083, Limassol, Cyprus  
 Tel: +357 25 822 133  
[emea@mindbyte.eu](mailto:emea@mindbyte.eu)

**Headquarters:**  
 Kosta Ourani, 5 Petoussis Court, 5th floor  
 CY-3085 Limassol, Cyprus  
[hq@mindbyte.eu](mailto:hq@mindbyte.eu)

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# What We Have Learnt from AI Development – Can it Be a Feedback in Our Daily Routines?

Let's professionalise procurement by giving decision-makers (doctors, board, ...) decision-making tools that bring objective, patient-centred and cost-oriented VALUE to the hospital sector. Procurement is part of healthcare management and holds the key to all topics that are lessons learned from COVID-19: supply chain management, sustainability, transparency, digitalisation, patient experience, innovation & economies.

ANDRÁS  
VARGHA



OA in Radiology  
Krankenhaus der Barmherzigen Brüder, Eisenstadt  
Austria

## key points

- The use of AI brings much more benefit and challenges than growing fears.
- Getting acquainted and involved more and more into AI I then realised that AI-tools have a very similar philosophy that incorporates a quality oriented workstyle.
- All the stake-holders (radiological staff, clinicians, hospital managers, reimbursement companies and regulators and even patients) should recognise that the use of AI-tools underlines the need and importance of an optimally structured, quality based and quality controlled clinical work environment.

## Introduction

There are some radiologists (and not few) who have fears that they will lose their jobs because AI-tools will replace their skills, are cheaper and do not get tired. I disagree.

Some think that the dearth of radiologists can be compensated with AI-tools, as they can compose reports themselves. The radiologist is only needed to approve and validate reports. I don't share this view.

There are many more such thoughts or beliefs which may be partly right (more or less) or wrong but they are only guess-work.

I look at the AI-development from another point of view. I believe the use of AI brings much more benefit and challenges than growing fears.

Maybe it will come to pass that AI-tools can perform much of our daily work but there is still a long way to go and in the meantime we are the ones who have to teach (train and validate) these tools. So I believe it unlikely that I would loose my job. Just the opposite, in fact.

I am waiting for the automated tool so that I will not have to spend my time with analysing follow-up tumor staging scans, searching for tiny lung nodules by myself or try to characterise small liver lesions. Worse, compare them in dynamic studies, maybe in examinations with different imaging protocols or from different venues, performed with different scanners.

I have spent many decades dealing with quality

management in addition to clinical radiological activities. At first, it was about implementing new imaging modalities into clinical practice, including protocol standardisation and harmonisation.

Later it was performing clinical audits in hospitals with subsequent roll-out of these nationwide.

I also had the opportunity then to contribute to QM activities of the ESR and in some international projects. And I have gained a lot from this experience.

It is my conviction that the clinical audit (which has been mandatory in Europe since 2018, see Euratom Directive 59/2013.) is the main tool for quality control and the subsequent quest for improvement is not just an administrative system

but really a philosophy.

I believe this because if we perform our daily routine adhering to standards, do it with care, are diligent in communicating our results, being open to feedback, then we basically perform the most important parts of clinical audit without any additional effort.

When we then talk about different decision support tools, it is even more evident that the training data should be robust, evidence based, bias free and as precise as they can be. Of course sometimes we are faced with uncertainty in our reports and that is normal and expected. During the training process, and later on

models that improve clinicians' workflows and help them deliver better patient care. As an AI radiology company, we need large, diverse, and high-quality datasets from various scanners, hospitals, and countries. The quality of our algorithms essentially depends on access to this data.

Maybe it will come to pass that AI-tools can perform much of our daily work but there is still a long way to go and in the meantime we are the ones who have to teach (train and validate) these tools

If we only quickly report the imaging and don't care about anything else that is another kind of, and to me inferior, workstyle and thus philosophy.

Getting acquainted and involved more and more into AI I then realised that AI-tools have a very similar philosophy that incorporates a quality oriented workstyle. How is that?

First we have to create an AI-tool. Then we have to train the tool. For this training process we need a huge number of data. This database should reflect what we do in our practice.

Thus not uniform because the equipments can differ, the patient populations differ etc.

This normal variation of data (diversity) is important but it has to be of a certain quality. For instance, when the data come from improperly performed examinations or not with standardised protocols then we cannot train the tool properly. For example, the protocol of contrast material administration in CT or even in MR, proper reconstruction algorithms, the appropriate use of different MR sequences (including parameters), imaging planes and many others.

during application process, we have to control what the AI-tool tells us. We have to look at the images, analyse them and confirm agreement or disagreement, without strong emotions or blaming.

Shouldn't we always work in that manner? With or without AI-tools? Is a decision making AI-tool able to make any decision without data? No!

The same way as we can't compose a correct or precise report without knowing the clinical data or based on sub-optimal images.

Sometimes it feels that we are expecting wonders from AI, whereas we only get from AI what we put in.

Therefore I strongly believe that all the stakeholders (radiological staff, clinicians, hospital managers, reimbursement companies and regulators and even patients) should recognise that the use of AI-tools underlines the need and importance of an optimally structured, quality based and quality controlled clinical work environment.

This is what an AI Company tells about this issue (talk with Catalina Barzescu, Aidence):  
Data is crucial to building well-performing

However, obtaining raw medical data that is sufficient and diverse is a major challenge. We often rely on publicly available datasets – (anonymised) medical images that patients have agreed to make available for research or product development. These datasets are not always representative of different demographics. Public data often originates from centralised clinical trials, typically in one geographical area and one or more institutions. Within the EU, we face the additional challenge of the limited availability of large, curated training datasets.

Ultimately, to build state-of-the-art, safe, and robust medical algorithms, we must work with and have the support of clinicians, data owners, regulators, and policymakers.

So, in my view, this teaching/training of AI tools while at the same time learning from that is a beautiful challenge during the development of AI-tools and hopefully will speed up the evolution of AI-tools and even our NI-tools (natural intelligence).

**Conflict of Interest**  
None. ■

# Integrative Diagnostics: a Vision for Better Care

Integrative Diagnostics is a pathway to more patient centered care with better outcomes but this disruptive innovation must clear significant hurdles in the current delivery and education system to achieve its potential for patients.



GERALDINE  
MCGINTY

Professor of Clinical Radiology and Population Health Sciences  
Weill Cornell Medicine Depts. Of Radiology and Population Health Sciences  
New York, USA

## key points

- The digitisation of pathology, advances in computing power and the ability of artificial intelligence to extract and knit together relevant data elements means that “Integrative Diagnostics” are within our grasp.
- While we push the boundaries to personalise treatment of cancer through immunotherapy, we are still sending faxes. Initiatives to transcend our diagnostic silos exist but they are few and far between.
- For our patients navigating the complexities of a system that often seems designed for every stakeholder but them we must strive to do better. Integrative Diagnostics is what better looks like.

## Introduction

As a breast imager I form part of a team that makes the diagnosis of breast cancer. That team typically comprises radiologists and pathologists and increasingly includes geneticists. A patient’s journey from screening mammogram to definitive surgical management can take weeks or even months as she and her care team piece together the puzzle that will identify her path to survivorship. Ask a breast cancer survivor about the moment she heard she had cancer and you’ll hear her relive that moment with crystal clarity. For most patients receiving this dreaded news the overwhelming desire is to move expeditiously from diagnosis to treatment and any delay can

seem agonising. The disconnected nature of our health system can compound this wait, requiring patients to request and deliver outdated CDs in order to seek second opinions. Inequities multiply the stress as women from minoritised communities wait longer to complete the diagnostic process, travelling further to secure advanced imaging when necessary. We need to do better.

The landmark Institute of Medicine report, “To Err is Human” identified a 10-15% diagnostic error rate that is responsible for thousands of deaths and some of the costliest malpractice suits. A follow up report: “Improving Diagnosis in Healthcare”, pointed to “information integration and interpretation” as a key opportunity to do better.

But what does “better” look like? Imagine a diagnostic pathway that seamlessly directed patients to the correct imaging modality according to their presenting symptoms. A process that sequenced testing across multiple departments with the patient’s convenience and wellbeing top of mind. Picture a holistic view of the pertinent patient data that used compelling graphics to support physicians in decision making and created materials that would allow the patient to understand and fully participate in their care. Dare to dream of a feedback loop that identified patients at risk and afforded an earlier diagnosis. A fantastical utopia? Not at all. The digitisation of pathology, advances in computing power and



the ability of artificial intelligence to extract and knit together relevant data elements means that “Integrative Diagnostics” are within our grasp.

With radiologist and pathologist colleagues we explored this topic in a publication titled

exacerbating workforce shortages, the energy to advocate for disruptive payment models that better support an integrated approach to diagnostic medicine is understandably lacking. The unfulfilled promise of AI must take some

teams whose training experience bridges radiology, pathology and genomics? Should there be a diagnostic medicine residency? Leaders in the field like Dr Nick Bryan who established the founding Department of Diagnostic Medicine at

## No sector both promotes and frustrates innovation simultaneously like healthcare

“Integrative Diagnostics: The Time is Now”<sup>1</sup> for the Journal of the American College of Radiology. In this paper we reviewed the limitations of the current fragmented diagnostic process and its impact on not only the quality but also the cost of care. We also highlighted the significant barriers that stand in the way.

No sector both promotes and frustrates innovation simultaneously like healthcare. While on the one hand we push the boundaries to personalise treatment of cancer through immunotherapy, on the other hand we are still sending faxes. Initiatives to transcend our diagnostic silos exist but they are few and far between.

Is it our United States fee for service payment system that keeps us locked in our segmented process? There is in fact no meaningful incentive for a collaborative process. Tumor Boards, an essential component of high value cancer care, are largely unreimbursed. With imaging volumes at an all-time high and physician burnout

blame. Surely there’s an algorithm that can effectively extract administrative costs from the system freeing personnel to focus on patient related tasks? In a ChatGPT enabled world why is breast imaging the rare imaging specialty issuing patient friendly lay letters? Why can’t we issue patient facing communications that reference data from both imaging and pathology as well as the Electronic Health Record in a format that meets the patient where they are? The requirements of the 21st Century Cures Act to make test results immediately available have piled additional burdens of communication onto already overworked clinicians rather than driving innovation that could inform patients in an intelligent but automated way.

Maybe we ourselves are the biggest barrier? We settle into specialty “swim lanes” very early. How often do we ask a medical student: “what specialty are you applying to” rather than “what problems in healthcare do you want to solve”? Do we need to create cross functional diagnostic

the University of Texas Dell School of Medicine have cracked open the door to a novel training pathway but questions about how to scale this approach.

I’m encouraged by the several cross-specialty conversations on Integrative Diagnostics in which I’m participating but I’m sanguine about the inertia that will need to be overcome. As healthcare spending in the U.S. continues to climb with outcomes that fail to match those peer economies we must continue to strive for the oft cited goal of “value-based healthcare”. For our patients navigating the complexities of a system that often seems designed for every stakeholder but them we must strive to do better. Integrative Diagnostics is what better looks like.

### Conflict of Interest

Board member and stockholder NextGen Healthcare Medical Advisory Board member: Agamon Healthcare and Ryver.ai. ■

# Use of Artificial Intelligence in Screening - Benefits, Challenges, and Impact on Patients' Pathways

Artificial intelligence (AI) has the potential to revolutionise medical screening by providing fast, accurate and cost-effective results. InHealth Intelligence is in collaboration with several AI technology companies with the aim to accelerate the implementation and validation of AI in diabetic eye screening programmes.



ELIZABETH  
COCKLIN

Software Technical Author  
InHealth Intelligence  
United Kingdom

## key points

- AI hold great promise as a screening tool in medicine
- Increasing evidence that AI is safe ethically and practically
- Further need for rigorous testing of AI software is paramount

**Vicki Prior** | Operational Head of Grading | InHealth Intelligence | United Kingdom

**Sean Hickey** | Chief Digital and Information Officer | InHealth | United Kingdom

## Introduction

InHealth Intelligence is the UK's largest specialist provider of diagnostic and screening services, among others diabetic eye screening, and is working with the NHS and the independent sector.

InHealth Intelligence is also collaborating with AI technology companies on clinical studies to accelerate the implementation and validation of

artificial intelligence (AI).

Artificial Intelligence has made significant advances in the medical field and is increasingly being researched for use within medical screening. (Medical) screening refers to the process of methodical identification for presence or absence (of health problems early before symptoms become obvious).

There are many screening programmes currently in existence, such as Diabetic Eye Screening Programme (DESP), Targeted Lung Health Checks and Breast Cancer Screening.

The incorporation of AI into medical screening programmes has the potential to revolutionise the healthcare industry by providing fast, accurate, and affordable diagnoses.

Diabetic eye disease is one of the leading causes of sight loss with over 500 million people worldwide suffering from diabetes and 40 %

Patients with retinal images graded R0, R1 and M0 will receive annual recalls, R2 and M1 will be sent for a routine referral or placed into a digital

R1M1, R2M0 and R2M1 the referable pathology goes to ROG for a referral outcome decision.

## The traditional screening process can be time consuming due to several layers of grading, costly, and requires the need for highly skilled graders who undergo regular quality assurance and training

of those have diabetic retinopathy (DR). Early detection of pathologies can significantly reduce the likelihood of visual problems.

Public Health England is working on guidance to help developers of AI understand the process for incorporating their new technologies into screening programmes (Dunbar 2019) and there are numerous clinical studies researching the validation of AI used within diabetic eye screening.

### The Current DESP Screening Process

NHS DESP health professionals take images of patient's retina. These images are assessed by trained professionals, graders, to determine if any eye condition is present and the severity of the condition. Depending upon the severity there are several outcomes: annual recall, routine referral, digital surveillance pathway, and urgent referral.

Types of diabetic eye disease and grading definitions:

- No retinopathy (R0 M0)
- Background retinopathy (R1)
- Pre-proliferative retinopathy (R2)
- Proliferative retinopathy (R3)
- Maculopathy (M1)
- Inadequate / unassessable images (U)

surveillance pathway, and R3 will be receive an urgent referral. There are several layers to the grading process to reach these outcomes:

#### Primary grading

- All patient's images are initially assessed by a primary grader. 90% of all patients screened will have no DR (R0M0 grade) which is their final grading, and they will receive annual recalls.

#### Secondary grading

- All patients graded R1M0, R2M0, R1M1 and R2M1 pathology by primary grading go to secondary grading.
- First and second graders agree: For grade R1M0 (background retinopathy) this is complete and the patient receives a result and annual recall.
- The DESP software selects 10% of R0M0 patients, which are sent to secondary grader for quality assurance (QA) checks.

#### Referral Outcome grading (ROG) and arbitration

- First and second graders agree: For grades

- First and second graders disagree: This will go to arbitration for review. If arbitration grade is R1M0 the patient receives a result and annual recall. If the final grade has referable pathology identified (R1M1, R2M0 and R2M1) this goes to ROG for a referral outcome decision.
- All R3M0 and R3M1 pathology from any level goes directly to ROG, as this is urgent pathology and takes priority.

### Why Incorporate AI into the Screening Process?

The traditional screening process can be time consuming due to several layers of grading, costly, and requires the need for highly skilled graders who undergo regular quality assurance and training. All human graders must consistently demonstrate a sensitivity of over 85%, and specificity of over 80% for identifying referable DR, and are routinely monitored (David Taylor, 2016).

AI may provide a cost-effective alternative to human grading to overcome these limitations and provide faster results. For instance, AI can be trained to identify patterns and anomalies in retinal images. By analysing these images,

AI algorithms can detect potential medical issues and could act as a triage to separate those patients who have diabetic retinopathy, or other abnormalities, from those who have no retinopathy.

This could aid the providers in diagnosis and reduce their workload, which would allow them to focus their expertise more on higher risk patients.

specificity 92.2%.

The performance of the artificial intelligence system was superior for no or mild diabetic retinopathy vs significant or referable diabetic retinopathy with a sensitivity of 95.4% and specificity of 92.0%. Significantly, no cases were identified in which the artificial intelligence grade had missed significant diabetic retinopathy.

were identified in which the artificial intelligence grade had missed significant diabetic retinopathy. This is important for implementation into live grading; AI could be utilised as a first layer to filter patients with disease versus no disease patients. This would have impact in reducing the workload on grading; better utilising the specialist skills of dedicated human graders allowing them to

## AI may provide a cost-effective alternative to human grading to overcome these limitations and provide faster results as it can be trained to identify patterns and anomalies in retinal images

### Why Is InHealth Intelligence Working with AI, What Are We Hoping For?

InHealth Intelligence, the leading provider of diabetic eye screening services in the UK, has collaborated with two AI based companies, Thirona, based in the Netherlands, and Optos, based in Scotland, to research the validity of using AI within the DESP service.

Results from the study with Thirona were published in 2023 (Meredith 2023).

InHealth Intelligence provided Thirona with 9,817 anonymised image sets which were processed by their deep learning artificial intelligence software. The sensitivity and specificity of the artificial intelligence system for detecting diabetic retinopathy was determined.

The results indicate that the artificial intelligence system was superior for no or mild diabetic retinopathy vs significant or referable diabetic retinopathy where the sensitivity of the artificial intelligence grading system was 69.7% and

The collaboration between InHealth Intelligence and Optos is in the early stages; 100,000 images which have been completed by graders at InHealth Intelligence have been shared with Optos. Optos have regraded the images using their AI. Any grading outcome differences being re-graded by InHealth Intelligence to identify the discrepancies and determine the sensitivity of the AI software.

### What Are the Benefits?

AI could be used as a quality assurance tool in the primary grading process. Approximately 90% of patients screened in the DESP are negative for diabetic retinopathy, these cases are graded by only one human grader in the. Adding in AI as quality assurance would mean all images were graded by AI and at least one human grader.

Alternatively, AI systems could potentially take out a layer of grading. The results from the Thirona study are significant, notably no cases

focus on grading patients identified with disease. Additionally, this could benefit patients as AI can process vast amounts of data in seconds. This speed is critical in the early detection of serious medical conditions and could reduce waiting times to diagnosis for patients.

Reducing the workload on healthcare staff also has the bonus of reducing costs of the screening programme. The InHealth Intelligence and Optos clinical study is therefore exploring if automated grading is clinically and cost effective for the NHS' Diabetic Eye Screening Programme.

### What Challenges Do We Face?

There are, however, some challenges to the widespread adoption of AI-powered medical screening.

One of the biggest challenges is the need for high-quality medical data to train the AI algorithms. If the data used to train the algorithms is inaccurate or incomplete, the resulting

diagnoses will also be inaccurate. AI can only identify what it has been trained to detect in images. To overcome this challenge, medical organisations need to ensure that they have access to high-quality, accurate data, from a diverse ethnic mix of individuals and populations, that can be used to train AI software to detect a wide range of diagnoses.

One can interpret from the results of the Thirona study that the AI system has a high sensitivity and tended to over grade the images. Although this has benefits in being overly cautious, it could result in increased referrals to the hospital eye service (HES) and added pressure on the health service.

Another challenge is the need for regulatory approval. AI-powered medical screening systems must undergo rigorous testing and be approved by regulatory bodies before they can be used in a clinical setting. This process can take several years and requires significant resources.

There are also ethical considerations to be addressed surrounding the use of AI in medical screening, and in healthcare overall.

There is concern about the potential for AI to be used to make medical decisions without

human input. Should AI be incorporated into the screening process, patients must be fully informed of the grading process involving AI, and how their images are being used.

Finally, there are also concerns about the privacy of medical data and the security of AI-powered medical screening systems.

To address these concerns, it is important for medical organisations to implement appropriate security measures and to establish clear ethical guidelines for the use of AI in medical screening. Public Health England is working on guidance to help developers of artificial intelligence understand the process for incorporating their new technologies into screening programmes (Dunbar 2019).

### Future Research

Further research is essential to provide healthcare systems with further confidence in using this technology, and to determine if incorporation of AI is a cost-effective solution.

The University of Liverpool recently announced a new spin-out company, AI Sight Ltd, that will commercialise a next generation AI system for diabetic eye screening (News 2023).

Their technology has been trained on over 1.6 million images. It is a highly sensitive and specific, web-based screening system that uniquely measures and displays the level of certainty of every automated image analysis. The system has the benefit of being easily integrated into different healthcare systems and is compatible with any retinal camera images.

### Conclusion

AI holds great promise to advance medical screening and is attracting a lot of attention and investment. There is increasing evidence that AI systems are safe to use within diabetic eye screening. Whether AI is used to replace a level of grading or to assist with quality assurance, there is potential for AI to benefit patients and healthcare providers by providing fast, efficient diagnosis. Before an artificial intelligence system is to be incorporated within healthcare it must undergo rigorous independent evaluation.

### Conflict of Interest

None. ■

### acknowledgement

InHealth Intelligence, Optos, Moorfields Eye Hospital and Queens University Belfast won the Artificial Intelligence in Health and Care Award run by the Accelerated Access Collaborative in partnership with NHSX and the National Institute for Health Research. The Award supports technologies across the spectrum of development from initial feasibility to evaluation within the NHS. The award is funding a clinical study to accelerate the implementation and validation of AI into NHS DESP and determine if automated grading is clinically and cost effective.

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# Trends in Telemedicine

Telemedicine Clinic (TMC), part of the Unilabs Group, is one of the largest providers of elective subspecialist teleradiology reporting services and night-time emergency teleradiology services in Europe, with more than 330 radiologists servicing around 140 hospitals in Sweden, Denmark and the U.K. HealthManagement.org spoke to Henrik about the vision of TMC, its services, and how he perceives the future of radiology to be.

HENRIK  
AGRELL

CEO  
TMC Telemedicine Clinic  
Europe



### **Reflecting on your vision for TMC in 2002, what materialised and what did not?**

When we started TMC 20 years ago, we wanted to bring high-quality radiology services to patients, regardless of location. Even if the patient was scanned in a small hospital, we wanted them to have access to specialist radiology reporting services by using teleradiology. In 2002, we started to promote teleradiology, but most hospitals were not ready to outsource radiology services. They saw the potential, but they were also very sceptical. Step by step, we built up a very large network of expert radiologists and matched the incoming exams with the right subspecialists. Today, we have more than 330 radiologists in our network, providing highly specialised services to our clients. That was the vision we managed to materialise. It took time and was complex, but today we have a powerful service up and running.

### **What other obstacles did you face, and how did you overcome them?**

We had a plethora of different obstacles when we started, not only technical obstacles, but credibility was also a big topic. Would a hospital trust us enough to send out part of its radiology production for external reporting? It was a lot of questions around responsibility, quality, and reliability of the service, and step by step, we had to secure that. We had a stable technology setup and the ability for quick image transfer and stability of data transfer back and forth. But we had to build strong credibility with respect to quality assurance.

The use of various types of teleradiology services, both outsourced and done between university clinics, for example, or their satellite hospitals, is a norm in practice today, not only in teleradiology but also in areas like telepathology

and teledermatology. Many of these image-based diagnostic areas are suitable for remote diagnosis to some extent. It is now an established tradition which has also been driven by technology, as now you have faster and more stable connections. It's also driven by need.

### **There is a shortage in many European countries of doctors in general and radiologists in particular. What role can teleradiology play in training and teaching radiology residents? Does TMC have any programmes which help hospitals in training radiologists?**

Teleradiology could have both a positive and a potential negative impact on the training of residents. If you take on the negative side first, when you outsource radiology volumes, you might send out a lot of relatively easy volume work, depending on what the hospitals decide to outsource. That can reduce the volume of non-complex scans for the residents. Sometimes there might also be a lack of senior radiologists on-site supporting the residents. These risks needed to be mitigated. Therefore, we created something we call the TMC Academy some years ago, providing a range of training services to residents and specialists. There is training through conventional courses and online training - what we call mini-fellowships - that we provide. Another thing we do for quite a few of our client hospitals is that we provide second reads for the local radiologists in training. They do the preliminary first reads locally, and then we provide subspecialty supportive feedback to the local residents. We also provide follow-up webinars that support them in their training. Our clients are increasingly interested in this because of the shortage of local senior radiologists. It's difficult

sometimes to have sufficient local capacity to support the registrars in their training.

### **Do you think teleradiology has a place in after-hours coverage regarding reading speed and the threat of malpractice?**

After-hours coverage is one of our most important service areas. We cover the night shifts for many hospitals in Scandinavia and the UK. We do that partly with radiologists based in Australia. We use the time difference, which allows us to work with night shift emergency cases during the Australian daytime. We think this can have a positive quality impact and help avoid night-time work. We have been doing that for around 15 years. It's a clever way to use teleradiology and explore possibilities with time differences. We can also provide subspecialties into the night shift services because we have many radiologists working in our remote radiology team. Instead of having junior radiologists working in the middle of the night, we have a whole group of radiologists working during the daytime. We also see an increase in the need for more complex scans during night shifts like stroke MRI, CT perfusion etc. The emergency radiology needs for hospitals are increasing in complexity, and it's advantageous if you have sub-specialist radiologists who can provide these services.

### **Given the number of radiologists you employ and keeping the shortages in mind, how do you attract radiologists?**

We need to be able to attract and retain good-quality radiologists. One of the key reasons why radiologists have chosen to work with TMC is our quality focus and the focus on subspecialist radiology. Our radiologists have the possibility to work with exactly the case types they are

interested in and have the skills for, which can sometimes be difficult in a hospital where you might have to work with a broader range of examinations. We also benefit from having a nice reporting location for our radiologists, which also helps. We have radiologists who report from our hubs in Noosa and more in Sydney. We

stroke and trauma, we typically have reporting times that are less than 10 minutes. We also have direct communication with the local referring clinician, the trauma surgeon, for example, and we have a direct phone or video link in some cases. You cannot deliver emergency services unless you can do that quickly because it is part

that are out there in the market space. I think we can safely say that we get quite an important and valuable quality gain by using AI. One of the areas that we are still trying to explore is how much efficiency gain we can get from AI. You sometimes need to look beyond the actual image interpretation activity and look at other aspects of

## The most important thing we can provide to a healthcare system is flexible access to high-quality radiology reporting

will soon offer possibilities to report emergency radiology from Japan and New Zealand back to Europe. Also, we are quite a strong medical-focused company. We try to provide the best possible working conditions, technical advice for our radiologists, everything from IT support and reporting environment, and possibilities to grow. All TMC radiologists have access to TMC Academy. We have a huge range of training services. Last year we produced around 27,000 CME credits for radiologists participating in TMC Academy activities. Hence, we see a positive influx of new interested radiologists and a high retention rate. We have many radiologists working for TMC for more than ten years, and some people have been here for over 15 years.

### **Do you think teleradiology can get final reports in a timely fashion for emergency room imaging readings? And if not, what would be needed to make this happen?**

We cannot deliver an emergency reporting service unless we can do that in a speedy and timely way. For very acute cases, for example,

of the service. There is no other alternative. We might even be able to provide a speedier service than you can do locally because many hospitals, before using outsourced radiology for the night shift, will need to bring a radiologist into the hospital within 30 minutes. We have the whole team on standby, so we can provide very short turnaround times for urgent cases.

### **Today, AI is everywhere. How much can it help TMC? What role does it play, and valuable is it in assisting radiologists?**

This is probably one of the most important questions we are working with. We were early adopters of AI and implemented our dedicated AI Centre of Excellence team four years ago. We have seen a huge, significant, positive quality impact using AI. We have several algorithms running continuously to help us detect pathologies that could sometimes be missed, especially in an emergency setting. We for example use algorithms today to detect bleedings in the brain or pulmonary embolism. We are carefully testing and evaluating solutions

the radiology workflow to get efficiency gains. We have, for example, implemented a tool that helps us ensure that the images are, automatically and correctly, presented for our radiologists. By triggering the correct hanging protocols, the cases are presented in the way that individual radiologists would like to have them presented, and you can save the time that it normally would have taken for the radiologist to hang the images themselves. We have also other solutions we're looking into to automate other parts of the workflow. But we are also testing solutions that can potentially, in the future, help us automate part of the interpretation as well, such as filtering out all the normal cases so that radiologists can focus on cases where they are more likely to be pathologies for example. It is a rapidly growing area. We are 100% sure that AI will play a very important role. It does already today, but it will play an increasingly important role going forward. Exactly how much would we be able to substitute what the radiologists are doing and when is very difficult to predict today. Some providers in the market claim they can provide full autonomous



rates for some areas, which is an interesting development. But it's still a lot of caution.

**What benefits can providers like TMC provide our audience to conduct their business?**

The most important thing we can provide to a healthcare system is flexible access to high-quality radiology reporting. We can also help them to increase quality and make sure they can introduce new radiology methods because we typically have subspecialties across a broad range of areas. For small and midsize hospitals specifically, who would like to introduce a new type of examination but might not have the local competence to do so, we can support them with complex exams for the night shifts. It's a no-brainer how valuable that is because it frees up daytime capacity for the hospitals and increases the quality of the services by using more senior radiologists working from a different time zone. It can also reduce costs, especially for small and midsize hospitals that might need radiologists on call doing very few cases.

**What are some countries TMC is considering expanding into? Is there any expansion on specific specialties?**

At TMC, we currently provide teleradiology services to clients in Sweden, Denmark and the UK. We are exploring other European markets and would like to bring our services into more European hospitals. We are also looking at other types of services. One example is the stroke MRI service during night-time that we recently implemented in Denmark. We also see several areas where we will implement more 24/7 coverage, in general, to provide acute reporting. We are also looking into other diagnostic areas.

We provided pathology services previously, and that's an area that is growing now, especially in the UK, where more and more pathology labs are digitalising their histopathology activities, which makes it possible to provide efficient telehealth services. We are looking into a wider range of telediagnostic areas but also to be there for a more complex development of medical imaging and radiology and to use our subspecialist approach to support our clients to introduce new methods, even if it's in the middle of the night. That is the focus area right now.

**Do you think radiologists will lose more ground in the future?**

That's a very interesting question. I think it's quite likely that some areas of radiology might go over to some clinician groups, such as orthopaedic surgeons. With more powerful AI solutions, it could be that AI plus non radiology clinicians could cover some of the radiology areas in the future. The role of radiology will slightly change. Also, going forward, if you have more AI solutions, doing more of the support work, radiologists will probably have a more consultative role in the future to participate even more in the clinical work with other colleagues in the tumour boards, for example, and to play more of a consultant, and spend less time for pure image reading potentially. It would be important for radiologists and for our profession, too, to make sure that we stay ahead and make radiologists still relevant in the future by adopting new technologies. Radiology is a very technology-driven profession, and many radiologists have a deep knowledge of technology. So I think radiologists are well positioned to take a proactive lead when it comes to introducing more advanced imaging

technologies but also AI and safely using these solutions.

Today, we are facing the problem of a shortage of radiologists, which in some countries, like the UK, is getting very problematic. We need radical new ideas to be able to deal with them. In some countries, it can take many weeks before a case is reported. I think a more radical solution might be needed to deal with this because it's a problematic situation. Since radiology has such an impact on patient care, it needs to deliver and work in a timely fashion. Let's see what role AI will play here, for example to prioritise cases with potential important pathology.

**Radiology is extremely well-paid in comparison to many other disciplines. Where's the problem? Why does nobody want to be one to become a radiologist?**

The shortage of radiologists is multifactorial and varies from market to market. There is a huge interest in radiology in general. This is a specialty that quite a few young doctors proactively decide to go for in their careers. There has been underfunding when it comes to radiology training positions in many countries for reasons that are difficult to understand. Hence, I don't think there's a lack of interest from young doctors. There was a discussion for some time that AI would take over a radiologist's job, and that would reduce the interest to come to this specialty. Today that is not the case. Most radiologists are interested in coming into this specialty because of the interesting things happening around the new technologies in general. I think it has been more of a chronic underfunding of training positions for a long period. ■



# Successful Digitalisation Pathways

# HCO's Using Digital Tools to Rebound from Pandemic, Supply Chain Issues

The last 3 years have been very difficult times for healthcare organisations as they have faced and dealt with the challenges of COVID-19, supply chain disruptions, and staffing problems. The 2022 Digital Health Most Wired survey, conducted by CHIME, shows how facilities are increasingly turning to digital tools to address infrastructure, security, administrative/supply chain, analytics/data management, innovation and other clinical and business areas.



STEPHEN  
LIEBER

Chief Analytics Officer  
College of Healthcare Information Management  
Executives (CHIME)  
United States

## key points

- The 2022 Digital Health Most Wired (DHMW) survey, conducted annually by the College of Healthcare Information Management Executives (CHIME), shows how facilities turned to digital tools to address several challenges in the recent years, including the impacts from COVID-19.
- 18 U.S. acute care organisations and 17 U.S. ambulatory organisations achieved the highest level of recognition. Many of them implemented advanced technologies, but they often leverage these technologies in innovative ways and have encouraged deep adoption across their entire organisation.
- Across the survey's nine sections, there are numerous findings that show not only how care delivery organisations are rebounding from the crises of the past several years but also how they continue to advance their digital health agendas.

## Results from 2022 Digital Health Most Wired Survey Show Digital Trends

Healthcare delivery organisations have faced a combination of historic global challenges over the past several years: pandemic, supply chain disruptions, and high inflation. These challenges have impacted clinical and business operations with a variety of outcomes and consequences.

These impacts are evident in the 2022 Digital Health Most Wired (DHMW) survey, conducted annually by the College of Healthcare Information

Management Executives (CHIME). This survey represents over 38,000 facilities from 10 countries, primary from the United States (U.S.). Those providers include organisations that serve patients across the continuum of care: acute care, ambulatory care, and long-term/post-acute care.

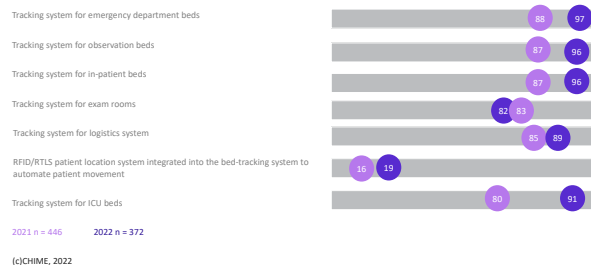
This year, 18 U.S. acute care organisations and 17 U.S. ambulatory organisations achieved the highest level of recognition, Level 10. In addition to meeting the criteria for levels 1–8, organisations at level 9 or 10 are often leaders in healthcare

technology who actively push the industry forward. Not only have many of them implemented advanced technologies, but they often leverage these technologies in innovative ways and have encouraged deep adoption across their entire organisation. As a result, they are realising meaningful outcomes, including improved quality of care, improved patient experience, reduced costs, and broader patient access to healthcare services. Some of the advanced technologies used to achieve these outcomes include telehealth

solutions, price-transparency and cost-analysis tools, access to data at the point of care, and tools to engage patients and their families throughout the care process.

Particularly related to the COVID-19 pandemic and resulting supply chain disruptions, the survey reports a historically high number of facilities achieving the highest level of recognition (Level 10) in the areas of Administrative & Supply Chain and Clinical Quality & Safety as care delivery organisations rebound from this double hit.

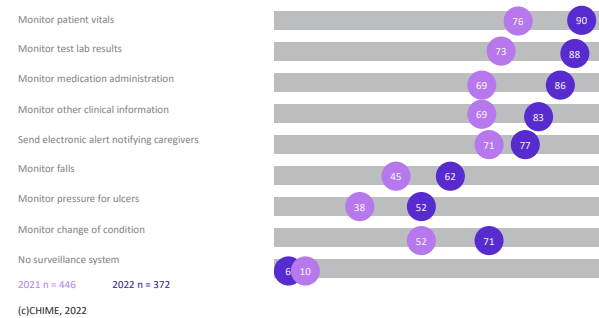
Real-time insight into supply chains, product inventory, and bed/exam room tracking is important, but the criticality of such insight became evident over the past several years. As a result from the disruption of supply deliveries, unprecedented demand for clinical supplies, and skyrocketing emergency care demand, real-time monitoring became a paramount concern. Significant increases were reported by the DHMW survey in the use of bed/exam room tracking and patient-flow software systems as compared to 2021. Among intensive care units, an area especially hard hit by the pandemic, such tracking system use increased by 11% over the previous year.



#### Bed/Exam Room Tracking or Patient Flow Software

The unprecedented patient demand, especially in the areas of emergency and intensive care resulting from COVID-19 related illnesses, also

impacted the extent to which care delivery facilities utilised digitally integrated clinical tools. Digitally integrated surveillance systems in the areas of monitoring patient vitals, monitoring test lab results, monitoring medication administration, and monitoring of other clinical information all increased by 20% or more over the past year.

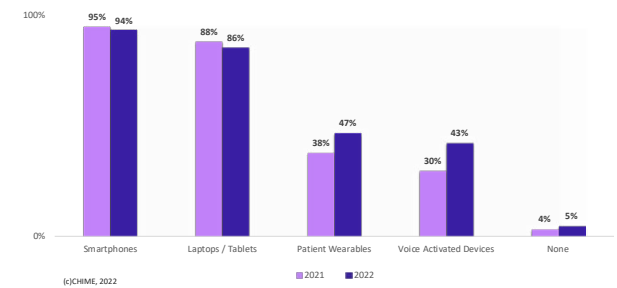


#### Surveillance System integrated with EHR

These results provide two important takeaways. First, leveraging digital technology to make the right information available to the right people when needed continues to be a key information technology objective. Second, the extremely high demand for clinical care for high-risk patients further increased the imperative to have digital tools integrating care into record keeping on a real-time basis. Between the high demand and staffing shortages, digitally supported care is critical to clinical quality and safety.

Across the survey's nine sections, there are numerous of findings that show not only how care delivery organisations are rebounding from the crises of the past several years but also how they continue to advance their digital health agendas. Areas ranging from wireless technology to analytics & data management to patient engagement show further adoption of digital technologies.

Infrastructure trends reported in the 2022 DHMW survey show significant year-over-year increases in mobile point of care devices (+9%) and traveling profiles (+8%) as the demand on clinical staff rapid response intensified during the pandemic and was exacerbated by clinical shortages. Furthermore, use of employee-owned devices for patient care has become near ubiquitous with 94% of facilities allowing use of employee-owned smartphones and 86% allowing use of employee-owned laptops/tablets for patient care.



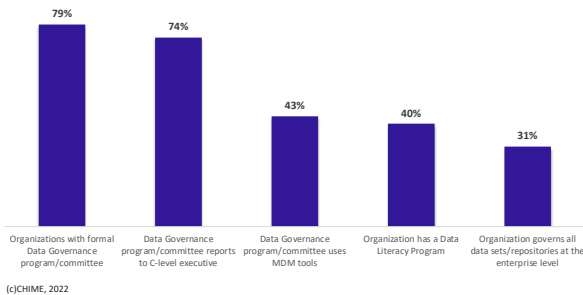
#### Adoption of Employee-Owned Devices in the Use of Patient Care

As widely promoted in trade show exhibitions and vendor advertisements, data analytics has been viewed as a growth area in health information technology. In fact, the survey does show significant growth in the use of near real-time analytics and in the delivery of data to clinical leaders. However, there is also evidence of gaps in adoption and level of sophistication.

Foundational components for clinical and business analytics, enterprise data warehouses (EDW) or operational data stores (ODS) exist in 94% of the responding facilities for their clinical and business intelligence efforts. But what is housed there varies: 69% send supply chain/ERP data to the EDW or ODS while only 39%

send CRM data there. The survey also found that clinical quality metrics were the most commonly delivered for real-time analytics while only 45% delivered data related to social determinants of health.

Style of data governance and use of data governance tools provide an insight into the level of data management sophistication for care delivery organisations. While 79% of respondents have established a formal data governance program/committee, just 43% of them use master data management tools and only 31% govern all data sets/repositories at an enterprise level. This illustrates the evolution still ahead for most care delivery organisations.



### Adoption and Execution of Data Governance Program

Not surprisingly in this pandemic era, digital tools to remotely connect and engage with patients show some of the largest increases reported. Increasingly, care delivery organisations are creating dedicated digital officers to drive their digital health strategies which are often focused heavily on engaging patients outside of the facility. The survey reported 16% increases in the use of patient/family facing videos to educate patients and to share lab and test results and an 11% increase in such videos to address medication prescriptions and related matters.

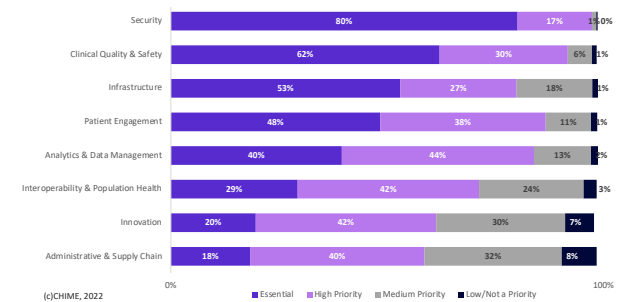
Conversely, as the 2020 and 2021

hospitalisation spikes were replaced by somewhat smaller spikes in 2022, telehealth visits among reporting facilities declined by nearly 6% to just 13% of total visits. Particularly in the United States where payment methodologies may influence visits, there remains much to be done to drive care to the most effective, most efficient, and most convenient locus of care.

A new section to the 2022 DHMW survey focused on innovation. Investments in new technologies and digital solutions are clear drivers of innovation. While the ability to pursue such investments is affected by the resources available for such purposes, nearly all reporting organisations (96%) are looking to drive clinical innovation through investment in these solutions. More than 23% of all reporting organisations expect to spend 10% or more of their IT spend on experimentation/trials of technological innovation, new ideas, ventures, and related solutions. This illustrates not only how important investing in innovation is but also how many are aggressively pursuing these strategies to improve their ability to deliver care and achieve optimal outcomes.

So where does this level of investment put health care organisations on their transformational journey? Sixty-eight percent report they are on or ahead of their schedule in their digital transformation execution, compared to plan with the biggest challenges to realising a successful transformation being a lack of dedicated budget (20%), cultural resistance (15%), tendency for short-term planning over long-term planning (12%), and an over reliance on legacy technology (11%).

Finally, the survey also asked participants to identify their organisational priorities for 2023. The highest reported priority, with 97% classifying this as an essential or high priority, was security. This was followed closely by clinical quality and



### Organisational Priorities for 2023

safety with 92% rating this area as an essential or high priority and the third most important priority for 2023 by these respondents was patient engagement at 86%. All are consistent findings with expectations held by most and despite heavy focus and investment in these areas over the past few years, they remain at the top of most priority lists.

The primary survey is conducted each year between April and June; however, organisations may contact CHIME at any time to receive the current year's survey instrument and submit their data for scoring. For more information, go to <https://dhinsights.org/analytics> and click on the I Am A New Provider Partner button. More detail on the 2022 Digital Health Most Wired survey can also be found in the National Trends Report which is available at <https://dhix.dhinsights.org/wp-content/uploads/2022/11/2022-DHMW-National-Trends-Report.pdf>.

### Conflict of Interest

I am on contract with CHIME as their Chief Analytics Officer but I have no conflict or derive no financial gain from the publication of this article. ■

# Radiomics in Cardiovascular Imaging: Current Role and Future Perspectives

Radiomics may lead to personalised management and treatment of cardiovascular diseases, which could impact patients' prognosis.



RAFFAELE  
ASCIONE

Department of Diagnostic Imaging  
Pineta Grande Hospital  
Castel Volturno, Italy

## key points

- In recent years, multiple radiomics-based tools have been investigated in the field of cardiovascular imaging.
- Radiomics may predict outcomes of cardiac diseases without the need of invasive procedures.
- Cardiac CT radiomics may enhance the assessment of advanced atheromatous plaques, improving risk stratification and treatment in patients with CAD.
- Radiomics may improve cardiac MRI prognostic value and its well-known capability of myocardial characterization even without the use of contrast agents.

**Carmela Nappi** | Department of Advanced Biomedical Sciences | University of Naples Federico II | Naples, Italy

**Andrea Ponsiglione** | Department of Advanced Biomedical Sciences | University of Naples Federico II | Naples, Italy

## Introduction

Radiomics represents a promising image analysis technique that aims to improve the diagnosis, the characterisation, and the prognosis of diseases by extracting objective quantitative features that may be missed by human eye (Sollini et al. 2019). While mainly developed through oncologic research to obtain information on the characteristics of tumours (Gillies et al. 2016), there is an increasing interest in the use of radiomics for cardiac purposes (Ashrafinia et al. 2021). As cardiovascular diseases represent the main cause of morbidity and mortality worldwide (Virani et al. 2020), there is an ever increasing

clinical request for non-invasive diagnostic approaches (Selvanayagam 2016). Therefore, radiomics biomarkers detected by data extraction from cardiac computed tomography (CT) and cardiac magnetic resonance imaging (CMR) may be a valuable tool to assess several cardiac pathologies, such as atherosclerotic coronary artery disease (CAD), myocardial viability, and cardiomyopathies (Kumar et al. 2012; Raisi-Estabragh et al. 2020). Recently, machine learning (ML) and deep learning (DL) algorithms have provided even more options, allowing to better evaluate the characteristics of cardiac disease (Langs et al. 2018).

## Radiomics in Cardiac CT

Cardiac CT angiography (CCTA) has gained a pivotal role in assessing CAD and plays a critical part in evaluating cardiac structures (Hoffmann et al. 2012). CCTA can noninvasively visualise coronary arteries and plaque morphology, representing an invaluable tool for risk stratification, and guide treatment plans in patients with CAD (Douglas et al. 2015).

Recently, some exploratory papers have evaluated the feasibility and diagnostic performance of cardiac CT radiomics analysis (Kolossváry et al. 2019; Mannil et al. 2019).

In the last few years, some authors developed

a radiomics-based ML model that proved to be superior to conventional evaluation of CCTA in the assessment of advanced atheromatous plaques. In particular, the model performed better than radiologists in measuring low attenuation areas and average Hounsfield units of the plaque resulting in a more accurate evaluation of high-

texture analysis in 2016, CT imaging could discern between healthy and scarred myocardium (Antunes et al. 2016). Soon afterwards, the advent of radiomics analysis increased the capability of cardiac CT in differentiating healthy myocardial tissue from infarcted myocardium. Hinzpeter et al. found that cardiac CT texture analysis was

from non-pannus (Nam et al. 2019). Chun et al. compared the capability of radiomics and CT attenuation values in differentiating left atrial appendage thrombus from circulatory stasis and found that the addition of radiomics features represented an added value to help radiologists to identify thrombus in a single early-phase scan

## Cardiac CT radiomics may become the next tool to detect image biomarkers more precisely, facilitating improved identification of vulnerable patients

risk atherosclerotic lesions, facilitating risk stratification of patients (Kolossváry et al. 2019).

Peri-coronary adipose tissue inflammation is another critical element in the development of atherosclerotic plaque, progression, and rupture. Radiomics features extracted from cardiac CT images have demonstrated potential in evaluating the association between atherosclerotic plaques and perivascular adipose tissue inflammation, fibrosis, and vascularity, more precisely than mean attenuation alone (Oikonomou et al. 2019). These results highlighted that the texture phenotype of adipose tissue might provide a non-invasive approach for identifying microvascular adipose tissue remodelling (Antonopoulos et al. 2017; Oikonomou et al. 2019). In some authors' opinion, this may represent a game-changer to distinguish patients with acute myocardial infarction from those with stable CAD or to predict patients with a high risk of major adverse cardiac events (MACE) (Lin et al. 2020; Oikonomou et al. 2018).

Myocardial tissue characterisation has always been a prerogative of CMR, but with recent technological improvements, even CT scanners can play their part. With the introduction of

helpful in determining healthy and infarcted myocardial tissue with good reproducibility and accuracy (Hinzpeter et al. 2017). Mannil et al. also demonstrated the capability of radiomics and ML in detecting myocardial infarction on non-contrast CT images acquired for calcium scoring (Mannil et al. 2018).

Ventricular arrhythmias (VA) represent an essential prognostic factor in patients with cardiovascular diseases. Researchers have also explored the capability of radiomic features to predict recurrent VA in patients with different remodelling patterns sustained by various cardiomyopathies, such as patients with high arrhythmic risk for left ventricular hypertrophy (Esposito et al. 2018; Kay et al. 2020).

Cardiac CT is also essential for the differential diagnosis of cardiac masses in order to establish optimal treatment strategies. However, differentiation is challenging due to the nonspecific clinical and imaging appearances of many cardiac masses (Poterucha et al. 2019). Nam et al. explored the role of CT radiomic features to differentiate pannus from thrombus and vegetation, showing that the algorithms were superior to radiologists in identifying pannus

(Chun et al. 2021).

Despite these exciting applications, they represent only preliminary explorations.

These findings, do however, indicate that cardiac CT radiomics may become the next tool to detect image biomarkers more precisely, facilitating improved identification of vulnerable patients.

### Radiomics in Cardiac MRI

CMR is pivotal in qualitatively and quantitatively assessing cardiac structure and function. However, quantitative measures are limited by technical factors and poor discriminatory power due to the overlap of similar appearances of different pathologies. This sometimes makes it challenging to distinguish among similar morphological patterns, such as hypertensive heart disease, hypertrophic cardiomyopathy (HCM) or athletic cardiac remodelling, whose distinctions are critical to guide the clinical assessment, management, and therapy of these patients. Furthermore, CMR likely plays a fundamental role in predicting prognosis in many different clinical settings but its ability is still limited (Moss et al. 2002; Stecker et al. 2006). CMR-based radiomics is emerging as a valid option to help

defining image phenotypes and improve diagnosis, prognosis and treatment selection.

Several papers have recently explored the feasibility and potential clinical utility of radiomics and texture analysis with CMR.

CMR cine images without using an intravenous contrast agent, which could be a fundamental achievement for CMR imaging in terms of time-saving and safety (Baessler et al. 2018).

In addition, a recently published article stated

literature about CMR radiomics is still limited, and further efforts are needed to confirm these preliminary results and to facilitate the radiomics transition from academic to clinical settings.

## CMR radiomics has the potential to improve myocardial disease classification and prognosis

Some authors have evaluated the ability of CMR radiomics analysis applied to non-contrast cine images to accurately differentiate between myocardial disease states and healthy, suggesting that radiomics features may be capable of highlighting myocardium alteration at a tissue level (Baessler et al. 2018). In particular, a recent study evaluated the ability of radiomics to identify distortions in myocardial architecture that are not detectable by the human eye. These signatures could discriminate accurately between the hearts of individuals with hypertension (morphologically normal at CMR) and those who are normotensive (Cetin et al. 2020).

Furthermore, Baessler et al. demonstrated that radiomic texture analysis applied to T1 and T2 maps was superior to mean T1, mean T2, and Lake Louise diagnostic criteria in discriminating infarct-like acute myocarditis (Baessler et al. 2019). The same group also demonstrated the possibility of accurately discerning patients with myocardial infarction from healthy controls through radiomics and texture analysis on

that radiomics analysis of late gadolinium enhanced (LGE) CMR images is capable of distinguishing acute myocardial infarction from chronic myocardial infarction (Larroza et al. 2017).

It is important to remember that the assessment of myocardial infarction and myocardial viability are two of the most frequent requests for which clinicians refer to CMR, and these new radiomic tools could be invaluable in offering better clinical support.

As to prognosis and prediction of clinical outcomes, a few studies have been recently published. In a study on patients with chronic myocardial infarction, Kotu et his group demonstrated that radiomics features extracted from LGE scar were superior to scar size and location in determining the risk of dangerous arrhythmias (Kotu et al. 2015). Similarly, Amano et al. showed that different textural features extracted from LGE images could be useful to predict VA in HCM patients (Amano et al. 2018).

In summary then, CMR radiomics has the potential to improve myocardial disease classification and prognosis. However, the

### Conclusion

Through specific, quantitative insights provided at a microstructural level, radiomics can favour a better understanding of the physiologic mechanisms of cardiac disease that can be of great value in developing tailored cardiovascular medicine therapy. And thus, in future, be gradually introduced into the clinical physicians' workflow.

However, even if most of the recently published papers have shown promising results applying radiomics to cardiac imaging, the current research is still far from supporting clinical decision-making. Radiomics-based cardiac imaging studies have been proved to show an overall insufficient methodological quality (Lambin et al. 2017; Ponsiglione et al. 2022). A more standardised methodology in the radiomics workflow is needed to cross the translational line between an exploratory investigation method and a standardised added value to precision medicine workflows.

### Conflict of Interest

None. ■

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For full references, please email [edito@healthmanagement.org](mailto:edito@healthmanagement.org) or visit <https://ij.ijm.tjdz>



# Why Should Radiologists Care about IT Standards and Interoperability?

Interoperability is essential in healthcare in general. In radiology, there are specific and relevant requirements, as radiology facilities are often completely digitised and a wide variety of systems need to communicate with each other.

The use of IHE profiles is a great help for users when deciding on new modalities or IT solutions, as there is no need to define individual aspects of standards. By specifying specific IHE profiles, manufacturers can very accurately assess what the requirements and expectations are. However, both DICOM and IHE rely on the involvement of users to ensure that medical concerns are appropriately addressed in the further development of the standards or integration profiles and prioritisation.



PETER  
MILDENERBERGER

Vice-Chair & Head of Radiology-IT  
Department of Diagnostic and Interventional Radiology  
University Medical Center Mainz, Germany

## key points

- Always good to review starting at the beginning, in this case reviewing the digital process in imaging.
- Standards are necessary for interoperability to be seamless.
- For radiologists to be able to seamlessly integrate in the health care chain, they should be part of the development and implementation of these connectivity standards.

## Radiology and Information Technology Have a Long History Together

The digitisation of imaging modalities began in the 1970s with digital radiography and computed tomography. This was followed in the mid-1980s by the introduction of the first radiological information systems (RIS). PACS (Picture Archiving and Communication System) solutions have been increasingly used in practice since the mid-1990s. Often, a dedicated IT department has been established in radiology facilities during this time. The

use of IT solutions then continued with speech recognition.

For about 20 years now, the topic of structured reporting and clinical decision support has also been a major digital development in radiology. This is also reflected in an exponentially increasing number of publications on these topics; a literature search in PubMed, for example, yields over 16,000 hits for the topic of structured reporting. And for the last few years, there has been a topic that is generating even more attention in radiology: artificial intelligence (AI). In 2022 alone, there are already over 1,400 publications on this topic.

### Without Standards: No Inter-operability

It is obvious and thus easy to understand that the use of such different solutions in a radiology department needs certain rules. The probability that all solutions can be provided by one vendor is rather low, resulting in a plethora of 'plug-and-play' applications. Therefore, standards are needed for these different issues, both regarding

Even if two people nominally speak the same language but have very different dialects, they may not understand each other. Therefore, special attention should be paid to this issue. One solution is to reduce such "language differences" through the use of so-called 'integration profiles'.

IHE is an international organisation that develops such integration profiles for various

in healthcare. It is accredited as a international standard by ISO under the number 12052. The DICOM standard is published in one version that is periodically updated. For this purpose, so-called supplements are developed that are later incorporated into the standard. Corrections to the standard can be made by so-called Change Proposals. DICOM has a continuous

The term inter-operability refers to the ability to connect & exchange information between different healthcare systems without any significant limitation in connectivity

physical connectivity and, for example, content.

The term inter-operability refers to the ability to connect and exchange information between different healthcare systems without any significant limitation in connectivity.

Which standards are relevant for radiology? On the one hand, these are standards that are used for the general definition of patient data or findings; historically, this is associated with the term HL7. For the imaging itself, the DICOM standard has been established in radiology for nearly 30 years. In addition, other general standards like from Internet technology, play a role.

A further development is the re-naming of HL7 to FHIR, and this standard is rapidly gaining in importance, since it provides support for web-based and mobile applications in particular.

As important and indispensable as standards are in radiology, they also have their limitations. Often variations, so-called options, are defined in the standard and depending on how these are implemented in an application, interoperability between different systems is easy, limited or even impossible. One can compare the implementation of standards with different gradations, for example, with different dialects of a language.

applications, especially in Radiology and in IT infrastructure. Manufacturers can then refer to these IHE profiles when developing their applications and submit corresponding integration statements.

A closer look at these most important areas for radiology:

### DICOM

The DICOM (Digital Imaging and Communications in Medicine) standard is an international standard that was initiated in 1993 by NEMA (National Electrical Manufacturers Association) and ACR (American College of Radiology) as well as the RSNA (Radiological Society of North America) and is now supported and co-developed by numerous other organisations, including the ESR (European Society of Radiology) and other national (European) societies. DICOM started in radiology, but is now used in many other medical fields, for example ophthalmology, cardiology, pathology or surgery, also with appropriate extensions.

DICOM is organised into so-called working groups (WG), of which there are about 30. DICOM is probably the most successful standard

maintenance process, which is ensured by WG 6. Manufacturers of IT applications must publish a so-called DICOM Conformance Statement, which shows the tasks of a product or software and how the different options have been implemented or which forms of communication are supported. Based on such DICOM conformance statements, it is possible to check whether two applications can communicate with each other.

DICOM continues to be a very active standard that continuously publishes further developments, in 2021, for example, on cone-beam CT dose reports, on MR prostate structured reporting, or on notation in pathology. In 2022, developments followed in the area of video transfer or support for PACS migrations through a so-called "Archive Inventory".

DICOM Working Group 23 has as its focus AI applications and application hosting. One of its goals is to ensure that AI applications that communicate with modalities or PAC systems use correct metadata.

### HL7

HL7 (Health Level 7) version 2 has been known in the healthcare sector for many years; in the

hospital environment, in particular, it is the standard for entering patients' medical data. A broad installation of HL7 faces some limitations, especially in the area of content definition, the so-called semantic interoperability. HL7 has developed a version 3 for this purpose, which provides for a so-called Common Document Architecture (CDA) and can thus ensure a further developed semantic interoperability. However, the adaptation of this standard in the market is very cumbersome and limited.

HL7 has drawn the consequences from this and developed a completely new approach under the name FHIR (Fast Healthcare Interoperability Resources), which is intended to ensure simple access, especially for web-based or mobile applications. This standard has been met with great interest worldwide and can already be found in numerous applications.

## IHE

IHE (Integrating the Healthcare Enterprise) is an initiative that was initially started by RSNA and HIMSS (Healthcare Information and Management Systems Society) about 20 years ago and was intended to improve the exchange of information in healthcare by reducing the interoperability problems that were based on different interpretations and uses of options. IHE therefore coordinates established standards and develops these so-called integration profiles with the aim of improving communication, simplifying implementation and thus ensuring more effective use of information in healthcare overall.

IHE has a standardised development process whereby a relevant topic is first identified, the interoperability requirement is defined, and an integration profile is developed. This can then be

implemented and tested by developers. Further down the line, adoption into products is then facilitated, while governance of interoperability is ensured through the publication of IHE interoperability profiles.

In the meantime, there are numerous integration profiles, especially in radiology, but also in other medical fields, for example cardiology, ophthalmology, endoscopy and others. A very essential area for IHE is also the definition of integration profiles for the general IT infrastructure, these are used in numerous regional or national eHealth concepts.

More recent examples in radiology are REM (Radiation Exposure Management), which was published about ten years ago and today forms the basis of dose management systems that have been in use now for several years. Another interesting application is the documentation of contrast medium application, whereby the CM injectors can document the volumes for contrast medium, saline solution as well as the pressure values in corresponding templates. This information can then be used across devices. The associated IHE profile CAM (Contrast Administration Management) has been published in 2021 as a so-called "Trial Implementation" edition.

Current integration profiles that are attracting a lot of interest in radiology are two profiles in the field of AI: on the one hand, the documentation and communication of AI results and, on the other hand, the orchestration of the workflow of AI tools. Here, it can be ensured according to certain rules that for certain examinations, for example a thorax CT, the relevant AI tool, in this case for the detection of lung foci, is assigned the task and the results are returned to the higher-level PAC system or RIS.

A very important development for IHE is the implementation of so-called Connectathons. These are usually five-day events for interoperability testing. Often 300 or more experts from numerous companies are involved who can live-test the interoperability of their applications with various other partners under the supervision of independent IT experts, so-called monitors.

In 2022 this Connectathon took place for the first time as a joint event simultaneously in Europe and the USA. A total of 89 profiles with 2,128 tests were tested, 219 of these tests were transatlantic. The results of the Connectathons can also be freely viewed in a browser, sorted by various criteria such as company or profile.

This type of product validation is supplemented by a web-based online offering from IHE, the so-called "IHE SHARAZONE". Here, data for various applications are available, which allow interested developers to test their own products regardless of time and place.

Internationally, IHE is organised in various regional committees and subsequent national committees for the further development and dissemination of IHE. The actual development of the integration profiles is done in domain-specific committees, for example for radiology, IT infrastructure and others.

For the first time in 2015, the European Commission referenced 27 IHE profiles that should be used for calls for tender. These are mainly profiles in the area of IT infrastructure, but also general profiles for use in radiological facilities, for example.

## Conflict of Interest

None. ■

## acknowledgement

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# New Public Procurement Specifications and New Public Procurement Flows Public-Private Collaboration

The future goes through the incorporation of innovative procedures in contracting, which through new specifications, achieve great solutions for the needs of citizens in management, technology, health, etc.

MARIO  
LEDESMA



Lawyer  
Specialist in Public Procurement Law

## key points

- Replacing an ageing health care infrastructure demands careful planning after.
- Realising that an ageing population, new and better therapies and new financials are only going to be more common.
- Government and private sector need to collaborate on all levels.

## Introduction

We do not discover anything new if we point out the great effort made by EU countries to maintain the welfare state, but when we talk about spending on health, we see that these figures do not stop increasing year after year, due to the ageing of the population through an increase in life expectancy (Spain is the country with the second highest life expectancy in the EU), the longer survival of pathologies, as well as the development of new and more effective drugs. Proof of this is that there has been an increase in per capita health budgets, compared to 2022, by an average of more than 7%, reaching an average of € 1,808 / inhabitant.

That is why the value-added of technology to

address these challenges of the present and, also of the future, at the healthcare level, allowing for a much more personalised medicine, as well as sustainability of the system, is undeniable.

This is also why Europe needs to modernise public services, boost the EU's industrial competitiveness and contribute to the development of new technologies in order to tackle the most pressing societal challenges. This, among other measures, requires the involvement of Member States by developing national strategies and policies to boost public procurement of funds for innovation.

Europe is aware of the need for innovation to turn research results into new and better services and products, thereby achieving a direct effect on the

community and, therefore, on improving our quality of life. That is why, within Directive 2014/24/EU on public procurement, the strategic use of public procurement is highlighted to promote innovation by making it the key to improving the efficiency and quality of services to citizens.

This European message is endorsed in Spain with Law 9/2017 on Public Sector Contracts (hereinafter PSCL), pointing out the need for use of public procurement as an instrument to implement innovation policies.

In this line of thought, and with the idea of favoring the most innovative companies, the PSCL introduces the new partnership procedure for innovation, which is regulated for those

cases in which it is necessary to carry out research and development activities regarding innovative works, services, and products, for their subsequent acquisition by the Administration?.

To all this, the PSCL adds the possibility of promoting innovation when designing the award

as opposed to being considered an obstacle, can be a very useful tool, if used properly.

This implies being aware of the existence and possibilities offered by the public purchase of innovation, through its different modalities that, succinctly, we can summarise in:

specifications, positively valuing innovation, through the award criteria and leaving open the specifications of the object of the purchase, so that the bidder can provide its innovative solution.

Likewise, the path of change referenced here can also happen through exploring some of the

That is why the value-added of technology to address these challenges of the present and, also of the future, at the healthcare level, allowing for a much more personalised medicine, as well as sustainability of the system, is undeniable

criteria or the special conditions of execution with the warning that its inclusion in the specifications must scrupulously respect the object of the contract to be conducted.

As far as the incorporation of technological innovations is concerned through the PSCL, an analysis of what is the existing need at all times must be previously established, after which, the doubt may arise as to whether the market has options, or not, to satisfy them. Fortunately, the PSCL has the mechanism of preliminary market consultations, which allow us to collect the necessary information to prepare the tenders, as well as to inform private operators about the contracting plans giving them time to prepare the projects that will be offered later.

In addition to all this, a thorough review of the scheme regarding how the public procurement of technology is being carried out must be undertaken, losing the fear of changes and being aware of the multiple options offered by the current regulations on public procurement, which,

- The **Pre-Commercial Public Procurement:** Research and Development Services of nonexistent solutions in the market, whose contracting is excluded from the PSCL, being necessary a new tender to acquire the result of all this.
- The **Innovation Partnership:** Research and Development Services of nonexistent solutions in the market in a first phase to then acquire in the same procedure their result, provided that it corresponds to the levels of performance and costs that would have been previously agreed.
- The **Public Procurement of Innovative Technology:** Acquisition of what, at the time of bidding, exists at the prototype level, or that may involve having to undertake the impulse of a new or improved technology, which must be feasible to have it in a not too long time.

All of this, without forgetting the possibility of carrying out a more ordinary purchase of innovation through its development in the tender

following avenues:

- ✓ Firstly, at the level of procedures, one can also innovate by abandoning the traditional “open procedure” and exploring the advantages that can offer, for example, in the bidding procedure with negotiation (negotiating those extremes that allow obtaining the best offer) or the competitive dialogue (to develop one or more solutions capable of satisfying the needs and that will serve as a basis for the successful candidates to submit a tender) or, even, according to each specific case, implementing systems for the rationalisation of contracting such as the Framework Agreement or Dynamic Procurement Systems.
- ✓ Secondly, it is essential, through the tools offered by current regulations on procurement, to promote, when possible, efficient contracts for the purchase of technology based on the value it can

generate for the Public Sector. This makes it important to control all the information that this type of contracts generates by in advance designing of indicators, digitalisation, professionalisation in new technologies, etc. This is a challenging task, but likely rewarding due to enormous benefits that can end up being obtained.

As to maintaining control of the process, this can also be done through innovative solutions, through what is known in the health field as a “command center”, that is, information centers focused on simplifying hospital processes and reducing duplications in terms of technology management.

- ✓ Thirdly, a solution such as the comprehensive approach to certain processes or pathologies is essential so as not to contract, with hardly any strategy and in an isolated and independent way, as we exhaust contracts and their extensions
- ✓ Fourthly, the existing technological obsolescence in Spain, especially striking in the health sector, requires the search for new formulas for the purchase of technology, depending on the needs and funding capacity of the public sector such as leases, with or

without purchase option, or services related to the availability of equipment.

- ✓ Fifthly, there are public-private partnership agreements which can serve, through their different modalities, to help address some of the shortcomings related to the public procurement of technology, for example, the often-existing underfinancing.

### Conclusion

In conclusion, the above contains some reflections on the scope that public procurement can have, which, through the eyes of those of us who are habitual actors in this area, we observe and will continue observing and, for which, it is imperative to have an ecosystem in which both

manufacturers and consumers, as well as good practice and transparency have a place.

Therefore, it is necessary to continue innovating and exploring new methods, with which the interests of the Public Sector and private operators are perfectly aligned. All this, without forgetting that in this process of search and change, it is necessary both to be aware of the novelties in public procurement and the new contracting formulas, as well as the adaptation of the existing needs, in each case, to the legal requirements that each of these new contracting formulas may have associated.

### Conflict of Interest

None. ■

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# Health Data Quality: A Dynamic Complexity

Data quality is about having confidence in the quality of the data that you record and reuse. For example, Artificial Intelligence applications consume tons of data. Since we do not know the quality of health data -and yes, we do not know-, may we trust the outcome of this growing number of important A.I. applications? High-Quality Health Data is a “must-have” requirement.

JENS  
DECLERCK



Data Quality Manager

## key points

- Data quality is an evolving requirement that needs to be redefined over time and over different projects. That is why i~HD refers to this as a dynamic complexity.
- Obtaining high-quality data seems evident and straightforward, unfortunately, this does not appear to be the case in a healthcare setting.
- Assessing, labelling, and improving the quality of health data is the responsibility of all stakeholders.
- How i~HD, a multi-stakeholder collaborative, finds itself in a prime position to facilitate the development of 'best practices' in collecting, storing, using and re-using health data quality.

**Dipak Kalra** | President

**Geert Thienpont** | Managing Director | The European Institute for Innovation through Health Data (i~HD) | Ghent, Belgium

## I. Health Data Quality, a Science on its Own

### A. High Quality of Data Implies TRUST

Data quality is about having confidence in the quality of the data that you record and the data you (re)use. In research, data quality is consistently described in terms of its “fitness for purpose/use”.

To assure that the data is of the highest quality and that it is usable, it has to meet some fundamental requirements (e.g., the data has to be complete, correct up to date...). We call these data quality dimensions. In order to describe and evaluate the complex multidimensional aspect of data quality, research has tried to define data quality dimensions. But at this point, there is still

little agreement about the exact definition and meaning of data quality dimensions.

During a series of workshops with clinical care, clinical research and ICT leads from 70 European hospitals, the European Institute for Innovation through Health Data (i~HD) identified nine data quality dimensions. These nine data quality dimensions were deemed most important to assess the quality of health data if this data is to be useful for patient care, for organisational learning and research.

Data quality is an ever-changing requirement that needs to be redefined over time and over different projects. That is the reason why we refer to data

quality as a dynamic complexity. Data quality is defined within the context of these requirements. The quality of clinical data should therefore be regularly assessed and reassessed in an iterative process to ensure that appropriate levels of quality are sustained.

### A. Small Errors, Major Impacts

Obtaining high-quality data seems evident and straightforward, unfortunately, this does not appear to be the case.

Several studies have highlighted significant issues regarding the availability and quality of data in the electronic health record (EHR). In a

survey conducted in 2020, 22 889 patients read their ambulatory visit notes in order to assess the frequency and types of errors within these notes. Of these patients, 21.1% reported a perceived mistake and 42.3% reported that the mistake was serious. Unfortunately, these errors in EHRs are common, and many of these errors are related to medications (Bell et al. 2020). Another example shows us that paediatric patients less than 2 years old and those in the intensive care units were at the greatest risk for medication errors, and incorrect dosage was found to be the most common error made (Weir et al. 2003).

To unlock the full potential of (re)using real-world data regarding primary (for example, clinical decision making) and secondary (for example, clinical research) use, it will be important to realise that data quality is not only about measuring and assessments. While measurement is an integral part of the data quality journey, it also involves the management of people, processes, policies, technology, and standards within a hospital or GP clinic. Obtaining, maintaining and improving data quality is not a one-man job. It is important to note that all stakeholders, including patients, within the healthcare ecosystem should actively participate in the data quality effort. In short, we need all stakeholders!

## II. We Need ALL Stakeholders!

Data quality is not only a relationship between the healthcare provider and his patient. i~HD brings all stakeholders within the healthcare ecosystem together in a neutral forum, so that they can learn from each other, share challenges, and work with us and our network of European experts to

develop solutions that enable us to scale up the quality of data and the (re)uses of health data.

Not only do patients and clinicians want health data to be safe, rapid and evidence-based, regulators and health technology assessment agencies also want to trust real-world evidence in decision-making. Healthcare funders need good-quality data to reward high-quality and value-based health care. Meanwhile, industry wants to re-use routinely collected health data to accelerate clinical research. Public health agencies need reliable data to guide healthcare and prevention programmes and policies. Data quality contains the effort and awareness of all these stakeholders involved in the ecosystem. And the quality can only be improved if all stakeholders are motivated to improve and invest in this data quality journey.

Assessing, labelling and improving the quality of health data is critical for all stakeholders to achieve our collective ambition to scale up the availability of trustworthy, reliable data that can improve the quality and safety of health care, maximise the efficiency and resilience of health systems, provide evidence for public health and prevention strategies and policy-making and accelerate research and foster innovation. It can also be used as input to calculate the economic and societal returns of health interventions.

## III. Solutions Provided By i~HD

### A. Education and Awareness

Because of i~HD's multi-stakeholder collaborative approach, the organisation finds itself in a prime position to facilitate the development of best practices in collecting, storing, using and re-using health data quality. This topic, for example, is

featured as one of the courses available on the i~HD e-Learning Platform, a part of the i~HD Academy.

i~HD, in collaboration with the University of Porto and the Health Data Forum and its partners, recently held the “Health Data Quality: a Dynamic Complexity” conference, the first international conference ever held on the topic of health data quality. The conference's objective was to demonstrate the dynamic complexity of high-quality data for primary as well as secondary use. This event attracted over 400 experts and participants from multiple public and industry organisations and stakeholders, including representatives from key policy-making bodies such as the European Commission, WHO, and national governments.



Figure 1: A moment during one of the sessions of Health Data Quality: a Dynamic Complexity in Porto, Portugal in November 2022



## B. Save the Date

Due to the success of this event, i~HD is already planning the i~HD Annual Conference 2023. Aside from taking off from the key points discussed during the health data quality event held in Porto last year, the 2023 conference will also encompass other important aspects to facilitate the optimal re-use of health data like information governance and trustworthy software systems.

This year's edition of the i~HD annual conference will be held in the historic city of Ghent, Belgium from the 29th of November to the 1st of December.

## C. i~HD Porto Declaration on Health Data Quality 2022

Another result of the Porto conference is the framing of the i~HD Porto Declaration on Health Data Quality 2022. This declaration calls on all stakeholders to urgently collaborate on agreeing on the standards for data quality assessment, scaling up data quality labelling of primary and secondary use data and strategies for shared investments to improve the systems and delivering training to the personnel needed to ensure the best possible health data across Europe. It emphasises joining forces to ensure the best possible health data wfor Europe.

The power of this declaration depends on the



stakeholders that support it. The invitation to endorse the declaration is still being extended to interested organisations. This may be done by visiting <https://i-hd.eu/ihd-porto-declaration-on-health-data-quality-2022/> or sending a mail to [jens.declerck@i-hd.eu](mailto:jens.declerck@i-hd.eu).

## 4. Data Quality Expert Group

Aside from its educational and awareness campaigns on health data quality, i~HD has also

taken early steps in forming the Data Quality Expert Group. This will be a multi-stakeholder collective which will promote, develop and share good practices for assessing, labelling and improving the quality of health data. This endeavour is also an answer to one of the five sections (containing 10 total action points) enshrined in the i~HD Porto Declaration on Health Data Quality 2022 where it addresses the engagement and support of secondary use stakeholders to invest in education and help the organisational changes which are needed to improve the data quality at the source.

## IV. Conclusion

High-quality data is not a “nice-to-have” requirement but a “must-have” requirement. Achieving high-quality health data in our healthcare ecosystem is neither a simple task nor a one-man’s job. It involves the management of people, processes, policies, technologies, and standards. If we can share the burden and the effort, we can also share the rewards and benefits of high-quality health data for Europe. Because data without quality can neither add value nor serve a useful purpose.

## Conflict of Interest

None. ■

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# The Patient Is the DATA

With the advent of digital technology in healthcare, data has become an essential component of modern healthcare delivery. The availability of patient data is crucial for providing quality care, managing patient privacy and safety, and promoting patient engagement. However, data silos and the lack of interoperability between healthcare systems have made it difficult to access patient data across the entire healthcare ecosystem. Using a quote from the CEO of Health House, Isabelle François: “In the future a hospital will not be brick and mortar, where you go for treatment and then home. Instead, a hospital will be an integrated healthcare entity that together with General Practitioners, Home Caregivers coordinate and work together to give the best possible assistance to the patient. An example of such is the Sheba Medical Centre in Israel where this close collaboration already exists”. To attain this at scale, a unified access to all data of a patient across the entire system is needed.



JAN VEKEMANS

Founder  
1patient1record4Belgium  
Belgium

### key points

- Unified Access must be able to integrate data from multiple sources, including hospitals, general practitioners, first and second line healthcare workers, as well as the patient and their relatives.
- To achieve a healthcare ecosystem based on prevention and minimised stays in hospitals, we need to ensure that all elements of our health are available.

### Unified Access to All Relevant Patient Data

Currently, a semblance of availability exists due to the use of Electronical Medical Records (EMR/ EHR) kept by the hospitals and the existence of a Generalised Medical Record (GMR) kept by the GP.

A unified information system would enable healthcare providers to access a patient’s

medical records from any healthcare facility or provider, however no such information system exists consistently across the ecosystem; this would improve patient care by providing a comprehensive view of a patient’s health history, current medical conditions, and ongoing treatments. The system would also facilitate communication between healthcare providers,

allowing for better coordination of care and reduce the likelihood of medical errors.

The system would allow patients and their families to access their medical records securely, providing them with greater control over their healthcare. Patients could easily access their records, track their progress, and communicate with their healthcare provider.



### Garbage in, Garbage out

This credo of Digital applies to Digital Health as well! So, before we discuss how and why to share data, we need to be certain that the data is clear, concise, complete and correct! Recent studies by Deloitte as well as other reputed institutions

records. Patients must be able to authorise access to their records, and healthcare providers must ensure that only authorised individuals can access the records. Patients must also have the right to view their records and ask to correct any errors. The most efficient way to achieve this is through a federated authority access system,

better connection between doctor and patient, but we need to allow the entire healthcare ecosystem to better communicate and share information. Clinical studies and research need access to data; ideally, unrestricted access but within clearly defined rules, obtaining direct patient consent rather than working through indirect channels.

A distributed universal Unified Access governing all patient data would allow access across the entire healthcare system unchaining the information that is required to open the doors of the future

raise concern that data in the EMR's is not to be completely trusted as being correct and/or complete. This stands for a large percentage of the accumulated information. In order to tackle this, we need to ensure that the current data is surveyed, compared and corrected where needed, otherwise chaos will ensue!

### Security and Privacy

Security and privacy are critical considerations in any accessible system. Healthcare providers must adhere to strict regulations governing the storage, transmission, and use of patient data, including GDPR and government regulations on local, regional, federal and EU level. Healthcare providers must ensure that patient data is securely stored and transmitted, using encryption and other security measures.

To ensure privacy, patients must have control over who can access what part of their medical

where the final say lies with the patient achieved through a non-technical control mechanism.

### Access to Different Sources

Unified Access must be able to integrate data from multiple sources, including hospitals, general practitioners, first and second line healthcare workers, as well as the patient and their relatives. This requires the use of standardised data formats and communication protocols to ensure that data can be shared seamlessly between different systems. The system must be designed to accommodate the needs of different healthcare providers, including those with varying levels of technical expertise.

### Access to Data for Not Just Primary Use but Also Secondary Use

To make the system affordable and healthcare more efficient we do not just need to facilitate

### Benefits

The system would offer several benefits, including:

1. Improved patient care: Unrestricted Access to patient data can help healthcare providers make better-informed decisions by providing them with a complete picture of a patient's health. This can help to improve patient outcomes and reduce the risk of adverse events. Having one overview access to the medical history, ongoing treatments, and care plans, as well as potential access to the IoT and personal data provided by social and auxiliary systems would show a more complete picture.
2. Enhanced communication and coordination between healthcare providers can reduce the likelihood of medical errors.
3. Improved patient engagement: Unified Access to patient data can also help to



improve patient engagement by giving patients greater control over their health information. Patients can access their data, review it for accuracy, and share it with other healthcare providers as they see fit.

4. Improved efficiency and cost savings by reducing the need for duplicate tests and procedures. This will reduce time to treat and any potential error which in itself will enhance the patient's trust with their doctor and treatment.
5. Use interoperable systems and standards: Through the use of standards, such as FHIR and HL7, the system for accessing patient data warrants interoperability and can work with existing systems. Key to success is that no existing system needs to be changed or replaced.
6. Patients MUST have control over their data: Patients should have control over their data, including the ability to review it for accuracy and share it with other healthcare providers as they see fit. This can be achieved through the use of patient portals or other tools that give patients access to their health information.
7. Enhanced research: Unified Access to patient data can help to advance medical research by providing researchers with access to a larger pool of data. This can lead to new insights and discoveries that can improve patient care.

### Concerns

We need to keep in mind that such system would also raise several concerns, including:

1. Security risks: The more accessible data is stored, the greater the risk of a data breach. It is important to ensure that patient data is stored securely and that access is limited to authorised individuals.
2. Technical challenges: Creating a unified system for accessing patient data can be technically challenging, especially if data is stored in multiple locations or in different formats. It is important to ensure that the system is interoperable and can work with existing systems.
3. Privacy concerns: Patients may be concerned about who has access to their health information and how it is being used. It is important to ensure that patients have control over their data and their privacy is protected.
4. Resistance to change: Some healthcare providers may be resistant to adopting a new system, requiring significant education and training.
5. Legal and regulatory challenges: There may be legal and regulatory challenges to creating a unified system for accessing patient data, especially if data is being shared across different organisations or jurisdictions. It is important to ensure that the system is compliant with relevant laws and regulations.
6. The system would have to be rightsized from the start as any fundamental change afterwards would come at a considerable cost. This does not mean the system needs to be largely oversized from the beginning, but must be architected for growth from the start!

### Recommendations for Achieving Unified Access to Patient Data

To achieve Unified Access to patient data while addressing the benefits and concerns outlined above, the following recommendations should be considered:

- o device an umbrella system. This can be defined as a system that does not tax the current investment in people, training, installed base or knowledge required to access and operate it. Every facility currently using EMR/GMR should NOT require any extensive retraining to use the additional information awarded by a unified access sharing.
- o Ensure that we start with healthy data instead of data that has not been verified to be correct and in the right fields. A unified access will only work if and when the data is correct and in the correct location in the original system. Unfortunately, we do not start from a clean slate, so knowing the source system has clean data will warrant reliable and trustworthy sharing. The patient will have a key role in supervising correctness of data up to a certain level.
- o Give patients control over their data: Patients should have control over their data, including the ability to review it for accuracy and share it with other healthcare providers as they see fit. This can be achieved through the use of patient portals or other tools that give patients access to their health information.
- o Ensure that patient data is accessed securely: It is important to ensure that patient data is accessed securely and that access is



limited to authorised individuals. This can be achieved using encryption, access controls, and other security measures. In case of secondary use extra measures such as anonymisation and synthetisation need to be covered.

- o Use interoperable systems: It is important to ensure that the system for accessing patient data is interoperable and can work with existing systems. This can be achieved through the use of standards such as HL7 or FHIR...
- o Comply with relevant laws and regulations: It is important to ensure that the system for accessing patient data is compliant with relevant laws and regulations, such as European Health Data Space (EHDS), Health Data Authority (HDA), i-HD and GDPR. This can be achieved using legal and regulatory experts, as well as working with governments.
- o We might consider decoupling the current bond between data and diagnosis as there seems to be an “intellectual property issue” with the latter.
- o Supplementing medical data with situational data (e.g. (non-medical) wearables, ...) will allow a more complete image of the patient and their ailments.

### Conclusion

A distributed universal Unified Access governing all patient data would allow access across the entire healthcare system unchaining the information that is required to open the doors of the future. To achieve a healthcare ecosystem based on prevention and minimised stays in hospitals, we need to ensure that all elements of our health are available. This means that first and second line healthcare professionals require patient information currently stored in silos and undetermined places, but also allows patients and loved ones to contribute with additional information. Just as a patients' life

does not revolve around an illness, data is not limited to strict medical observation and instead can be obtained from wearables and personal observation from people around the patient. To able unrestricted movement of people around the globe, our healthcare data needs to be as easily available as our passport and just as trusted, and if we want this to be true, we better start at the local level but with the end goal in mind!

Plan globally, execute locally!

### Conflict of Interest

None. ■

#### disclaimer

# Why Adopt Population Health Management Software

We all wish to be equal when it comes to health. Yet, people's residence, socio-economic status, and demographics significantly influence their health. How do we take all of the above into account to improve healthcare services for different groups of people?



INGA  
SHUGALO

Healthcare Industry Analyst  
Transition  
Colorado, USA

## key points

- The term “population health” was coined in 2003 to determine the influence of different factors on the state of health in a particular group.
- Population health comprises the health outcomes of a certain population while public health is the approach used to make the health of a particular population better.
- Health outcomes build upon five factors: genetic predisposition, environmental factors, socio-economic conditions, lifestyle and access to healthcare services.
- Three elements make up the core of any population health management solution: it should be designed to analyse big data, report on individual and group outcomes, and manage targeted care delivery by enhancing coordination between providers, payers, and patients.

The term “population health” was coined in 2003 as part of an effort to determine the influence of different factors on the state of health in a particular group. Almost seven years later, the medical community has turned to [medical app development](#) in order to facilitate these efforts, and its popularity has grown significantly since then. Let's explore what the population health management (PHM) tech does and why medical organisations are adopting it.

## Public Health vs Population Health

Before we discuss population health management solutions, let's first look at what population health is all about, as it is often confused with public health. Population health comprises the health outcomes of some group of patients — a certain

population. The group can come from just one clinic, a city district, a county, a state, or the entire country. Public health is the approach we use to make the health of a particular population better. Now the terminological fog is dispelled, so let's clarify what population health depends on and how it relates to software.

## Population Health Factors

The outcomes of diverse populations' health do not emerge from nowhere. Health outcomes build upon five factors, namely:

- Genetic predisposition to specific health conditions
- Environmental factors, including housing, availability of healthy foods, clean air and water, and exposure to toxins

- Socio-economic conditions like income, education, employment, and culture
  - Lifestyle: alcohol consumption, tobacco use in any form, diet, and exercising
  - Access to healthcare services and their quality
- But how do experts determine their influence on populations? Checking and analysing all available parameters manually would be exhausting and error prone. This is where automated tools step in to speed up the process and make it less costly.

## Three Pillars of Population Health Management Solutions

Three essential elements make up the core of any population health management solution: it should be designed to analyse big data in order to classify patients into certain populations by the risks of

experiencing some events, report on individual and group outcomes, and manage targeted care delivery by enhancing coordination between providers, payers, and patients.

patients. Unfortunately, according to the [2019 Commonwealth Fund research](#), this lack of coordination is a major problem in the U.S. healthcare system.

Population health management software allows

to increased reimbursements to the families of insured individuals. Finally, CVD deaths are preventable, and prevention is in the payers' interest as well.

This is where providers join the game. For

## Population health management software allows creating clinical pathways for mapping diverse patient journeys

### 1. Data analytics and reporting

It's not enough just to store relevant data. A detailed analysis is needed to stratify patients into cohorts. However, running it without machine assistance is time- and cost-intensive.

Fortunately, several analytical tools can speed up these tasks. For example, predictive modelling, in which algorithms comb through a multitude of historical healthcare data to create models for forecasting potential results.

This analytical approach found its use at Mass Gen Brigham (Boston, MA). The clinic provided their congestive heart failure patients with remote monitoring devices to upload real-time updates on their weight, blood pressure, and other metrics aggregated in the hospital's intelligent system. The system relied on these data sets to single out at-risk patients in need of specific intervention. As a result, the tool helped lower the readmission rate and the number of nurses necessary to cover patients' needs, which led to cost reduction.

### 2. Care coordination

In a clinical setting, treating a patient is rarely a single doctor's responsibility. As a rule, the process involves 2-3 professionals in different medical fields, lab analysts, and nurses. Their efforts need to be coordinated, especially when dealing with chronic disease

creating clinical pathways for mapping diverse patient journeys. PHM tools don't automatically transfer paper-based documents to a digital environment and let them be. Powered by machine learning technologies, these tools rely on the uploaded clinical documents to set and coordinate tasks all across teams in the care continuum. This way, they help clinicians accelerate the care cycle and refine its quality, which also ensures a better patient experience.

### 3. Engagement and collaboration

When it comes to PHM, patients, providers, and payers are on the same page.

Patients want to control their health. According to Statista, [65% of Parkinson's disease patients](#) took some steps to study the disease and/or actively engaged in their health. At the same time, contacting a doctor or a clinic whenever they detect some missing lab analysis is exhausting. The majority of patients let go of their health management until the next hospitalisation.

Insurers are also interested in improving their clients' health. The World Health Organization reports that cardiovascular diseases (CVDs) are the most frequent cause of death worldwide. The American Heart Association adds that roughly [every 40 seconds](#) someone falls victim to a CVD. Naturally, for insurers, this potentially leads

example, they may introduce a mobile healthcare app to let patients connect to their EHRs and make informed decisions about their health from anywhere. Such an app can also become a part of the clinic's digital environment, allowing teams to access EHRs, supervise patients' efforts in managing their health, and intervene when necessary. At the same time, providers can pilot population health management and break patients into several cohorts regarding their conditions and associated risks. This can help streamline inventory management and workload to deliver better care, simultaneously cutting costs.

### PHM: Is it Worth the Investment?

Now, as we've looked at PHM and the software required to facilitate it, it's time to answer the key question: is it worth going for? Absolutely. Population health management assists with delivering personalised care to high-risk individuals, timely preventing relapses, and improving care outcomes. It also allows caregivers to fine-tune their resource management and lower costs. As for the software, it significantly speeds up analytics and care administration.

### Conflict of Interest

None. ■



# Cybersecurity: Preventing the Worst-Case Scenario



# Shifting from Cybersecurity to Cyber Resilience

A paradigm called “Cyber Resilience” includes a long-term defense against cyberattacks. It covers all three phases of a cyberattack, including mitigation techniques, reaction to an incident, and recovery. An organisation’s cyber resilience attempts to lead it through such challenging circumstances and speed up its recovery. Additionally, it seeks to protect the entire business by considering all potential mistakes, which can range from basic human error to weaknesses in internal and IT controls. The COVID-19 crisis has highlighted the necessity of making investments in digital health technology in order to improve, for instance, the effectiveness and efficiency of surgical procedures. Even though the unit’s overall performance is currently more than excellent, there is still plenty of opportunity for upgrade and enhancement. It is crucial to increase the Radiology Unit’s resilience and capability to guarantee the effectiveness and scope of care as well.



CHRISTODOULOS  
PAPADOPOULOS

Founder  
geevo® and CPbros Group  
Chairman  
Cyprus Association of Information Protection and Privacy (CAIPP), Cyprus

## key points

- Cyber Resilience has evolved dramatically since the outbreak of COVID-19.
- eHealth has already started taking place in Cyprus since 2021.
- Artificial Intelligence must be optimised for our patients’ better outcomes.

## Cyber Resilience vs Cybersecurity

Cyber resilience can be defined as an organisation’s capacity to consistently execute contracted services, operations, and results in the

face of cyber incidents. These occurrences may have a negative influence on facilities, systems, information, people, and technology. What distinguishes cybersecurity from cyber

resilience? Endpoint security, network security, and security awareness training are some of the sub-components of cybersecurity, which is a component of cyber resilience. These collectively

make up the wide category we refer to as “cybersecurity.”

When data backup and recovery are added to the mix—which in turn includes services like endpoint backup and recovery, backup for Microsoft 365, server backup, migration services, and more—we start to talk about cyber resilience

management system (ISMS) to manage assets security such as employee details, financial information, intellectual property or third-party entrusted information.

Cyber resilience provides organisations a competitive advantage over companies without it. Enterprises that develop management systems

qualified IT professionals to help manage it all.

## Advantages of Cyber Resilience

### Protection of Data

Security controls are used to protect the data from cyberattacks and ensure that the work remains unaffected.

Nowhere is resilience on better display than in nature. Trees are designed to bend but not break under the weight of snow or high winds

in a broader sense.

When data security plus data backup and recovery come together to keep your business online, we call it cyber resilience.

## The Importance of Cyber Resilience

A cyber resilience strategy is vital for business continuity. It can provide benefits beyond increasing an enterprise’s security posture and reducing the risk of exposure to its critical infrastructure. Cyber resilience also helps reduce financial loss and reputational damage. And if an organisation receives cyber resilience certification, it can instil trust in its clients and customers. Further, a cyber-resilient company can optimise the value it creates for its customers, increasing its competitive advantage through effective and efficient operations.

To attract customers and gain their business, some organisations comply with international management standards, such as ISO/IEC 27001 provided by the International Organization for Standardization. ISO/IEC 27001 provides conditions for an information security

based on best practices, such as Information Technology Infrastructure Library (ITIL), create an effective operation. So, too, do they when developing a management system for cyber resilience. And as a result, these systems create value for their customers.

A true cyber resilience solution can help businesses solve for:

- **An evolving threat landscape** where more than half of small businesses report having suffered a data breach.\* To defend against polymorphic malware and malicious, evasive scripts, you need way more than a traditional antivirus.
- **Ubiquitous connectivity** has dissolved the traditional network’s edge, stretching IT resources and involving multiple cloud applications. This opens the door to data loss from malicious actors, human error, system failure, network outages, and natural disasters.
- **Market complexities** involving ever-stricter data security and compliance regulations, including GDPR, plus a dire shortage of

### Data Recovery

It aids in recovering the most data in the shortest length of time with the least amount of data loss.

### Training

The staff of the company receive the necessary instruction on how to handle data safely and what to do in the event that a cyberattack occurs. In addition, the employees are also trained on an organisation’s security protocols in protecting the data and help identify their responsibilities during a data breach.

### Data Backup

Data and statistics are used to run every organisation. Every business’ ability to operate effectively depends on data. Therefore, data backup is crucial during cyberattacks or natural disasters. The data backup also lessens the likelihood of data loss and its associated expenditures.

### Blocking

When cyberattacks are made against an

organisation, cyber resilience serves as an additional layer of protection. It aids in stopping harmful threats from getting into the system.

**Access Control**

Regular resource and asset monitoring by the security team aids in preventing unauthorised access to sensitive data. Implementing zero-trust security, which requires multiple-step authentication to stop illegal and unauthenticated data access, is another way to achieve restricted access. Cyber resilience therefore aids in preventing data loss and in identifying unauthorised users.

**Regular Maintenance**

Regular maintenance of IT infrastructure and security measures is made easier with the aid of cyber resilience. Conducting routine internal and external audits will help with this. Thus, achieving a proper security architecture against a cyber-attack is made possible by cyber resilience.

**Cyber Resilience in eHealth**

The word “eHealth” refers to a broad range of Information and Communication Technologies (ICT)-based technologies designed to enhance health and lifestyle management, monitoring, and prevention.

Online collaboration between patients and health service providers, data sharing between various healthcare organizations, and communication between patients or health professionals are all examples of electronic health (eHealth). It also includes telemedicine services, electronic health records, networks of health

information, and systems for monitoring and assisting patients.

To identify better solutions and share best practices among Member States, the European Union is pushing a “European eHealth Area” while organising various efforts and facilitating synergies between related policies and stakeholders. The creation of an electronic health record system, information sharing and standardisation, electronic prescription (ePrescription), and other goals are all special to the EU.

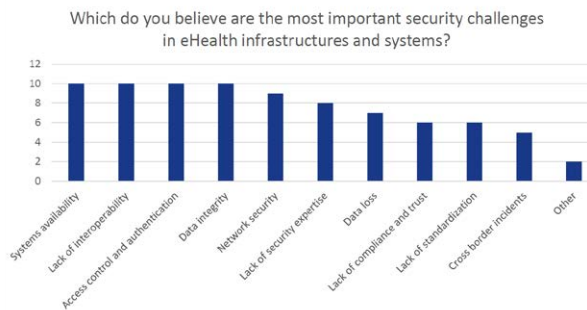


Figure 1

**Cyber Resilience in Cyprus and the eHealth Challenge**

Cyprus lacks an eHealth-specific strategy and/or policy. In Cyprus, eHealth activities are in the very early stages. The Ministry of Health has started taking advantage of eHealth standardisation processes (to create infrastructure for electronic health records) at two large hospitals (Nicosia General Hospital and Famagusta General Hospital), as well as the effective management of electronic materials and electronic prescription.

The Ministry of Health began to implement various projects that contribute to a better approach to cross-border healthcare. Some of the most important projects are the following:

- (a) The creation of an Integrated Health Information System, which consists of 13 subsystems that deal with how hospitals operate, such as managing e-prescriptions, electronic patient records, patient billing, laboratory test management, etc. The Integrated Health Information System is designed to encompass the essential aspects of hospital operations, allowing for both quality and cost management of patient care. Both Nicosia General Hospital and Famagusta General Hospital, as well as a few of the Health Centers in the two districts, use the Integrated Health Information System.
- (b) Drugs Information management system. This system operates in all hospitals, pharmaceutical stores and many health centers.
- (c) Spreading the word of the Makarios Hospital for Children as a single place for complete paediatric care.
- (d) Enhancing the image of the Paphos and Limassol General Hospitals

In addition to having a significant impact on the digital shift, the digitalisation of cross-border healthcare and the tracking of infectious illnesses also aims to boost public health policies. With increased accessibility and equal rights for all residents thanks to digital health solutions, social cohesion can be further enhanced.

## General cross-border eHealth services are being implemented in Cyprus, including: a) patient summaries; and b) ePrescription/eDispensing (part of eHealth)

### Objectives:

The main objective of this reform is to support Cyprus efforts to be part of a secure peer-to-peer network allowing the exchange of Patient

- Enable the national deployment of cross-border services across all healthcare stakeholders integrated with the currently emerging national eHealth digital infrastructure.
- Allow Cyprus to move more quickly toward developing the European Health Data Space for the exchange and access to various types of health data (electronic health records,

- practical precautions, such as maintaining data confidentiality, integrity, authenticity, availability, and non-discouragement.
- Establishing a suitable method for the control of health data entering and leaving Member States, which will enable duly accredited official entities to adequately oversee existing data collecting, processing, translation, and transmission systems.

Nature is inherently designed for resilience - and we believe it's time for us to take a similar approach to security. This requires a move from a posture of Cybersecurity to one of Cyber Resilience

Summaries and ePrescriptions, reaching the following general objectives:

- Facilitate secure access to patient health information and seamless cross-border treatment between European healthcare systems, particularly with regard to the sharing of patient summaries and ePrescriptions.
- Contribute to patient safety by reducing the frequency of medical errors and by providing quick access to patient health information, as well as by increasing the accessibility of a patient's own prescriptions, also when abroad.
- Reduce the need for repeated diagnostic procedures by giving medical staff life-saving information in emergencies.
- Assist COVID-19 in its ongoing talks about policies and procedures in EU institutions (such as the eHealth Network) pertaining to the necessary eHealth infrastructure for cross-border services.

genomics data, data from patient registries, etc.), not only to support healthcare delivery (referred to as primary use of data), but also for health research and health policy making purposes (so-called secondary use of data).

- Encourage the incorporation of AI functionality, particularly in relation to patient management, analytics, and decision-making, in cross-border services.

### Challenges:

The National Contact Point for eHealth with other Member States is the National eHealth Authority (NeHA), which was established by law. The following are some issues that need to be resolved in this area:

- To build the proper data security and data protection systems in order to adhere to all applicable national regulations as well as cross-border e-services standards.
- To ensure data security by taking all

### Conclusion

As countries transition into a post-industrial, knowledge-based economy characterized by dramatic developments in the information technology area, the digital transformation of the healthcare sector is a crucial development. In order to sustain sectoral development and, eventually, its antifragility, the adoption of the newest technologies and their applications in the health and care ecosystem must be managed properly from the perspectives of cyber security and resilience. The fundamental ideas that must define the strategic vision of a robust and sustainable digital transformation of healthcare, however, are yet only partially understood.

Heavy snow and rains will come. Prepare for the worst - and be the tree that bends but doesn't break.

### Conflict of Interest

None. ■



# Governance and Leadership

# Healthcare Procurement in 2023: Let's Shape the Beginning from the End!

Let's professionalise procurement by giving decision-makers (doctors, board, ...) decision-making tools that bring objective, patient-centred and cost-oriented VALUE to the hospital sector. Procurement is part of healthcare management and holds the key to all topics that are lessons learned from COVID-19: supply chain management, sustainability, transparency, digitalisation, patient experience, innovation & economies.

DANNY  
HAVENITH



CEO  
MERCURHOSP  
Chairman

European Health Public Procurement Alliance, Belgium

## key points

- How do we in healthcare procurement manage the start of procurement from the end?
- Value in healthcare means procurement with view on the whole ecosystem.

There is no doubt that procurement increasingly includes a dimension that we have to call value. Price is in the foreground; in these times of crisis, it remains a must. A transparent vendor neutral description of products and services puts procurers in the public health system in a position that in football is called the one who passes the ball. And that is towards the specialists in each field.

In 2023, public tenders are meeting points

where engagements are taken in all transparency. Every stakeholder in the health system - be they a doctor, a manager or a nurse - should not have their decision-making authority taken away from them. These people are the professionals and the procurer has the task of providing these people with objective criteria. This requires expertise, digital tools and a spirit of innovation, courage and diplomacy on the part of the procurer.

But how can the third dimension, the VALUE

discussion, the measurement of output, the inclusion of patient experience be integrated? In short: how do we in healthcare procurement manage the start of procurement from the end? Or to put it another way:

Can we optimise healthcare systems through comprehensive governance in procurement?

Let's start with a dream that has been set in almost all other sectors for generations: let's imagine that the hospital board has a

C-level procurement officer, a CPO. After all, procurement affects between 30 and 40% of an average hospital budget. So the area should be represented by a professional.

Procurement, like medicine, patient experience,

procurement, it weakens our sector.

Value on an equal standing means: setting up the process with the involvement of all stakeholders between the health care sector and partners from industry and business, in such a

Adopting a clear, transparent and well-communicated procurement policy is essential for managing procurement.

Implement accountability and promote the improvement of the health system towards

## Let's imagine that the hospital board has a C-level procurement officer, a CPO

has the potential to accelerate health system reforms and address current challenges to deliver better quality, more accessible, more efficient, personalised, integrative and value-based care. However, many healthcare organisations still lack a holistic approach to implementing procurement governance.

Good procurement in the triangle of hard price criteria, objectification in description, integration of patient-experience requires digital, innovative foundations that first create transparency, legality, responsiveness, crisis preparation, supply chain security and continuity, and last but not least, sustainable purchasing in a circular economy.

Only then will there be justice between requirements and application, effectiveness and political regulations, which will keep our sector capable of acting regionally, but which will be value-oriented and global in procurement. Let's work on the C-level to end the fragmentation of

way that solutions and investments are made possible, whereby there is a return on investment for all parties involved and not, as is the case today: a sector in (often) the red and an industry that still draws correct margins from the publicly financed health care sector.

As a procurer, co-define your health enterprise, identify all stakeholders and users and engage them from the outset with a clear focus on the immediate must-can-nice-to-have issues of procurement.

Agree on what data should be collected so that quality and value in execution can be measured.

Agree on instruments for governance in procurement: how do I specifically incorporate topics such as sustainability, supply chain, innovation - where is the strategic focus of my institution?

Determine who is in charge and gather all stakeholders who have the critical resources.

patient-centered and integrated care.

Review, update and continuously adapt the institution's procurement governance to the changing needs of the health system as innovative development continues.

Not losing sight of the broad objectives to ensure equitable and affordable access to quality health services and to improve and protect the health of the population.

Procurement with a value-based approach should move health systems forward, as well as medicine, and must lead to transparent measurable health management in the ecosystem of the partners of 2023.

### Conflict of Interest

None. ■

# Women Leadership in Healthcare – Time to Walk the Talk

Being a woman in leadership is a big challenge by itself. When we talk about female leadership in technological fields and healthcare that challenge becomes even greater. Women represent 70% of the 43 million workers in the global health care industry, according to the WHO.

Yet, at the executive level, women make up just 25% of healthcare leadership positions. The Glass Ceiling, as shown before, still exists and acts like an invisible barrier that prevents women from reaching the top leading positions.

However, research has shown that having more women in leadership positions can bring a range of benefits to healthcare organisations.

RITA  
VELOSO



Executive Board Member  
Centro Hospitalar Universitário de Santo António  
Portugal

## key points

- Women represent 70 % of the 43 million workers in the global health care industry, according to the WHO. Yet, at the executive level, women make up just 25% of healthcare leadership positions.
- Women shouldn't think or act like men, they should think about finding a way to display and build the same confidence for leadership positions as man.
- Maybe the rise in AI will result in that leaders with the ability of managing people will be a better fit for leadership roles, and that will result in more room and opportunities for women in leadership positions.
- We need to better understand the challenges women encounter and identify strategies to increase the number of women in leadership roles and support their success.

## Introduction

In 2021, the theme of the International Women's Day was 'choose to challenge'.

The main topic was based on the fact that, individually, we are all responsible for our own thoughts and actions – all day, every day. We can all choose to challenge and call out gender bias

and inequality. Under this context, the International Hospital Federation ask its Members, me included, to share how we were celebrating International Women's Day and working to challenge gender disparity in their organisations or work field. As a result I choose to challenge "Women in Tech" active within the healthcare sector.

Being a woman in leadership is an especially big challenge by it itself. When we talk about female leadership in technological fields and healthcare that challenge becomes even greater. It might sound counter-intuitive, but it is not: human and people management qualities are increasingly needed to achieve an effective and desired digital



transition in our society, emphasising that going digital is not de-humanising and virtual does not necessarily mean distant.

Fortunately, in Portugal, there are several companies, including multinationals, which are

College), the proportion of female medical students in 2019 being 50.5%, and still increasing. In Portugal more than 75% of the health field students are women.

over” - revealing that women have outperformed men at the highest level in these two traits: taking initiative and being goal oriented.

So, if women are “more” competent than men, why is the number of women in management

As a leader in healthcare, I #choosetochallenge women in tech. It might sound strange, but it is definitely not, soft skills are increasingly needed to achieve a truly digital transition in our society, reminding that digital is not dehumanising and virtual does not mean distant And these skills are part of a female DNA

currently led by women who are excellent at this and highly competent. Particularly in my hospital, Centro Hospitalar Universitario de Santo António, more than 52% of leadership positions are occupied by women.

But we all know that there is still a long way to go.

In fact, when we look at some impressive statistics, the healthcare sector seems overwhelmingly “female.”

Women represent 70 % of the 43 million workers in the global health care industry, according to the WHO. Yet, at the executive level, women make up just 25% of healthcare leadership positions. Women account for 71% of all global workforce professionals as well as 59% of all graduates in the medical, biomedical and health sciences fields. Despite women occupy the majority of positions in the medical field, it seems to be more rare, more difficult for women to reach positions of responsibility and leadership.

It is encouraging that more women are now studying medicine than men (According to the AAMC (Association of American Medical

### Is Progress Finally Happening?

The digital world offers a great potential to promote gender equality, to be less prejudiced and more inclusive than the “traditional” world, and yet the digital world is still largely led by men. Why?

The Glass Ceiling still exists and acts like an invisible barrier that prevents women from reaching the top leading positions.

Men are still seen as the default leaders, even more so when we talk about technology, reinforcing the time-honoured perspective that to “think like a man” is a skill. If this is true, should women who seek leadership roles start “to think like a man”?

A Harvard Business Review study compared male leadership with female leadership considering 16 competencies that are associated with greater overall leadership effectiveness. The results are in line with the stereotype that women “care” - women scored higher than men in establishing relationships, inspiring and motivating others, boosting self-development. But it also contradicted the stereotype that men “take

positions still unbalanced? Is it really a question of a misperception of confidence and not of effective competence?

Why does it seem so easy for “incompetent” men to become leaders? And why is it so difficult for “competent” people - especially “competent” women - to take the lead?

Well, we generally misinterpret demonstrations of confidence as a sign of competence, and because of that we are led to believe that men make better leaders than women.

Women shouldn’t think or act like men, they should think about finding a way to display and build the same confidence for leadership positions as man.

In my opinion, it is not true that women do not aspire to this type of roles. It is my strong conviction, that was reinforced over the years in which I had the privilege of dealing with many strong women who sought one day to take on leadership positions.

It is my true belief that men tend to perform better when the focus is on task management, while women tend to perform better when the

focus is on managing people.

In the digital age, this may work to women's advantage:

Along with the rise of artificial Intelligence, is it expected that automation of most task-oriented leadership components may occur. Maybe

It could further be said that the current world desperately needs women's leadership, it needs their aptitude to motivate their staff and teams, their talent to make things happen particularly in demanding and adverse scenarios like the one we currently face.

strategies to increase the number of women in leadership roles and support their success.

The challenges of the Leadership in Healthcare in 2030 is likely to be influenced by several emerging trends and challenges in society, technology, and the business world.

## women in leadership positions can bring a range of benefits to healthcare organisations, including improved patient satisfaction, enhanced collaboration and teamwork, and a more inclusive workplace culture

that will result in that leaders with the ability of managing people will be a better fit for leadership roles, and that will result in more room and opportunities for women in leadership positions.

We, women, have two unshakable forces in our favour: intuition and passion. In top management one is faced with situations that require immediate response in which common sense and intuition are the indispensable tools to have in these crucial moments.

Daniel Kahneman, the Nobel Prize in Economics in 2002 for his work "Thinking, Fast and Slow", defends the existence of "two brains": one that effectively thinks fast and the other that thinks slowly, and we all rely on both in our different decision-making processes.

When we look at today's digital world, a world augmented by the recent pandemic that affected us all, it is precisely the personal characteristics of empathy, closeness, fast decision making, emotional intelligence, leading by example, and the ability of making more and better leaders, that enables Institutions to deal with this new reality and to survive.

Studies on female leadership in healthcare illustrate the experiences and perspectives of women in leadership positions within the healthcare industry. This can encompass areas such as hospitals, clinics, in public health, and in medical education. Some of the topics studied within this field include the challenges faced by women in leadership, the impact of gender on leadership style, diversity and inclusion, and the influence of mentorship and networking on career advancement.

Research also show that having more women in leadership positions can bring a range of benefits to healthcare organisations, including improved patient satisfaction, enhanced collaboration and teamwork, and a more inclusive workplace culture.

However, women in healthcare leadership continue to face gender-based barriers and biases, including a lack of representation at the highest levels of decision-making, unequal pay, and limited access to mentors and networking opportunities. The goal of these studies is to better understand these challenges and identify

Some of the key changes that are likely to shape leadership in 2030 include:

- Greater emphasis on collaboration and teamwork: Leaders in 2030 will be expected to foster a culture of collaboration and teamwork, leveraging the strengths of individuals and teams to achieve collective goals.
- Increased focus on ethics and social responsibility: As consumers become more socially conscious, leaders in 2030 will be expected to prioritise ethical and socially responsible business practices.
- Adaptability to technological change: Leaders in 2030 will need to be agile and able to quickly adapt to rapidly evolving technology and its impact on their organizations and industries.
- Empathy and emotional intelligence: As emotional intelligence becomes increasingly valued, leaders in 2030 will be expected to demonstrate empathy, emotional intelligence, and an ability to connect with and motivate their employees.

- Strategic thinking and foresight: Leaders in 2030 will be expected to have a clear vision for the future and the ability to anticipate and prepare for change, both within their organisations and in their wider industries and markets.
- Cultural competence: Leaders in 2030 will need to be culturally competent and able to lead diverse and inclusive teams in an increasingly global and interconnected world.

This can be illustrated by the response to generation Z (born between 1997 and 2012), an enormous challenge for leadership. We will face “new” hospitals, “new” employees, “new” patients from this generation, why?:

- Technology integration: Generation Z has grown up with technology and expects it to be integrated into their work environment, including the use of electronic health records, telemedicine, and other digital tools.
- Flexibility and autonomy: Generation Z values flexibility and the ability to work from

anywhere, as well as the freedom to make decisions and take ownership of their work.

- Diversity and inclusivity: Generation Z is more diverse and culturally aware than previous generations and values a workplace that is inclusive and promotes diversity.
- Personal and professional growth: Generation Z is interested in developing their skills and advancing their careers, and they expect opportunities for personal and professional growth within their healthcare positions.
- Social responsibility: Generation Z is socially conscious and values employers who have a positive impact on society and the environment.

All these challenges in healthcare will need both new and old skills, both “brains” (fast and slow) and that’s why the presence of more women in leadership in healthcare institutions is so crucial to face our future and provided better and more healthy workplaces and better health for everyone.

Together, we can inspire and thrive – it’s time to walk the talk.

### Conflict of Interest

None. ■

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# Managing Hospital Communication

From care activities to administrative activities in a health unit, communication is a critical factor for the strategy of organisations. That is why a strategic vision for communication in hospitals is essential. Through the three communication al-sectional dimensions for the implementation of communication management in health units, we can understand the importance of these processes.



J. ANTONIO  
CIRINO

Director of Education and Development  
Agir, Brazil  
PhD and postdoc in Communication  
Completing new postdoc in Information and Communication  
Universitat de Barcelona, Spain

## key points

- Leaders and health professionals need to reflect on communication flows and how structured they are for delivering value to patients.
- It is critical we understand the three communication paradigms for the implementation of communication management in health units.
- Hospitals that do not manage their communication have less chance of achieving their vision in the short, medium and long term.

## A Critical Factor for the Strategy

From care activities to administrative activities in a health unit, communication is a critical factor for the strategy of organizations. This is precisely why leaders and health professionals need to reflect on communication flows and how structured they are for delivering value to patients, with care centered on each person served.

That is why a strategic vision for communication in hospitals is essential. This is not only an operational theme, but also at the tactical and strategic level of health units and should receive the necessary attention to ensure that processes are defined, monitored and evaluated for

continuous improvement.

To maximise results in this area, we recommend (Cirino 2018, 2019) that the organization's first focus be on aligning strategic communication. This paradigm aims to structure the activities that concern the construction of the identity of this hospital, from its brand and slogan, for example, but also to its organisational identity, which defines its mission, vision, values and purpose.

Another crucial point is the formalising of communication policy, a document that guides the practices related to the institutional position regarding its internal and external communication flows, as well as the nature and purpose of each

means of communication of the organisation.

This policy needs to be managed through indicators and alignment meetings to increase its possibilities of effectiveness in the implementation of the procedures it defines.

Pertaining to strategic communication, it becomes important to define the format of communication management in this health unit: will there be a sector of its own? And/or a commission? How will we work on the activities of projecting, progress of activities and subsequent revision of these themes? These reflections will result in the analysis of those responsible for conducting this activity in the hospital and what are the main

attributions and results that can be expected by the entire organisation.

The second paradigm, organisational communication, works in the context of internal commu-

Another essential aspect in this paradigm is communication for patient safety. The flows of care communication should be considered at this stage and structured in order to ensure the miti-

the external media, with a highlight for collaboration with the press, since the media is a social health agent (Tuzzo and Cirino 2019) and contributes directly to the practices of local and global

Hospitals that do not manage their communication have a higher chance of care errors, less employee stake in organisational strategies, and less chance of achieving their vision in the short, medium and long term

nication between the public sits in the hospital. In order to unfold the identity and make it real, this stage implements media that contribute to the dissemination of the organisation's values for the construction of the organisational culture. These means need to be implemented in order to meet the needs and expectations of employees and other stakeholders by information, keeping them updated.

Another crucial point is that organisational communication also deals with a periodic communication planning that will contain a schedule of disclosures and practices that must be scheduled at each moment and for each hospital audience. This planning needs to be managed, with continuous evaluation of your results for the optimization of unit practices.

gation of the risks of failures that can cause harm to patients and collaborators (Cirino 2021a,b). Thus, we emphasise here that in addition to being strategic for the hospital's processes, there is a possibility of a substantial reduction in care errors when managing the communication of the health unit.

The third paradigm is institutional communication. Now that the identity has been developed internally, at this stage we are concerned with the implementation of flows that contribute to the dissemination of the health unit to the external public, creating the image of this organization. The focus here is that we have the greatest possible coherence between what unity is (identity) and what stakeholders think it is (image).

In addition, it will also be necessary to structure

health systems. Thus, social media, mobile app's and the hospital's website are a structuring part of communication with society as a whole.

Precisely because of these points presented in the three communication paradigms for the implementation of communication management in health units, we can understand the criticality of these processes.

Hospitals that do not manage their communication have a higher chance of care errors, lower employee stake in organisational strategies and less chance of achieving their vision in the short, medium and long term.

### Conflict of Interest

None. ■

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# Managing Efficiently Future Pandemics

# Health at a Glance Europe 2022: Addressing Legacies from the Pandemic

The 2022 edition of OECD's Health at a Glance: Europe examines key challenges European countries must address to develop more resilient health systems following the COVID-19 pandemic.

FRANCESCA  
COLOMBO



Head of Division  
OECD Health Division  
Member of the Lancet Commission on COVID-19  
Member of the Advisory Committee  
The European Health Forum Gastein, Paris, France

## key points

- While mortality from the pandemic mainly affected older people, the pandemic also affected greatly the mental and physical health of young people in Europe, with large numbers reporting unmet needs for mental health care.
- In addition, the disruption of health services during the peak waves of the COVID-19 crisis created a backlog of patients waiting to receive primary, mental health, cancer, chronic and elective care, with the recovery period in different countries affected by the length and degree of disruptions and the ability to mobilise additional resources to increase activities following these disruptions.
- The pandemic has revealed the need to prioritize not only communicable disease prevention, but also the prevention of non-communicable diseases notably by addressing behavioural and environmental risk factors that have major impacts on people's health and mortality.

**Gaetan Lafortune** | Senior Economist | OECD Health Division | Paris, France

**Noémie Levy** | Research Officer | OECD Health Division | Paris, France

## Introduction

The pandemic has had a dramatic impact on people's lives in Europe and around the world. It has led to a reduction of more than one year in life expectancy in the EU in 2021 compared with the pre pandemic level – the largest drop observed in most EU countries since World War II. By the end of October 2022, more than 1.1 million COVID 19 deaths had been reported across the 27 EU countries. Over 90% of these deaths have occurred among people aged over 60.

The 2022 edition of Health at a Glance: Europe examines key challenges European countries must address to develop stronger and more resilient health systems following the acute phase of the COVID-19 pandemic. It includes a special focus on how the pandemic has affected young people's mental and physical health, and assesses the pandemic's disruption of a wide range of health services for non-COVID patients and the policy responses to minimise the adverse consequences of these disruptions. The report also addresses

a number of important risk factors to health that have exacerbated the impact of the pandemic, highlighting the need to put a greater focus on the prevention of both communicable and non-communicable diseases.

## A Major Impact on the Mental and Physical Health of Young People

While few people's lives have been unaffected by the pandemic, there have been concerns about the mental and physical health of the millions of



young Europeans whose formative years have been marked by fear, uncertainty and disruption – particularly given the critical importance of early experiences in shaping health and well-being later in life. Prolonged periods of social isolation and break in education and employment opportunities seriously disrupted the lives and routines of young people at a critical time of their physical and social development.

School closures, the closure of sports facilities and other mobility restrictions were associated with a reduction in physical activity amongst children and adolescents in virtually all European countries with available data. Alongside a decline in physical activity during the pandemic, many children and young people experienced a worsening of their nutrition habits and developed increased sedentary behaviour such as staying seated and screen time, with indications of a rise in child overweight and obesity in some countries.

The pandemic and the measures implemented to contain it fuelled an unprecedented worsening of population mental health, with the prevalence of symptoms of depression amongst young people (aged 18-29) more than doubling in several European countries such as Belgium,

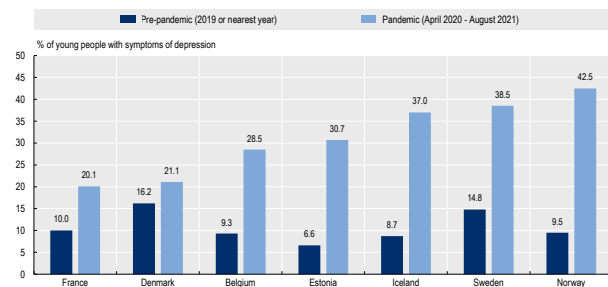


Figure 1. The share of young people with symptoms of depression increased greatly during the pandemic.

Source: OECD/European Union (2022), Health at a Glance: Europe 2022, [Chapter 1](#).

Estonia, France, Sweden and Norway (Figure 1). Young people in precarious financial circumstances and young people at risk of exclusion were at particularly high risk of mental distress.

The pandemic also disrupted mental health services, particularly during the first wave. The measures implemented to contain the pandemic not only disrupted the prevention and identification of mental health issues, but also their treatment. Following the initial disruption, the demand for mental health care has increased in many European countries, challenging already-stretched mental health care systems. One in two young Europeans with unmet healthcare needs reported that these unmet needs were related to mental health care in spring 2021 and in spring 2022 (Figure 2).

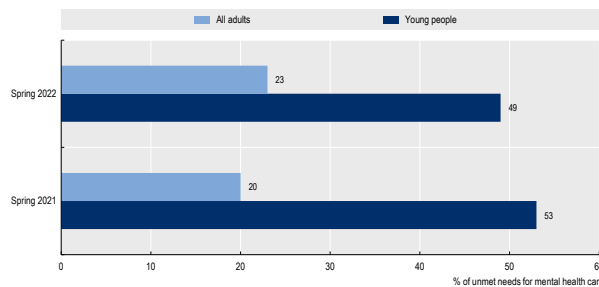


Figure 2. Almost one in two young Europeans reported that their unmet health care needs was for mental health care in spring 2021 and spring 2022

Note: Respondents were asked about types of medical examinations or treatments that they needed but were currently unable to receive, including mental health care. The data relate to the population who reported current unmet health care needs (14% of 18-29 year-old respondents reported current unmet health care needs in spring 2022).

Source: Eurofound (2022), [Fifth round of the Living, working and COVID-19 e-survey: living in a new era of uncertainty](#), reproduced in OECD/European Union (2022), Health at a Glance: Europe 2022, [Chapter 1](#).

Care Disruptions During the Pandemic Led to Backlog of Patients for Cancer and Elective Care The pandemic also disturbed the provision of care for other non-COVID patients. Disruptions

in primary care, cancer screening and treatment, care continuity for people with chronic conditions, and elective (non-urgent) surgery were especially severe during peaks of the epidemic and lockdown periods.

During the first months of the pandemic in spring 2020, disruptions in cancer screening and early detection programmes resulted in increased number of cancer cases being diagnosed at a later stage, reducing survival probabilities. Many countries were able to offset some of the initial reductions in cancer screening by scaling up activities in the second half of the year. However, screening rates for breast and cervical cancer still fell by 6% on average in EU countries in 2020. Delays in cancer screening resulted in a substantial reduction in the number of patients admitted to hospital for cancer care in 2020 (Figure 3), raising concerns about timely treatment.

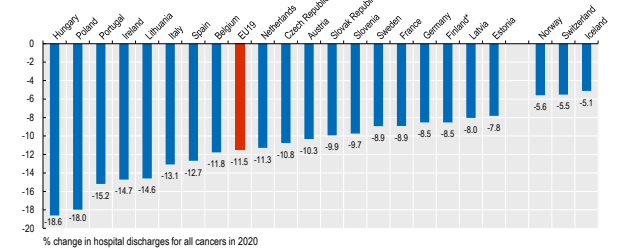


Figure 3. Hospital discharges for cancer dropped in all European countries in 2020

Source: OECD/European Union (2022), Health at a Glance: Europe 2022, [Chapter 2](#).

Most EU countries suspended elective care at different times during the pandemic to divert efforts towards COVID-19 patients and avoid people being infected while seeking care. This created a backlog of patients awaiting elective



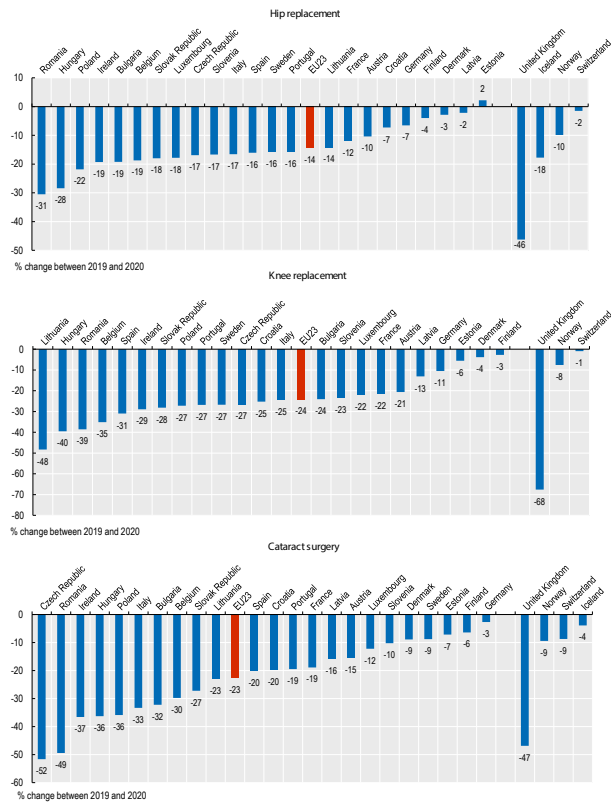


Figure 4. The volume of elective surgery fell sharply in most European countries in 2020  
Source: OECD/European Union (2022), Health at a Glance: Europe 2022, Chapter 2

interventions, generating longer waiting lists and waiting times. In 2020, 2 million fewer elective surgical procedures were performed than in 2019 across EU countries – a decrease of one sixth compared to pre pandemic volumes. Hip replacements fell on average by 14% in 2020 compared with 2019, whilst reductions in knee replacements and cataract operations were even larger in most EU countries, falling by 24% and 23% on average (Figure 4). These “missing volumes” of operations have increased waiting

times for patients. Many EU countries have provided additional funding to address these backlogs, but the main constraint to scaling up volumes of surgical procedures has been shortages of health workers. Incentives were provided to staff to work longer hours, but these clearly had limits and ran the risk of leading to burnout and resignation.

## The Development of Teleconsultations Offset at Least Partly the Reduction in In-Person Consultations

On a more positive side, the rapid development of teleconsultations at the beginning of the pandemic helped to maintain access to care, in particular for patients with chronic conditions. In some countries, the overall number of teleconsultations and in-person consultations in 2020 exceeded the number in 2019 because the

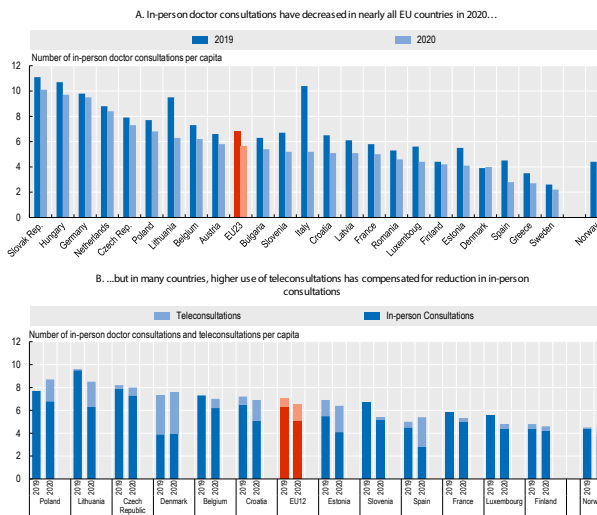


Figure 5. In many countries, teleconsultations compensated at least partly for the decrease in in-person consultations during the pandemic  
Source: OECD/European Union (2022), Health at a Glance: Europe 2022, Chapter 2.

increase in teleconsultations more than offset any reduction in in-person consultations (Figure 5). Although it is encouraging that the vast majority of people who used telemedicine expressed high satisfaction, there are nevertheless concerns that some teleconsultations provide little benefit and that teleconsultations pose risks of widening health inequalities through digital exclusion for older and poorer people and those living in rural areas.

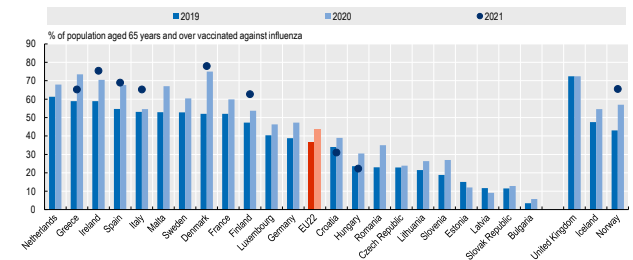


Figure 6: In nearly all European countries, influenza vaccination among older people increased during the pandemic  
Source: OECD/European Union (2022), Health at a Glance: Europe 2022, Chapter 2

## Reducing Risk Factors and Prioritising the Prevention of Infectious and Non-Communicable Diseases

Health at a Glance: Europe 2022 also highlights that despite much talk about the importance of prevention, health spending remained overwhelmingly focused on curative care before the pandemic, with only 3% of total health spending going toward prevention on average. In 2020, most EU countries substantially increased their spending on prevention, at least temporarily, to fund testing, tracing, surveillance and public information campaigns related to the pandemic. In 2021, large additional resources were allocated to

the roll-out of COVID 19 vaccination campaigns. The rapid deployment of vaccines was an important contributor to the management of the pandemic, although vaccination rates among vulnerable groups remain quite low in some countries.

During the pandemic, many European countries also made substantial progress in vaccinating vulnerable groups against seasonal flu, with the proportion of people aged over 65 vaccinated increasing by over 10 percentage points in several countries (Figure 6). Despite some temporary challenges in 2021, most European countries were also able to maintain childhood vaccination programmes.

One of the lessons from the pandemic is that maximising people's health and minimising their exposure to risk factors before a crisis is critical. Obesity and chronic conditions, such as diabetes and respiratory problems, were important risk factors for serious complications and death upon COVID-19 infection. The prevention of risk factors can go a long way to improving people's health and reducing the prevalence of chronic diseases and deaths.

Despite progress in reducing smoking rates over the last decade, nearly one in five adults on average across EU countries still smoked daily in 2020 (Figure 7). Tobacco consumption remains the largest behavioural risk factor to health,

accounting for about 780 000 deaths per year in the EU.

Alcohol consumption has also been declining over the past decade, but harmful alcohol use remains widespread and alcohol consumption is still responsible for nearly 300 000 deaths per year in the EU.

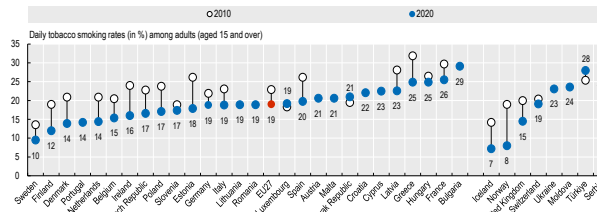


Figure 7: Despite progress in reducing tobacco smoking, nearly one in five adults still smoked daily in 2020

Source: OECD/European Union (2022), *Health at a Glance: Europe 2022*, Chapter 4

## Conclusion

The COVID-19 pandemic is the largest shock many health systems have faced. The response of health systems to this crisis provides insights into their resilience. On the positive side, *Health at a Glance: Europe 2022* highlights the rapid evolutions to new ways of safely delivering health care at the beginning of the pandemic with a doubling of the share of teleconsultations, and the rapid and widespread delivery of COVID-19 vaccinations. However, the report also highlights the extent and impact of disruptions in usual health services during the

pandemic and the unmet health care needs that resulted from these disruptions, as well as the growing needs for certain types of care such as mental health services. The pandemic and the confinement measures to contain it resulted in an unprecedented worsening of population mental health, particularly among young people with evidence of a substantial increase in depression and anxiety symptoms that fluctuated during the various waves of the pandemic but generally remained higher two years into the pandemic than prior to the pandemic. European countries have implemented some measures to support young people's mental health, but further action is needed to ensure the pandemic does not leave permanent scars on a generation of young people.

European countries can use the experience gained since 2020, including the indicators shown in *Health at a Glance: Europe 2022*, to strengthen the recovery and resilience of their health systems. Lessons from the pandemic can help countries prepare and respond to other future shocks arising from climate change, armed conflict and anti-microbial resistance, among other risks.

## Conflict of Interest

None. ■





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