Sustainable & Green Strategies

THE JOURNAL 2023

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ALEXANDRE LOURENÇO

Hospital Administrator I Centro Hospitalar e Universitário de Coimbra I Adjunct Assistant Professor I Nova National School of Public Health I Portugal I Editor-in-Chief HealthManagement. org, EXEC

Sustainable & Green Strategies

In light of the climate crisis's imminent threat to human well-being and the profound economic consequences it carries, we, as healthcare managers, occupy a crucial position in addressing these multifaceted challenges. Our roles extend far beyond traditional healthcare administration, encompassing a vital responsibility for environmental sustainability within healthcare systems. We must allocate resources wisely, ensuring investments in eco-friendly technologies and sustainable procurement practices. Healthcare managers play an instrumental role in policy development, advocating for and implementing measures to reduce waste, increase recycling, and minimise energy consumption. Furthermore, we must actively promote and adopt environmentally conscious technologies, such as energy-efficient medical equipment and telemedicine solutions, all while prioritising education and training on sustainable practices for their staff.

Additionally, we must prepare healthcare systems to face an increased demand for services resulting from the health impacts of climate change, ensuring their resilience and adaptability. By forging partnerships, advocating for green initiatives, and engaging with communities, healthcare managers can significantly contribute to the creation of resilient, equitable, and environmentally sustainable healthcare systems that address both the current and future health impacts of climate change. In this issue, our contributors discuss **Sustainable & Green Strategies**, outlining how healthcare organisations can improve the efficiency and delivery of patient care while becoming more sustainable and eco-friendlier.

Simona Agger Ganassi highlights the importance of awareness, systems approach, interaction from top-down and bottom-up, and willingness and urgency to take action and tackle the climate change problem with the decarbonisation of the health sector. Cale Lawlor and co-authors discuss the challenges of decarbonisation and sustainability and how the health sector can mitigate climate change while improving public health outcomes.

Karolina Mackiewicz offers Insights on making healthcare and hospitals more sustainable and strategies to make them more efficient and capable of leveraging digital technology to pursue these goals. Joshua Dworsky-Fried and co-authors offer an overview of Canada's interest in environmental sustainability within its healthcare system and outline the country's initiatives to build a more climate-resilient healthcare infrastructure. Will Clark discusses the role of healthcare leaders, their responsibility to act against climate change, and how hospitals must prioritise climate-smart initiatives and integrate sustainability into their daily operations for a healthier future for both people and the planet.

Teja Kikelj Mermal describes five perspectives and solutions across Europe and Canada that highlight innovative initiatives to enhance sustainability and mitigate the environmental harm the health sector unintentionally causes. Beatriz Piñeiro Lago discusses how healthcare facilities can take the lead in transitioning to net zero and describes the climate-smart initiative implemented by the Galician Health Service. Don Sweete talks about SNOMED CT, a comprehensive, multilingual healthcare terminology developed for healthcare professionals to document individual patient care within electronic health records.

In today's demanding and fast-paced medical environment, physicians are challenged by time constraints, information overload, and waning job satisfaction. John Nosta highlights how Assistive AI technologies offer promising solutions to the signal-to-noise conundrum in medicine. Henrique Martins and co-authors present the journey towards the European Electronic Health Record Exchange Format as a standardisation process for digital health interoperability to be a reality and to reap the benefits of digital transformation.

Inga Shugalo explores the use of business intelligence tools for data-driven decisions and insight. Patrick PT Jeurissen highlights the rise of for-profit strategies, including consolidation, segmentation, and turnaround management and how they can affect the future hospital landscape and disrupt the traditional one-size-fits-all approach.

We hope you enjoy reading this issue and welcome any feedback.

Happy reading!

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As Executive Director of HCWH Europe, Will Clark leads the organisation forward, creating its overall strategy. He is an environmentalist with over 20 years' experience in corporate social responsibility, carbon management, and resource efficiency. Prior to joining HCWH Europe, he spent nine years working in the NHS in the UK, where he created an award-winning and sector-leading sustainable healthcare programme, Care Without Carbon.

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Laurent Chambaud is a public health physician and former director of the School of Advanced Studies in Public Health (EHESP) from 2013 to 2022. He has extensive professional experience at all levels of decision-making: local, regional, national and international.

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Anderson Carmo, Portugal

Anderson Carmo has a PhD in genetics and molecular biology, with significant experience on the European Commission eHealth project management. He is very motivated and enthusiastic regarding the development of eHealth assets at cross-border context.

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Marc Lobbes is a radiologist with special interest in breast imaging, interventions, MR mammography, and MR guided breast interventions. Presently, he is the Chairman of the Board of the Department of Medical Imaging at the Zuyderland Medical Center in Sittard-Geleen, the Netherlands.

Prior to this role, he served as a Member of the Scientific Committee for LRCB – Dutch Expert Centre for Screening from 2018 to 2023, and continues to be a visitor and trainer since 2021. Before his involvement with LRCB, Marc was an Educational Committee Member for the European Society of Breast Imaging.

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Karolina has over 14 years of professional experience in international projects in health and wellbeing. She worked for the WHO European Healthy Cities network, leading the WHO Collaborating Centre for Healthy Cities and Urban Health, and the Development Manager at MyData Global. Karolina has developed and led numerous international projects and cooperated with the EC, OECD, World Bank and other key regional and national stakeholders.

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John Nosta is a thinker entrenched in the world of technology, science, medicine, and innovation. He is the founder of NOSTALAB. John focuses on guiding companies, NGOs, and governments through the dynamics of exponential change. He has a keen understanding of the diffusion of innovation into complex systems, particularly in technology, AI, and LLMs. His associations with renowned entities like World Health Organization, Roche Advisory Council, Google Health Advisory Board, and ARK Invest further solidify his influence and credibility in the scientific and technology communities.

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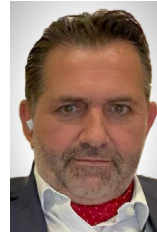
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Spotlight

A New Era of Nuclear Medicine and Molecular Imaging Through Innovation

United Imaging Healthcare debuts next-generation PET/CT Systems, the uMI Panorama Family, and the Integrated Molecular Technology Platform at the European Association of Nuclear Medicine (EANM) annual meeting, pioneering a new era of nuclear medicine and molecular imaging.

United Imaging Healthcare (UIH), a global leader in advanced medical imaging and radiotherapy equipment, introduces its next-generation PET/CT systems, the uMI Panorama™, and the integrated molecular technology platform named uExcel, at the European Association of Nuclear Medicine (EANM) 2023 annual meeting taking place from September 9-12 in Vienna, Austria. As the sponsor of the "EANM Young Authors' Award" and "EANM Technologists' Award" of this year's EANM, United Imaging is playing a significant role in driving innovation in molecular imaging and nuclear medicine globally.

The new wide-bore uMI Panorama is a family of products that include the uMI Panorama, the uMI Panorama GS, and the NeuroEXPLORER. The new uMI Panorama features a 2.9 mm NEMA resolution, 35 cm axial FOV, 143cps/kBq effective system sensitivity, and 194 ps timing resolution, leading to unprecedented system performance. A uMI Panorama has recently been installed at the Huntsman Cancer Institute, a renowned Comprehensive Cancer Center, part of the University of Utah healthcare system in Salt Lake City, United States.

EANM Congress Chair 2023-2025 Prof. Valentina Garibotto joined together with the President of International Business of UIH, Dr. Jusong Xia, and UIH Europe General Manager Lukasz Mizerka presented the EANM "2023 Young Author's Award" to this year's winners.

The uMI Panorama GS, deriving its name from the term "gold standard", was born to set the gold standard in molecular imaging and revolutionise whole-body PET imaging. The uMI Panorama GS stands out as the flagship product of the uMI

key points

- United Imaging Healthcare (UIH) is a global leader in advanced medical imaging and radiotherapy equipment.
- UIH has provided high-end medical imaging equipment to over 11,300 clinical and research institutions in over 60 countries.
- UIH recently introduced its next-generation PET/CT systems, the uMI Panorama™, and the integrated molecular technology platform named uExcel.
- United Imaging's portfolio of MI products empowers clinical and research studies.

Panorama family, boasting an FDA 510(k) cleared and CE-submitted PET/CT system with an impressive 148cm Axial Field of View (AFOV), significantly facilitating whole-body imaging in a single bed position. Striving to enhance patient experience and broaden research areas, this system delivers exceptional functional and anatomical imaging capabilities and redefines quantification accuracy for lesion-detection precision. Additionally, this long axial FOV PET/CT system breaks the sub-200 ps limitation for the first time ever.

The uMI Panorama

The Model of uMI Panorama GS

The NeuroEXPLORER (NX) is a revolutionary innovation for exploring the brain universe. Supported by the BRAIN initiative grant, created through partnerships involving Yale, UC Davis, and United Imaging, the NX was innovated to push forward the brain PET protocols and applications and stands as the most advanced DOI-TOF PET/CT scanner globally.

In tandem with uMI Panorama, the uExcel is an advanced molecular imaging technology platform meticulously integrated with hardware and software components. This platform enhances system performance, imaging capabilities, and overall functionality. Based on deep learning iterative reconstruction, the uExcel enables the uMI Panorama to improve image outcomes even in challenging scan conditions. Underpinned by artificial intelligence (AI), the uMI Panorama family offers quicker scans with reduced doses while simultaneously enhancing imaging quality and consistency across all clinical settings.

United Imaging's whole portfolio of MI products greatly empowers clinical and research studies. At the satellite symposium, Dr Joniada Doraku from Ospedale Sacro Cuore Calabria Hospital related how she has unleashed the power of the digital PET/CT uMI 780 in her clinical practice. She showcased the high resolution of uMI 780 and the superior image quality it can bring by reporting its satisfactory performance in tumour and neurological diagnosis. Reviewing the contribution made by uEXPLORER to Zhongshan Hospital of Fudan University over the past four years, Dr Hongcheng Shi noted that uEXPLORER greatly simplifies PET/CT examinations and expands the scope of PET clinical applications with its 194cm AFOV and high sensitivity. Drawing on the clinical cases he presented, uEXPLORER delivers comprehensive disease assessment, caters to specific needs with fast scans, provides abundant information through dynamic studies, facilitates low-dose scanning, and ensures low radiation, cost-effectiveness, and high-quality imaging.

Dr Jeffrey Yap from Huntsman Cancer Institute discussed how the uMI Panorama is redefining imaging performance standards and the intelligent, streamlined workflow. Dr Li Huo from Peking Union Medical College Hospital also praised uMI Panorama. Through a series of tests conducted on over 1800 patients using more than 15 different radiopharmaceuticals with uMI Panorama in just one year, she has revealed numerous innovative clinical applications for this PET/CT scanner. These applications are particularly noteworthy in the field of clinical translational research, which encompasses the use of multiple novel tracers. Dr Richard Carson focused on the design and applications of NeuroEXPLORER (NX), revealing its strong performance as a human brain PET imager in highly precise spatial resolution, highly high sensitivity, and highly accurate head motion estimation. He

Visitors at EANM

commended NX for its potential achievements in radiation dose reduction, methodological improvements, and new brain imaging paradigms, including small brain structures imaging, low-density binding-site identification, spinal cord imaging, dynamic neurotransmitter release, and small within-subject changes measurement.

United Imaging has consistently been at the forefront of innovation in the molecular imaging field in Europe. The journey in Europe began with the installation of the first digital PET/CT system in Poland in 2019. In early 2022, United Imaging expanded its footprint in Europe by installing the uMI 780 in Italy. This year, the National Institute of Oncology Marie Curie Skłodowska has also installed uMI 780.

Celebrating its one-year anniversary since its IPO, United Imaging has reached a new milestone by providing high-end medical imaging equipment to over 11,300 clinical and research institutions in more than 60 countries worldwide. Since its establishment, United Imaging has remained committed to pushing the boundaries of medical innovations and fostering collaborations with globally renowned clinical and scientific research institutions, including but not limited to Yale University, Washington University in St. Louis, and the University of Texas. As of today, United Imaging has introduced over 90 ground-breaking products, all of which have had their core technologies developed in-house.

(Note: The uMI Panorama and the uMI Panorama GS are CE pending and not yet commercially available. Mentioned products/features may not be available in all countries).

About United Imaging Healthcare

United Imaging Healthcare was founded in 2011 with a commitment to provide high-performance medical imaging products, radiotherapy equipment, life science instruments, and intelligent digital solutions to global customers. With a mission " To Bring Equal Healthcare for All" and a vision to "lead healthcare innovation", United Imaging is continuously devoted to creating more value for its customers and improving the accessibility of high-end medical equipment and services worldwide through close collaborations with hospitals, universities, research institutions, and industry partners.

Benefits of Contrast-enhance Mammography for Supplemental Screenings

MARC LOBBES

MD, PhD, Chairperson of the Board, Department of Medical Imaging at Zuyderland

With the European Council's revision of breast screening recommendations last year, radiology departments are facing a new era for mammography. With the addition of digital breast tomosynthesis (DBT), also known as 3D mammography, to the radiology toolkit, this opens the way to new advancements in patient health.

One of these advancements, contrasted-enhanced mammography (CEM), has seen several important technical improvements since it first came to market in 2011. CEM technology can help identify lesions in breast tissue by utilizing the same contrast agent as computed tomography (CT) technology. Following the application of the contrast agent, it moves throughout the breast tissue via blood flow and accumulates where lesions are forming and growing. The result is a highlighted area that stands out against the breast tissue that could provide additional physiological data for diagnosis.

In my experience, since the first generation of CEM systems used existing mammography units that were refitted with additional hardware and software, I observed that they were plagued with issues from CEM-specific artifacts, such as the 'breast-in-breast' artifact, skin line enhancement and ripple artifacts caused by slight motion during the acquisition. Additionally, those retrofitted mammography units could not be utilized for imaging in the multiple days required to upgrade the system.

Today, CEM systems are not retrofit, which resolves the issues seen on previous generations. As image quality has continued to improve, this has helped increase the popularity of the technology among radiologists. As this technology continues to improve, it provides many benefits for hospitals and clinics as a means to help improve workflow, decrease demand for hard-to-schedule breast MRI and enhance patient care.

Delivering Better Patient Care

The European Council revisions to breast screening guidelines now recognize DBT as the preferred mammography imaging system. This landmark recommendation acknowledges the extensive body of research on and benefits of DBT, advocating that all women—not just those with dense breast tissue—will benefit from this modality DBT gantries, such as the Hologic 3Dimensions® Mammography System that we use at Zuyderland, have been shown to detect up to 65% more invasive cancers than a 2D mammogram alone[1], and to reduce recall rates compared to full field digital mammography.[2]

The European Council's recommendations also call for the use of breast MRI, where appropriate, to supplement a mammogram. However, there are several limitations to MRI screenings, including scheduling issues for this multi-disciplinary tool that could lead to a delay in breast cancer diagnosis.

Thankfully, CEM utilizes a health care center's existing DBT system, enabling clinicians and radiologists to engage with a technology that is solely based on breast imaging. This triaging can help alleviate demand for breast MRI, while also reducing diagnostic delays. Studies show that CEM and breast MRI both have comparably high sensitivity in the detection of breast lesions[3], meaning CEM can offer a faster[4] alternative to MRI[5] without compromising on results. This can enable more patients throughout the health care system to utilize MRI when it is truly needed and reduce the amount of time between screening and diagnosis for breast cancer patients.

At my own facility, we use CEM throughout the breast health journey, including for evaluating screening recalls, preoperative staging of breast cancer (including invasive lobular carcinomas), problem-solving,

and response monitoring of women treated with neoadjuvant chemotherapy. With the recent updates to European breast cancer screening guidelines, we are also considering including extremely dense breast tissue as an additional indication.

By looking at the entire workflow of breast cancer patients, CEM can be utilized to create fast diagnostic pathways by taking a multi-disciplinary approach, such as contrast-enhanced biopsies to optimize diagnostic workflow. This approach has enabled my facility to see a patient on the morning of day one, and have the entire pre-operative plan completed in the afternoon of day two, even in more complex cases.

Analyzing the Return on Investment

This is a bold statement that needs to be made— CEM alone is not cost effective. This technology is only one part of breast imaging, which is a small percentage of imaging being performed in general radiology departments. Additionally, most countries within the continent do not fully reimburse for CEM.

Instead, facilities are reimbursed for the mammogram, excluding the cost of the contrast agent.

That being said, when reviewing the return on investment (ROI) of CEM against imaging overall, there can be significant benefits. As addressed previously, the utilization of CEM opens spaces for other patients to use MRI. At Zuyderland, our department observed a substantial decrease in the number of breast MRI examinations in our hospital when introducing CEM. These MRI slots are immediately consumed by other imaging specialties, which means that the adoption of contrast-enhanced technology is indirectly creating more room on the scanner for patients with other illnesses. So, in terms of cost-efficiency, it might not be beneficial for breast imaging alone, but it could have a positive impact on the department overall.

For health care centers that do not have MRI on-site, CEM also provides an opportunity to keep patients at the facility to help streamline the time between discovery and diagnosis. By utilizing the facility's existing DBT system, patients can

remain in-house for supplemental screenings and diagnosis, which helps reduce scheduling delays and streamline radiology workflow. Some studies have shown that CEM can provide comparable diagnostic performance, so all facilities—those with MRI or without—can maintain timely imaging procedures without compromising image quality.[6] Considering the entire spectrum of capabilities that are needed for a mammography unit, state-of-the-art systems like the 3Dimensions gantry enable facilities to support a wide variety of offerings, including CEM, that streamline radiologist and patient workflow.

CEM is a preferred technique at the Zuyderland radiology department because of its availability within the facility and the ease at which supplemental screenings and biopsy procedures can be performed. With the recent adoption of DBT as the preferred screening method in the European Union, CEM has much to offer facilities looking to enhance patient experience while balancing ROI.

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Cover Story

From a Polluting Healthcare Sector to Environmentally Conscious Healthcare Systems: Actions, Strategies, Actors to Make it Possible

Awareness, systems approach, interaction from top-down and bottom-up, willingness and urgency to take action and tackle the climate change problem with the decarbonisation of the health sector will require efforts from people involved in healthcare and the environment, according to the principle of "One Health". Interventions are urgent. Time is of the essence.

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key points

- The greenhouse effect is when solar radiation penetrates the atmosphere and hits the Earth with energy as short-wave rays. It strikes the Earth, generating heat that gets re-emitted as infrared rays, that is, long-wave rays. The greenhouse gases retain a relevant portion of those infrared radiations and form a coating around the troposphere, the closest layer to the Earth's atmosphere.

- Greenhouse gas (GHG) is any gas that has the property of absorbing infrared radiation (net heat energy) emitted from the Earth's surface and re-radiating it back to the atmosphere, thus contributing to the greenhouse effect. Carbon dioxide, methane, and water vapour are the most important greenhouse gases.

- A moderate layer of greenhouse gases in the troposphere, when regulated mostly by nature, was performing a positive role with its protecting effect and its temperature. The accumulation of a thick layer of GHG in the troposphere has a profound negative effect on the energy budget of the Earth's system, producing excessive heat, with consequences on human and environmental health and the disasters related to climate change.

- Carbon footprint measures human impact on the environment with the amount of greenhouse gases produced.

- Ecological footprint measures human demand on the Earth's ecological capacity.

- CO_2 E or CO_2-eq. is a metric measure used to compare emissions from various greenhouse gases based on their global warming potential (GWP).

- Decarbonisation is a set of coordinated actions aimed at eliminating or reducing near-zero emissions of a single infrastructure or a set.

- Systems theory and systems analysis are basic approaches when studying human and other living environments in the complexity of their relations.

Framework

"Primum non nocere - First do no harm" is the oath of ethics historically taken by physicians.

Health professionals and anyone dealing with health matters know the Hippocrates oath and assume it originally referred to doing no harm to your patient.

It took a long time and a long evolution of society to reach an organisation and physical structure - the hospital in the modern sense - for taking care of sick persons. It was not even considered a question that the hospital had to respect the complexity of its patients based on the ancient "first do no harm". The hospital became synonymous with a place for recovery. Most of us remember the blunt definition of the famous architect Le Corbusier of the hospital as "la machine à guérir" or the healing machine.

With the evolution of the concept of where and how to give medical assistance to sick persons, what was happening inside the main healing machine came under scrutiny: on one side, the question of how the patients were treated and the hygienic conditions, on the other emerging evidence that there were materials and procedures, used inside hospitals, that could do harm to patients and not only to them.

One of the most important international organisations that started promoting inquiries about the matters was and continues to be Health Care Without Harm (HCWH). This organisation was created in the U.S. more than 30 years ago and is now present in all continents and, in the last 20 years, has also been operating in Europe. One of the most relevant battles won by HCWH has been the elimination of the use of mercury in hospitals, which proved to be dangerous for patients and medical staff.

In recent times, healthcare and its specific authorities, such as NHS in the U.K. or SSN in Italy, and other private systems publicly subsidised, started to attract attention from the economic aspect of politicians and policymakers. Healthcare was openly declared too heavy a burden on public finances; especially the energy consumption of the major infrastructures, the hospitals, came under scrutiny.

Hospital managers were aware of the large energy consumption of their infrastructure, but realistically, even with increasing fuel prices, they were pointing out that the total staff needed, the medicines and the medical devices were, by a large margin, a heavier burden due to insufficient finances. Energy costs, certainly with some relevance, were contained, almost hidden, among the general maintenance costs.

Analysing only the economic factor, this evaluation could be justifiable due to the poor or insufficient awareness of the related environmental problems. In a large survey conducted in 2012 with hospital managers involving eight countries in a European project, the burden on the environment for satisfying the needs of "energivorous" structures as the hospitals were not yet considered. A good number of hospital managers answering the questionnaire declared that how energy was produced and supplied to hospitals was not "their problem", and their primary duty was curing patients.

The effects of climate change were already starting to be more and more evident. Calamitous events had started to directly involve hospitals, like the Katrina Hurricane in 2005, destroying an entire hospital in New Orleans, Louisiana, and then others that followed. Disastrous heatwaves in many countries caused hospitals to fill up with sick people, especially from the weakest strata of the urban populations. Healthcare was made to recognise the relevance of climate change and the need to consider it a danger.

In a relatively short time, the focus became the need to defend against the effects of climate change on the healthcare infrastructure, with justified concern for safeguarding their operability, from energy and water supplies to electricity, communications, connection infrastructures, such as roads, bridges, etc., - in short to protect their serviceability in case of calamities. In other words, the aspects related to the protection from the possible **risks** to which climate change could subject hospitals became an emerging important duty of the hospitals.

We devoted ourselves intensively to studying and talking about resilience, mitigation, and adaptation - in short, to see how to protect hospital infrastructures from the problems posed by the '**enemy**' climate change, without having sufficiently understood, at least at first, that **they were and are also part of that enemy.**

In the years when ecological thinking was growing and developing, there were attempts by scholars to address the problem of assessing the footprint, i.e. the burden of hospital infrastructures on the environment. They were, however, relatively few and not sufficiently understood. This was matched by a larger contribution in studies, guides, standards and regulations on the challenge to the risks caused by climate change on healthcare infrastructures. I directed a study for S.I.A.I.S. (Società Italiana dell'Architettura e dell'Ingegneria per la Sanità) called "Sustainable and Climate Change Resilient Healthcare Facilities in Europe: the Challenge", which was awarded a prize for leadership in climate change in 2018 at the First Climate Change Summit In London, held by Health Care Without Harm, Europe.

The Gradual Recognition of Healthcare as a Polluter

More recently, a serious introspection of the situation began to be more largely felt as necessary inside the healthcare system. In the beginning, this was mostly considering, but not limited to, the contribution to the greenhouse effect. Different types of pollution were progressively brought up to the front by the medical staff directly involved in the therapeutic part of healthcare.

In the day-to-day activities of individual healthcare units and the medical sector in general, attention

began to be paid to the set of factors that led the healthcare system as a whole to be one of the most critical contributors not only to the production of GHGs but also more extensively for air pollution and plastic invasion with the addition of indirect pollution produced by its supply chain, an indispensable factor of the hospital operational activity.

Although the documentation is beginning to be relevant, it is not yet completely homogenous, nor is it sufficiently permeated into the day-to-day working of the health systems in the different social, economic, and urban characteristics and environments. Another problem, which unfortunately is not affecting only healthcare, is the enormous difference in awareness of these problems from country to country and globally, due, among others, to the different languages with little circulation of knowledge and information, determining a state of poor common action, despite the efforts relevant of the European Union. The "energy transition is suffering from the same problem", even if energy was the first to receive attention because of its repercussions and links initially with economic aspects, then slowly with environmental problems.

However, it is necessary to grant, support and try to valorise that a certain relevance of analysis has been reached. Many aspects that make the hospitals contributors, not merely victims, to the effects produced by climate change and related health problems start to be identified and tackled as we will explore, in a more diffused way and should start to produce results.

Studies that have focused their attention on the healthcare system as a producer of GHGs, the various types of gases that are trapped mostly in the lower layer of the atmosphere, the troposphere, have led to the attribution to healthcare worldwide of around 5% of the total climate-changing gases, consisting mainly of the most influential, long-lasting-greenhouse gases, carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). These are joined by other gases in smaller proportions, but some, such as the group of fluorinated hydrocarbons, have a high impact on air quality and are relevant inside the hospitals.

The percentage of GHGs produced by the healthcare sector is not the same in different areas of the planet, depending on geomorphological characteristics and economic, social, and urban factors (that is, anthropomorphic) in each area. For Europe as a whole, it is considered to be between 4 and 5%, while some studies attribute higher values of 7 to 10% to the United States, and even higher percentages are attributed to other areas of the planet.

Global warming is now well known for all its direct negative effects and consequences. Air pollution is the fourth leading cause of mortality worldwide. In Europe, it causes around 350,000 deaths a year. The relationship between the presence of air pollutants and the increase in respiratory or cardiovascular diseases has already been proven in several studies. In recent times, surveys carried out by the European Space Agency in periods before, during and after the pandemic have shown a significant correlation between pollution levels and the spread of COVID-19.

It is evident, from these initial considerations, that those who work in the health sector have and are starting to take into account the issue of emissions coming from health activities as one of the fundamental problems that must be qualitatively and quantitatively analysed to develop actions for their reduction, if not their elimination. The aim is to have health systems that are taking concrete action to reduce pollution and stop contributing to unhealthy living conditions when healing people.

Under the stimulus of the goals developed during the Conference of Parties (COP) 21 in 2015 and collected in the document known as the Paris Agreement, many studies have emerged dedicated to showing how much the health sector has to become conscious of its **environmental sins.**

Among them, the study produced by HCHW in collaboration with the research company ARUP, "Health Care's Climate Footprint - How the Health Care Sector Contributes to the Global Crisis and Opportunities for Action", was among the first to explicitly highlight the healthcare sector's contribution to the global climate change related crisis and possible actions against it. A further value of this study was that it pointed the finger at the socially unjust aspect of the effects of climate change. Striking is the example of Bangladesh, one of the poorest countries in the world and most affected by catastrophic flooding due to climate change, which has put a crowded and fragile territory at risk, even though it is responsible for only 0.1% of climate-changing emissions.

Gradually, more studies deepened the link between climate change and human health. The Centre for Disease Control and Prevention (CDC) defined the nation's leading science-based, data-driven impact
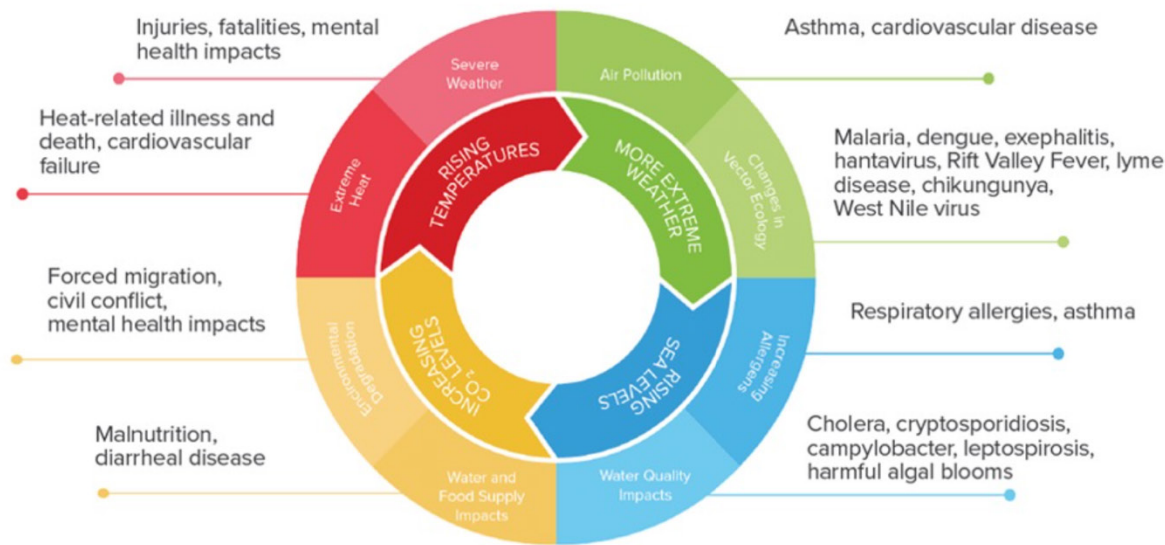
Figure 1. Impact of climate change on human health (**Source:** U.S. Center for Disease Control and Prevention)

of climate change on human health (Figure 1).

In parallel to this, there have been and continue to be studies extending the knowledge of how the healthcare sector has an environmental impact. The concept of carbon footprint is now considered in hospitals, and its evaluation progressively is addressed to all the aspects of the possible harm to patients and staff.

The Carbon Footprint of the Healthcare System - One of the Main Actors

The environmental footprint of people or systems, in this case, the healthcare system, is referred to as the **carbon footprint**. This does not encompass the totality of the hospital's polluting factors. In most cases, the focus is on the largest climate-altering

gases, such as CO_2, in the complex of hospital activities, which directly contributes to climate change. The **ecological footprint**, on the other hand, goes beyond what is covered by GHGs. The evaluation of the ecological footprint takes into account which and how many resources are required and taken away from/subtracted to the planet's ecological systems to operate and involves also looking at other types of pollution that cannot be measured by CO_2 and CO_2 E . Carbon dioxide equivalent (CO_2-eq), is a metric measure used to compare emissions from various greenhouse gases on the bases of their global-warming potential (GWP). To be even clearer, GWP measures how much energy the emissions of 1 ton of a gas will absorb over a given period relative to 1 ton of carbon dioxide (CO_2) emissions. It also takes into consideration the duration of the effect.

The difference between carbon footprint and ecological footprint was already expressed by Professor Samanthi in 2011, when he said, "The fundamental difference between the ecological footprint and the carbon footprint is that the ecological footprint measures human demand on the Earth's ecological capacity, while the carbon footprint measures human impact on the environment with the amount of greenhouse gases produced measured in units of carbon dioxide or carbon dioxide equivalent" (reproposed by Richie et al. 2020).

Among the various visualisations of differences, two complementary images seem the most representative:

The first observation when examining the carbon footprint of hospitals is that we encounter multiple gases. Even in the healthcare system, there is a prevalence of CO_2. The other gases include methane CH_4, various nitrogen compounds from NO with limited toxicity to the very polluting NO_2, nitrous oxide and all the other combinations of nitrogen and oxygen, indicated as NOx, to the variety of fluorinated hydrocarbons.

The burden of the hospital footprint can be seen through CO_2 equivalent, making it possible to find a way to measure the weight of each gas on global emissions and consequently to make the sum for determining the total burden. According to the protocol drawn by the scientists of the International Panel on Climate Change, each pollutant is assigned a GWP (Global Warming Potential). Starting with the 'weight' equal 1 for CO_2, it rises to 25 for methane and 298 for NO_2, nitrous oxide, and well beyond for fluorinated hydrocarbons. The numbers given here are the ones reported by Eurostat.
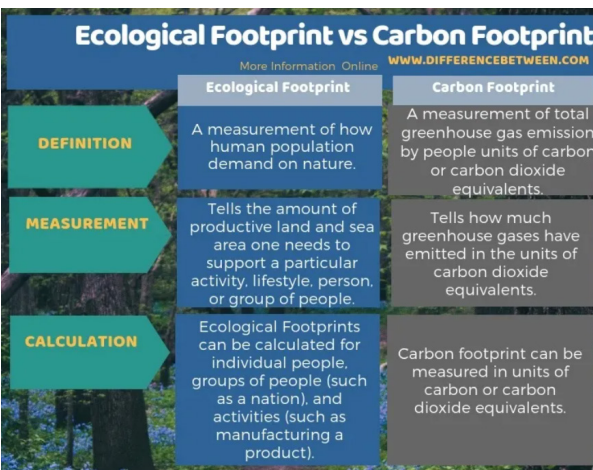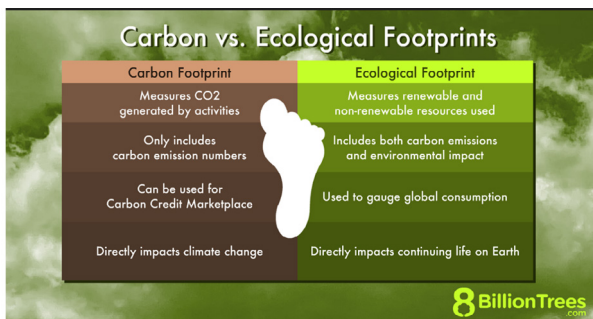
Image: Carbon footprint by Notnarayan via Wikimedia Commons

There are many studies on the hospital footprint. A study by Rodríguez-Jiménez et al. (2023) conducted an electronic search that produced 4368 records. After the screening process, 13 studies were included in their review. The studies were all in English and conducted in different locations between 2012 and 2022: one in Morocco, one in Japan, two in the United States, three in Australia, two in Switzerland, one in the U.K., one in China and two in Canada. This literature review included studies that calculated the carbon footprint of a complete hospital and some only a functional unit in a healthcare setting. The studies were done using one of the following methods: bottom-up life cycle assessment (Keller et al. 2021; Lim et al. 2013; MacNeill et al. 2017; Mtioui et al. 2021); top-down cycle assessment or economic input–output analysis (Eckelman et al. 2018; Eckelman and Sherman 2016; Malik et al. 2018; Nansai et al. 2020; Wu 2019); or a combination of both, also known as hybrid model (Tennison et al. 2021).

The Tennison study applied the hybrid model and provided with its analysis the most comprehensive view of the carbon footprint of hospitals. Stressing the usefulness of the greenhouse accounting, it clarifies the strategic points where to concentrate mitigation efforts. It has focused on evaluating the carbon footprint involving NHS healthcare facilities in England (Tennison et al. 2021). Since its publication, it has become a point of reference for the work concerning the carbon footprint of hospitals, making it worth a more extensive examination.

The methodology started with quantifying emissions using the Greenhouse Gas Protocol associated with NHS emission categories. The emissions are subdivided according to Scopes 1, 2 and 3, which is routinely done, even if the items referred to in the three scopes have some variations from one work to another. In the case of this study, the attribution to the scopes of the emissions was:

- **Scope 1** - Covers the direct emission deriving from the provision of care;

- **Scope 2** - Covers emissions from the energy in almost all the cases still purchased for the general operation of supplying the care, including the use of medical equipment;

- **Scope 3** - Covers water needed and waste produced, measurable gases emitted by equipment for treatment, such as sprays, with some other qualifications. Scope 3 also includes GHG emissions from the chain of suppliers in making and delivering products and those from services commissioned to third parties.

In this study, patients' and visitors' travels were considered a part of the study since they are not included in the NHS protocol. The same is true for commissioned health services. Due to the not always similar focus of the research, differences in the attribution to Scope 2 or 3 are noticeable among studies, without changes to the validity of the findings.

The NHS study covered the period 1990-2019 and focused on gas emissions of CO_2, CH_4, N_2O and some categories of fluorinated gases. It correctly underlined that some medicines and pharmaceuticals, in addition to the manufacturing footprint of the production (considered in the supply chain), have emissions that were appropriate to be included in Scope 1. Precisely, they are anaesthetic gases, propellants of inhaled medicines and other medical and surgical gases producing GHGs when used inside the hospital. Volatile anaesthetics such as sevoflurane, isoflurane and desflurane are potent greenhouse gases, not considered pollutants till relatively recent times, and now finally getting attention.

The following figure represents the situation in 2019 when the study was completed. Some important observations can be made to give a correct interpretation of the figure and the results

	Delivery of care	Personal travel	Supply chain	Commissioned
Scope 1	• On-site fossil fuel use • Anaesthetic gases • NHS fleet and leased vehicles			
Scope 2	• Purchased electricity			
Scope 3	• Water and waste • Metered dose inhalers • Business travel	• Staff commute	• Pharmaceuticals and chemicals • Medical equipment • Non-medical equipment • Business services • Food and catering • Other procurement	• Commissioned health services
Non-Protocol*		• Patient travel • Visitor travel		

Table 1. Sources of emissions organised by Greenhouse Gas Protocol Scopes and NHS emission categories. Columns represent NHS emission categories, and rows the Greenhouse Gas Protocol Scopes. NHS=National Health Services

that it visualises. In the article, the authors themselves offer some relevant keys of interpretation.

The first is that the situation exposed is representative of NHS, with England as the primary region of focus. The authors underline that it can also be referred to as U.K. The first specific observation, certainly one of the most evident from the figure, than follows, is the very relevant weight of the supply chain, even more, compared with the delivery of care. This can be influenced by the fact that in 2019 in the U.K. and also in England, NHS could count on advanced decarbonisation of energy production; therefore, Scope 1 comes out in this study as having reduced its relative weight, making the weight of the supply chain more relevant. It is, however, necessary to highlight that in the 13 cases examined in different local and national contexts by the study reported previously (Rodríguez-Jiménez et al. 2023). the weight of the supply chain came out as very high in many cases due to manufacturing, packaging and transport of medicines and goods. As stressed in the NHS-England study, it is undeniable that there is an objective difficulty for the healthcare sector to take action to get improvements from the supply chain.

Inside the Delivery of Care

Scope 3: The present situation could be described as the health sector being dependent, especially on the so-called big pharma, mostly from the pharmaceutical and medical equipment sectors, which has been highlighted in many circumstances. The experience of the recent pandemic is a confirmation of the present state. The reduction of the weight of Scope 3 cannot be left to the goodwill of the supply chain, nor is it possible to accept the "greenwashing" that has started to emerge in some healthcare-related production areas without delivering tangible results. The healthcare systems need to concretely realise the reduction of their carbon footprint. It is possible not to be at the mercy of the supply chain. It is a matter of discussion to see which possible ways to reach results in this scope.

Scope 2.: This is related to the supply of energy. The answer should be easy because the energy sector was the first to receive the initial pressure to reduce its costs (energy saving campaigns, efficiency, use of renewable energy sources, etc.), so it should be ready to switch to clean, renewable energy use. Up to now, the results have not been as good as they could and should be. The photovoltaic has made a big advancement. Eolic use of green hydrogen, new construction materials and technology devoted to energy saving are also promising. In front of this great development of new technologies, what is still missing is the support of a political and policy vision in some European nations more than in others. For example, the EU made large funds available from the Next Generation Europe, developing the "Recovery and Resilience Plan" programme. Italy got the largest amount of funding. The plan of investment was prepared. Among the six missions to be implemented, there was one called "Energy Revolution", supposedly devoted to energy transition in a number of production sectors. Despite the recognised relevant need for
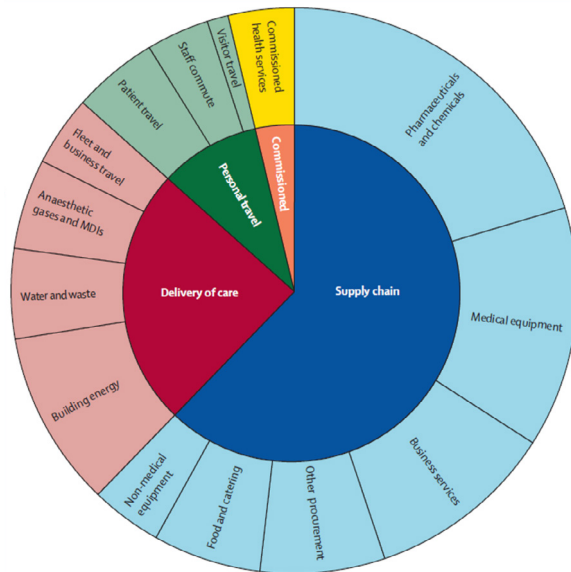
Figure 2. Contribution of different sectors to the greenhouse gas emissions of the NHS England, 2019.

energy in the healthcare sector, it was not considered for receiving a contribution from these funds. So, the energy transition of the healthcare sector toward the reduction of GHGs regarding energy, for lack of more consistent public financial support, is dependent on the meagre funds of the hospitals and/or on the decisions of energy producers, based mainly on economic evaluations.

Scope 1: This is not as irrelevant as it could be perceived at first glance. We start to analyse what goes on inside the hospitals in care delivery or what used to go on until "yesterday". The first point is the **extra-consumption** (=waste) and **misuse** inside the hospital, which consists of energy, use of pharmaceuticals and chemicals, and excess tests and

medicines. We can also consider hazardous waste production, general waste production (including the part coming from food), and the production of plastic waste with single-use gloves and utensils.

This overview cannot leave out what needs to be done better/differently, as the management of the buildings is certainly very important. Hospitals have to contribute to reducing GHG production and protecting (guaranteeing resilience, mitigation, etc.) from the risks of the already advanced climate change. Transport and commuting are relevant producers of emissions. It is realistic to say that this sector, which involves the relationship with the so-called "territorial healthcare" and the relationship with the served territory, could be highly improved. Certainly, the necessity of a new vision rethinking institutional as well as organisational changes has to be holistic.

Towards Environmentally Conscious Healthcare Systems

We mentioned before that the decarbonisation of the health systems requires a comprehensive vision and systems approach. Digitalisation cannot involve only a sector of the hospital organisation, nor (systemic approach) the effects an action can have on other parts and, enlarging the circles, on the entire system. The work that needs to be done is certainly complex. It requires environmental awareness of the stakeholders, medical and non-medical staff and the patients, but the need for change has to also be shared by policymakers at all levels. Examples that indicate the way exist and are starting to become known. One of the recent and relevant is the decision of the NHS Scotland to eliminate desflurane. It has

become the first national health service in the U.K. to stop using an anaesthetic with a high global warming potential. Desflurane used as an anaesthetic during surgery, has, as many studies report, a global warming potential 2,500 times greater than carbon dioxide.

The danger to the environment of the anaesthetic gases is not a new discovery. Yasny et al. (2012) stated that "for several decades, anaesthetic gases have greatly enhanced the comfort and outcome for patients during surgery. The benefits of these agents have heavily outweighed the risks. In recent years, the attention towards their contribution to global climate change and the environment has increased. Anaesthesia providers have a responsibility to minimise unnecessary atmospheric pollution by utilising techniques that can lessen any adverse effects of these gases on the environment."

This proves how updating the parameters to evaluate care procedures in hospitals is necessary. NHS Scotland has to be praised for this important step. It received, among others, the first prize during CleanMed 2023, one of the most significant European events regarding health and the environment, with one week of exchange and brainstorming about healthcare problems, solutions, and vision organised this year in Berlin by HCWH-EU. Hopefully, it will be followed by many other systems and hospitals. But a fundamental question that needs to be raised is timing. Considering how fast the devastations of climate change are happening, do we have the option to take it easy? Should we not accelerate the actions of decarbonisation? Especially now that we know much better where we have to focus. Success in the healthcare sector could also be evaluated

by examples from other sectors, considering how diffused is its supply chain.

This brings us to the tender spot, which is the large consensus that healthcare can do very little about the supply chain. An interesting discussion paper developed as part of a collaboration between AstraZeneca and The Health Policy Partnership Ltd. raises the point: "Health systems are complex, and decarbonisation strategies must take a systems approach to have a meaningful impact". Equally, if not more interesting to consider, is what concerns the supply chain, "the supply chains make a significant contribution to carbon emissions through the production, transport and disposal of goods and services (e.g. medicines, medical devices, food and hospital equipment). Health systems could support lower-carbon supply chains by ensuring manufacturers are decarbonising their processes with verifiable targets, such as the Net Zero Corporate Standard defined by the Science Based Targets initiative. Suppliers could also provide evidence of their progress in line with these targets."

This goes with what several sources say that the key to control the supply chain is public procurement. We are convinced that tools like PPI (Public Procurement of Innovation), P-CP (Pre-Commercial Procurement) and others could make a difference. The subject is complex and multifaceted and deserves a full article, but it is important to register that also, from the supplies side, interventions are pointed out as necessary.

Even part of the supply chain indicates that while it is difficult to make it go towards decarbonisation, it is not impossible. The crucial point is the willingness, at all levels, to acknowledge the importance and to give the public sector the necessary tools and power to make decarbonisation a priority.

Conclusion

It is important to go back to the statement about timing. A lot of knowledge has been acquired for the decarbonisation of the health sector. There are certainly other sides that need to be considered. Antonio Bonaldi is a great expert on the matter, the originator of the great activity undertaken by the Local Health Authority Bergamo-est, leading Italy in a systemic approach to decarbonisation and collaboration with local government. He is now working with other important actors on improving the ecological outputs of healthcare: the MMGs. Their potential contribution is twofold: to have the healthcare outside hospitals minimise its impact while not reducing the quality of care and possibly improving it, and contribute to awareness of people, starting with patients.

Back to the biggest polluter of the health sector: the hospitals. A question that emerges is whether the definition of green hospitals expresses sufficiently and adequately the present role of this crucial health entity. Environmentally conscious health systems and sub-systems of the larger healthcare sector appear to be highly significant, but more than a definition, what is important is the action/the actions. We cannot take it easy with decarbonising hospitals, waiting for other important sectors to move. The financial means that will bring enormous co-benefits need to be found urgently. Time is of the essence for making the health sector, and its major actor, the hospital, not only in the first line for "repairing" persons' health but also a leader in "repairing" the environment.

Conflict of Interest

None. ∎

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Champalimaud Foundation Collaborates with Philips to Accelerate its Healthcare Sustainability Initiatives

Aims to reduce carbon emissions by 50% with sustainable Philips healthtech innovations

In a stride towards sustainability and innovation in healthcare, the Champalimaud Foundation in Lisbon, Portugal has forged a strategic partnership with Philips. This collaboration aims to reduce the carbon footprint resulting from Champalimaud's diagnostic and interventional imaging equipment by a staggering 50% by the year 2028. The partnership showcases a shared commitment to global sustainability in healthcare. Additionally, these measures will enhance the quality and efficiency of care delivery at Champalimaud Foundation. As a result, more patients are expected to benefit from the hospital's cutting-edge diagnostic healthcare services.

key points

- The Champalimaud Foundation partners with Philips, aiming to reduce carbon emissions from its medical equipment by 50% by 2028.
- The partnership extends beyond imaging technology, encompassing responsible consumption, climate action, and circular economy solutions.
- The collaboration aligns with the United Nations Sustainable Development Goals (SDGs) to combat climate change, promote sustainable consumption and improve health and wellbeing for all.

A Shared Vision for Sustainable Healthcare

The partnership between Champalimaud Foundation and Philips represents a shared commitment to combatting climate change and advancing the United Nations Sustainable Development Goals (SDGs). With global healthcare systems accounting for 4.4% of worldwide CO$_2$ emissions[1], more than the aviation or shipping industries[2], embracing sustainable practices in the healthcare sector is urgent. At the same time, the healthcare sector is experiencing the impacts of climate change firsthand, treating the people who are impacted.

A Holistic Approach to Sustainability

The transformation of Champalimaud Foundation's imaging technology infrastructure will be realized through a series of practical, scalable measures and innovations. These include equipment upgrades, extending equipment lifespans, digitalization of processes, circular financing solutions, and transitioning to renewable electricity sources. Beyond reducing their carbon footprint, these measures will enhance the quality and efficiency of care delivery at Champalimaud Foundation. As a result, more patients are expected to benefit from the hospital's cutting-edge diagnostic healthcare services.

Image 1: Champalimaud Foundation and Philips Partnership ceremony, 09 March 2023 Philips

Philips: A Leader in Sustainable Innovation

Philips is at the forefront of the sustainable healthcare revolution. Leveraging its expertise as a health technology company, Philips incorporates sustainability into its innovation process through EcoDesign, circular economy principles, renewable energy sourcing, and digitalization for workflow improvement. The company's unwavering commitment to these principles has earned it a top spot-on LexisNexis' 'Top 100' list of companies contributing to UN SDG3: Good Health and Well-being. Philips was one of the highest scorers among health technology companies for the UN SDG3.

A Commitment to Excellence

Philips will collaborate closely with the Champalimaud Foundation to update and renew its diagnostic imaging technology capabilities. This includes introducing Philips' latest innovations in diagnostic imaging, such as state-of-the-art CT and MR systems. These innovations advance diagnostic capabilities, reduce resource demand, and increase the use of recycled materials, thereby contributing to a sustainable healthcare ecosystem.

> ## This partnership will allow us to continue to ensure the best care for our patients while at the same time helping to reduce the healthcare sector's environmental impact.
>
> *Leonor Beleza, President of the Champalimaud Foundation*

"The healthcare sector is a significant contributor to CO_2 emissions and therefore has an important role to play in mitigating climate change," said Leonor Beleza, President of the Champalimaud Foundation. "This partnership will allow us to continue to ensure the best care for our patients while at the same time helping to reduce the healthcare sector's environmental impact."

Robert Metzke, Global Head of Sustainability, Philips, is very optimistic about the partnership with Champalimaud Foundation. "Sustainability is a fundamental component of Philips' strategic vision. We are acutely aware of the environmental impact of the healthcare sector and its vulnerability to climate change. We are deeply passionate about collaborating with leading healthcare providers worldwide to help them diminish their carbon footprint. Sustainability is an integral part of our corporate strategy, and we recognize that achieving it requires the concerted efforts of partners like Champalimaud. Our goal is to enable patient care where and when it is needed while minimizing our impact on the planet.

Beyond Imaging Technology

This partnership goes beyond imaging technology. By installing sustainable healthcare solutions, Philips will support the Champalimaud Foundation's sustainability targets. This includes the Philips Spectral CT 7500, which uses 62.5% less energy [3]. Additionally, installing Philips MR – Ingenia Ambition 1.5T will also provide benefit as it requires significantly less helium than other systems. These innovations underscore Philips' dedication to environmentally responsible healthcare.

Image 2: Aerial view of the indoor garden of the Champalimaud Centre for the Unknown. Philips

Philips' Broader Vision for Sustainability

Philips' commitment to sustainability extends beyond SDG3 to include SDG12: Responsible Consumption and Production and SDG13: Climate Action. The company actively promotes circular economy solutions to minimize waste and reduce the extraction of finite natural resources. For example, Philips' Circular Edition portfolio offers customers access to refurbished, upgraded, and quality-tested technology at a reduced cost. By 2025, Philips aims to generate 25% of its total revenue from circular propositions, with 100% of its products designed using its whole lifecycle EcoDesign principles.

As the healthcare sector grapples with its environmental impact, Philips is actively working to reduce its carbon emissions. The company has been carbon neutral in its operations since 2020 and leads sustainability programs throughout its value chain.

In addition, Philips is leveraging its expertise to assist health systems around the world in their efforts to decarbonize their operations. The partnership with the Champalimaud Foundation represents a key example of Philips' collaboration with health systems to achieve a more sustainable and equitable healthcare future, driven by cutting-edge technology

and an unwavering commitment to global well-being. 'Learn more about partnering with Philips; Strategic Partnerships & Healthcare Solutions / Philips Healthcare

Watch video: Philips healthcare & Champalimaud Foundation: Partnering to Drive Sustainable Healthcare

About Champalimaud Foundation:

The Champalimaud Foundation was created in 2004 by the last will and testament of the Portuguese entrepreneur António Champalimaud. It is one of the largest European foundations dedicated to scientific research in the field of Medicine. The Champalimaud Foundation essentially supports research in neurosciences, cancer and vision.

The mission of the Champalimaud Clinical Center (CCC) is to actively develop advanced research and technological innovation programs, alongside the interdisciplinary delivery of clinical care in the prevention, early diagnosis and treatment of cancer. Its clinical activity is patient-centered, through the personalization of care and promotion of quality of life, providing excellence in care, based on multidisciplinary teams, and providing patients with the opportunity to participate in innovative diagnostic and treatment programs.

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[1] Health Care Without Harm (2019). Health care's climate footprint: How the health sector contributes to the global climate crisis and opportunities for action (p.22). https://noharm-global.org/documents/health-care-climatefootprint-report Scope 1 direct emissions originate from the hospitals' own operations: emissions from the building and transportation. Scope 2 indirect emissions are generated by the production and distribution of energy that is consumed by the hospital. Scope 3 are indirect CO2 emissions caused by the production and transportation of goods and services needed by hospitals such as medicines, food, equipment, clothing and waste treatment.

[2] https://www.bmj.com/content/366/bmj.l5560

[3] When compared to an equivalent CT model of one of the industry leaders

Leveraging Digital Technology to Make Healthcare Sustainable

Insights on making healthcare and hospitals more sustainable and strategies to make them more efficient and capable of leveraging digital technology to pursue these goals.

KAROLINA MACKIEWICZ

Innovation Director l ECHAlliance - The Global Health Connector l Finland

key points

- Globally, the healthcare sector is responsible for 5% emissions. If healthcare was a country, it would be the fifth largest emitter.
- ECHAlliance - The Global Health Connector is a membership organisation that works to connect, convene, amplify, and accelerate digital health stakeholders. We recognise that one of the key topics to work on globally is sustainable healthcare.
- One of its many endeavours is the Green Health initiative, which brings together stakeholders to work towards decarbonising health systems.
- The goal of sustainability can be realised through the use of digital technology and Artificial Intelligence.

Introduction

In the race to net zero, healthcare is working on greenhouse effects and making attempts on a very high level. Globally, the healthcare sector is responsible for 5% of emissions, more than aviation. If healthcare was a country, it would be the fifth largest emitter. Emissions from the healthcare industry are comparable to emissions from some 500 coal plants. However, while coal power plants can be closed down, it is impossible to shut down hospitals.

So, how can healthcare/hospitals be more sustainable? How can they become more efficient, and how can digital technology be used for this endeavour? ECHAlliance - The Global Health Connector is a membership organisation that works to connect, convene, amplify, and accelerate this process. We are able to provide our members and partners with a platform to meet, share and learn from each other about how to decarbonise the healthcare system, build more climate-resilient healthcare facilities or develop the green skills of healthcare professionals.

Sustainability for Healthcare: Digital Tools

Digital technology and Artificial Intelligence (AI) in healthcare are being applied on a much broader scale than before. The technology can be used to improve patient care in a sustainable fashion.

Sustainability is a broad term. What healthcare systems need to focus on is action. Hospitals and hospital leaders need to act as soon as possible with different measures that include looking at and thinking about buildings, energy, and waste and evaluating the supply chain, where most

healthcare emissions come from. Healthcare leaders need to be more aware of the choices they make and the effects of those choices on the carbon footprint.

The fact that the net zero initiative is integrated into the policies is excellent progress. In terms of funding, more resources are being allocated specifically for

U.K., Europe, or elsewhere. The goal is to ensure the net zero is centre stage by showing healthcare leaders how to look for efficiencies. Most healthcare

Sustainability is a broad term. What healthcare systems need to focus on is action.

Achieving Net-Zero Health Systems: What's Working and What's Not?

The U.K. health system was the world's first health system that aimed to build net zero requirements into legislation. One of the key things within this legislation and now within the policy to the net zero agenda is that every organisation that supplies the NHS must have a carbon reduction fund. However, after legislation comes policy, procedure, and, more importantly, change in culture and behaviour.

net zero efforts. It is important to consider the broader landscape of government involvement. There's a responsibility to decarbonise the supply chain, which amounts to approximately 70% of greenhouse gas emissions.

Carbon quantification is very difficult, yet it does not need to be that complicated. Some interventions can help companies with carbon quantification through machine learning and AI. The urgency of net zero is a huge challenge, but there are many other pressing challenges in the healthcare system, whether in the

organisations have a healthcare pathway model that is effective and efficient for the patient. But net zero is a complex topic as it covers many areas, from patient pathways to energy infrastructure. Yet there are also several solutions. In this new digital era, it is imperative to utilise these solutions to protect the planet.

Conflict of Interest

None.

Healthy people, healthy planet: Supporting Sustainability in Healthcare with the Cloud

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If the health sector were a country, it would be the fifth-largest emitter of carbon dioxide equivalent (CO2e) on the planet. To become more sustainable, the health sector is turning to the cloud.

A sustainable healthcare system is one that "improves, maintains, or restores health, while minimizing negative impacts on the environment and leveraging opportunities to restore and improve it, to the benefit of the health and well-being of current and future generations," according to the World Health Organization (WHO).

While sustainability in healthcare encompasses environmental sustainability, it also considers how to design a sustainable care delivery system. This includes solutions to address equitable access to high-quality healthcare, clinician burnout, cost and resource strain, and targeted therapies to improve effectiveness of all forms of resources deployed. In terms of technology, researchers are seeing

that computing power demands are now doubling approximately every two months, as compared with every 24 months prior to 2012. Likewise, as the healthcare industry begins to leverage advanced technologies like artificial intelligence (AI) and machine learning (ML), emissions related to healthcare IT workloads will continue to increase.

To address these needs, studies show that cloud technology is a key enabler of sustainable healthcare systems. A 2022 World Economic Forum report recommends health systems to consider shifting to the cloud to save on the materials needed for on-site enterprise hardware and reduce CO2 emissions. Studies by 451 Research found that Amazon Web Services (AWS) can lower customers' IT workload carbon footprint by nearly 80% compared to surveyed enterprise data centers. This will rise to 96% as Amazon drives toward being powered by 100% renewable energy by 2025.

Optimizing healthcare IT infrastructure

Healthcare organizations looking to operate more sustainably may consider a data-driven approach to reduce the environmental impact of their physical estate, including their IT infrastructure. AWS provides customers with best practice guidance and tools to examine and optimize carbon emissions associated with their AWS usage.

Illumina is a biotech company with a mission to improve human health, and it's committed to operating responsibly and sustainably. Illumina uses the AWS Customer Carbon Footprint Tool to track the carbon emissions of its AWS usage. This tool uses simple-to-understand data visualizations to provide customers with their historical carbon emissions, evaluate emission trends as their use of AWS evolves, approximate the estimated carbon emissions avoided by using AWS instead of

an on-premises data center, and review forecasted emissions based on current use. Across a 12-month period ending in November 2022, the tool reported that Illumina achieved an 89% reduction of carbon emissions—estimated at 2,367 metric tons of carbon dioxide equivalent (CO2e) saved—by using AWS as compared to running the workloads on premises.

Leveraging data and analytics to build more sustainable anesthesia-related practices

Beyond optimizing workloads in the cloud, healthcare organizations can use AWS's broad set of data and analytics services to intelligently derive insights for driving sustainability initiatives.

Practice Greenhealth, an organization that delivers environmental solutions in healthcare, reports that gases used to produce general anesthesia are extremely potent greenhouse gases. For example, the anesthetic gases nitrous oxide and desflurane respectively trap 310 times and 2,540 times more heat than carbon dioxide.

Using AdaptX's Adaptive Clinical Management analytics solution, built on AWS, the sustainability team at Seattle Children's Hospital used data captured from their electronic medical systems, which includes gas flow data from their anesthesia-gas machines, to examine sources of anesthesia-gas related emissions in near real-time. The AdaptX solution helped them visualize current and historical emissions, as well as monitor emissions as they implemented reduction interventions over a

five-year period. This led to evidenced-based protocol changes, including removing desflurane vaporizers, unplugging nitrous oxide hoses, and decreasing the default anesthesia machine fresh gas flow. Over five years, these data-driven efforts led to a 87% reduction in their anesthesia-gas related emissions, or 500,000 kg CO2e per year, without any impact in patient outcomes. Furthermore, these improvements are saving the hospital more than US$175,000 per year in reduced costs for anaesthesia gases.

Transforming care delivery to support sustainability in healthcare

Around the world, there has been a significant shift in care delivery—moving from resource-intensive clinical facilities to networked, lower-cost settings and at-home care. There is a great potential to optimize efficiency of clinical delivery in these settings using cloud-supported technologies like telehealth, AI-driven clinical decision support, improved diagnostic tools, precision and personalized treatments, and more.

Induction Healthcare is one example of an organization using technology to provide these services. Their Attend Anywhere telehealth consultation solution is hosted in the AWS Cloud and is used at scale across the United Kingdom National Health Service (NHS) in more than 70% of NHS Trusts. A year-long independent study of these video consultations estimated that they have saved 78 million miles (126 million kilometers) of patient travel, which approximates 14,200 tons of greenhouse gas emissions—not to mention the

collective 530 years saved in travel and waiting times for patients and clinicians. Fewer in-person visits also resulted in 11 million fewer single-use personal protective equipment (PPE) items, such as face masks, creating further cost savings for the NHS.

Learn more about sustainability in healthcare

By using cloud technology to optimize processes, reduce waste, and improve collaboration, healthcare systems can become more sustainable while also improving patient outcomes and reducing costs.

As a first step, healthcare stakeholders can learn about cloud computing, so they can facilitate effective collaboration and make data-driven decisions in deploying the limited physical and human resources available to deliver the right services, at the right time, and to the right people.

AWS's infrastructure is 3.6 times more energy efficient than the median of surveyed US enterprise data centers, and up to five times more energy efficient than the average in Europe and Asia Pacific. Plus, AWS continues to innovate at the chip-level to drive energy efficiency. For example, AWS launched AWS Trainium, a high-performance ML chip designed to make training of generative AI models more cost-effective and power-efficient, in 2022. AWS Trainium is up to 29% more energy-efficient and can reduce costs by up to 62% versus comparable instances.

Beyond energy efficiency, running operations sustainably also means reducing the amount of water

used to cool AWS data centers. AWS is already well on the path to becoming water positive by 2030. According to the 2022 Amazon Sustainability Report, AWS's global water use efficiency metric of 0.19 litres of water per kilowatt-hour is a 24% improvement from 2021.

To gain an overall understanding of AWS's sustainability transformation, explore Sustainability Transformation with AWS, a 45-minute, fundamental self-paced course. Learn about the commitments of Amazon and AWS to sustainability, how to optimize workload architectures for sustainability, and AWS as a technology partner for sustainability transformation.

AWS is the trusted technology and innovation partner to the global healthcare and life sciences industry, providing unmatched reliability, security, and data privacy. Healthcare and life science organizations around the world use AWS to reinvent how they collaborate, make data-driven clinical and operational decisions, enable precision medicine, and decrease the cost of care. Learn more at AWS for Health.

Health Systems Decarbonisation: The Essential Shift

The health sector occupies a unique position as a contributor to carbon emissions but also a sector that pays for the damages of climate change through health impact. By decarbonising, the health sector has a dual opportunity to meet the challenges and benefit from sustainable changes. For this, a systems approach to change is needed that considers the most vulnerable and marginalised, ensuring a just transition.

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key points

- Decarbonising the health sector has the opportunity to not only help mitigate and adapt to climate change but also to improve public health and decrease the current and future burden on health systems.
- By rising to the challenges of decarbonisation and sustainability, the health sector will decrease its impact, and will also stand to gain from a number of co-benefits, inside and outside of public health, and act as an advocate to other sectors.
- Decarbonisation works hand in hand with health promotion and disease prevention, and efforts to improve population health will positively impact climate footprint.
- Technological improvements will not be enough to prevent climate; systems change is needed to move away from models based on fossil fuel extraction and consumption.
- International collaboration and support are essential in adapting to change and building provision, capacity and resilience.

The Healthcare System and Carbon Footprint

Amid the pressing global issue of climate change, a comprehensive effort to decarbonise every facet of society has gained urgency. Surprisingly, the health sector often evades attention in climate discourse despite its sizeable contribution to carbon emissions. If ranked as a country, the health sector would be the fifth-largest carbon dioxide emitter, accounting for 4.4% of global carbon emissions (Health Care Without Harm and ARUP 2022), which accounts for more than the aviation and shipping sectors combined (Gabbatiss 2019). Carbon footprint varies across different systems; the average per capita health carbon footprint in 2014 (in Organisation for Economic Co-operation and Development (OECD) countries, and China and India) was 0.6 tonnes of carbon dioxide (tCO_2) per capita, varying between 1.51 tCO_2 per capita in the United States, and 0.06 tCO_2 per capita in India (Pichler et al. 2019). This emphasises the imperative of health sector decarbonisation, not only for mitigating climate change but also for bolstering the sector's resilience against climate-induced health and environmental crises. Systems thinking is needed to tackle such complicated problems.

In the context of this paper, the health sector refers to not only acute care facilities but also the structures for health protection and prevention, as well as organisational and social structures working towards health, such as disability and elderly care.

Climate change is a justice issue, and the disparities between different populations highlight the inequity and inequality in health

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status. The Global North has contributed the most to a changing environment, yet it is the Global South that is suffering and will suffer more greatly from climate events (Deivanayagam et al. 2023; Hickel 2020; Intergovernmental Panel on Climate Change 2023). The Global South contributes the least to global emissions, yet they often have less capacity for health systems, technological, economic and infrastructure resilience to weather shifting climates (Intergovernmental Panel on Climate Change 2023). For example, the impacts of flooding on health sector operations and public health status in low-lying Pacific Island nations, including infectious disease risk (Paterson et al. 2018; WHO 2017), or the effects of prolonged drought in a sub-Saharan nation (Masih et al. 2014), stand to significantly impact health. The Global North need to not only decarbonise but also assist in boosting the resilience of nations that are bearing the brunt of the climate crisis, despite their negligible contribution to its cause.

The health sector's substantial carbon footprint stems from a number of factors in different scopes of emissions. Scope 1 emissions are related to the direct use of sector-owned or controlled resources, which encompass waste management, transportation, and on-site fuel combustion sources, such as boilers and gas appliances (Health Care Without Harm and ARUP 2022). Scope 2 emissions are indirect and

come from the consumption of purchased energy from a utility provider, including electricity, heat and cooling (Health Care Without Harm and ARUP 2022). Scope 3 is by far the largest contributor to the health sector's carbon footprint, accounting for, on average, 71% of the footprint (Health Care Without Harm and ARUP 2022). These

> The health sector plays a crucial role in spearheading the necessary global transformation needed to meet the challenges of climate change

emissions are indirect and arise principally from procurement, goods and materials distribution, transportation including patient commuting, pharmaceuticals (including medical gases), construction, waste generated in operations (such as catering),

and use of products by patients, all when not directly under the control of the sector (Health Care Without Harm and ARUP 2022).

Adding to this, the health sector's large carbon footprint paradoxically aggravates a range of health issues. The system will be burdened with further costs through increased service demand, escalated stress, and damage to infrastructure and social systems. Climate change poses an increasing risk to global public health and disease management, leading to a greater incidence of morbidity and mortality due to direct and indirect causes. Direct causes will include infectious disease and pandemic risk, as well as direct environmental stressors, such as heat, severe weather and flooding, while indirect causes will include decreased water security, distorted and strained food systems, forced migration and negative mental health impacts, among others (European Public Health Alliance 2023; WHO 2019). The effects of these proximate causes are unevenly felt across society and by both non-vulnerable and vulnerable populations. Vulnerable populations include older people, children, pregnant women, those with a mental illness or an underlying condition like respiratory disease and diabetes, and people of lower socioeconomic status (Guivarch et al. 2021). Thus, decarbonising the health sector presents a dual opportunity: curtailing its contribution to global carbon emissions,

thereby reducing its public health impact and enhancing the resilience of health services to climate change-induced health threats.

According to the WHO, the health sector plays a crucial role in spearheading the necessary global transformation needed to meet the challenges of climate change and having an opportunity for public health prevention in terms of climate change related risk (WHO 2019).

Strategies for Healthcare Decarbonisation

To drive and accelerate the decarbonisation of the health sector, several strategies have been developed, some of which are currently being deployed across various settings. As extensively outlined by Health Care Without Harm in a collation of recommendations from the World Health Organization and World Bank, these strategies fall into three areas: (1) facilities and operations, (2) supply chain, and (3) the wider economy and society (Health Care Without Harm and ARUP 2021). Table 1 shows an overview of actions in these areas. To achieve a more comprehensive scope, additional areas of action from various sources have been integrated, enhancing the overall coverage of healthcare decarbonisation.

By implementing these recommended changes in different areas of action, the healthcare sector could stand to drastically reduce its environmental and climate impact. In this process, however, the healthcare sector can also stand to profit from a range of related co-benefits for the health and wellbeing of populations, as well as its own operations, efficiency and resilience. With healthcare staff being among

Area of action	Changes to be implemented	Sources
Renewable energy	This category involves focusing on energy efficiency and the use of renewable energy sources, enabling the sector to consume electricity with lower carbon intensity and influencing suppliers to adopt greater sustainability measures. The approach advocates for broader energy transitions, ambitious targets, policies, and research.	• (Health Care Without Harm & ARUP, 2021) • (Markandya et al., 2018) • (Romanello et al., 2021) • (World Health Organization, 2020b)
Zero emissions buildings and infrastructure	In this category, the focus is on building resilient, eco-friendly healthcare facilities. This includes optimising designs for natural ventilation and resource efficiency, such as telemedicine. Alongside this, green spaces and roofs are also promoted, serving dual purposes: they absorb CO_2 and enhance the wellbeing of patients and staff. These strategies collectively form part of a broader environmental management system, advocating for sustainable land use and healthy communities.	• (Guenther & Vittori, 2013) • (Health Care Without Harm & ARUP, 2021) • (Health Care Without Harm, 2015) • (U.S. Department of Health and Human Services, 2014) • (World Health Organization, 2015) • (World Health Organization, 2020b)
Zero emissions and sustainable transport	For facilities and operations, this means transforming the transport modalities of staff and the vehicle fleet through active public transport incentives, vehicle upgrades and low emissions zones. In the supply chain and wider society, this means promoting and procuring sustainable vehicles, prioritising bulk orders, and advocating for clean and sustainable transport systems and mobility plans. There is also a role in preventing the need for transport, such as healthcare staff housing policies to reduce commute distance and stress.	• (Health Care Without Harm & ARUP, 2021) • (Shaw et al., 2014) • (United Nations, 2021)
Healthy, sustainable and resilient food systems	Inside the sector, this means providing nutritious, locally sourced and seasonal food provision, as well as low-carbon footprint foods, such as plant-based foods, and sensible use of water resources. Outside of the sector, this entails pushing for sustainable, plant-based foods, reducing food waste and packaging, and pushing for healthier agricultural systems.	• (Gerber et al., 2013) • (Health Care Without Harm & ARUP, 2021) • (Health Care Without Harm, 2023) • (Smith & Bustamante, 2014) • (World Health Organization, 2020a)
Low-carbon pharmaceutical systems	Inside the sector, this means promoting less medication-intensive medical management, and mitigating pollution from inhalers and anaesthetic gases, for example, by recapturing. Outside of the sector, this means incentivising change to lower pollutant pharmaceuticals, including medical gases, and advocating for healthier lifestyles less reliant on pharmaceutical intervention. In addition, it is important to encourage further research and development to exploit opportunities to diminish the environmental impact of pharmaceuticals and medical devices without compromising patient care. Further, production plants of pharmaceuticals and medical devices should be more environmentally-friendly, more decentralised, and closer to the end-users to reduce the need for global transportation.	• (Health Care Without Harm & ARUP, 2021) • (Stockholm County Council, 2013) • (Wen & Liu, 2023)
Circular and sustainable healthcare waste management	Inside the sector, this includes reducing waste, reducing incineration, increasing recycling and responsible disposal of potent global warming chemicals such as F-gases. Reprocessing and remanufacturing single-use medical devices should be seen as an opportunity. In related sectors, the health sector can encourage, procure and incentivise along the same principles and work to shift wider society and communities towards less waste-creating systems.	• (Guzzo et al., 2020) • (Health Care Without Harm & ARUP, 2021) • (Health Care Without Harm Europe, 2020) • (MacNeill et al., 2020) • (Rizan et al., 2021)

Increased health system efficiency	In facilities and operations, increasing organisational efficiency, decreasing over-intervention and unnecessary procedures, and internal review mechanisms with climate change in mind can help decrease carbon footprint. The sector can affect supply changes and the wider economy and society by ensuring strong information technology systems, efficiency and accountability of the services it engages with by providing a leading example of how other sectors can increase efficiency and decrease preventable emissions. Investment in preventative health, health promotion and primary care also has an important role to play in decreasing health system consumption by reducing the need for service utilisation, specialised services and interventions. Health staff education on sustainability will also be key.	• (Beatson et al., 2008) • (Edwards et al., 2023) • (Health Care Without Harm & ARUP, 2021)
Promote Telemedicine and Digital Health Services	Telemedicine has the potential to dramatically reduce travel-related emissions for both healthcare providers and patients. Its deployment should be part of a broader strategy involving consultations, remote monitoring, digital prescriptions, and long-distance follow-up care. Consideration should also be given to the energy efficiency of the technology platforms used and their compliance with data protection laws.	• (Holmner et al., 2014) • (Lokmic-Tomkins et al., 2022) • (Purohit et al., 2021)
Energy-Efficient Medical Devices	Transitioning to energy-efficient medical devices decreases electricity consumption and sets an example for suppliers, encouraging them to develop more energy-efficient products. This action should be aligned with a broader strategy that includes regular auditing of energy consumption, planned obsolescence, and eventual recycling or disposal of medical equipment in an environmentally friendly manner.	• (Duque-Uribe et al., 2019) • (Guetter et al., 2018) • (Mohamed, 2020)
Water Conservation Programs	By incorporating water-saving technologies such as low-flow faucets and water-efficient sanitation systems, healthcare facilities can drastically reduce their water consumption. This category should also include educational programs on water conservation, the monitoring and treatment of wastewater, and the potential for water recycling and reuse within the facility.	• (Eckelman & Sherman, 2016) • (Gettler et al., 2023) • (Hernández, 2020) • (Priyalal et al., 2015)
Local Sourcing of Medical Supplies	Sourcing medical supplies locally not only minimises the carbon footprint associated with transportation but also supports local economies. A comprehensive approach would involve creating a local procurement policy, fostering relationships with local suppliers, and performing a life-cycle assessment of products to ensure they meet environmental standards.	• (Alderwick et al., 2021) • (Connor et al., 2010) • (Modisakeng et al., 2020)
Green Roofs and Urban Green Spaces	Installing green roofs or investing in adjacent green spaces not only absorbs CO_2 but also enhances patient wellbeing. Such initiatives should be part of a broader environmental management system that may include the use of native vegetation, rainwater harvesting, and integrating therapeutic landscapes into healthcare settings for patient and staff wellbeing.	• (Din et al., 2023) • (O'Hara et al., 2022) • (Ode Sang et al., 2022)
Educate Staff and Patients	Developing and implementing sustainability training and awareness programs for healthcare professionals and patients can encourage the responsible use of resources. This education should extend beyond waste management to include energy conservation, sustainable commuting, and the impact of lifestyle choices on both health and the environment.	• (Alderwick et al., 2021) • (Asaduzzaman et al., 2022)

Table 1: . Areas of action for healthcare decarbonisation

some of the most trusted professions in society (Ipsos 2022), such a healthcare system and its staff, with a focus on sustainability and low climate impact, will be able to inspire other sectors and wider society to take sustainability seriously.

Co-Benefits from Healthcare Decarbonisation

Decarbonisation must be a goal of all industries for a sustainable future. At the same time, it offers an opportunity for co-benefits while reimagining how sectoral activities are organised and re-centred around planetary health.

Healthcare spaces and processes can thus be purposely (re)designed to be more people- and community-friendly. Together with infrastructure resilience, indoor air quality can be improved by designing for better insulation, better natural ventilation, and more efficient heating and cooling in healthcare facilities, with the air exchange rate deliberately incorporated in the building design. The use of green spaces can counteract the heat island effect, encourage socialisation, and have beneficial effects on mental health and mild effects of physical activity (WHO 2016).

Additionally, with health experts emphasising that a diet rich in plant-based foods and with fewer animal-source foods brings about improved health, healthcare facilities should be leading the way in making sure the foods they offer are tailored to nutritional needs and do not further threaten climate stability (Department of Health and Social Care U.K. 2020). Food waste deserves a special mention too,

as it has been estimated that it can range from 6% to 65% in healthcare facilities (Health Care Without Harm 2016). This comes with planetary and monetary consequences – according to the NHS Hospital Food Review, food waste costs are around £230 million annually only in the UK (Department of Health and Social Care U.K. 2020), at a time when climate change threatens food systems (European Public Health Alliance 2023).

Ensuring waste efficiency could greatly modify the effect of the health system on public health. With a significant percentage of the waste generated within healthcare facilities classified as hazardous, it is essential that it is handled and disposed of responsibly and that these processes are considered in healthcare systems with a view to increasing their sustainability (Health Care Without Harm Europe 2020). One of the notable co-benefits of efficiently managing waste would be lowering the risk of spreading environmental antimicrobial resistance (AMR), which on its own threatens to exert a massive burden on healthcare in the future (Marschang and de Stefani 2016). As with climate change, AMR risks creating a feedback loop of deterioration, impacting healthcare and provision. Rethinking the food systems in healthcare facilities would, therefore, have triple benefits for the people, planet and economy and improve population health, decreasing the burden from the health system.

The Progress of Healthcare

Decarbonisation

Health sectors are beginning to rise to the task of decarbonisation, with a number of countries publishing plans to reduce their carbon impact. Whole-sector transformation has become the ambition of some health systems, such as the British National Health Service establishing in 2022 its Net Zero Plan to decrease their climate impact (NHS England 2022). Building upgrades, technological upgrades, such as energy efficiency management systems and artificial intelligence (AI), on-site renewable energy generation, staff transport modal shift and transport electrification, reducing the environmental impact of medicines and pharmaceutical, and reforming the way food and catering are managed, aim to greatly reduce emissions in all scopes. The Plan signals to the supply chain and procurement that they are expected to decarbonise as well. Patient care will lean more towards the prevention of chronic disease, focus on digitalisation, and on capacity building. Importantly, the Plan acknowledges the health inequalities of different populations, such as greater environmental hazard exposure faced by marginalised populations (for example, from air pollution), as well as less access to positive environments (such as green space) and the way that a changing climate will change energy needs.

Attention to the physical infrastructure and working with nature (often termed nature-based solutions) have seen physical health sector infrastructure reduce its environmental impact but also increase its adaptation capacity and resilience. Last year, a Bangladeshi hospital won the global award for best building (The Guardian 2022). The building uses natural ventilation, plans space, light and shade to reduce energy use and increase efficiency, uses rainwater collection and harvesting, plans access around anticipated staff and patient flow, and provides courtyards and focal points for people to meet (ArchDaily 2022). By paying attention to the surrounding climate and geographical needs, in this case, in terms of rain, flooding and severe storms, as well as energy and lighting needs, infrastructure can be planned to reduce climate impact and improve resilience to a changing climate while catering to population needs.

Strict emissions reporting requirements are essential for effectively reducing carbon emissions in the health sector, ensuring transparency and accountability. The Dutch government is making significant strides in measuring healthcare emissions, which accounts for 4-8% (depending on the type of energy use and measure methodology) of the national carbon footprint, such as through the piloting of the Operation Zero methodology led by Health Care Without Harm (Health Care Without Harm n.d.). This initiative is a collaborative effort with the National Institute for Public Health and the Environment and the Ministry of Health, Welfare, and Sport. Phase one involved establishing a rigorous methodology to accurately measure carbon footprints, identify emission hotspots, and track progress. This

included analysing emissions in material extraction, blue water consumption, land use, and waste generation. Drawing from the lessons learned, the pilot emphasised the importance of harmonising data with hard-to-measure sources, such as anaesthetic gas releases and employee commuting, to develop a comprehensive climate footprint analysis and decarbonisation roadmap.

Future Directions of Healthcare Decarbonisation

While a number of developing fields will assist in the mitigation of the healthcare sector's impact on the environment and climate, technology alone will not resolve an issue deeply entrenched in a system of fossil fuel extraction and consumption. Systems change focused on shifting to cleaner systems based on energy efficiency, sustainability, and equity is the cornerstone of action in facing the climate crisis.

Tackling healthcare waste by developing cleaner, less plastic-based solutions can reduce environmental impact. Reducing systemic waste and promoting a circular economy based on decreased waste acceptance whilst allowing for recycling and safe disposal offers low-hanging fruit for the decarbonisation of the sector.

Technology is assisting this transition and presents various opportunities for the healthcare sector to decrease its impact, increase efficiency and resilience, and show global leadership to help protect the climate and global health. Telemedicine, popular during the COVID-19 pandemic, has been shown to be an effective intervention to reduce health sector-related emissions (Purohit et al. 2021). Promoting digital access and literacy can help aid in reducing climate impact. AI and Data Analytics also have the potential to streamline energy use in healthcare facilities, as outlined in the NHS Net Zero Plan. Machine learning algorithms, for example, can be employed to analyse patterns of energy use, anticipate future energy requirements, and implement strategies for energy conservation (Benti et al. 2023).

Successful health sector decarbonisation demands robust policy frameworks at the national and international levels. These policy frameworks should incorporate specific emission reduction targets, incentives for adopting green practices, and rigorous enforcement of environmental regulations. Policy can help enable and nudge the healthcare sector to secure the necessary transformations through financing, taxation and ring-fencing, and research and development. The healthcare sector can also significantly contribute to promoting change through the enforcement of diligent procurement standards, food system standards, land use management, and advocacy. The healthcare sector has notable political power as an anchor institution in communities to advocate for change, which ultimately stands to greatly benefit the sector by protecting public health (Reed et al. 2019). Similarly, the sector can lead by example, including through the example of healthcare staff, who should be leaders and educators when it comes to sustainability.

All of society can contribute to the healthcare sector's decarbonisation, particularly through the application of a One Health and Planetary Health lens, which sees the health of people and the environment as inextricably linked. Policy approaches, such as Health-in-all-Policies (HIAP), take into account climate and can assist in decreasing morbidity and mortality, including from environmental exposures (such as air pollution) and chronic disease (such as cardiovascular disease related to transport noise). All policies have the potential to enable healthcare sector decarbonisation, working together to protect the environment and health.

The importance of prioritising population health cannot be overstated. The most sustainable impacts on healthcare can be achieved through reducing the need for healthcare and promoting a healthy lifespan, including into older age. Healthier populations with less need for healthcare (especially including older age populations) will mean a healthcare system using less resources and energy and producing less emissions. Robust measures to protect and promote population health will see a decrease in the impact of healthcare emissions.

Health equity and justice remain vital issues when looking at healthcare sector decarbonisation. Health inequities exist across society, including internationally and in terms of healthcare access. Action on the prevention of morbidity and mortality locally, regionally and internationally has a massive role to play in healthcare-related emissions. Ensuring that all populations, regions and nations have the resources to mitigate and adapt to climate change

is essential in protecting health and ensuring health equity.

Conclusion

Decarbonising the health sector represents a unique opportunity to both mitigate climate change and improve public health outcomes. While the progress to date is encouraging, the path ahead is still long and requires sustained commitment. Ambitious actions and policies that 1) realise the tight interlinkage between healthcare sector emissions and public health and 2) see expenditure as the health investment that it is, are a vital component in protecting public health. All policies should take health and climate into consideration and work to reduce health inequity, both locally and further afield. International justice will be a key pillar for necessary change. Systems change needs to occur, with a rapid, deep, sustained shift to sustainable, low or no-carbon methods. Technology and innovation will offer opportunities to increase efficiency and decrease impact. It is necessary for climate change to be recognised as a profound threat to public health, recognising the role of each sector within health systems in facing climate change and ensuring a just transition that protects the marginalised and vulnerable through effective policies. Finally, we must acknowledge that countries are not on the same footing to tackle this dramatic transformation. The way to mitigate carbon footprint in very sophisticated healthcare organisations will be different, especially when needing to build a resilient healthcare system in countries where the basic needs are not yet covered. Systems approaches to complicated problems and stakeholder engagement with a focus on equity and inclusion are essential to truly protect public health.

Conflict of Interest

None. ∎

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How DSOs Can Implement a Balanced Sustainability Strategy

Explore different sustainability dimensions for dental support organizations and identify two factors that can help DSOs enable sustainable growth and standardize clinical excellence.

JOERG AUMUELLER

Vice President and Global Head of Enterprise Solutions l Straumann Group

key points

- 95% of business leaders believe sustainability is important.
- Sustainability means more than making environmentally conscious business decisions—it refers to any action that ensures the longevity of the DSO and the community, society, and environment it coexists with.
- Sustainability and profitability are not mutually exclusive for DSOs.
- Collecting and analyzing practice data can provide DSOs with visibility into opportunities for sustainable growth.
- In line with the standard for sustainable dentistry, holistic workflows replete with the training, materials, and support needed to render treatments can eliminate inefficiencies to reduce expenses and waste, save time, and produce more consistent outcomes.

According to a survey by Software AG, 95% of CEOs around the world consider sustainability to be a high priority. However, some 84% feel that sustainability initiatives take a backseat to commercial objectives in times of economic instability.

Decision-makers of dental service organizations can certainly understand these sentiments. DSOs face the seemingly insurmountable challenge of establishing and enforcing a policy of sustainable growth across a diverse network of practices.

Disjointed efforts to become a more sustainable organization can be a waste of time and resources. But a harmonized approach that balances all the demands of sustainability and profitability will benefit the organization in manifold ways.

Additionally, implementing effective solutions and working with partners who have set a course for a sustainable future can help DSOs to reach their own sustainability goals and reap the benefits.

Why Aim for Sustainability?

While the word 'sustainability' may bring to mind concepts such as waste reduction and shrinking a company's carbon footprint, the term has much broader meaning and value. Sustainability refers to efforts made to benefit the current generation without having a negative impact on the next.

Sustainability therefore means sustaining a profitable company itself while preserving a place on Earth and among human society where it can continue to thrive.

It is easy to point to the fact that there is currently no real market consequence for lacking a sustainability strategy, but that could soon change. Even if the risk of penalty is not a significant impetus for establishing a sustainability policy, there are more important reasons for DSOs to consider how they can make their organizations more sustainable.

Sustainability has direct and indirect impacts on profitability. Sustainability and profitability are not mutually exclusive. In fact, profitability is an integral part of a healthy and sustainable organization. DSOs who are interested in growing their profitability do well to consider how they can become more sustainability-focused entities. By providing more sustainable oral care, DSOs could eliminate inefficiencies to improve the way treatments are delivered, resulting in the saving of time and resources.

Sustainability initiatives deliver essential immeasurable value. At its core, sustainability is about humanity, and DSOs are human-centered businesses. Sustainability initiatives include efforts to better support employees and customers of a business, and there are ample ways for DSOs to do so for their own employees, clinicians, and customers, as well as the communities they interact with. By establishing and publicizing a sustainability initiative, DSO can strengthen their brand and demonstrate their commitment to helping those affiliated with them to reach their goals. This can deliver immeasurable yet immense value for the company and its shareholders by helping to attract oral care consumers and clinicians to the organization.

Sustainability is essential to growth. Sustainability is becoming increasingly more important to the up-and-coming generations of investors and clinicians who will keep the organization running for many years to come. Younger generations of today are more concerned with issues like social equality and climate change, as these issues will have a more immediate impact on their lives, including their retirement plans. By pivoting their companies onto the path to sustainability, DSOs can essentially become magnets for the human resources they need to grow and thrive.

Sustainability inherently includes risk mitigation. Part of being a sustainable corporation includes maintaining compliance with local regulations and legislation, as well as maintaining transparency in company finances.

The Two Keys to Sustainability

Incorporating sustainability into the company's values is only the first step. The real challenge lies in implementing the culture on a granular level among all practices in the network.

Sustainability in clinical dentistry is defined as the provision of preventative care and treatments of the highest quality to ensure long-lasting outcomes and to reduce the need for future interventions.

This approach could result in:

- an advanced patient experience

- an elevated employee value proposition (EVP)

- time savings which can improve overall access to oral care

- long-lasting oral and overall wellness that allows patients to enjoy a better quality of life

While sustainable dentistry is ideal, it is no simple feat to implement it in every practice in a DSO's estate.

There are two factors that can help DSOs effectively implement a balanced strategy that satisfies commercial objectives and supports digital transformation while helping organizations meet their goals for sustainable growth: data-driven decision making and comprehensive workflows.

Data-driven decision making. The ability to aggregate and analyze all types of data from across the network yields vital insights into opportunities to improve profitability, eliminate inefficiencies, leverage the potential of the current patient cohort, identify the potential to improve sustainability, and benchmark treatment outcomes and clinician performance. Data supplies DSO leadership with big picture-level visibility into the performance of the organization as a whole, enabling them to make informed decisions tailored to the unique needs and capacities of each practice in the network.

Comprehensive workflows. End-to-end workflows that provide all the training, materials, and support needed to render treatments can help clinicians

to achieve consistently excellent outcomes while reducing appointment times. Such workflows also centralize supply ordering for specific procedures to reduce the costs and waste production typically associated with those treatments. This streamlined efficiency and economy, when enacted across multiple practices, can assist DSOs in reaching their goals for rendering sustainable dentistry to their customers.

Conclusion

Far from being a corporate buzzword or a nonessential luxury, sustainability is a must for DSOs seeking to build a long-lasting and thriving company now and for future generations. Instead of coming at the cost of profitability, efforts to become a more sustainable organization can have a positive impact on profitability. Sustainability initiatives can include enhanced data collection and analysis and comprehensive workflows that eliminate inefficiencies and reduce costs.

Straumann Group has developed sustainability initiatives that reflect our commitment to building a brighter future and partners with DSOs to help them execute solutions that give them greater insight into and control over the sustainable growth of their organizations.

Visit Straumann Group's resources page for DSOs to learn how.

Straumann Group's Sustainability Initiatives

Advance Oral Care

Help 10 million + smiles per year by 2030

Today: 4.4 million smiles

Provide 35% of our educational activities in low- and middle-income countries

Today: Goal Maintained

Empower People

50% of leadership positions to be held by women by 2026

Today: 39%

By 2026, at least 80% of our employees to report that they have good opportunities to learn and grow

Today: 76%

Caring for The Planet

100% renewable electricity by 2024

Today: 80%

Achieve net zero emissions by 2040

Today: Set target in 2022

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International Solutions Reduce Healthcare's Damaging Environmental Impact

Individual countries and healthcare organisations have largely been working independently – or sometimes in small partnerships – to improve sustainability and reduce the environmental damage that comes as a biproduct of healthcare provided globally. Building on these successes, Health Proc Europe and HealthPRO Canada have launched Project PROcure as a solution to connect buyers, suppliers and governments from around the world to share insights and best practices.

TEJA KIKELJ MERMAL

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key points

- The global health sector casts a significant environmental footprint.
- If the world's health services were a country, it would be the fifth-largest carbon emitter on the planet.
- Healthcare organisations on both sides of the Atlantic are coming up with innovative solutions to clean up the environmental harm the health sector unintentionally causes as it cares for patients.
- A global coalition of partners has assembled to improve sustainability in healthcare through an innovative new initiative called Project PROcure.

Innovative Thinking Inspires Global Approach

Healthcare organisations on both sides of the Atlantic are coming up with innovative solutions to clean up a problem that has received too little attention for years – the environmental harm the health sector unintentionally causes as it cares for patients.

It's an unfortunate reality that the health sector casts a significant environmental footprint. If the world's health services were a country, it would be the fifth-largest carbon emitter on the planet. The combined emissions from hospitals, health services and the medical supply chain across the OECD (Organisation for Economic Cooperation and Development) group of market-based economies, as well as China and India, make up approximately 5% of the global total. This represents a larger impact than either the aviation or shipping industries.

Until the recent launch of Project PROcure – an international collaboration to advance sustainability, supply chain resilience and innovation in healthcare, there hasn't been a global organisation focused on one of its most critical aspects – procurement – to address these challenges.

Individual countries and healthcare organisations have largely been working independently – or sometimes in small partnerships – to improve sustainability and reduce the environmental damage that comes as a by-product of healthcare provided around the world.

This article offers a selection of five curated perspectives and solutions across Europe and Canada to highlight initiatives that aim to tackle the reduction of the environmental harm caused by the healthcare industry.

Sustainable Healthcare Procurement in Europe

Procurement of medicines has been a core focus for Trine Ann Behnk for more than 20 years working in the pharmaceutical industry. Behnk serves as Group Healthcare Business Development Director with Rud Pedersen Group, a strategic European based communications consulting firm. Her background includes serving on the European Health Public Procurement Alliance organisation as a vice president for EU tenders.

In this role, she was involved in a 2022 study on best practices for public procurement for the European Commission, which examined procurement policies across 32 European countries and included the influence of healthcare procurement on protecting the environment.

In part, the study, called Study on Best Practices in Public Procurement of Medicines, found that a small but growing number of healthcare organisations are adopting environmental sustainability criteria as they procure medicines and services. It also found prior consultation with suppliers on the criteria can lead to greater success without negatively affecting prices or the number of competitors submitting bids.

Behnk said that suppliers generally want to engage with sustainability criteria through procurement – particularly when it is coordinated across jurisdictions to avoid wide variations among contracts. "They are following a clear, strict protocol with the stakeholders, together with the suppliers identifying which criteria fit in and then implementing them", she said. "The purpose of the dominant environmental criteria is to put aside the discussion of only price. People are responding and coordinating and showing it's possible to have well-accepted sustainable criteria, even including centralised procurement or joint procurement set up across countries".

Behnk said she favours initiatives that enable like-minded healthcare organisations to share best practices and work towards common goals, such as environmental sustainability. "It was found during the pandemic there's a need for healthcare organisations to learn from each other and capitalise on best practices", she said.

Sustainable Healthcare Procurement in Canada

Through procurement, HealthPRO Canada acts as a gateway to more sustainable options for its members and suppliers.

"As Canada's leaders in healthcare procurement, we go beyond managing contracts and supply chain. We're forging the path to a healthier planet to enable better health overall", said Alam Hallan, HealthPRO Canada, Clinical Director of Pharmacy, Signature Contracts. "We're blending our healthcare procurement expertise with data-driven insights and innovative technologies on behalf of our 1,300 member-healthcare facilities nationwide to build a system that emphasises environmental responsibility at all levels of the supply chain".

HealthPRO Canada has launched a Sustainability Toolkit to empower buyers to make more sustainable choices, including a Sustainability Scorecard, which highlights supplier performance based on established criteria in three categories – environmental, economic and social. In addition, HealthPRO Canada allows buyers to dig deeper through Impact Assessment Tools, helping them make more informed decisions at the product level. For example, hospitals can select and compare alternative anaesthetic gas options, assessing environmental impact and price based on usage.

"It's not just about measuring the carbon footprint of the products we procure; it's more like a compass helping direct our members and suppliers to a more sustainable future", said Hallan. "It's about providing the right tools and helping them bring the change we see happening nationally and internationally".
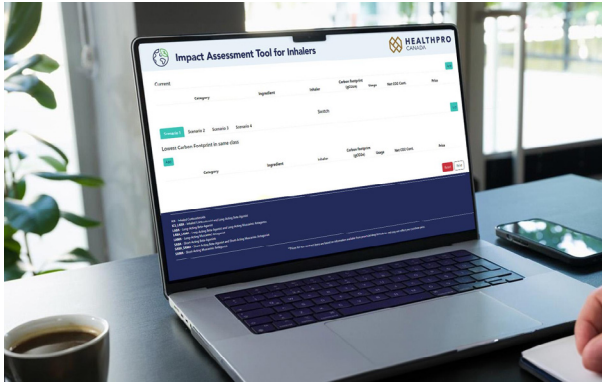
HealthPRO Canada has also introduced regular Sustainability Rounds events that bring together hundreds of healthcare professionals, suppliers and government representatives from across the global supply chain to exchange ideas and accelerate the adoption of practical actions that have proven impact.

Environmental Leadership from Norway

Several countries in Scandinavia and elsewhere in Europe are serving as role models for their global healthcare partners who want to strengthen their environmental sustainability.

Norway has a long track record of leadership in environmental sustainability in healthcare for its innovative approaches to reducing the healthcare supply chain's environmental impact. The Norwegian Hospital Procurement Trust (Sykehusinnkjøp HF), the national organisation which procures supplies and equipment for all Norwegian hospitals, created procurement criteria several years ago to begin phasing out harmful chemicals from healthcare products and services contracted by hospitals when safer alternatives exist.

"We have the phase-out list because we want to make sure that vulnerable patients in the hospitals are not exposed to dangerous chemicals when they are there to improve their health", said Maiken Sele, Manager, Environment and Climate, Norwegian Hospital Procurement Trust. "That is very important to us, but also for the environment in general. We need to make sure that we pollute less".

The Trust has been working with its partners in healthcare procurement in neighbouring Scandinavian countries and across Europe to expand the use of the phase-out list across the healthcare supply chain.

Health Care Without Harm Europe, a network of thousands of hospitals, healthcare leaders and healthcare professionals committed to more sustainable healthcare, has formally adopted the phase-out list and administers it. The phase-out list covers eight groups of chemicals of concern, including:

- Substances of very high concern

- Carcinogenic, mutagenic or substances toxic to reproduction

- Polyvinyl chloride (PVC)

- Phthalates

- Bisphenols

- Flame retardants

- Antimicrobial agents

- Per- and poly-fluoroalkyl substances (PFAS)

"The list applies to the eight chemical groups with chemicals we don't want in any products in hospitals for environment and health reasons", said Sele. "The environment and health are very often connected, much more connected than people often realise".

With the support and partnership of Health Care Without Harm Europe, Sele is hopeful a growing number of healthcare facilities and their suppliers will begin to gradually replace chemicals of concern with safer alternatives. "We're using the phase-out list to try to contribute to a more circular economy and safeguard the environment and the patients in our hospitals", she said.

Iceland Increases Impact Through Cooperation

Landspitali, the National University Hospital of Iceland, has been able to harness the power of procurement and cooperation with healthcare organisations in neighbouring countries to significantly improve its environmental performance over the past decade.

"We have this history of cooperation among the Nordic countries and working to minimise our environmental impacts. That has affected the hospitals", said Hulda Steingrimsdottir, Environmental Manager, National University Hospital of Iceland. "There is a great consensus on chemicals and the effect of chemicals on the environment and health. Together, that has resulted in new ideas and innovation".

The 660-bed acute care hospital in Reykjavík has implemented several initiatives to shrink its environmental footprint, with a major focus on reducing greenhouse gas emissions related to anaesthetic gases such as nitrous oxide and desflurane.

"We have also been working on greening our travels regarding our employees and how we transport our products", said Steingrimsdottir.

Like other healthcare organisations in Iceland, the hospital is working with suppliers to reduce and replace harmful chemicals from products and medicines when possible. Because it is relatively small, the National University Hospital of Iceland has found it can have a greater impact by working together with its healthcare partners in other Scandinavian countries to leverage their collective strength. Establishing common tender criteria on issues such as phasing out unwanted chemicals helps all players achieve their sustainability goals.

"The suppliers are happy we are working together as a group of Nordic countries (Nordic Pharmaceutical Forum). It's better for the suppliers that we have the same criteria for them to fulfil", said Steingrimsdottir. She recommends hospitals of all sizes work cooperatively with suppliers and introduce tender criteria to minimise healthcare's negative impact on the planet. "It's a very effective way to push the market. This summer and recent summers have shown us that we in healthcare need to take responsibility for our actions, and we can do that through procurement in a very effective way", said Steingrimsdottir. "I know suppliers are also ready. If you set criteria, they are ready for you. And through that dialogue, we can change a lot".

Practical Green Solutions in Germany

In Germany, the healthcare group purchasing organisation PEG is helping to lead the country's shift to green healthcare practices through holistic, practical solutions. The Munich-based firm oversees procurement for approximately 400 hospitals, 700 rehabilitation clinics and more than 1,000 homes for the elderly across the country.

After more than 25 years working in healthcare, CEO Jens Leveringhaus said he and his company began to focus heavily on the sector's environmental impact in 2020, recognising that the healthcare supply chain contributes a significant portion of Scope 3 (indirect) emissions. "Since we are a purchasing organisation … I said if it's not us who starts moving in this direction, who else should?" he said.

PEG carried out a survey among the hospitals and health organisations it serves and found that approximately 85% of them ranked environmental sustainability as a priority, but the vast majority had not made meaningful progress in reducing their impact.

Leveringhaus set his sights on developing practical solutions to help PEG's clients meet their goals. The company established a small environmental sustainability consultancy team that supports organisations on initiatives to achieve their targets, including Corporate Sustainability Reporting Directive (CSRD) reporting. "We are using a very systematic approach", he said. "We are working with IT companies to provide our customers with solutions that they can move from strategy to implementation to CSRD reporting. It's a 360-degree approach and a systematic approach".

Leveringhaus is publishing a book to increase awareness of healthcare's environmental footprint and provide organisations with ideas to reduce how much they contribute to the sector's collective impact. *Green Health: Sustainable Management Within Healthcare* is scheduled to be released in September. "It will focus on practical examples of what hospitals and other health organisations can do to become more sustainable", he said. "It is a book written by people with experience on the ground floor for people who want to implement similar practical projects".

While Leveringhaus said the healthcare industry in Germany has been somewhat slow to address environmental sustainability, he's confident there is growing recognition of the importance of taking action. "I believe that sustainability within healthcare only works if government, industry, and the public work together. I don't think individually we'll be able to find a solution. It has to be a systematic approach", he said.

Project PROcure Creates a Global Solution

In recognition of the global nature of healthcare's impact on the environment, a global coalition of partners has assembled to improve sustainability in healthcare through an innovative new initiative called Project PROcure.

The initiative was jointly founded by Health Proc Europe, a non-profit association of procurement professionals representing more than 5,000 hospitals and healthcare facilities across Europe, and HealthPRO Canada, the largest group contracting organisation for healthcare in Canada, representing over 1,300 healthcare facilities.

Born out of an international collaboration to co-create solutions to global challenges, Project PROcure connects buyers, suppliers and governments to share insights and best practices and co-create solutions. This is essential to demystifying the sustainability transformation and elucidating a pragmatic and achievable path forward.

Kickstart Your Sustainability Mission

Key Takeaways

1 An important first step to launching your sustainability mission is defining your organization's priorities in the short, medium and long run.

2 There is a clear appetite among organizations to start their sustainability mission. Many organizations have already started their sustainability missions while other have plans to within the year.

3 Starting and maintaining sustainability initiatives is challenging and organizations face many hurdles including tracking data, getting buy-in from leadership, getting enough resources and funding, or just not being sure where to begin.

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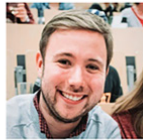
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"The climate crisis is a public health crisis, and our time is running out", said Elisa Frenz, CEO, Health Proc Europe and Co-founder of Project PROcure. We need transformative solutions, and the only way we stand a chance is through collaboration and immediate action to strengthen partnerships among buyers and suppliers".

Project PROcure aims to empower healthcare procurers to shape a sustainable future, guided by the UN Global Compact and the Sustainable Development Goals, European Principles for the Environment, and Canada's Net Zero Emissions by 2050 goal.

"Project PROcure is harmonising healthcare procurement voices on global, sustainable and resilient practices to make the future of healthcare better", said Jennifer Potvin, Vice President, Marketing, Communications and Public Affairs, HealthPRO Canada, and Co-founder of Project PROcure. "Our mission is making this transformation simple, practical and achievable. That's what Project PROcure is all about".

By uniting public and private healthcare buyers from across Europe and North America, Project PROcure will continuously build various products and services. Among the first are:

- A Sustainability Toolkit, which will have products added to it over time. The goal will be to help buyers make decisions based not just on price but also on greenhouse gas emissions and other key sustainability indicators.

- A comprehensive Sustainability Scorecard that will help healthcare procurement professionals make more sustainable choices based on the environmental impact of the goods and services they buy from suppliers.

- The Healthcare Buyers Community, a digital forum that brings together public and private healthcare procurement institutions, solution providers, and MedTech from across Europe, Canada and beyond. The initiative aims to create a more sustainable and efficient healthcare supply chain ecosystem by leveraging technology and data-driven solutions.

- A programme for organisations within Portugal, Belgium, Switzerland, Canada and the United Kingdom to understand how to empower procurement organisations to drive sustainability and support members in reducing Scope 3 emissions.

To engage with and learn how Project PROcure can help you advance your sustainability journey, visit https://www.healthprocanada.com/sustainability

Conflict of Interest

None. ■

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A Canadian Health Sector Approach to Environmental Sustainability

An overview of the Canadian health system's interest in environmental sustainability and efforts to build a more climate-resilient healthcare system.

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key points

- The Canadian Coalition for Green Health Care is Canada's premier green healthcare organisation.
- Canada is warming at a rate more than twice that of the global average, with Canada's north warming at three to four times that rate.
- Climate change is increasing risks to health systems in Canada and can disrupt care and service delivery when Canadians need them most - during extreme weather and natural disasters.
- The Coalition's vision of an environmentally sustainable, climate resilient, net-zero Canadian health system parallels the commitments of the Government of Canada.

Introduction

Canada's commitment to planetary health, climate-change resiliency and preparedness has been increasing steadily over the past several years. This article sheds light on the Canadian health system's interest in environmental sustainability and efforts to build a more climate-resilient healthcare system. The authors will delve into key motivators, national initiatives, and the role the Canadian Coalition for Green Health Care (the Coalition) plays in driving sustainable healthcare practices.

By way of background, the Coalition (a national not-for-profit) is Canada's premier green healthcare organisation, a virtual platform committed to supporting those seeking to build a stronger, healthier and more sustainable health service delivery system with improved access to best practice information, innovative goods and services that offer a clear environmental advantage to users, and the provision of a venue for stakeholders across Canada to work together to reduce healthcare's environmental impact.

Climate Change Impacts as Motivator

Worsening weather events continue to have negative impacts on both the health of Canadians and on the physical healthcare facilities (HCFs). They have also caught the attention of senior healthcare leaders who are beginning to embrace mitigation actions within their organisations.

Overall, Canada is warming at a rate more than twice that of the global average, with Canada's north warming at three to four times that rate (Rantanen et al. 2022). In 2022, a hurricane that was the strongest storm in Canadian history pummelled Atlantic Canada with over $800 million in damage (Reinhart 2023). Floods have occurred in the provinces of Manitoba (Dawkins 2023), Nova Scotia (IBC 2023), and British Columbia (BC) in the past two years, which have added up to over $1 billion in damage. The BC flood was considered an atmospheric river and was the most expensive natural disaster in BC's history (Gillett et al. 2022). Heat waves are becoming more common (Clark et al. 2021),

and in July 2023 several provinces reported a record number of heat alerts (O'Neill 2023).

In June 2023, Canada's wildfires made international news, and so far this year, Canada has endured 6,000 fires with over 1,5400,000 hectares burned. The carbon emissions from wildfires have surpassed 300 mega tonnes (Voiland 2023). Economically, in this decade, the total cost of weather-related disasters has grown to over 5% of Canada's annual gross domestic product (GDP), up from an average of 1% over the previous 30 years (Sawyer et al. 2020).

The *Health of Canadians in a Changing Climate: Advancing our Knowledge for Action* is Health Canada's assessment report on the health impacts of climate change. The report indicates climate change is increasing risks to health systems in Canada and can disrupt care and service delivery when Canadians need them most - during extreme weather and natural disasters. It further posits that reducing greenhouse gas (GHG) emissions within and outside the health sector can have significant immediate and long-term co-benefits for health and that the economic value of the health co-benefits can help offset the implementation costs of measures. Examples of impacts on HCFs and health systems from recent wildfires include:

- During forest fires, impacted HCFs such as hospitals and long-term care homes had to close, and patients/residents were evacuated and transferred to safe locations.

- Smoke from forest fires required healthcare facilities, even those far away from forest fires, to have air filtering systems. Where filtration was not in place, hospitals had to cancel surgeries due to poor indoor air quality.

- Increase in asthma rates during forest fire and smoke events resulted in increased use of health services.

> ## This year, Canada has endured 6,000 fires, with over 1,5400,000 hectares burned

Prioritising Sustainability and Climate Resilience

Canada's commitment to climate change action and environmental sustainability is evidenced in the Canadian Net-Zero Emissions Accountability Act, which became law on June 29, 2021, and enshrines in legislation Canada's commitment to achieve net-zero emissions by 2050.

Canada also recognises the importance of environmentally sustainable leadership in its healthcare system by formally committing to a climate resilient, sustainable, low carbon health system through the World Health Organization (WHO)-led initiative at COP 26 (conference of the parties) in Glasgow, Scotland.

The Coalition's vision of an environmentally sustainable, climate resilient, net-zero Canadian health system parallels the commitments of the Government of Canada as indicated above and aligns with multiple other Canadian healthcare organisations, many of which understand the inextricable link between human health and our environment, as indicated by the Joint Position Statement: *Toward an Environmentally Responsible Canadian Health Sector* signed by some of the largest healthcare organisations in Canada. They comprehend that a concerted effort is required to move our health system toward our mutual goal of environmentally sustainable, climate-resilient healthcare.

Canada joins other countries that have also introduced carbon pricing by implementing a carbon tax, gradually increasing over time. This commitment aligns with the country's healthcare facilities investing in carbon mitigation and resilient infrastructure.

Accreditation Canada, in an effort to advance quality and safety in healthcare, released new standards for Leadership and Governance in June 2022, which, for the first time, include language surrounding environmental sustainability and climate change. For example, the new Accreditation Standards specify an organisation must reduce its impact on the environment and be prepared to respond to environmental and climate changes. This has been a major step in guiding our hospitals in environmental action; however, many agree the language will need to get stronger over time.

Involvement in International Activities

Canada's commitment to climate resilience and sustainability is also reflected in its participation in global initiatives such as the WHO's Alliance for Action on Climate Change and Health (ATACH) Working Groups, where Health Canada co-chairs the climate resilience working group together with the Ivory Coast. Canadian experts, including those from the Coalition, participate in this and other working groups that focus on greening the supply chain, low carbon and sustainable healthcare, health system financing, climate action and nutrition.

Health Canada and numerous Canadian experts also actively contribute to many WHO resources, including *climate change and health: vulnerability and adaptation assessment* and *WHO guidance for climate resilient and environmentally sustainable healthcare facilities.*

The Coalition's Resources

For over two decades, the Canadian Coalition for Green Health Care has championed environmentally sustainable healthcare practices and provided resources and assistance to help healthcare organisations become more sustainable.

The *Green Hospital Scorecard (GHS)*, a unique, made-in-Canada environmental benchmarking tool developed in collaboration with the Ontario Hospital Association and Ontario hospital representatives in 2013 and led by the Coalition since 2016, enables hospitals to measure their environmental performance and progress towards sustainability goals (Voiland 2023; Sawyer et al. 2020). Since its inception, the GHS has collected data from over 90 Canadian hospitals.

> The Canadian Coalition for Green Health Care has championed environmentally sustainable healthcare practices

More recently, a new environmental scorecard for long-term care and retirement homes (LTC/RH) has also been developed to assist in identifying, measuring and reporting on environmental performance while helping to enable sector-wide benchmarking of energy use, water use and waste management, pollution prevention, corporate leadership, food, transportation and climate change – a valuable tool for use by senior leaders to improve decision-making on topics of advancing sustainability and environmental performance.

Developed in partnership with Health Canada and the Nova Scotia Department of Environment, the *Health Care Facility Climate Change Resiliency Toolkit* includes a robust checklist to assist healthcare facilities in identifying areas within their facilities and departments which may be vulnerable to climate change which could ultimately impact their ability to deliver service during a natural disaster or climate incident.

The Coalition's *Environmental Stewardship Guidebooks* were created as condensed guidance primers for hospitals and long-term care homes in response to the newly released Accreditation Canada Standards. Senior healthcare leaders are encouraged to look at the most impactful GHG mitigation items listed in the guidebooks and to commence actions to reduce their GHG emissions. It is important to note that many of the listed actions are not expensive to implement, and many may actually begin to reduce an organisation's overall costs. Overt actions by leadership may also serve as an impetus for others to more fully engage in the greening process.

Important guidebook greening actions to consider in your organisation:

1. Create and implement a corporate leadership strategy that embraces GHG emissions reduction, climate change preparedness/mitigation and environmental sustainability.

2. Divest foundation/endowment funds of investment in fossil fuel companies and migrate to sustainable and low-carbon investments.

3. Adapt Choosing Wisely Canada principles of reducing unnecessary tests and treatments.

4. Ensure weighting for sustainability on all new procurement contracts meets a minimum 10% threshold.

5. Increase plant-based food options for patients by 25%.

6. Encourage and promote green transportation such as public transit, bicycles, e-bikes, etc.

7. Deprescribing medications wherever possible - reducing or stopping medications that may be harmful or no longer needed.

8. Remove the anaesthetic gas Desflurane from the formulary.

9. Remove centralised nitrous to eliminate pipe leakage.

10. Hire an energy manager to oversee and optimise all aspects of your hospital's energy use and coordinate programmes throughout the organisation.

Other resources include:

- *Green Office Toolkit for Clinicians and Office Managers* - This toolkit was designed to simplify and inspire the 'greening' of healthcare practices and office buildings.

- *A Circular Economy Model for Hospital-Generated PPE and Medical Single-Use Plastic (mSUP) Waste: Demonstrating Opportunities for Reduction and Reuse* - This project explored and identified reuse and reduction opportunities for personal protective equipment (PPE) and selected mSUPs, which complemented and enabled resource conservation

- Electrifying the healthcare grid is also on the Coalition's radar with two zero-emission vehicle projects: *Advancing awareness, support and adoption of zero-emission vehicles (ZEVs) and technology in Canada's health services sector* and *Battery-Powered Micro-Mobility Solutions*.

- *Canadian Green Health Care Digest* is a free bi-weekly electronic digest delivering news about current and upcoming events and initiatives in green healthcare in Canada and beyond, as well as updates on Coalition activities and initiatives.

The Coalition encourages all healthcare facilities to join with your colleagues and help make our health system climate resilient, sustainable and low carbon.

Conflict of Interest

None. ∎

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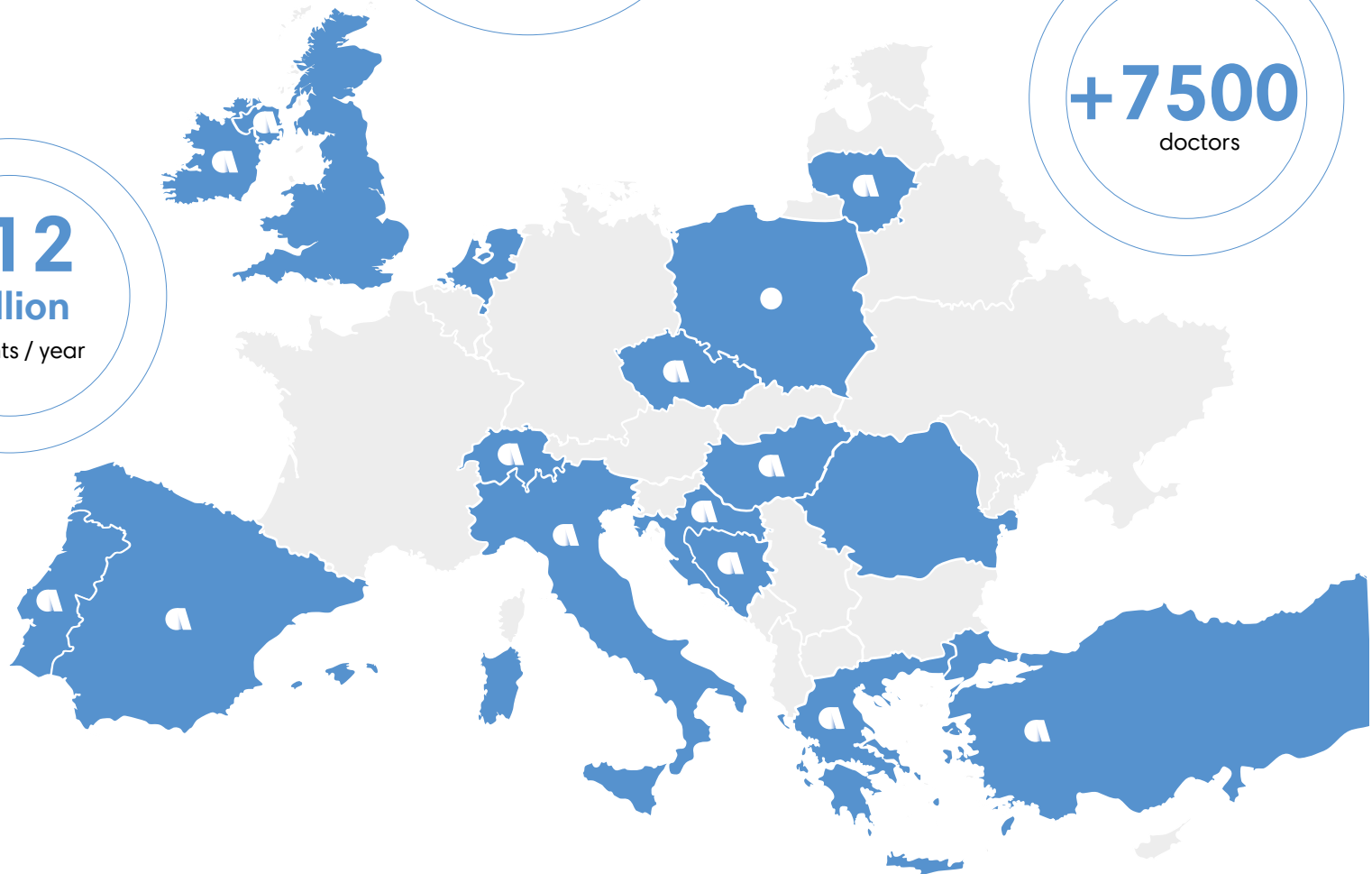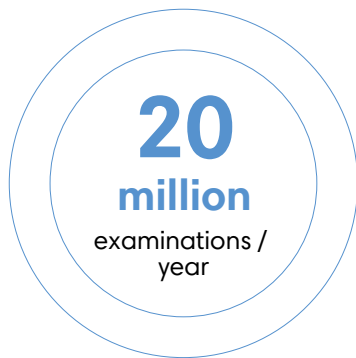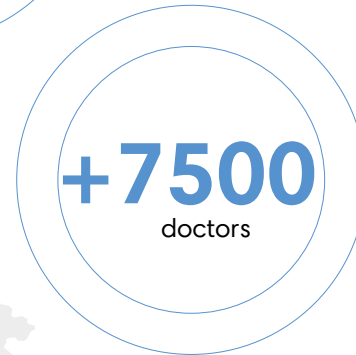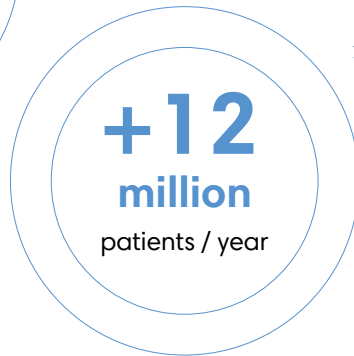
Why Climate-Smart Healthcare Must Be a Priority

As a healthcare leader, you have the responsibility and opportunity to take action against climate change and prioritise zero emissions for your hospital.

WILL CLARK

Executive Director l HCWH Europe l Brussels, Belgium

> **key points**
>
> - By taking climate action, healthcare can seize the opportunity to combat the greatest threat to human health and protect an already overstretched sector.
> - You don't have to do it alone. Hospitals across Europe are already successfully implementing climate solutions, putting them on the path to net zero healthcare.
> - By creating a climate-smart hospital, you can drive change across your organisation and become a role model for an entire health system, region, or even country.

Climate-smart healthcare is no longer a nice to have - it must be the norm across European healthcare operations to protect both people and the planet. Climate change is the greatest threat to human health we face today. As a healthcare leader, you have both the responsibility and opportunity to take action to address this threat and make zero emissions a priority for your hospital.

Climate change is perceived by many as a distant risk - a problem that will affect future generations, often in far-flung places. However, we continue to have global temperature records being broken every summer in Europe - leading to tens of thousands of excess deaths from heat-related illnesses and unprecedented environmental destruction causing harm and disruption to local communities.

Climate change's impact on human health is increasingly visible through injuries, illness, and death caused by extreme weather events and the spread of infectious disease vectors. This places an unprecedented burden on an already overstretched healthcare sector.

Protecting Patients and the Planet

Climate change presents a unique set of challenges for the healthcare sector. While it is busy treating the growing health impacts associated with a changing climate, it also directly contributes to climate change. Healthcare is responsible for 5% of global net emissions. If it were a country, it would be the fifth largest emitter on the planet. Without action, these emissions could triple by 2050.

This presents a huge opportunity for you. By taking immediate climate action, you can fight one of the biggest challenges facing healthcare while at the same time setting an example for other sectors to build a future that is better for people and the planet.

Future-Proofing Healthcare Services

As well as reducing their emissions, healthcare services need to prepare for the challenges and disruption that climate change presents. The rising frequency of extreme weather events is already affecting healthcare services operationally, financially, and structurally.

Climate-related disasters negatively impact medical equipment, impede laboratory testing, and present a serious risk to vulnerable patients.

Healthcare workers are also at risk - climate change negatively affects health professionals' mental health, increases their already heavy workload, and requires them to operate during times of crisis more frequently. As frontline staff, they see the health impacts of climate change in their patients firsthand while at the same time recognising the sector's role in the crisis. Healthcare professionals are actively calling for change both within and beyond the sector. Prioritising climate action allows you to respond to that call and put their needs first.

Healthcare Climate Action

Hospitals across Europe are already successfully implementing climate solutions, putting them on the path to net zero healthcare. Several hospitals in Spain and the UK are electrifying their fleets and improving charging infrastructure to address the significant emissions from their ambulances. Operating theatres also present a major source of emissions. Hospitals are cutting out unnecessary plastic packaging, medical trays, and anaesthetic gases with a high carbon footprint, while others are addressing emissions by turning off ventilation and anaesthesia gas scavenging systems out of hours.

Other hospitals are spearheading campaigns to shift away from single-use items and unnecessary pharmaceutical waste. A region in Denmark is funding initiatives to reduce waste and unnecessary items during medical procedures. Disposable bedsheets, single-use cups, and pharmaceutical waste due to expired medicines are all being targeted by this campaign.

These are just a few of the inspiring projects happening across Europe. We already know the how. What we need now is widespread action. Each additional hospital that commits to driving zero-emissions healthcare can snowball progress across the entire sector.

> Each additional hospital that commits to driving zero-emissions healthcare can snowball progress across the entire sector

One Hospital Can Change An Entire System

As a healthcare leader, you can determine the future direction of your organisation, but you can also have a lasting impact across the wider sector. One hospital can become a role model for an entire health system, region, or even country. With HCWH Europe's support, Lluís Alcanyís Hospital of Xàtiva supported 11 hospitals in the Valencia region to calculate their healthcare emissions and develop carbon management plans. Through this project, one hospital has put 11 other hospitals on the path to zero emissions healthcare.

The Scottish Government's National Green Theatres Programme started as a tiny change made in one surgical theatre by one clinical team and then grew into a national initiative. One team replacing desflurane

and nitrous oxide with sevoflurane, which has a lower carbon footprint, at Raigmore Hospital turned into the larger Green Theatre project, which outlines ten simple actions any operating theatre can introduce to reduce its environmental impact. Due to the project's success, it was adopted by the Scottish Government and became the National Green Theatres Programme.

Driving Change for Net Zero Healthcare

Healthcare leaders can drive this change within their healthcare facilities and make net zero emissions possible. Every European hospital must prioritise climate-smart healthcare and integrate sustainability into its daily operations. By measuring your emissions, developing a net zero strategy, and setting up green teams, healthcare leaders can mainstream this in the everyday working environment of healthcare staff.

The good news is that you don't need to do this alone. You can consult the many resources and templates for building carbon management plans, green teams, and targeting specific emissions already available. European healthcare providers can also exchange knowledge, learn from each other, and replicate successes. HCWH Europe's Global Green and Healthy Hospitals network offers networking opportunities and critical resources to support you on this journey.

Building a climate-smart hospital that prioritises carbon reduction and climate resilience is not only achievable but also a crucial step towards building a healthier future for both people and the planet.

Conflict of Interest

None. ◼

The Journey to Climate-Resilient Healthcare

Beatriz Piñeiro Lago, Health Innovation and Sustainability Technician at the Galician Health Service (SERGAS), spoke to HealthManagement.org about several climate-smart initiatives implemented at SERGAS and how healthcare facilities can take the lead in transitioning to net zero.

BEATRIZ PIÑEIRO LAGO

Health Innovation and Sustainability Technician | Galician Health Service (SERGAS) | Galicia, Spain

Can you describe the climate-smart initiative that Galician Health Service (SERGAS) has implemented?

I would like to begin by pointing out the roadmap of the Galician Health Service, which started in 2004, almost two decades ago, with the computerisation of the medical record, a corporate electronic medical record system (IANUS) oriented towards management by processes, health problems, and allowing a model of care for patients with chronic conditions in which the health organisation, the patient and their environment are involved.

The Galician Health Service has been considered a benchmark in digital health for years. Technology is allowing us to change the way of doing things in the SERGAS to make it more efficient, improve and optimise processes, facilitate the work of professionals, and be more sustainable and resilient. Our health system is structured in seven health areas that cover the entire territory of Galicia.

Among the latest advances is the eighth health area, a fundamentally digital area, which will support the other seven territorial areas with the provision of technological infrastructure in primary and hospital care. This includes implementing the intelligent clinical history, deploying teleconsultation throughout primary and hospital care, and the patient's health folder, which allows citizens to communicate their own data to the health institution. It also includes a medical imaging centre that allows diagnosis from hospitals other than the place where the patient is treated or in the promotion of diagnostic imaging in pathological anatomy and the development of a system for identifying outbreaks.

The digital health area includes the acquisition and deployment of a networked Intensive Care Unit management platform and intelligent operating theatres in all healthcare areas, the extension of an integrated and standardised information system for laboratory tests, and the development of technology for resource planning, analytical and simulation of clinical and administrative processes. The keys are sustainability, digitalisation and resilience, a total commitment of the Galician government to a 100% resilient, sustainable and environmentally friendly healthcare system.

Adaptation activities plan for the inevitable impacts of climate change and reduce risks. In what ways are healthcare facilities adapting to become resilient to climate change impacts?

For the last 20 years, we have been in a process of transformation towards a sustainable and resilient health system that improves people's health without harming

the planet. With the SERGAS 2010-2014 strategy, a paradigm shift was made, putting the patient at the centre of the system. Thanks to two European projects, Hospital 2050 and innovasaúde, we have been able to develop eco-hospitals, energy efficiency plans, and development of technological platforms such as TELEA, a technological platform for home care that was of great help during the COVID-19 pandemic and helped us to care for many patients from their homes without the need for hospital admission.

The SERGAS integrated logistics platform has enabled the standardisation of all logistics management in a single product warehouse. It has a single, centralised computer application that makes it possible to reduce the stock level and reduce hidden losses. This has an impact on improving the quality of care perceived by citizens, as it allows health services to have the necessary products available at the right time and to achieve the ongoing satisfaction of all the agents involved in the supply chain. Since 2019, we have been developing the circular economy strategy of the Galician Health Service with a 2030 horizon already approved by the Government of Galicia, which was presented publicly in September. In a few months, we will have it in English so that it can be more widely disseminated and serve as an example to other health systems.

How are healthcare facilities trying to reduce the impact of their operations on the environment?

When the circular economy strategy of the Galician health service was launched four years ago, we set up an internal working group with professionals from the seven healthcare areas and an external working group with the three Galician universities,

> All the improvements that are made in the health system will have an impact on the health of people and the environment

the Galician health cluster, the wood cluster, the Regional Ministry of the Environment with the Directorate General for Climate Change, the Galician Forestry Industry Agency and the Regional Ministry of the Rural Environment, where the initiatives that had already been carried out over the years in the area of sustainability have been highlighted.

Through the strategy, we have defined five strategic axes: resources and raw materials, waste and environmental footprint, eco-design of processes, research, innovation and investment, and social behaviour, that define the actions to be followed until 2030. We have pilot projects such as Life Resystal, a European project developing different solutions to help European healthcare infrastructures become more climate resilient, or the elimination of plastics in the health sector, Plastic Free towards health care Europe 2.0, or Low Carbon for the decarbonisation of hospitals.

How do these actions impact patient care?

We must conceive health in all areas. We are nature, and we are part of it. All the improvements that are made in the health system will have an impact on the health of people and the environment. Integrating circularity in healthcare is a good example of this.

In this sense, an initiative in the spirit of circularity is the collaboration framework of the Galician Health Service and the Galician Forest Industry Agency to promote unique projects that favour the improvement of the quality of life of people living in Galicia and at the same time promote a greener and more environmentally friendly economy in accordance with the objectives of sustainable development, promoting the progressive implementation of biophilic design and the use of natural materials especially the use of

wood that contributes to mitigating climate change. Wood is the alternative with the lowest carbon footprint. It fixes, retains and replaces CO_2 from the atmosphere. It is the material par excellence of the 21st century.

Hospitals are improving their rate of energy consumption and overall efficiency. Can we see a positive difference? Have the measures been cost-effective? What changes and/or investments are still needed?

Having developed energy efficiency plans and eco-hospitals since 2010 has given us a background and a way of doing things that have helped us to have a BREEAM-certified hospital (Álvaro Cunqueiro hospital) in 2015. Today we have solar panels in almost all the centres, and we are also promoting aerothermal energy and biomass in the centres that do not yet have them.

We also have the Government of Galicia's energy network, REDEXGA, which encompasses all the infrastructures of the regional administration, including the Galician Health Service. The body in charge of promoting the principles of energy saving and diversification within the Galician administration is the Galician Energy Institute, so we have a more technically efficient system as it is a unified management of all facilities and tends to lower consumption and lower expenditure and more transparent, a single public tender system for the entire public sector in Galicia. The electricity supply is certified through the system of Guarantees of Origin of 100% renewable or high-efficiency cogeneration.

Is there a standardised method for assessing the carbon footprint of digital health interventions?

A method as such does not exist. We use two tools to calculate our carbon footprint - one is at the international level HCWH (Hippocrates) and the other at the national level SCOPCO2 of Health for the climate. We are also preparing a training programme with a specific chapter on recommendations to reduce the digital carbon footprint in the health sector.

> The Galician Health Service has a commitment to a sustainable and resilient health system that addresses climate challenges

Can you discuss how digitalisation is helping to accelerate the shift towards sustainable healthcare models?

Progress is being made towards a clinical record that is both intelligent and proactive.

Other objectives include the path towards the evolution of telecare and self-care platforms to enable the virtualisation of safe, effective and accessible healthcare, complementing face-to-face actions and improving the current model. The goal is to implement a platform for citizen relations to improve digital health services and reduce bureaucracy in healthcare activity; and the development of a platform for citizen relations to improve digital health services and reduce bureaucracy in healthcare activity. It also aims to develop a system for predicting and managing demand in real time to anticipate the volume of work in health centres and the extension of a network of smart health centres to boost the resilience of SERGAS in a climate-smart way.

What are the key actions leaders should undertake to foster green and healthy hospitals? How can leadership translate those actions down the command chain?

To be an entrepreneur, you have to be open and creative. Human capital is fundamental, and transmitting your passion for what you do is essential for other professionals to follow you, believe in what you do and work with your mind and heart.

The health sector is complex and has a significant impact on the environment. You have to transmit the values of sustainability and justify the need for change and how it will have a positive impact on people's health. This is the way to incorporate it into the organisation from the chain of command. In the case of the Galician Health Service, it has been a firm and decisive commitment to a sustainable and resilient health system that addresses climate

challenges by taking responsibility for the impact of its activity.

In what ways do you see the workforce engaging with sustainable practices? How has their role and their responsibility in the system changed?

Employees become committed when they understand the why and what sustainability is for. My role is to work transversally to help professionals make that commitment, which, in turn, can lead to a commitment from the public to work together towards sustainability, towards the change we need to make in the way we live and do. Climate change is a fact, and it is the biggest health crisis we face. Social behaviour is key to this change, and working with behavioural science will help us to get the messages across to all citizens.

How can we engage them to be part of this transition more?

Training in circularity, sustainability, health and climate and the involvement of each professional is essential. We have developed an open and participatory strategy for a circular economy in health that is being nurtured by pilot projects and actions that are replicated and help to understand sustainability based on circularity and the resilience of a health system that cares for people without harming the planet.

Is there a more concrete set of goals to achieve, and what are they and in what time frame?

The Galician health service is committed to the United Nations Race to Zero, and we have committed to a 60% reduction of CO_2 equivalent emissions by 2030 and a net zero by 2040.

The circumstances in which people are born, grow up, live, work, and age, including the health system, directly influence people's lives. Health systems must be part of the solution; a commitment to climate change mitigation and adaptation is the way forward. That is why addressing our own Circular Economy Strategy has been a firm commitment for our roadmap to 2030. The health sector has a great impact on the environment. We work 365 days a year, 24 hours a day, and we have to be responsible for our actions.

Conflict of Interest

None. ∎

SNOMED International Contributes Clinical Terminology as a Critical Key to Sustainable Healthcare

An overview of SNOMED CT – the most comprehensive clinical terminology in use worldwide and the benefits it offers for health systems globally.

DON SWEETE

Chief Executive Officer l SNOMED International l London, United Kingdom

> ### key points
>
> - SNOMED CT is a comprehensive, multilingual healthcare terminology created by healthcare professionals.
> - SNOMED CT can unite health systems with structured clinical terminology, enabling communication and understanding for better, more efficient patient care, data analytics and research.
> - Collaboration is a key component of SNOMED International's strategy to work closely with other standards and clinical bodies, professional organisations, researchers, academics, industry and others to improve the content in SNOMED CT.

SNOMED International, the not-for-profit organisation that develops and maintains SNOMED CT, participates in several initiatives that contribute to enabling more sustainable digital-based healthcare systems worldwide. SNOMED CT is a comprehensive, multilingual healthcare terminology created for use by healthcare professionals to capture the care of individuals in an electronic health record and facilitate sharing, decision support and analytics to support safe and effective health information exchange.

But what is sustainability in healthcare, and why is it important?

One facet of healthcare sustainability relates to managing the growing burden of age-related illness as an increasing percentage of the world's population gets older through prevention and treatment; others include managing the costs of delivering care and the human and other resources required and reducing the environmental impact of healthcare delivery.

Acknowledging the progress many countries have made in advancing digital health, as well as the outstanding challenges many resource-constrained countries still face, the World Health Organization (WHO) also recognises the imperative of sustainability – environmental, financial and systemic – in improving access to and delivery of healthcare globally. Its Global Strategy on Digital Health 2020-2025 states that "digital health should be an integral part of health priorities and benefit people in a way that is ethical, safe, secure, reliable, equitable and sustainable".

Partnering for the Global Good

SNOMED International's vision is to make SNOMED CT the one language of healthcare globally. Uniting health systems with structured clinical terminology enables communication and understanding – all of which contribute to better and more efficient patient care.

In addition to a long-tenured membership model to extend the use of the SNOMED CT product and its related services, the organisation has made it a priority to provide affiliate licences for thousands of non-profit, academic and research users in non-member countries at no cost, broadening the use of SNOMED CT while also enhancing the digital health infrastructure of emerging and developing markets.

Collaboration is a key component of SNOMED International's 2020-2025 strategy. Working closely with other standards and clinical bodies as well as professional organisations, researchers, academics, industry and others augments and improves the content in SNOMED CT to benefit a global population. Collaboration plays a crucial role in improving sustainability in healthcare by fostering the sharing of knowledge, resources, and best practices among various global stakeholders.

A Collaboration Project With Public Good Intentions

A recent SNOMED International collaborative initiative with the Bahmni Coalition is one example of how the organisation and its members are contributing to more sustainable healthcare. The joint project has produced a SNOMED CT module for integration with Bahmni's open-source electronic medical record to equip users with SNOMED CT's standardised clinical terms, enabling structured documentation of diagnosis and related clinical data, decision support and reporting.

Bahmni, a recognised Digital Public Good developed by global technology consultancy ThoughtWorks, is the preferred solution in many Asian and African countries and a strategic asset for

many large humanitarian organisations. Built on the OpenMRS (medical record system) platform, it brings together essential functionalities, such as patient registration, appointments, recording diagnosis and procedures, billing, lab, pharmacy, and more, into one cohesive platform.

> Digital health should be an integral part of health priorities and benefit people in a way that is ethical, safe, secure, reliable, equitable and sustainable

Supporting Patients Through Climate Change and Natural Disasters

Another example of SNOMED International's commitment to sustainability in healthcare is the organisation's recent efforts to quickly respond to requests for concepts specific to the real-world impacts of climate change and natural disasters on the world's citizens in the International Edition of SNOMED CT.

The organisation worked with member representatives to add most of the content to the September 1, 2023 release of the SNOMED CT International Edition. This

content will make it easier for clinicians and providers to respond to their patient's care needs arising from a wide range of environmental conditions, to share that data more easily and use it for analysis and policymaking.

Focusing on the diverse aspects of sustainability is increasingly important to SNOMED International, its governing bodies and its stakeholders around the world. That includes how it works as an organisation to ensure its practices, policies, and activities meet the ever-evolving needs of its members, other users and its many collaborative partners so it can continue to deliver SNOMED CT in a way that promotes sustainability in all health systems for the long haul.

Conclusion

There will always be more that SNOMED International and other healthcare-focused organisations can do to further incorporate sustainability concepts and practices into their day-to-day work and future strategic plans.

Advocacy and leadership will continue to shape the path for the heightened pursuit of sustainability in health and digital health. Advocacy at local, national, and international levels and leadership by example will inspire others in the industry to embrace sustainable, altruistic practices.

Ultimately, embracing these principles across the digital health ecosystem will foster a healthcare system that improves patient outcomes through our joint humanitarian efforts.

Conflict of Interest

None. ∎

The Psychological Struggle: A Trading Mindset

An overview of the psychological struggle many professional traders experience and how they can circumvent common pitfalls and save time.

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> **key points**
>
> - Fear is one of the primary factors behind failure to achieve consistent success.
> - It is impossible to eliminate emotion from trading, though one can learn to control their response to the emotional challenges from engaging with the financial markets.
> - A trading strategy that always generates winning trades is impossible.
> - On average, over a sample of trades, one can expect 70% of the trades to be winners.
> - Fear in trading can be reduced through a technique known as systematic desensitisation.

My first oversight was believing that trading was straightforward. Markets go up, and markets go down; how hard could it be? This is where most begin their trading journey, invariably ending in frustration and eye-opening disappointment.

I intend for this to be a straightforward post, shedding light on my journey through the lens of a trader with 15 years of market experience. The focus will be on the psychological struggle many professional traders experience; hopefully, this will help some readers circumvent common pitfalls and save time.

Fear

Fear is so powerful it can make us hesitant to trade and drive us to make poor decisions. Fear can override the ability to think rationally, and we must be able to think rationally and objectively to trade successfully. Throughout my time in the markets, I learnt that fear is one of the primary factors behind failure to achieve consistent success, whether you trade or invest in foreign exchange markets, stock markets, bonds, commodities, etc. On a physical level, I feel we almost enter a *fight or flight* mode when we trade. Why this occurs is difficult for me to understand. All I can put it down to is our brain thinking that the possibility of a losing trade is a *threatening* situation.

You often hear (and read) traders and investors recommending to 'trade without emotion'. I understand why they propose doing this. However, irrespective of whether you base your trading decisions on a discretionary, partially discretionary or non-discretionary approach, there will always be an element of psychological influence. It is impossible to eliminate emotion from our trading, though we can learn to *control* our *response* to the emotional challenges from engaging with the financial markets.

The point is that while removing fear is impossible, learning to *control* fear is possible and is a *learned skill*. Those who have attained a level of consistency in their trading and fall into the bucket of consistent winners have, among other things, learned to understand, control and accept fear.

I never acknowledged the need to focus on my trading mindset until later in my career, which was a mistake. I believed if I had a strategy that had a positive expectancy, that was all I needed. A strategy with positive expectancy informs the trader how much they can expect to generate from each trade in the long run.

Expectancy = (Average Gain * Winning Percentage) – (Average Loss * Losing Percentage)

To be clear, you need a strategy that delivers positive expectancy, as your account will eventually be emptied over the long run without one. But you do not need a trading strategy that always generates winning trades; that is impossible. Most professional traders I know only win 50-60% of the time (some much less), though they still manage to generate a consistent return through favourable risk/reward: they win more on the winning trades than they lose on losing trades.

You will be wrong, and you will have losing trades. The quicker this is acknowledged and accepted, the more straightforward trading the financial markets will be. This is something professional traders accept and is key to achieving consistent success. Consistently successful trading limits losses and employs optimal trade management on winning trades.

How Do We Control Fear When Trading?

As far as I am aware, there is no easy way to reduce the fear of trading and risk, and this is why I believe many successful traders can take so long to reach a level of consistency.

The only way I have found to help reduce fear in trading (that made sense to me) is through a technique known as *systematic desensitisation*. While I am by no means an expert regarding this method, I approached this technique in three steps:

1. Learning how to control my breathing to regulate

> While removing fear is impossible, learning to control fear is possible and is a learned skill

the nervous system: This helped me lower my stress levels when in a trade. I largely used *numbered breathing* exercises, allowing me to be more present in the trade. This was difficult for me initially.

2. Listing my fears relating to trading: My fears concerning trading are simple: the fear of failure, the fear of being wrong and the fear of losing money. These are common fears among traders as well as investors.

3. Gradual exposure to these fears: To seek measured exposure to the risks and fears of trading, I began with a demo account. I also used the FX tester to backtest strategies. This provided me with statistics that elevated my confidence to trade live funds.

I then began with a small trading account. I cannot emphasise this point enough; it is crucial to begin small, as emotional influences can affect your decision-making process when employing oversized trading accounts and turn a winning system into a losing one. I started with a small account and risked 1%; remember, the idea was to acclimatise to the risk and fear associated with trading gradually. If I grew my account over the next quarter, I would feel comfortable increasing my account size incrementally and, consequently, my risk.

How much should you increase your account by? That will be down to the individual trader. We are all unique and have different goals. The point is to continually increase your account size as you become more familiar with the fears you listed in step two, helping to make trading a far less frustrating task.

I have found this is the best way to not only increase confidence but also help reduce the fear of trading.

No One Knows What Will Happen on a Trade-By-Trade Basis

I have met a lot of brilliant traders, and all of them have reaffirmed this point: no one knows what will happen on a trade-by-trade basis. This is a crucial

point many traders merely pay lip service to and do not truly accept that they have no control over the next trade's outcome. It does not matter whether your system has a winning percentage of 70%. It is impossible to know whether the next trade will be a winner or a loser. But, on average, over a sample of trades, we can expect 70% of the trades to be winners, but it's impossible to know which ones will be winners in that sample.

As independent traders, we can only control four things:

- Entry and Exit
- Risk Management
- Mental State of Mind
- Trading Plan

It Is Not About Being Right or Wrong

Alongside understanding that we have no control over the next trade, we must understand and accept that while in a trade, it is not about being right or wrong. It is ok to be wrong in trading. In fact, we will be wrong, and we will be wrong a lot, and the sooner we accept this, as I noted above, the more straightforward trading will become.

We already know we cannot put any emphasis on one individual trade, so if we know that, and we know that risk is controlled, then why are we concerned with winning and losing if we understand through our back test and forward test (those statistics I mentioned at the beginning of the article) that we have a strategy with positive expectancy?

Let's think about this. We spent the time backtesting and likely forward testing on a demo account to validate our trading strategy, and we have the statistics to back this up. And let's say that in our back test, our maximum drawdown consisted of eight consecutive losses, so why would we panic after two or three consecutive losses when trading a live account, as this is not new information? If you put the work in with the backtesting, it will make trading with live funds a far simpler and less stressful venture.

Digitalisation

The Signal-to-Noise Ratio in Medicine: Leveraging Artificial Intelligence to Elevate Care and Job Satisfaction

In today's demanding and fast-paced medical environment, physicians are challenged by time constraints, information overload, and waning job satisfaction. Assistive AI technologies offer promising solutions to the signal-to-noise conundrum in medicine.

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key points

- The avalanche of clinical and administrative information demands a balance between discerning the relevant signal and filtering out the incessant noise.
- Symptoms of burnout, disillusionment, and detachment have become increasingly common.
- There is an urgent and unmet need for solutions that address the symptoms and underlying systemic issues.
- The emergence of assistive AI technologies, such as GPT models, offers promising solutions to the signal-to-noise conundrum in medicine.

Claude Shannon's Signal-to-Noise Ratio: A Foundational Framework

The pioneering work of Claude Shannon in information theory has left an indelible mark on modern communication, computer science, and digital media (Hardesty 2010). His groundbreaking 1948 paper, "A Mathematical Theory of Communication," introduced the key concepts of signal-to-noise ratio, channel capacity, and error-free transmission (Shannon 1948).

In this context, the signal represents meaningful information, while noise refers to irrelevant or distracting information. The ratio between the signal and noise determines the quality and efficiency of information transmission. A high signal-to-noise ratio ensures a clearer message, while a low ratio leads to confusion and inefficiency.

The Physician's Challenge: Signal-to-Noise in Medical Practice

In today's demanding and fast-paced medical environment, physicians find themselves at the intersection of a multifaceted struggle, challenged by time constraints, information overload, and waning job satisfaction. The pressure to see more patients, maintain meticulous electronic health records, and stay current with the ever-changing landscape of medical research and guidelines leaves physicians in a relentless race against the clock.

Time, a once manageable resource, now becomes a limiting factor that penetrates every aspect of their professional life. Lengthy working hours encroach upon personal life and family time, while the quest to remain updated with the latest advancements stretches the limits of

cognitive capacity. The avalanche of information, both clinical and administrative, demands a delicate and taxing balance between discerning the relevant signal and filtering out the incessant noise. This information glut not only burdens the physician's cognitive abilities but also threatens the very core of patient-centred care, where empathy and individualised attention are vital.

Add to this the burgeoning administrative tasks that often feel disconnected from the actual practice of medicine, and the picture of a strained profession becomes clear. The bureaucratic demands placed on clinicians, such as compliance with healthcare regulations and engagement with various reporting systems, divert valuable time and energy away from clinical care, further straining the physician-patient relationship.

These factors converge to form a potent mix that contributes to a tangible decline in job satisfaction. Symptoms of burnout, disillusionment, and detachment from the core values that initially drew individuals to the medical profession have become increasingly common. The idea of healing, once a passionate pursuit, risks being overshadowed by the unyielding demands of modern medical practice.

Within this intricate web of challenges lies an urgent and unmet need for solutions that address not merely the symptoms but the underlying systemic issues. From harnessing the potential of AI and Large Language Models to aid in information management to reimagining workflow structures that prioritise physician well-being, the path forward must be marked by innovation, empathy, and a renewed focus on the humanistic principles that define medicine. It's a complex but crucial endeavour that seeks to restore balance, purpose, and joy to a profession dedicated to the noble and compassionate art of healing.

AI and LLMs: Indispensable Tools for Modern Medicine

In an era where technology innovation drives progress, the emergence of assistive AI technologies such as GPT models offers promising solutions to the signal-to-noise conundrum in medicine. A

> The integration of AI and LLMs in medical practice has shifted from an optional innovation to an imperative need

recent study showcasing the impact of ChatGPT on mid-level professional writing tasks did not specifically involve physicians, yet its findings carry important implications for the clinical environment (Noy and Zhang 2023).

A remarkable 40% increase in efficiency in professional writing tasks translates into a model that could be applied to medical documentation, patient communication, and more. Imagine the possibilities for healthcare professionals: faster completion of complex tasks could free up critical time, allowing clinicians to engage more deeply with patients, participate in further education, and conduct critical research.

Meanwhile, the 18% improvement in quality observed in the study is not merely about enhancing writing; it's about fostering excellence. By extrapolating these results to the clinical setting, we could see a higher standard in the precision of medical records, clarity of patient instructions, and accuracy of diagnostic reporting.

The study's exploration did not stop at efficiency and quality; it also illuminated a noteworthy increase in satisfaction among the participants. This uplift in contentment transcended mere gratification with task completion and unearthed a transformative shift in how work is approached. When extrapolated to the demanding sphere of medicine, this finding reveals critical value that may resonate deeply with physicians. The application of AI can transmute the drudgery of certain repetitive or administrative tasks into a vehicle for personal creativity and satisfaction. Instead of being mired in routine procedures and paperwork, medical professionals could harness technology to reallocate time and mental energy towards innovative care strategies, cutting-edge research, or meaningful patient interactions. This potential evolution in task management not only offers the promise of enhanced professional fulfilment but also opens a path towards reclaiming the joy and

human connection that often drew individuals to the practice of medicine in the first place. It's a resonant insight that reimagines technology not as a mere tool but as a partner in reviving and nurturing the core essence of medical practice.

From Option to Imperative

The integration of AI and LLMs in medical practice has shifted from an optional innovation to an imperative need. The triad of productivity accomplishment—efficiency, quality, satisfaction—is a synergistic force that can redefine medical practice.

The insights from the recent study present a compelling vision for healthcare, where technology enhances human capability rather than merely replacing it. By optimising the signal-to-noise ratio in clinical care, AI can usher in a new era of precision, compassion, innovation, and a renewed sense of purpose.

In the end, Claude Shannon's seminal concepts find foundational application in the very heart of human wellness and care, guiding clinicians in their vital mission and transforming the practice of medicine for the better. It's a vision where technology and humanity collaborate, achieving new heights of excellence in the ever-challenging and inspiring field of healthcare.

Conflict of Interest

None. ■

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Towards the European Electronic Health Record Exchange Format: XpanDH Project Support and Risks of a Delayed Regulation on the EHDS

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This paper presents the journey towards the European Electronic Health Record Exchange Format (EEHRxF) as a process of standardisation as social actors in Europe accept how necessary it is for digital health interoperability to be a reality to reap the benefits of digital transformation. The way the XpanDH project is set up and how it is providing its contribution to this effort is presented with a reflection on the risks associated with a delayed or amputated European Health Data Space Regulation.

key points

- Digital health standardisation is as much a process as it is a necessary activity to ensure health as a human right is achieved.
- XpanDH project, alongside other initiatives, is there to support the European digital health ecosystem to co-create and adopt the European Electronic Health Record Exchange Format (EEHRxF). It is central to ongoing efforts while preparing to hand over and expand through other projects and initiatives.
- The EHRxF is more than a set of format dispositions in communications, recommendations and the proposal for a regulation on the European Health Data Space (EHDS); it is a necessary instrument to achieve EU-wide health data interoperability and better care for all.
- There is a risk to the formal dimension of the EEHRxF if the regulation on the EHDS is not co-legislated in early 2024, or it is but at the expense of significant amputation.

Introduction

The digital transformation in the health sector was initiated in the 80s and intensified in the early 2000s (Marques et al. 2020). With the urgent need to digitalise health data and create the first healthcare systems, there was a decentralised development and implementation of these systems in the European Member States (MS) in an independent way that resulted in a lack of interoperability among the systems.

The national development of eHealth solutions identified the need to exchange health data among the EU MS to facilitate and improve the patient treatment that was outside their home country or looking for specialised treatment outside their home country.

Standardisation is the process of developing and agreeing on common technical specifications for products, services, and processes. It is a key enabler of innovation and economic growth and holds a relevant role in ensuring the interoperability and compatibility of technologies (Feng 2003).

Two main perspectives on standardisation can help us: the functionalist perspective and the constructivist perspective. The functionalist perspective views standardisation as a rational and objective process driven by the need to improve efficiency and reduce costs. The constructivist perspective, on the other hand, views standardisation as a social process influenced by the interests and power of different stakeholders.

Standards have a long tradition, dating back to ancient China, yet they can be used and are often key to achieving process innovation (improving how things are done) and product innovation (creation of new products or services). Standards play a vital role in the global economy. They help ensure that products and services are compatible and interoperable, which is essential for trade and commerce (Tamura 2021).

Standards also help to improve safety and quality. Quality standards help to ensure that products meet certain performance requirements, for example, preventing accidents and injuries. These have been progressively associated with quality of care and patient safety initiatives.

By providing a common framework for innovation, standards can help to reduce the cost and risk of developing new products and services. Only with large integrated and purposeful sets of health data can we truly change health systems into learning ecosystems where patients not only access and own their data but can meaningfully use it and make informed decisions about their health and wellbeing (Moen et al. 2022).

Past Projects, Initiatives and Legislation

Considering the real need to exchange, integrate, and cross-country mobilise health data, many projects and initiatives have arisen to support interoperability development in the health sector in Europe. They were supported by funding, communications and recommendations from the European Commission.

The need for interoperability to access and exchange health data among the European MS has mobilised the European Commission and the MS to achieve interoperability in a cross-border context (Release of a Recommendation on 2 July 2008 (2008/594/EC).

The project epSOS (2008-2014) pioneered evaluating and piloting the first electronic exchange of health data in Europe. It has supported the creation of the MyHealth@EU.

The project CALLIOPE (2008-2010) has developed an interoperability roadmap for eHealth that was published a few years ago and is still valid, especially for semantic interoperability (Directive on applying patients' rights in cross-border healthcare (2011/24/EU) of 2011). The legal foundation was created within it to set up the eHealth Network (art. 14), whose main objective is to *'work towards delivering sustainable economic and social benefits of European eHealth systems and services and interoperable applications [...]'.*

To support the eHealth Network and health interoperability efforts, the joint action eHAction, following a series of other joint actions, aimed to reflect digital health importance as a complementary resource for public health and services. We are striving to explore technologies and tools to facilitate chronic disease management, increase the sustainability and effectiveness of health systems, enable personalised care, and empower people.

The European EHRxF was first discussed in Lisbon during an eHAction activity, contributing to the deliverable "Policy document about technology report". At the time, it was considered that the format should aim to "*make it possible for people to access their health records across EU borders as needed for cross-border healthcare purposes such as in case of accidents while travelling, or to seek treatment of chronic conditions, or rare diseases. In any situation where a person requires healthcare treatment in another Member State, having access to their personal health records will support and improve the quality of this care, for example, by enabling faster, more accurate diagnosis and improved prognosis*". It is intended to facilitate the flow of information of health data among the MS in an interoperable way.

In February 2019, the European Commission released the "Recommendation on a European Electronic Health Record Exchange format (C(2019)800) of 6 February 2019", where a set of common principles, cluster of standards and the acknowledgement of the need to focus efforts on five priority health data domains was the core message. These five areas were: i) patient summaries, ii) electronic prescriptions and electronic dispensations, iii) medical images and image reports, iv) laboratory results and v) discharge reports.

From this recommendation, some EU projects initiated the development of services and improvements to speed up the achievement of health interoperability in the EU. Based on the EEHRxF recommendation, the X-eHealth project aimed to promote a faster and sustainable EU digital transformation by elaborating specifications and architecture propositions for implementing the five health domains indicated in the EEHRxF regulation.

XpanDH - Expanding Digital Health Through a Pan-European EHRxF-Based Ecosystem

XpanDH project supports an expanding ecosystem of individuals and organisations developing, experimenting and adopting the EEHRxF, providing a crucial contribution to the European Health Data Space (EHDS). It is a two-year Coordination and Support Action financed by the Horizon Europe Framework Programme.

Our focus is empowering individuals and organisations to create, adapt, and explore interoperable digital health solutions that truly make a difference. That is why we are mobilising and building capacity to ensure the widespread adoption of the EEHRxF.

The project has a stepwise approach for collecting specifications (functional, technical, semantical) feedback to support the creation of the required assets to implement solutions based on the EEHRxF. XpanDH is also working with all others who have already made progress in this area, and it is also talking to patients to make sure their needs are heard in a co-creation process.

Proposal for Regulation on the European Health Data Space

The EHDS is an initiative from the European Commission that intends to support the citizens to have control of their health data, better healthcare delivery and enable the MS to exchange health data in a secure and interoperable way.

The EHDS will be a health-specific ecosystem delimited by rules, common standards and practices, infrastructures, and governance framework. It will provide a trustworthy setting for secure access to and processing a wide range of health data.

The European Commission has presented a proposal for a Regulation on the EHDS, where different aspects regarding the scope and requirements, as well as the implementation

> EHDS will be a health-specific ecosystem delimited by rules, common standards and practices, infrastructures, and governance framework

mechanism for the EEHRxF, are established by legal means, as well as the associated EHR certification needs which intimately relate to the format and the capacity for the format to truly exert its harmonisation effect. As the EHDS relates to the processing and exchanging of health data that is highly sensitive, the approval of its regulation will officialise the rules that must be adopted by the MS, ensuring the security and further developments that shall be in

place for its full implementation. The discussion of the proposed regulation started in May 2022 and is taking place in the EU. Both the European Parliament and the Council have been incredibly active in view of getting to a vote by no later than April 2024, after which, due to European Election and its aftermath, we could expect a delay of two to three years, projecting the practical effects of the Regulation, particularly regarding EHRs, certification and the use of an European EHR Format for as near as 2030 (if approval moves from 2024 to 2027, with two to three years of entry into full effect plus the time for the publication of implementing decisions).

How XpanDH is Developing the EEHRxF

XpanDH is an ongoing project aimed at maturing and accelerating a sustainable and scalable interoperability environment in Europe for digital health innovations based on the EEHRxF, involving both the supply and demand sides of healthcare provision.

An ecosystem approach to Digital Health Innovation and creating conditions for new cross and intra-border interoperable environments around a proposed set of standards – in this case, an EEHRxF-based infrastructure – differs from the EU cross-border initiatives that have been mostly governmental lead. Understanding digital health as an ecosystem means accepting some systemic properties:

1. Open innovation.

2. Multiple leadership

3. Concepts over action plans

4. Industry involvement and co-creation spaces

5. Government as coordinators

XpanDH understands an "infrastructure based on the EEHRxF" as a "publicly driven bundle of interoperability assets that allow the secure and ethical exchange of health data according to the EEHRxF related specification, guidelines and ethos" that was herewith named as the X-Bundle, which is conceived as a technical, personnel and processes infrastructure. The X-Bundle does not imply using a particular or unique IT infrastructure or level of interchange. This means its applicability extends from intra-organisational infrastructures and health data exchanges (i.e., inside an HCP using its interoperability infrastructure) to inter-organisational exchanges at local, regional, national or cross-border levels.

An adoption domain specifies the application of a use case to one or more particular care pathways and patient groups (or clinical/organisational/inter-organisational workflows) for which the digital solutions implementing the use case are expected to deliver value. It, therefore, provides a focus on the use case. As such, the EEHRxF adoption domain could be considered as "an instantiation of a use case, with a specific case application, that has meaning from a health system or clinical perspective, with defined implementable requirements (simple if only one EEHRxF priority category is uses or composite if data from more than one is required), that satisfies all the conditions for users to be ready to implement data exchange in conformity to EEHRxF guidelines and specifications".

Finally, following a bottom-up approach, we understand the required feasibility verification to mean the capacity to show how organisations were able to get ready to adopt and hence adapt to the EEHRxF through different degrees of testing and usage that can be perceived as intra-organisational experimentation. "Experimentation bubbles'' are sets of organisations collaborating within the project

> The best way to develop the EEHRxF is in collaboration with the eHealth community to identify the real needs of the patients and healthcare professionals

to jointly adopt and demonstrate the use of digital solutions (including interoperability) for an adoption domain. The bubble somehow includes the technical solution providers as it strives to exemplify how one or more healthcare organisations would jointly or separately procure, install, and use interoperable solutions from one or more ICT providers, mimicking the market situation.

For the necessary scale and pan-European impact, XpanDH will deploy the activities mentioned above through the XpanDH X-Nets - networks of stakeholders (EU or MS organisations) that, linked by similar interests, form the existing pan-European

(Digital) Health space and can potentially use or benefit from the widest adoption of the EEHRxF.

Preliminary XpanDH Achievements

XpanDH has already defined six adoption domains to proceed with experimentation in collaboration with the project network. These serve to identify gaps, details to be further defined and issues that could come up with the EEHRxF implementation. They are distributed into two different domains: discharge reports and laboratory reports. The experimentation on the adoption domains intends to demonstrate the feasibility of EEHRxF-related solutions and recommendations for adoption.

The project also expands and brings awareness to the stakeholder community through the X-nets (networks of digital health ecosystem actors that need to be engaged with the Format). It will start to mature a "community of doers" with hopes to kick-start a patient-industry-led lead movement of concrete, hands-on support for promoting and developing EEHRxF tools and assets. Through the X-nets, XpanDH is raising awareness and collecting key information for developing the specifications and the bundles of assets necessary for an organisation to produce or implement EEHRxF-compatible digital health solutions (so-called X-bundles).

Expected Impact of EEHRxF for Digital Health Ecosystem

XpanDH project, by supporting the EEHRxF, is contributing to achieving the following impacts established for the Implementing Decision C (2021)1940: "European standards, including for operations involving health data, ensure patient

Expected Societal Impact

- Citizens (patients, carers, healthy persons) will benefit from safer, low-error, higher quality and better evidence-based healthcare seamlessly delivered anywhere in Europe.
- Care to patients will be better informed by improving access for health and care professionals to more complete EHRs, and care decisions will be better supported by smart applications taking advantage of interoperability.
- HCP organisations critically rely upon high-quality, fine-grained, real-time patient information to optimise service delivery, detect risk situations, and monitor quality and outcomes.
- Health authorities and healthcare payers will be able to envisage patient-sensitive outcomes-based reimbursements and the ability for payers to accurately compare performance, outcomes and safety.
- Member States will benefit from better information to support strategic decisions, which maximise the efficiency and safety of health services they govern, reducing direct or indirect costs through payer organisations.
- Wider adoption of EEHRxF will have an environmental impact. It may reduce the need for large amounts of paper printouts, particularly as patients are often given these forms of health data support, as no other forms of communication with HCP exist.

Economic Impact

- Better-defined interoperability services, backed by harmonised assets, will lower the cost of standards adoption and open up standardised interfaces to a plug-and-play market. Interoperable component-based health ICT architectures and products are vital to stimulate the market, stimulate competitiveness, and enable innovation, especially amongst SMEs.
- SDOs will demonstrate why standards need financial investment to improve productivity and quality and how they can provide better support to standard adopters. SDOs will have greater clarity on working together and producing better-harmonised standards.

Scientific Impact

- Big Data research, especially population research such as epidemiology, will thrive as more and more patient-level data resources can become integrated and robustly de-identified.
- Open science and citizen participation in S&T development is poorly researched. XpanDH will create tools and contexts for original research on how patients and professionals can act as digital health co-creators.
- IT and IT adoption research communities will thrive on the existence of a new EU common context of health IT usage, assuming the EEHRxF and its adoption as an object of research in itself.

Table 1. Impact of EEHRxF for Digital Health Ecosystem

safety and quality of healthcare services as well as effectiveness and interoperability of health innovation and productivity of innovators." as well as "Health industry is working more efficiently along the value chain from the identification of needs to the scale-up and take-up of solutions at the national, regional or local level, including through early engagement with patients, healthcare providers, health authorities and regulators ensuring suitability and acceptance of solutions".

The digital health ecosystem is composed of many different actors. Their benefits have been anticipated (Table 1) due to our collective capacity to implement in MS and at the EU far more advanced interoperable solutions strengthening the digital transformation of health systems.

Co-Creation is a Keyword for EEHRxF

The best way to develop the EEHRxF is in collaboration with the eHealth community to identify the real needs of the patients and healthcare professionals (HCP) and create practical and useful solutions for health. In that sense, XpanDH has created the concept of a "community of doers, " which joins patients, professionals, and programmers surrounding the EEHRxF to be ready to help others use and engage with digital health interoperability. These communities will co-create assets that support the adoption of the X-Bundle in real-life use cases. The ecosystem will showcase the drivers and benefits of interoperability and demonstrate how to capture value from it, while a community of doers will co-create assets for the X-Bundle and foster support to further adopters.

This concept is also present at the policy level, where regulation of the EEHRxF is key and requires active and capacitated national digital health authorities in permanent communication with the EC and spaces such as the eHealth Network and its sub-groups. The European Commission assumes a leading position in this activity by guiding the developments, where the diverse stakeholders' contributions would have a voice. In this way, the real needs of the patients, health professionals, researchers and others can be routed into the EEHRxF specifications and implementing decisions. However, it is via the active participation of the national government and authorities (digital health, certification, inspectorate and others) and how they relate to the digital health industry. The healthcare providers delivering interoperable tools for the health sector can become a reality in each of the 27 MS, and some are following and preparing to adopt the EEHRxF.

Risk if Regulation on EHDS is Not Co-Legislated in 2024

Multiple scenarios are possible, and a detailed analysis of what could happen if a specific article

or provision is or is not included in the final text is beyond this paper. To look at the impact on the EEHRxF adoption and a European single digital health market, we can consider three main scenarios:

a). The EHDS regulation will be co-legislated in 2024 with no significant changes to articles related to the EEHRxF or the EHR certification schemas.

b). The EHDS regulation will be co-legislated in 2024, and there is a reduction in the scope and ambition for the EHRxF, particularly in timing and in implementing instruments, and with shy provisions on EHR certification schemas.

c). The EHDS regulation is not co-legislated in 2024. It is postponed to the next political cycle, most likely recovered as a topic in 2025, looking at final voting in 2027 or later.

Scenario One: Regulation on the EHDS approved in 2024

In scenario one, XpanDH, and more recently xShare project, the new XT-EHR Joint Action and a set of other forthcoming initiatives will need to further align its work to deliver concrete support and boost government, industry, and providers capacity to implement and adopt the EEHRxF as early as 2025. In this scenario, an acceleration and interest in digital health interoperability and significant stress on National Authorities, as well as industry and health providers, is likely to arise, as preparation and gradual uptake of standards have been traditionally slow and lagging in the EU even compared with the United States and some other non-EU countries.

With the development and rise of new technologies

in the context of the EEHRxF and by improving the health systems, it will receive a diverse range of data to support the accurate diagnostics of the patients and improve the treatment.

For example, the genomic data could also be integrated into the EHR, allowing GPs to identify early possible development of diseases, such as cancer and degenerative diseases, by defining regular check-ups for patients with a medium-high probability of developing any genetic disease. In addition, many genetic variants are associated with the drug metabolism. In this regard, a more accurate prescription could be available to the patients, supported by the adoption of EEHRxF. Nevertheless, as the genomic data are highly sensitive, there is a need to align security protocols to ensure the privacy of these patient data.

The development and training of Artificial Intelligence (AI) tools could support the diagnostics and indication of treatment if implemented as tools in the eHealth systems. AI tools can also be applied in other categories, such as patient morbidity or mortality risk assessment, disease outbreak prediction and surveillance, and health policy and planning (Schwalbe and Wahl 2020). However, developing these tools requires good quality data and coherent data about each patient, which can only be truly achieved if digital solutions can integrate data seamlessly.

Scenario Two: Shy regulation on the EHDS approved in 2024

The EHDS regulation was co-legislated in 2024 at the expense of significant compromise between different legislative interests and amongst MS scepticism of its

need and the capacity of different national interests and industry capabilities to embrace interoperability. Scenario two is that of a shy final document, striped from ambitious articles, with some of the early ideas pushed and parked and recitals which few will read and even fewer will consider when considering investments in digital health.

If the reduction in the scope and ambition for the EHRxF, particularly in timing and in implementing instruments, means an amputated EEHRxF is what can be enforced in the Union, we are likely to get a paralysis effect. This means MS which were investing in health interoperability efforts, such as commonly agreed minimum datasets or other semantic and technical agreements between their digital solution providers and broad ecosystem actors, may be stopped or feel restrained to do this, alongside hesitation on digital health investment at scale and the national level.

If the deadlines presented are too far away to ensure compromise solutions between mature and less mature MS on their capacity to uphold EEHRxF demands, we can face a lack of necessary time-related stress. The need is there, but too far into the future.

Finally, if shy provisions on EHR certification schemas mean a loose EU harmonisation function, too laissez-faire approach to national certification is the outcome of the negotiations, then a very fragile implementation strategy is possible to achieve a truly single digital health market. For example, the absence of mechanisms, even if only progressive, for mutual recognition of certification for digital health solutions regarding their adherence to EEHRxF requirements

would mean that a company may need to file for certification in all or many of the 27 MS, which could mean more barriers to entry than at present when the ethos of the EHDS is that digital health solution providers could grow as their offer grows from a national footprint to an EU-wide one.

Scenario Three: Regulation on the EHDS delayed to 2027 or beyond

The EHDS regulation is not co-legislated in 2024 in scenario three. It is postponed to the next political cycle, the configuration of which is unknown and highly unpredictable, particularly in a post-COVID era, where health is losing political attention to war in Europe, energy crisis and other permacrisis elements. At best, the topic of a common space of rules, data and digital for health is recovered in 2025, which may mean revamping the proposal and/or looking at a final vote in 2027 or later.

MS will continue to work to use digital for better health, stimulated by compelling evidence, powerful speeches and stimulating Digital Health events such as the recent 2nd Symposium on Digital Health by WHO Europe, the HIMSS Europe enthusiasm or the Radical proposals from the Helsinki Festival. This is not bad, and apart from the occasional unhealthy competitiveness, cooperation and sharing instruments such as the eHealth Network and several EU-funded projects will continue to contribute to divergence forces. However, in the absence of regulation on the EHDS or similar, there will be NO convergence that could mean a common market of interoperable solutions. Establishing national discrepancies in

certification schemas will inevitably further fence national and niche markets, rendering our companies as small as our ambition to have a large European Health Data Space.

Conclusions

The EEHRxF is not to be seen as a standard itself but makes use of and will surely live off standards. Its co-creation, implementation and adoption are nonetheless a standardisation process. Two main perspectives on standardisation can help us: the functionalist perspective and the constructivist perspective. While the constructivist perspective of standardisation would help us understand how the EHDS is influenced by the interests and power of different stakeholders and could fool us into accepting a possible delay or downsizing as inevitable. A functionalist perspective would suggest that such unwanted outcomes would impact the realisation of the vision for an adoptable EEHRxF resulting in lost opportunities for improvements in efficiency and reduction of costs, in quality of care and avoidance of risks to patients' lives.

While the XpanDH project, in its humble contribution to supporting the efforts for a European Electronic Health Record Exchange format, is progressing well with its work, it now turns is concern to the sizable risk of seeing its core object – the EEHRxF – losing momentum or consistency as the negotiations for voting on a final text of the Regulation on the European Health Data Space unfold to a conclusive drawn in 2024, or towards postponement into the

future. On the other hand, XpanDH and a family of projects directly or indirectly related to the EEHRxF are gathering forces. They can influence the ecosystem, which, democratically, can reach its European Parliamentarians and elected governments, advocating for the need for a worldwide innovative way of moving digital health together, harmonised and co-creating.

Conflict of Interest

Henrique Martins and Anderson Carmo are coordinators and project managers for the EU-funded project XpanDH, which is a Coordination and Support Action to promote the development and adoption of the European Electronic Health Record Exchange Format. ■

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How to Select a BI Solution for Your Healthcare Practice: A Five-Step Guide

A huge amount of data is generated in healthcare. How can healthcare organisations process and benefit from this data? This article explores the use of business intelligence tools for data-driven decisions and insight.

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key points

- With business intelligence tools, medical professionals can extract actionable insights and make data-driven decisions affecting patient health and lives.
- Healthcare BI solutions help medical providers improve clinical and administrative workflows.
- Five steps can help you select the right BI solution – quality data, an implementation plan, a review of different BI solutions, strong security and the total cost of ownership.

With the expansion of diagnostics methods in healthcare, the amount of data generated, captured, and copied by devices has increased. According to Statista, 181 terabytes of data will be generated, captured, and copied globally by 2025. Meanwhile, RBC Capital Markets adds that 30% of this data will be pertinent to healthcare.

How can healthcare organisations process and benefit from this data? With business intelligence tools for healthcare, medical professionals can extract actionable insights and make data-driven decisions affecting patient health and lives. But how to choose a suitable Business Intelligence (BI) solution for your clinic?

A Five-Step Guide for Choosing a BI Solution

Healthcare BI solutions help medical providers improve clinical and administrative workflows. They are widely used for enhancing population health management and individual care outcomes. In addition, BI tools can have a decisive say in non-clinical aspects of typical hospital activities, including staff management, optimising the supply chain and revenue cycle, or quality reporting. Consider the following steps to ensure you're ready to implement a BI solution.

Step 1 - Preparing Data

Quality data is the basis for effective BI analysis. However, it is difficult to maintain the growing volume of data from your hospital's systems (CRM, EHR, HIM, etc.) in order. You should continuously monitor data quality in your hospital solutions to prevent duplicates, erroneous information, lack of critical data, and missing information. You should erase inaccurate data and faulty entries and fill in information gaps. However, it is time-consuming and will require the efforts of QA specialists.

In case you haven't reviewed your data regularly before launching a healthcare BI project, you should perform data cleaning.

For this matter, you can employ in-house IT specialists or go for data QA outsourcing.

Step 2 - Creating an Implementation Plan

You should clearly set your goals for implementing a business analytics solution and ensure seamless top-down cooperation between your team members. If you cooperate this way, you'll manage to address the needs of all user groups, including clinicians, nurses, administrative, and IT teams. Make sure that your execution plan corresponds with the desired outcomes.

Step 3 - Comparing BI Tools

First, consider your budget when reviewing BI solutions for your healthcare practice. After you have shortlisted budget-friendly solutions, you can try them and assess whether their functionality meets your business requirements. If a particular solution fits well, you can move on to the third vital criterion – the existing IT infrastructure.

In some cases, ready-made business intelligence solutions can't marry your requirements. It can happen with highly specific clinics that operate complex multi-source data. In such cases, going for custom development is advisable. To select a suitable vendor, you should review their portfolio and assess the security procedures they follow. You can also request feedback on cooperation from their clients ordering similar projects. Pay specific attention to negative feedback.

Step 4 - Ensuring Strong Security

Healthcare BI tools help providers improve diverse aspects of a clinic's daily work, from care personalisation to fraud detection and revenue flow

improvement. It means such solutions operate three ample types of data:

- Patient health data (diagnoses and allergies, case notes, and lab test results)
- Demographic data (patients' names, addresses, and contact details)
- Administrative data (billing records, insurance claims, staffing or inventory optimisation, etc.)

> BI tools help improve diverse aspects of a clinic's daily work, from care personalisation to fraud detection and revenue flow improvement

This data is highly sensitive and appealing to cybercriminals. According to the Annual Data Breach Report 2022 by Identity Theft Resource Center (ITRC), for the third consecutive year, U.S. healthcare organisations suffered from the highest number of data breaches (344). This is an alarming trend that should be addressed immediately. Ensuring compliance with the globally established data protection standards (e.g., HIPAA, GDPR) and

following specific security practices can help mitigate the threat. Adherence to such standards ensures that sensitive information is safely sealed and transmitted with minimal risk. When implementing BI solutions, healthcare providers should undertake security measures, such as data encryption, access control, and staff training.

Step 5 - Calculating the TCO

The total cost of ownership (TCO) goes beyond the price of a BI solution. It also includes expenses for the tool operation and maintenance over time. Interestingly, the TCO for cheaper business intelligence software can be greater than that for more expensive healthcare BI tools. Therefore, when choosing a suitable offer, you should compare the TCO of different solutions to determine which offers the most value for your organisation. In addition, assess the return on investment (ROI) prospects of an appropriate solution and its influence on your medical practice performance.

Final Note

Though the medical BI software market caters to many tastes, choosing a solution that fits your clinic is still challenging. If you still have doubts after a thorough market analysis, you can refer to healthcare BI consulting experts for help. They will answer your questions or provide a detailed consultation on any healthcare BI-related issue.

Conflict of Interest

None. ■

Affordability & Value

What Does For-Profit Ownership Imply for Hospital Management Sciences?

For-profit hospitals are getting an ever-increasing share of the healthcare market. Since they do not structurally outperform other ownership types, questions arise on the desirability of this trend. For-profit strategies, such as consolidation, segmentalisation, and turnaround management, will affect the future hospital landscape and may disrupt current one-size-fits-all hospitals.

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key points

- For-profit hospital penetration has been rising for many years.
- From a societal perspective, for-profit hospitals do not outperform other ownership types.
- For-profit hospital companies follow specific strategies: consolidation, segmentalisation, and turnaround management.
- In assessing for-profit hospital care, we should also assess the necessity of such strategies.

For-Profit Hospitals Increase Across the Globe

Over the past decades, many countries saw a substantial increase in for-profit hospital ownership (Palley 2023). In the U.S. and Germany, the two biggest hospital markets, the number of beds under for-profit ownership is now nearly twenty percent. In the U.S., these numbers were no more than a few percentage points in the mid-sixties, just before the start of the Medicare programme; the situation in Germany was the same until the late eighties (Jeurissen et al. 2021). Investors see hospital care as an attractive and stable growth market for many years to come with high cash flows. Politically, the trend of increasing investor-owned hospitals is controversial. Proponents of for-profit ownership point out that such companies are more efficient than public and non-profit hospitals. They bring competition and innovation, which is needed to help healthcare systems stay sustainable.

Critical voices point to possible adverse effects on the quality of care, access to care, and suspicions of cream skimming by for-profit hospital chains. For-profit healthcare flags political antagonism like a few other themes in the area of the welfare state in healthcare. The growth of for-profit hospital ownership seems to imply that these types have essential advantages. What does social science tell us about this?

From a Societal Perspective, For-Profit Hospitals Do Not Outperform Other Types

Many studies were conducted to determine if for-profit hospitals perform better than other ownership types. Typically, the answer is "no" (Kruse et al. 2018). However,

commercial awareness and performance may differ substantially between physician-owned, smaller for-profit providers, smaller chains, listed companies, and private

equity-owned hospitals (Kruse and Jeurissen 2020). A recent BMJ review found no consistent beneficial impacts of private-equity ownership in healthcare and associations with harmful effects on costs and, sometimes, quality of care. The empirical studies included in this review were all from the U.S., but on average, for-profit hospitals scored better than for-profit nursing homes and other provider types (Borsa et al. 2023). These outcomes may be explained by the fact that for-profit hospitals that rely on fee-for-service payments increase margins by treating more patients; nursing homes rely on fixed per diem rates and typically increase margins by saving on the services in such a timeframe (Jeurissen 2010).

Frank Sloan, a longtime scholar on the issue and who has published many studies from the U.S. that tend to be somewhat favourable on for-profit hospital ownership, recently concluded that the observed differences between for-profit and non-profit hospitals are mostly "a little deal". Sloan rightly points out that for-profit providers respond more to external financial incentives (Sloan and Valdmanis 2023). This implies that governments may capitalise on this flexibility, but only if they can design the right external incentives. Of course, it may also be the other way around. In that case, regulatory capture and looking for the edge of regulations are real risks. Nobel prize laureate Kenneth Arrow (1963) pointed out that non-profit ownership may be a sign of trustworthiness and rational governance in cases of information asymmetry. Indeed, in those days, for-profit hospital ownership hit an all-time low, and

scholars tried to explain why non-profits were on the rise (Pauly and Redisch 1973).

Overall, the evidence on the performance of for-profit hospitals versus other ownership types is inconclusive and difficult to interpret. For-profits may operate with a somewhat lower cost base but hold higher margins and thus charge more to payers. Healthcare outcome data are sparse and hard to compare. Still, if for-profits perform slightly better in

> A significant advantage of for-profit hospital ownership is their capability for effective turnaround management

pockets of healthcare delivery, this is probably easily balanced by these providers' typically treating an average lowercase mix. Access is more dependent on the inclusion or exclusion of for-profit hospitals in the mandated healthcare system. For-profit hospitals usually are included in insurance-based healthcare systems such as Germany, the U.S., or Switzerland. Still, they may be excluded or must comply with strict regulations in certain NHS-type healthcare systems, including the U.K., Canada, and the Nordic countries.

Paradoxically, it is through exclusion from the broader healthcare system that for-profit hospitals add to unequal access since, in those cases, they cater to a more prosperous clientele, and the 'worse' the performance of regular care (long waiting times, appearance), the more robust the demand for private care (Jeurissen 2010).

For-Profit Hospitals and Management Sciences

Hospital managers and leaders can learn from the experience of for-profit hospitals by studying their strategies for broader lessons. Here, I will shortly present five major strategies that are applied by big for-profit hospital chains: 1) consolidation, 2) shared back-office, 3) turnaround management of the acquired providers, 4) segmentalisation of services, and 5) tapping the financial markets when opportunities appear.

For-profit hospitals have access to the financial markets. Although such commercial equity capital is expensive and typically exceeds the capital costs of public loans or non-profit endowments, they may give for-profit providers significant advantages when business chances appear. Risk-bearing equity capital gave well-run for-profit companies the financial ammunition to become big consolidators. Only a few companies dominate a strongly consolidated submarket in almost all countries where for-profit hospitals hold a substantial share. For example, the U.S. for-profit hospital market is dominated by HCA (185 hospitals) and the German market by

Helios (90 hospitals). Both also own many more locations for elective surgery, outpatient care, and less intensive treatments. Such numbers exceed the typical non-profit and local public hospital chains by far. The bigger for-profit chains have strong national positions, much negotiating power over payers, and may dominate certain local and regional markets. When national opportunities to consolidate are getting dry, they may expand to other countries. Helios is also active in Spain with 60 hospitals. Ramsay has gotten outside its home country of Australia and is now involved in France, the U.K., and the Nordic countries, as well as in certain developing Asian economies. Since healthcare systems may vary a lot between countries, this comes with the difficult task of managing and complying with such regulations.

A significant advantage of for-profit hospital ownership is their capability for effective turnaround management. If struggling providers are acquired and reformed, it may improve the performance of the total pool of hospitals. In contrast to the broader economy, where more prominent companies chase attractive smaller companies with considerable growth potential, such as in the life sciences sector, in hospital care, the underperforming providers seem the most attractive acquisition candidates. Such providers are 1) cheap, and their (public) owners may be glad to be able to sell them, sometimes with a dowry (this happened in the east of Germany after reunification); and 2) easy turnaround management strategies such as optimal reimbursement and merging back-offices can quickly improve hospital bottom lines. Consolidation also correlates to efficiencies of scale, and this is what all for-profit hospital systems try to accomplish

through shared back-office functions, such as billing, marketing, etc., and bulk purchasing of medical goods and equipment.

Capital costs (return-on-equity) typically are higher for for-profits, who thus need and seek bigger margins than the other ownership types. Besides, most payers do not have adequate cost-based reimbursement mechanisms, and (massive) cross-subsidies between different hospital services are the norm. This then contributes towards a segmentalisation towards

> For-profit hospitals are more specialised and cater to smaller locations than their public or non-profit counterparts

the more profitable services by for-profit providers. Specialisation also acts as a strategy to increase efficiencies of scope. For-profit hospitals typically are more specialised and cater to smaller locations than their public or non-profit counterparts (Jeurissen 2010). The latter is also illustrated by the fact that for-profit hospital systems are underrepresented in running academic medical centres and tertiary care hospitals that are very complex and difficult to manage and thus carry high administrative costs.

Here, governance becomes very complicated, and virtual positive margins compete with other (loss-making) goals such as research, education, delivering uncompensated care, etc. For-profit hospitals, like other ownership types, face the same challenges in aligning their interests with those of the medical profession. However, they have additional financial instruments to do so, for example, by letting them share in the companies' profits.

Do For-Profit Hospital Management Strategies Improve Future Healthcare?

For-profit hospitals seek different strategies versus public- or non-profit providers. They tap the financial markets to consolidate to create additional powers to negotiate with third-party payers and improve efficiencies of scale. They lean towards the more attractive segments of the markets, which also improve efficiencies of scope, and they have more instruments to align the interest of the physicians with the goal of the company. Because research indicates that at this moment in time, the societal performance of for-profit hospitals does not seem to exceed those of other provider types, the critical question is if the management strategies of for-profit companies may help to accomplish future necessary healthcare transformations. Otherwise, stimulating further for-profit growth seems not to make too much sense.

Most scholarly evidence does not support a strong case for for-profit hospital ownership. However, for-profits are more responsive to external financial incentives, which also creates possibilities if

professional regulators can counteract opportunistic behaviour or rent-seeking. Turnaround management of struggling providers is clearly in the public interest.

It is also an open question whether current one-size-fits-all hospitals with large inpatient wards will be the backbone of future healthcare like before. Technological innovations create evermore possibilities for outpatient treatments, and communication technologies facilitate digital health. Segmentalisation of the one-size-fits-all hospital may represent opportunistic profit-seeking and show us new and efficient models of care and delivery that fit better to those trends (Duran and Wright 2020). On the other hand, for-profit hospital providers now clearly do not provide the cost minimalisation that many health systems are looking for. And they may lean towards rent-seeking if the complex health systems and regulations let them. A level playing field between public and non-profit providers may imply taxing them more and returning those resources to the health system.

Conflict of Interest

None. ■

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