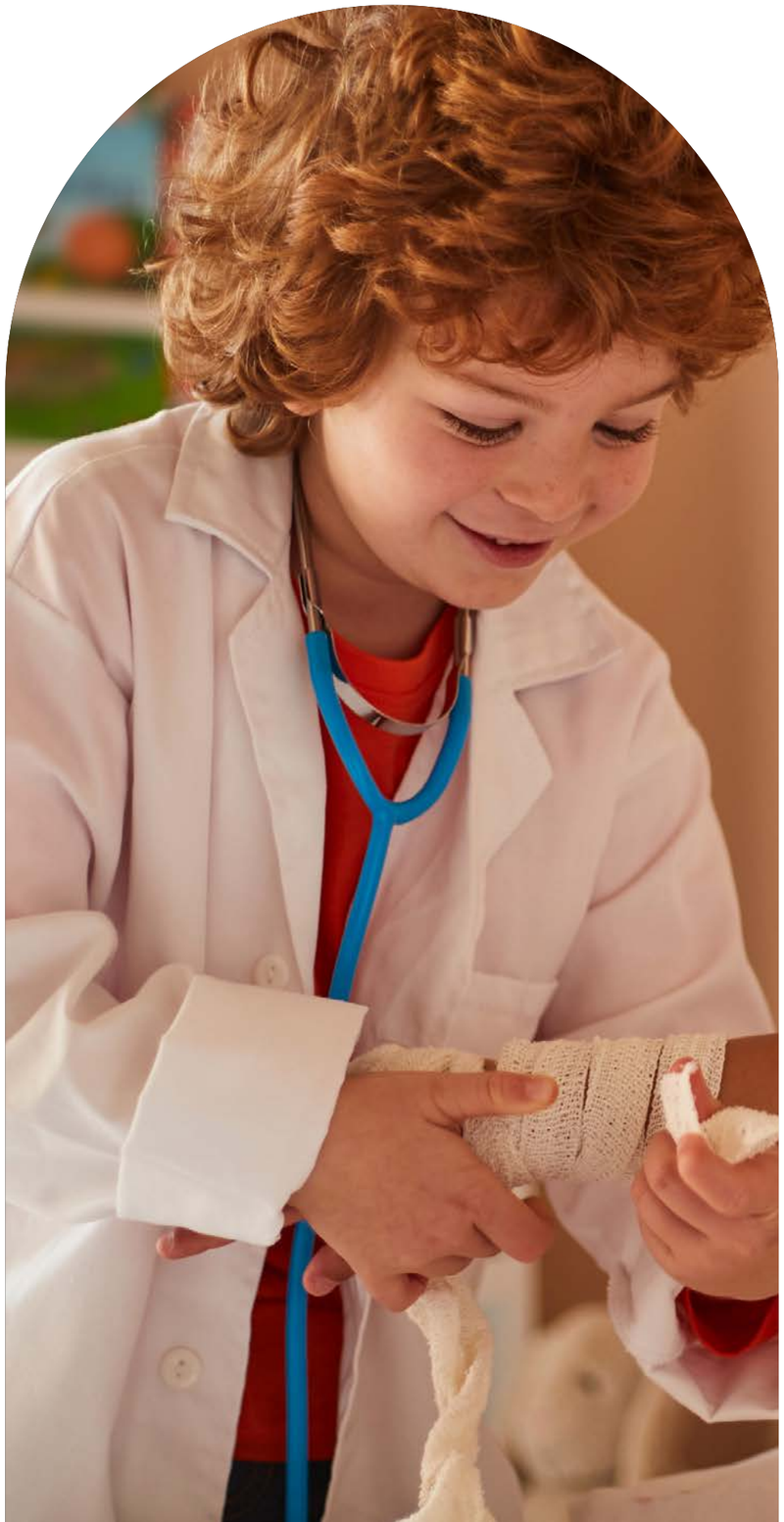
BD Healthcare Resilience Barometer

2024 edition

BD



Contents

> **Today, healthcare systems across the globe are at a crossroads.**

Roland Goette
Executive Vice President and President EMEA, BD

Foreword

The COVID-19 pandemic exposed the vulnerabilities of our current healthcare models – making it clear that a fundamental transformation is required. Two critical themes are emerging at the core of this transformation: the sustainability and the resilience of our healthcare systems. Only through systemic change will we be able to sustain solid foundations for the future of healthcare. In 2023, the first BD Healthcare Resilience Barometer explored the variety of factors that impact the stability of our healthcare system – from shifting population demographics and resourcing constraints to developments in the macroeconomic environment and the increase of chronic disease.

This year, we are looking closer at three core components that impact care delivery: the patients, the workforce, and the processes that drive overall efficiency. These components are tightly interconnected. Therefore, the challenges affecting them must be addressed holistically to enable us to build sustainable and resilient healthcare systems that can preserve access to safe, high-quality care for current and future generations and minimise the impact on the environment.

Why do we consider it essential to spotlight these three specific areas in the 2024 BD Healthcare Resilience Barometer?

The core mission of any healthcare system is the provision of safe and high-quality care for patients. Prioritising safety throughout the entire patient journey not only benefits the patients themselves but also leads to enhanced operational efficiencies. As staff shortages and burnout continue to increase,[1,2] shorter hospital stays, and lower readmission rates can enable the optimisation of existing resources and improved staff wellbeing can translate into improved patient safety.[3] Collectively, this will elevate standards of patient care. At the same time, it is also key to address the impact of challenges such as the carbon footprint of healthcare.[4] This virtuous cycle is what we must look to as the guiding principle of the transformation that lies ahead.

The comprehensive solutions that are needed to address the challenges of today's healthcare systems call for collaboration and collective commitment from all actors connected directly and indirectly to care delivery. It includes policymakers, regulators, researchers, academia, healthcare providers, funders, insurers, patients, and industry.

The 2024 BD Healthcare Resilience Barometer captures the perspectives of stakeholders across the healthcare ecosystem and outlines the role we can all play in building sustainable healthcare systems that stand resilient, responsive, and ready for the evolving needs of our societies.

1 World Health Organisation (WHO). *Ticking timebomb: Without immediate action, health and care workforce gaps in the European Region could spell disaster*. https://www.who.int/europe/news/item/14-09-2022-ticking-timebomb--without-immediate-action--health-and-care-workforce-gaps-in-the-european-region-could-spell-disaster

2 Intensive Care Med. 27 March 2023. *High-level burnout in physicians and nurses working in adult ICU: a systematic review and meta-analysis*. https://pubmed.ncbi.nlm.nih.gov/36971792/

3 PubMed. *Healthcare professionals' perception of their working environment and how to handle mental strain*. https://pubmed.ncbi.nlm.nih.gov/37132084/

4 Health care Without Harm. *Healthcare climate footprint report*. https://no-harm-global.org/sites/default/files/documents-files/5961/HealthCaresClimate-Footprint_092319.pdf

Executive summary

1

Patients

Patient safety challenges such as healthcare-associated infections (HAI) (see page 15) and adverse effects of medical treatment (see page 17) are prevalent across EMEA – exacerbating the burden of disease while also resulting in significant cost to healthcare systems.

2

Patients

While healthcare systems have started to introduce measures to control infections, greater efforts are needed to develop hospital guidelines and surveillance systems to consistently reduce the risk of infection and combat the threat of antimicrobial resistance (AMR) (see page 19).

3

Healthcare workforce

Burnout among healthcare staff is prevalent across regions (see page 38) with the BD Healthcare Resilience Barometer highlighting an acute need for national frameworks around occupational health and safety to ensure healthcare workers' wellbeing and that institutions hold themselves to high standards (see page 41).

4

Efficiency

While Europe performs relatively well on the BD Healthcare Resilience Barometer overall, a deeper dive into the area of efficiency shows poor performance on measures of length of hospital stay and preventable deaths – revealing the need for better care management and resource allocation across healthcare services.

5

Efficiency

Reducing inefficiencies in care provision is crucial as it can unlock tremendous opportunities for healthcare systems to deliver better patient safety, outcomes, and experience, improve the wellbeing of the healthcare workforce, optimise spending and address the environmental footprint of the sector.

Methodology

Selection of resilience indicators

This year's edition of the BD Healthcare Resilience Barometer measures the resilience of healthcare systems in 100 countries across Europe, the Middle East, and Africa (EMEA) through the lenses of three core pillars of a healthcare system – its patients, its healthcare workforce, and the processes and workflows that impact the overall efficiency and sustainability of care delivery.

According to the WHO (World Health Organisation) a resilient healthcare system is one "that can effectively prevent, prepare for, detect, adapt to, respond to, and recover from public health threats while ensuring the maintenance of quality essential and routine health services in all contexts."[5]

We have adapted the methodology of the first edition of the BD Healthcare Resilience Barometer, using a new set of resilience indicators covering three thematic areas.

The indicators were selected to reflect the challenges facing healthcare systems from the perspective of the patients, the healthcare workforce, and the efficiency and sustainability of care delivery.

The 2024 BD Healthcare Resilience Barometer is formed of a total of 22 indicators. Countries' inclusion in the BD Healthcare Resilience Barometer was conditional to having data available for at least 10 out of the 22 indicators.

5 World Health Organisation (WHO). *Health Systems Resilience*. https://www.who.int/teams/primary-health-care/health-systems-resilience

Figure 1: 2024 BD Healthcare Resilience Barometer – Core themes

Table 1: 2024 BD Healthcare Resilience Barometer Indicators by Theme

Patients	Healthcare workforce	Efficiency
Universal health coverage	Staff to patient ratio – nurses	Inflation
Adverse effects of medical treatment	Staff to patient ratio – doctors	Health expenditure
Complications following therapeutic procedures	Ratio of nurses to doctors	Healthy life expectancy
Healthcare-associated infections (HAI)	Nurses aged 55 or above	Preventable deaths
Surgical site infections (SSI)	Healthcare staff burnout	Length of hospital stay
Sepsis	Occupational health and safety policy	Healthcare % of national footprint
AMR-related deaths		Healthcare CO2 emissions per capita
HAI surveillance		
HAI guidelines		

The BD Healthcare Resilience Barometer was developed using a selection of primary literature and secondary datasets from internationally recognised sources including the World Health Organisation (WHO), the Organisation for Economic Cooperation and Development (OECD), the Institute for Health Metrics and Evaluation (IHME), the World Bank and the European Centre for Disease Prevention and Control (ECDC). Primary research was also conducted to complement the findings. This included a multi-market survey among healthcare professionals (HCPs) and a series of in-depth interviews with key opinion leaders in the healthcare sector in EMEA.

Please note that the content of each interview reflects the perspective of the individual stakeholder on the topics discussed, and not necessarily the position of the organisation which the stakeholder represents, or of BD.

See the Appendix (Tables 12–15) for detailed references, further information about the research and a full list of stakeholders consulted.

Resilience scoring

The resilience indicators selected for the BD Healthcare Resilience Barometer were grouped into one of our three thematic areas shown above. With raw data points collected on different scales and measurements, all resilience indicators were standardised on a 0-100 scale to allow for comparison.

Within each of the three themes, indicator-specific scores were aggregated to produce a thematic score, and then to create the overall resilience score at a country level. Please note that a higher Barometer score always corresponds to a stronger (positive) performance.

Further information about the data standardisation and scoring process can be found in the Appendix.

Chapter 1
Patients

Although the concept of healthcare resilience can be understood and measured in different ways, some of the most important indicators of the robustness of a healthcare system are related to patients. The various strengths and weaknesses of care provision can be reflected in patient outcomes, patient safety, or patient experience. Building resilient healthcare, therefore, must be driven by the objective of creating systems that meet the needs of current and future patients in a safe and efficient way.

In this first chapter of the report, we explore healthcare resilience in EMEA through the lens of patients and patient safety. At BD, we believe that patient safety is critical to healthcare resilience. The vulnerabilities inherent in medical care mean that implementing innovation to minimise the risk of harm to patients must be a priority for all healthcare organisations. Raising awareness and training staff to identify and effectively mitigate risk of harm throughout the patient pathway is also essential in order to enable the sustainable delivery of safe, high-quality healthcare for current and future generations.[6]

Advances in medicine over recent decades have significantly improved patient safety around the world, but there remain ongoing and newly emerging threats.[7] The cost of unsafe care is considerable – both in terms of the health burden for patients affected, and in terms of the share of financial cost attributable to patient safety incidents.[8,9]

In assessing the resilience of healthcare systems in EMEA countries from a patient perspective, the BD Healthcare Resilience Barometer focuses on key issues including access to care, antimicrobial resistance (AMR), HAIs and treatment complications. While these specific topics do not comprehensively reflect all the challenges around patient safety, it is useful to delve into some of the most acute patient safety issues that represent a larger disease burden.[10]

6 European Union Network for Patient Safety (EUNetPaS). *Use of Patient Safety Culture Instruments and Recommendations*; 2010. https://webgate.ec.europa.eu/chafea_pdb/assets/files/pdb/2007109/2007109_eunetpas-report-use-of-psci-and-recommandations-april-8-2010.pdf

7 Organisation for Economic Co-operation and Development. *The economics of patient safety*; 2020. https://www.oecd.org/health/health-systems/Economics-of-Patient-Safety-October-2020.pdf

8 Organisation for Economic Co-operation and Development. *The economics of patient safety*; 2020. https://www.oecd.org/health/health-systems/Economics-of-Patient-Safety-October-2020.pdf

9 Slawomirski, L, Auraaen, A, Klazinga, N. *The economics of patient safety: Strengthening a Value-Based Approach to Reducing Patient Harm at National Level*. https://doi.org/10.1787/18152015

10 World Health Organisation. *Patient Safety: Global Action on Patient Safety: Report by the Director-General*. Accessed August 3, 2022. https://iris.who.int/handle/10665/327526

Figure 2: Map showing overall 'patients' Barometer performance at an EMEA level

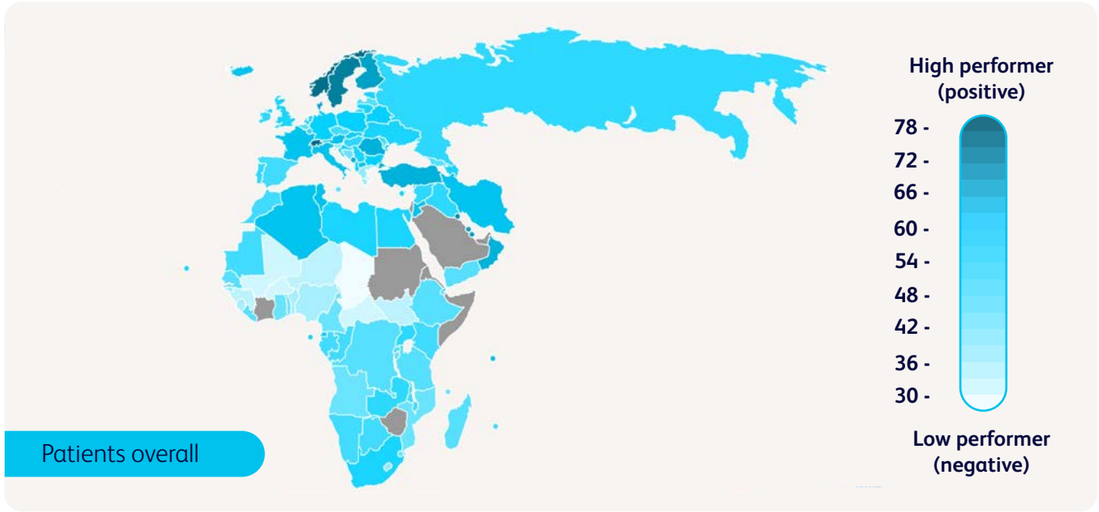


Table 2: Overall Barometer performance 'patients' – selected countries (in ranking order)

Countries (in ranking order)	EMEA ranking (out of 100 countries)
1. Switzerland	2nd
2. Sweden	3rd
3. Denmark	6th
4. France	21st
5. Italy	22nd
6. Poland	23rd
7. Germany	26th
8. United Kingdom	38th
9. Netherlands	40th
10. Ireland	45th
11. Spain	53rd
12. Belgium	67th

Disclaimer: For the BD Healthcare Resilience Barometer report, our primary objective was to provide a comprehensive view of healthcare systems' resilience across Europe, the Middle East and Africa (EMEA). To ensure the relevance and applicability of our findings, we consulted with a wide range of key opinion leaders across the region. During our interviews, it became apparent that while a broad overview is essential, there is also a need to delve deeper into regional performance and explore how challenges in patient safety, healthcare workforce and efficiency continue to impact the resilience of more advanced healthcare systems in Europe. The inclusion of figures focused on a select group of countries serves to enrich the analysis and provide deeper insights into regional healthcare dynamics.

Access inequalities across EMEA

When considering the patient perspective, it is important to begin with access to healthcare. It is meaningless to assess and analyse the resilience of healthcare systems that remain inaccessible to a large proportion of the population.

Across the EMEA region, the BD Healthcare Resilience Barometer reveals stark disparities in the level of universal health coverage (UHC). According to World Health Organisation (WHO), UHC means that all people have access to the full range of quality health services they need, when and where they need them, without financial hardship. It covers the full continuum of essential health services, from health promotion to prevention, treatment, rehabilitation, and palliative care across the life course.[11] As Table 3 illustrates, Northern and Western European countries perform best, while many populations in Africa are facing barriers to essential services.

Table 3: Universal health coverage – top 5 and bottom 5 performing countries (EMEA)

Source: UHC service coverage index - SDG 3.8.1(WHO)

Top 5		Bottom 5	
1 Iceland	4 United Kingdom	1 Chad	3 South Sudan
2 Germany	5 Norway	2 Central African Republic	4 Madagascar
3 Portugal			5 Niger

11 World Health Organisation. *Universal health coverage (UHC)*; 2023. https://www.who.int/news-room/fact-sheets/detail/universal-health-coverage-(uhc)

Identifying and addressing disparities in access to essential care services is paramount in ensuring patients across the world have more equal opportunities for getting the treatment and care they require. Globally, our healthcare systems can only be truly resilient if they can serve patients regardless of geographic location and socioeconomic status.

When healthcare itself is a risk

Even with access to healthcare and treatment, patients face inherent risks associated with medical care, ranging from adverse effects of medications to treatment complications and HAIs.[12] These risks persist not only in low-and middle-income countries, but also in better-funded healthcare systems which may impact patients, the healthcare workforce, and the broader efficiency of the healthcare provision.

Healthcare-associated infections (HAI)

Estimates show that in Europe alone, 8.9 million distinct HAI episodes occur every year in acute care hospitals (ACH) and long-term care facilities,[13,14] as patients contract these infections while receiving care. With data showing that 42% of patients with a HAI are readmitted to hospital within 30 days,[15] the burden of these infections on the system is significant.

HAIs and other healthcare-associated injuries and diagnostic errors are events that can account for more than 65% of the cost and epidemiological burden[16] - with surgical site infections (SSIs) being particularly costly, accounting for an annual burden of of $3.5 to $10 billion due to extended length of stay, visits to accident and emergency departments (A&E) and readmissions.[17]

12 Organisation for Economic Co-operation and Development. *The economics of patient safety*; 2020. https://www.oecd.org/health/health-systems/Economics-of-Patient-Safety-October-2020.pdf

13 Suetens, C, Latour, K, Kärki, T, et al. Prevalence of healthcare-associated infections, estimated incidence and composite antimicrobial resistance index in acute care hospitals and long-term care facilities: results from two European point prevalence surveys, 2016 to 2017. PubMed. https://doi.org/10.2807/1560-7917.ES.2018.23.46.1800516

14 Suetens, C, Latour, K, Kärki, T, et al. Prevalence of healthcare-associated infections, estimated incidence and composite antimicrobial resistance index in acute care hospitals and long-term care facilities: results from two European point prevalence surveys, 2016-2017. PubMed. https://doi.org/10.2807/1560-7917.es.2018.23.46.1800516

15 PHC4. *The impact of healthcare-associated infections in Pennsylvania*, Accessed August 2022. https://www.phc4.org/wp-content/uploads/hai2010report.pdf

16 MarketResearch.com. Patient Safety in Healthcare. Forecast to 2022. Accessed July 4, 2022. https://store.frost.com/patient-safety-in-healthcare-forecast-to-2022.html

17 A Ban, Kristen, Minei, J, Laronga, C, et al. *Surgical Site Infection Guidelines*, 2016 Update. J Am Coll Surg. https://doi.org/10.1016/j.jamcollsurg.2016.10.029

Sepsis

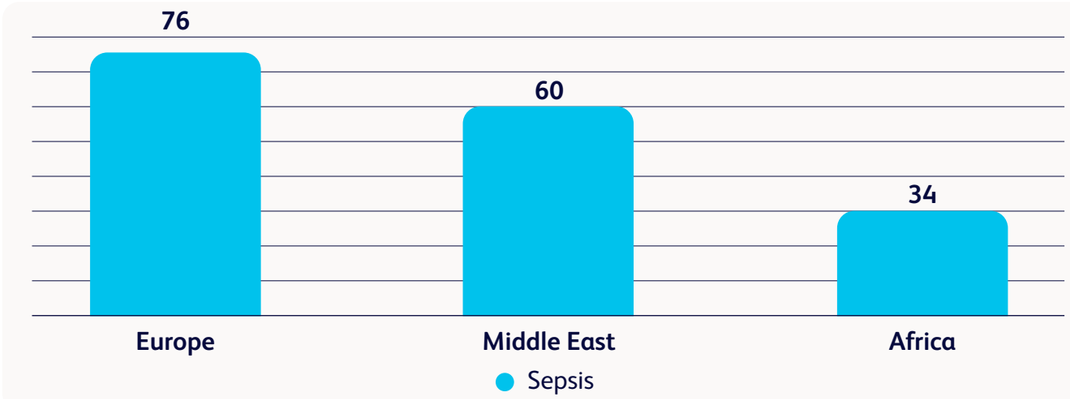
When looking closer at the topic of infections, one of the most pressing patient safety issues is sepsis.[18] On average, nearly 15% of patients in intensive care units (ICUs) experience severe sepsis, with 2 in 3 cases resulting in septic shock.[19]

Although the BD Healthcare Resilience Barometer demonstrates that out of the three EMEA sub-regions, the burden of sepsis is lowest in Europe and remains highest in Africa (see Figure 3), the costs associated are very high, even in the better-performing countries. In France, for instance, the per-patient cost of severe sepsis is estimated at €22,800.[20]

Figure 3: Sepsis incidence – average Barometer performance by region

Source: Sepsis ASIR per 100,000 (Lancet Publication)

Barometer scale: 100: high performance (low sepsis incidence) – 0: low performance (high sepsis incidence)



Errors and adverse effects of medical treatment

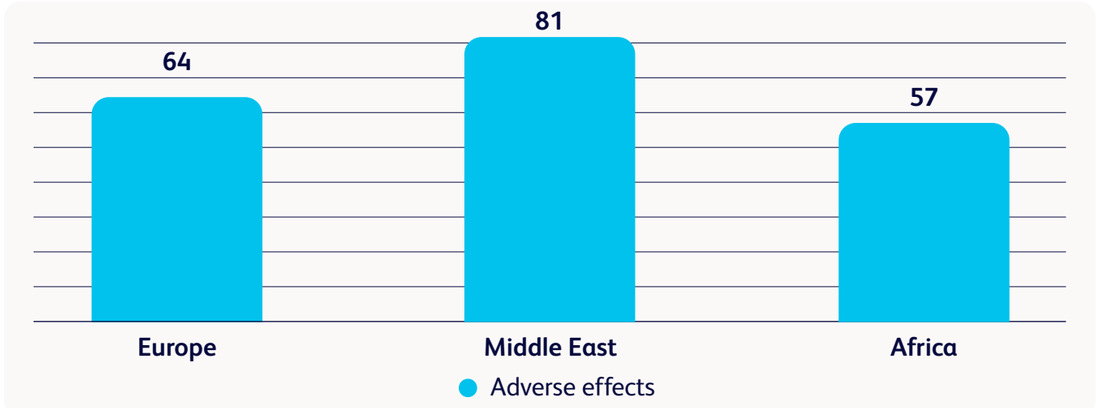
While the fundamental aim of medicine is to cure, the reality is that errors can occur – including mismanagement of medications, errors in administration, or prescription inaccuracies.[21] Even when no errors are made, medications and treatments can result in unexpected adverse reactions in patients.

A critical patient safety risk the BD Healthcare Resilience Barometer explores is the adverse effects of medical treatment.[22] The BD Healthcare Resilience Barometer data reveals (see figure below) that the Middle East outperforms Europe on this measure, with countries like Qatar and Kuwait performing particularly strongly. Meanwhile, healthcare systems in European countries like Greece and Slovenia grapple with a higher rate of **adverse effects**. It is important to note, however, that potential discrepancies in the consistency of patient safety incident reporting across countries may impact the data and should be taken into account when interpreting the findings.

Figure 4: Adverse effects of medical treatment – average Barometer performance by region

Source: Adverse effects of medical treatment – deaths (per 100,000) (IHME)

Barometer scale: 100: high performance (low prevalence of adverse effects) – 0: low performance (high prevalence of adverse effects)



18 World Health Organisation (WHO). *Patient Safety: Global Action on Patient Safety: Report by the Director-General*. Accessed August 3, 2022. https://iris.who.int/handle/10665/327526

19 Brun-Buisson. E*pidemiology of severe sepsis*, 2006. PubMed. https://doi.org/10.1016/s0755-4982(06)74627-9

20 Adrie, C, Alberti, C, Chaix-Couturier, C, et al. Epidemiology and economic evaluation of severe sepsis in France: age, severity, infection site, and place of acquisition (community, hospital, or intensive care unit) as determinants of workload and cost. J Crit Care, 2005. PubMed. https://doi.org/10.1016/j.jcrc.2004.10.005

21 Kopp, B, Erstad, B, Allen, M, Theodorou, A, Priestley, G. Medication errors and adverse drug events in an intensive care unit: direct observation approach for detection. PubMed. *https://doi.org/10.1097/01.ccm.0000198106.54306.d7*

22 World Health Organisation. *Patient Safety. Global Action on Patient Safety. Report by the Director-General*. https://iris.who.int/handle/10665/327526

Preventing errors and adverse effects

Estimates suggest that between 2 % and 14 % of patients in European hospital settings are subject to medication errors.[23] Despite advancements in medical science and quality improvement initiatives, the reality of healthcare-associated risks underscores the need for robust patient safety and infection prevention strategies to mitigate harms and safeguard not only the patients, but the wellbeing of all stakeholders involved in care delivery.

Importantly, with data indicating that half of all patient safety incidents are preventable,[24] collective efforts to elevate the standard of care and prevent adverse effects can yield significant economic benefits for countries.[25]

As healthcare systems recover from the shocks of the pandemic, the importance of ensuring quality care and patient safety beyond acute settings is also coming into focus.

The fight against drug-resistant pathogens

Having explored the burden of adverse effects of medical treatment and the potential improvement opportunities that could result from addressing these challenges, both from a clinical and a cost savings perspective, we now need to turn to what happens when antimicrobial medications simply fail to work.

Given its profound impact on the efficiency of healthcare provision worldwide, the growing threat of AMR is a fundamental issue in evaluating healthcare resilience from a patient safety perspective.

Annually, approx. 700,000

patients die from drug-resistant pathogen infection[26]

There are a range of factors contributing to this issue, including the inappropriate prescription of antibiotics.[27] AMR affects all sub-regions across EMEA, with the below table showing the lowest-performing countries in terms of AMR-related deaths. It is important to note that the AMR burden is significantly less prevalent in the Middle East with countries across the region achieving consistently strong scores.

Table 4: AMR-related deaths – bottom 5 performing countries by region

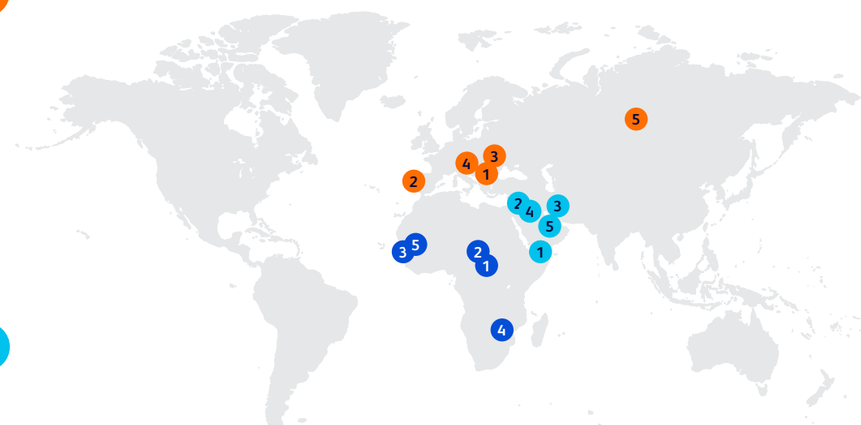
Source: AMR Deaths (IHME)

Europe

1. Bulgaria
2. Portugal
3. Romania
4. Serbia
5. Russia

Middle East

1. Yemen
2. Syria
3. Iran
4. Iraq
5. Bahrain



Africa

1. Central African Republic
2. Chad
3. Guinea
4. Lesotho
5. Mali

At BD, we believe that a collective commitment to elevating practices around antimicrobial use is fundamental to enhancing resilience in healthcare.

Studies have demonstrated that the initiation of appropriate versus inappropriate antibiotics can significantly reduce mortality, reduce treatment failure, and decrease length of stay, highlighting the importance of broad-spectrum empirical therapy and rapid diagnostics for early identification of the causative pathogen.[28]

This can alleviate the strain on healthcare workers and make care provision more efficient.

23 European Medicines Agency (EMA). *Streamlining EMA public communication on medication errors. European Medicines Agency Science Medicines Health;* 2015. https://www.ema.europa.eu/en/documents/other/streamlining-ema-public-communication-medication-errors_en.pdf

24 Organisation for Economic Co-operation and Development. *The economics of patient safety*; 2020. https://www.oecd.org/health/health-systems/Economics-of-Patient-Safety-October-2020.pdf

25 Organisation for Economic Co-operation and Development. *The economics of patient safety*; 2020. https://www.oecd.org/health/health-systems/Economics-of-Patient-Safety-October-2020.pdf

26 Wellcome Collection. *Antimicrobial resistance: tackling a crisis for the health and wealth of nations / the Review on Antimicrobial Resistance chaired by Jim O'Neill.* Accessed July 28, 2022. https://wellcomecollection.org/works/rdpck35v

27 CDC Archive. *CDC: 1 in 3 antibiotic prescriptions unnecessary*. https://archive.cdc.gov/#/details?url=https://www.cdc.gov/media/releases/2016/p0503-unnecessary-prescriptions.html

28 Bassetti, M, Rello, J, Blasi, F, et al. Systematic review of the impact of appropriate versus inappropriate initial antibiotic therapy on outcomes of patients with severe bacterial infections, 2020. *International Journal of Antimicrobial Agents*. https://doi.org/10.1016/j.ijantimicag.2020.106184

Key opinion leader perspective

Putting patients first is not just something to be encouraged – it must be at the heart of everything we do.

Dr Maria Cruz Martín Delgado

Past President, FEPIMCTI (Pan-American and Iberian Federation of Critical Medicine and Intensive Care), and Head of Department Intensive Medicine, Hospital Universitario 12 de Octubre, Madrid, Spain

Dr Martín Delgado's expertise in the field of intensive medicine, which spans across healthcare, teaching and research, has provided her with firsthand experience of the issues facing patient safety in the healthcare system, both in her home country, Spain, and internationally. In this conversation, Dr Martín Delgado discusses the role that organisational adaptability and shared responsibility play in ensuring continuous improvements in patient safety going forward.

Uncovering the unknown challenges

With extensive experience working in ICUs, Dr Martín Delgado is acutely aware of the pressure facing the healthcare workforce when trying to prioritise patient safety in highly stressful, emergency situations. Recalling the crisis brought about by the pandemic, she states that hospital staff "didn't have the knowledge nor the understanding of how best to respond to this unprecedented burden." Dr Martín Delgado believes that the key to patient safety lies in building adaptability – and resilience – within healthcare organisations.

Discussing the importance of preparedness, she explains that "the complexity of patient safety – especially in ICU – stems from the fact that the workforce is facing some unknown challenges and rapidly evolving situations. When looking at the issue of antimicrobial resistance (AMR), for instance, Dr Martín Delgado notes that "much more work needs to be done to properly quantify how often and in what circumstances it is occurring, and what factors influence the speed at which it develops."

"Not feeling prepared or empowered to respond to these challenges can take a significant emotional toll on healthcare staff." Dr Martín Delgado advocates for comprehensive competency programmes, detailing that practitioners should have access to training programmes that include a range of competencies from washing hands correctly, to handling sensitive information and managing crises. "Putting patients first is not just something to be encouraged – it must be at the heart of everything we do. And staff need to be trained accordingly" - she adds.

Responsibility at the core of patient safety

When asked about the future of patient safety, Dr Martín Delgado stresses that all improvements must be built upon a sense of shared responsibility. "This is not just on hospitals – politicians, industry, and individuals all have a role to play" - she says. "It is also key for patients and their families to be more engaged: they should be explained the different treatment options, and encouraged to participate, ask questions and learn about their treatments as opposed to blindly agreeing." Dr Martín Delgado believes that empowering patients in this way has a significant impact on overall the patient experience.

Industry is also seen by Dr Martín Delgado as having a critical role in transforming patient safety and health outcomes. "Digital innovation and technology are having a profound impact on how we work. Companies in the sector are introducing technologies that can make our work quicker, more effective, and safer for both patients and healthcare staff" - she notes. In addition, Dr Martín Delgado explains that technology also helps healthcare providers to adapt to new situations and provide more specialised care to each patient.

In wrapping up, Dr Martín Delgado reflects on the advances in patient care over the last decades. "The issues we are facing nowadays are not nearly as grave as they used to be. Most of the time, patients receive safe and effective care – but there are always opportunities to assess what works well and what can be improved" - she points out. Dr Martín Delgado concludes by reiterating the importance of continuous development and cross-border collaboration. "Patient safety is not a national issue – it is an international challenge that we all have a shared responsibility to address."

Key opinion leader perspective

> **Until we have healthcare systems that are commissioning for excellence across that spectrum, we are stifling innovation and our ability to deliver the very best to these patients.**

Dr Ron Daniels

Founder and Chief Executive of U.K. Sepsis Trust, England and Vice President of Global Sepsis Alliance

Dr Ron Daniels has years of experience and expertise in the field of sepsis care, both in the U.K. and on a global scale. He is an innovator and leader in the creation of the Red Flag Sepsis recognition tool and the Sepsis Six bundle. In this conversation, Dr Daniels discusses the challenges facing sepsis care in the U.K., including the link between infections and the climate, and how to improve infection control at a global level.

Resilience and equity

For Dr Daniels, the definition of healthcare resilience must be built around equity and equality. He believes that access to healthcare should be irrespective of socio-economic status, ethnicity and gender as "in a resilient healthcare system, we should not see the geographical variation in quality, access and outcomes." He notes that the current economic situation also has a disproportionate impact on the healthcare resilience of communities with predominantly low/middle incomes.

Speaking of the issues affecting sepsis prevention, diagnosis and management specifically, Dr Daniels highlights key demographic differences such as the increased sepsis-related risk of death in non-white children and adults from areas of higher socio-economic deprivation, demonstrated as particularly marked in those of Pakistani descent in the UK. Dr Daniels calls out the lack of investment in managing and addressing complaints around sepsis. He adds that while certain financial incentives have led to improvements in sepsis outcomes, we have subsequently seen sepsis performance monitoring decline.

Sepsis, climate and the future

Dr Daniels raises key points around the environmental impact of sepsis. He explains that there is an intrinsic link between sepsis, antimicrobial resistance (AMR) and climate change. "For example, the migration of pathogens beyond their typical habitat is accelerated by both climate change and the globalisation of people. Displacement due to factors like overcrowding, famine and malnutrition is also causing a more rapid spread of infection across countries" - he adds.

Further commenting on the link between sepsis and AMR, Dr Daniels says that while healthcare professionals do not want to over-prescribe antibiotics, they often do not have enough information to feel confident withholding them. He argues that the messaging to both HCPs and the general public needs to be repositioned. "AMR is not a future threat. The reality as we know it is that AMR is affecting people in their millions. It's here today, it is immediate, it is personal."

Concluding the conversation, Dr Daniels recommends healthcare commissioning for excellence in infection management, based on four pillars: pathogen surveillance and pandemic preparedness; infection prevention and control; rapid treatment and diagnosis of sepsis; and antimicrobial stewardship. "Until we have healthcare systems that are commissioning for excellence across that spectrum, we are stifling innovation and our ability to deliver the very best to these patients" - says Dr Daniels.

Key opinion leader perspective

Innovation from industry can ensure healthcare professionals are able to do their job in a more efficient way.

Dr Eva Marie Castro

Head of Quality at RZ Heilig Hart Tienen and PhD at The Institute for Healthcare Policy (LIHP) KU Leuven, Belgium

Dr Eva Marie Castro's experience within the healthcare sector has primarily revolved around patient care and is supported by her health policy-focused post-doctoral studies. In this conversation, she speaks about the need to amplify patient voices and discusses the role of industry innovation in enabling the healthcare workforce to operate more efficiently.

Patient-centred innovation

For Dr Castro, resilience in healthcare must be understood both at a system level and at the individual level. "Resilience is not just about how the system can adapt to crises, it's also about whether individual healthcare workers can adapt and whether patients are equipped with the knowledge and support to navigate and overcome the crises they may be facing in their healthcare journey" - she explains. At a system level, Dr Castro emphasises the need for planning for the long-term sustainability of each healthcare organisation and recommends The Flanders Quality Model (FlaQuM) to do so. At an individual level, she argues that patients must be actively engaged in the decisions made about the healthcare systems they rely on.

"We should focus more on co-creation with patients" - Dr Castro points out. "The voice of the patient, the patient's loved ones, and the patient associations still have less influence than necessary in the construction and evaluation of healthcare systems" - she adds. Dr Castro believes that all innovations aimed at building resilience should be developed in collaboration with patients. "Patients should be treated as equal partners in decision-making", she notes, stating that this approach is crucial in redesigning healthcare delivery and integrating innovation in a way that best serves the interests of patients.

Industry's role in increasing workforce efficiency and wellbeing

Acknowledging the burden on healthcare staff, Dr Castro says that rigidity in the legal and financial functions within healthcare often lead to limited access to technological innovation. "The legal and financial frameworks are actually a hindrance to adopting innovations that could promote a more resilient system" - she states. Dr Castro believes that against the backdrop of extended waiting times and treatment delays, the streamlining of internal processes is more important than ever.

"Across countries, the pressures on the workforce are significantly impacting the availability of personnel and the overall quality of care" - she notes, emphasising that access to technological innovation is key in increasing operation efficiency and therefore should be a priority for healthcare management everywhere. "Innovation from industry can ensure healthcare professionals are able to do their job in a more efficient way and can truly benefit their wellbeing. When technology makes processes more efficient, healthcare professionals can focus on the reasons why they chose the profession in the first place" - she concludes.

Key opinion leader perspective

Collaboration, not only in hospitals, but beyond the walls of the hospital, it is going to be the new normal.

Dr Ilke Montag
Chairman of Board of Directors at THE Institute and 'De Maakbare Mens' (Home - De Maakbare Mens) and Medical Policy Advisor at Socialist Mutual Funds, Belgium

In our conversation, Dr Montag discusses the importance of the patient voice in the provision of quality care, as well as the need for a centralised digital system to reduce waste and facilitate smoother communication and distribution of information.

Healthcare resilience requires all the cogs to keep turning

Early on in our conversation, Dr Montag highlights several contributing factors to healthcare resilience – "flexibility and adaptability, emotional resilience, collaboration, self-care and continuous learning and improvement are the cogs in the wheel of ensured healthcare resilience."

The current macro issues affecting the system include potential pandemics, climate change and environmental disasters. These issues can affect the flexibility of healthcare systems, with staff shortages and burnout contributing to further disruptions to healthcare delivery. Dr Montag states that addressing these issues requires an integrated approach at all levels. It must be "aimed at strengthening health systems, improving access to affordable care and medicines, reducing inequities, and ensuring the quality and safety of care provided."

The COVID-19 pandemic, while it brought about increased opportunities for technology and different ways of delivering care, had a significant impact on care in Belgium. Challenges arose that resulted in issues of hospital overload, postponement of non-essential care, impacted mental wellbeing and changes in healthcare protocols and procedures.

Dr Montag declares that an important part of the resolution is "collaboration, not only in hospitals, but beyond the walls of the hospital, it is going to be the new normal." Additionally, she calls for a move away from a fee-for-service financial model towards one that encompasses Pay for Performance (P4P)/Pay for Quality (P4Q), welcoming moves towards a value-based model.

Giving patients a choice in their care

On the topic of patients, Dr Montag stresses that better communication across teams should be a priority when improving the system in Belgium. "The different groups need to really start working together; now, too often, people work side-by-side and not with each other." Throughout our conversation, Dr Montag emphasises the inclusion of the patients themselves in discussions about their care, calling it "necessary to patient empowerment and engagement."

To facilitate this, she speaks of the importance of valuing the patient voice from as young an age as possible to maintain their confidence to speak up for themselves about their options and the care they wish to receive. When presented with decisions to make regarding their care, Dr Montag explains that this is often a time for reflection for patients. Patients should be given the choice about the route they want to take and how it will shape their future.

Key opinion leader perspective

All avoidable deaths are linked to some type of patient safety issue.

Denis Herbaux

CEO at PAQS and Deputy CEO at Santhea, Belgium

Denis Herbaux holds around a decade of experience and expertise in facilitating patient care and supporting public health in Belgium's healthcare sector. In this conversation, Herbaux speaks on the issues affecting patient safety and the importance of education in improving quality of care.

Bureaucracy and resilience

With a decade of experience in optimising healthcare and patient safety, Denis Herbaux's vision for better resilience in Belgium is built on the streamlining and simplification of bureaucratic processes. He believes that the complexity embedded within Belgian healthcare limits the system's ability to react to change. "Competencies are split between the federal and regional level. Hospitals are mostly financed by the federal level, but their norms, standards and the healthcare training for staff are mostly established at the so-called regional level."

This multilayered governance model, Herbaux argues, can pose a significant challenge to healthcare resilience. However, he points out that the learnings from the pandemic have been instrumental in encouraging a shift towards a more agile approach.

"The healthcare system felt like a war zone – but the gravity of the situation meant that we were forced to learn how to act, make decisions, and adapt quickly."

The role of education in patient safety

Turning to patient safety, Herbaux is quick to emphasise the gravity of the issue. "All avoidable deaths are linked to some type of patient safety issue" – he claims. Herbaux feels that patient safety is currently not at the top of the agenda. "Belgium is not talking enough about patient safety and the budget allocated to the issue is also very limited."

While Herbaux believes that healthcare decision-makers hold a significant responsibility to take action, he thinks that true resilience requires a reform of healthcare education as well. "What is taught in medical and nursing schools should be revised to make future healthcare professionals aware that they will be working in a very complex environment, and that this kind of environment can lead to safety issues" – he states. Those who want to work within the patient care sector need to be prepared to handle complex scenarios as a team while also having the ability to make individual decisions."

Key opinion leader perspective

We could see that the patients' voice was heard, but now it's being amplified, and it's really been taken into consideration.

Dr Neda Milevska Kostova

Immediate Past Chair of the International Alliance of Patients Organisations (IAPO), U.K.

With more than 20 years of experience in health research, policy and patient advocacy, Dr Neda Milevska Kostova is a key leader in patient and caregiver engagement. In this conversation, Dr Kostova offers a patient perspective on how the role of the patient is integral to system efficiency and to the future of sustainable healthcare.

The value of patient perspectives

Dr Kostova begins with a positive post-pandemic reflection that patients now have the opportunity to be far more vocal in healthcare discussions. "We could see that the patients' voice was heard, but now it's being amplified, and it's really been taken into consideration, the lived experiences of people." Dr Kostova expresses her hopes for this to become a lasting influence, that the lived experience of patients can be shared to provide understanding to others and support them in maintaining a quality of life – "for what we call expert patients to really be used as expertise to support the sustainability of future healthcare [systems]."

As for using their voice going forward, Dr Kostova says patient expectations are focused on investing upstream in preventive healthcare. She explains that our health largely depends on environmental, social and lifestyle determinants and, therefore, "when things come to the point of knocking on the door of the healthcare system, it often means already many chances have been missed to prevent disease and ill-health." Dr Kostova echoes this sentiment with the statement that it is impossible for healthcare systems to satisfy every healthcare need, and emphasises the importance of every individual taking as much care of themselves as possible.

Importance of reliable information when providing value

On the topic of value-based care, Dr Kostova considers that the roll-out and provision of this type of care is dependent on culture, as she says "creating the adapted solution for each context in each country" would be most appropriate because "…what is considered common value for one country, might not yet be achievable for another."

Continuing on the topic, Dr Kostova comments that value is also dependent on societal perceptions and the salience of different types of information. In cases of information abundance or asymmetry, this can influence how society perceives value. This, in turn, can influence choices at both individual and system levels, such as the top priority treatments or care.

Finally, Dr Kostova believes it is the provision of reliable information, education and explanation that will improve the acceptability of innovation among the patients while driving the sustainability in the healthcare system. To achieve this, we must foster a partnership approach between healthcare providers and patients working together.

Key opinion leader perspective

Dr Ruth Hecker

Chairwoman of Patient Safety Action Alliance and Chief Patient Safety Officer at University Hospital Essen

> **The general population should have access to transparent numbers, data and facts. Being well-informed will encourage them to be loud when they have the feeling something is wrong.**

Dr Hecker's role as Chief Patient Safety Officer at University Hospital Essen equips her with a valuable perspective on the topic of patient safety, as she speaks of the need for greater recorded transparency of patient experiences and data in order to build resilience among both patients and the wider healthcare system. While similar positions exist in other hospitals in Germany, Dr Hecker stresses that the role of 'Patient Safety Officers' should be made more visible throughout the sector.

The need for transparent patient safety data

A key step towards building resilience, Dr Hecker begins, is around more efficient use of data in healthcare. "The parties involved must have a common will to make figures, data and facts transparent" - she says. Dr Hecker believes that data usage and transparency in healthcare currently lags behind other sectors like nuclear energy, aviation and banking – despite the fact that health is also a sector where errors can have serious consequences. She recommends a more detailed, accurate, and trackable record-keeping of mistakes or errors that can be used to establish goals for reduction and prevention of repeated incidences. "I think it would be great if I went through a hospital or doctor's office and it said, 'For 400 days, we haven't confused a patient or mixed up medicines.'" The introduction of the Transparency Act will be a useful first step, Dr Hecker says, but she would like to see annual improvements made to the register to eventually ensure transparency in all areas of healthcare provision.

At the core of the conversation with Dr Hecker is the need for consensus among stakeholders to prioritise patient wellbeing above all else. This, she says, will require efficient cooperation and collective commitment globally to ensuring the safety and provision of quality care to patients. Commenting on the challenges around coordination across the healthcare system in Germany, Dr Hecker says that "coordination is what is missing in politics, both at the regional, state and federal levels, and also in the various institutions." Instead, "new corporations and institutions are repeatedly formed that do not bring any added value to the citizens."

Prospects of healthcare reform

On the topic of the upcoming healthcare reform in Germany, Dr Hecker expresses a generally positive attitude but highlights a gap in consideration for outpatient care. She recognises that, while this will lead to significant changes in process, private sponsors that have pioneered in this area are modelling and implementing it well.

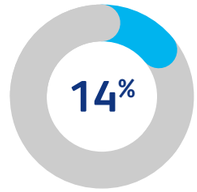
Dr Hecker is particularly optimistic about the amplified voice the healthcare reform will provide patients. Citing the Patient Reporting Experience Measures that are available internationally from health insurance companies, she questions why these responses cannot be collected as a standard throughout Germany. For medical professionals, this would allow the observation of regional differences in patient recorded experiences which would then facilitate the analysis of what works and does not work in different areas of the healthcare sector in Germany, and ultimately build resilience. Reiterating the value of collecting data, Dr Hecker advocates for the value this can provide patients. "The general population should have access to transparent numbers, data and facts. Being well-informed will encourage them to be loud when they have the feeling something is wrong" - she concludes.

Elevating the standard of care through surveillance

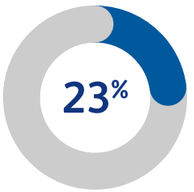
In the face of the variety of patient safety risks explored in this chapter, the way forward lies in developing and adopting a whole-system approach that includes robust frameworks for antimicrobial stewardship. The BD Healthcare Resilience Barometer reveals that although countries have started to recognise the importance of these initiatives, there remains a long way to go.

Across Europe, countries with comparatively strong healthcare systems score poorly on the indicators assessing the reported prevalence of HAI surveillance systems in healthcare settings – with Ireland, the Netherlands and Belgium key examples of this issue. More progress seems to have been made in Scandinavian countries, with Norway performing well on both HAI surveillance and the presence of HAI guidelines for hospital staff.

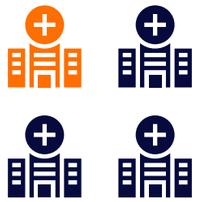
Despite the recognition that most medication errors could be preventable,[29] BD market research, Medication Errors survey, has found that:



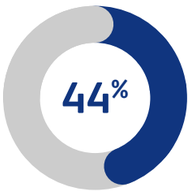
of hospitals do not routinely track medication errors,[30]



do not use route cause analysis about such errors,



and one-in-four hospitals are not aware of the number of medication errors registered.



Even more notably, almost half of hospitals do not have trained healthcare staff to detect medication errors.[30]

With the growing amount of research conducted on preventing patient safety incidents, cross-stakeholder collaboration is fundamental in our shared ambition to elevate the standard of care.

By pooling resources and insights across industry, academia, and governments, we can unlock opportunities to facilitate patient recovery and improve patient experiences, while also empowering healthcare staff to work more efficiently and to optimise healthcare operations.

Together, we can build momentum to tackle the challenges ahead, and build safe and resilient systems for patients.

29 Lahue BJ, Pyenson B, Iwasaki, K, Blumen, H, Forray, S, Rothschild, J. National burden of preventable adverse drug events associated with inpatient injectable medications: healthcare and medical professional liability costs. *Am Health Drug Benefits*. 2012;5(7):1-10. https://pubmed.ncbi.nlm.nih.gov/24991335/

30 European Collaborative Action on Medication Errors and Traceability – ECAMET, 2022. https://ecamet.eu/

Chapter 2
Healthcare workforce

Although the discourse surrounding healthcare resilience today tends to centre around the intricacies of systems and structures, it is essential not to overlook the fundamental fact that care is ultimately delivered by individuals. Behind every medical breakthrough, every successful treatment, and every comforting word, there are healthcare professionals who have dedicated their lives to taking care of others.

Recent years have shone a glaring spotlight on the challenges faced daily by healthcare workers, whether related to working conditions, underfunding, lack of planning or other obstacles that hinder efficient and safe care delivery.[31] Just as patient safety is integral to healthcare resilience, so too is the wellbeing and safety of the healthcare workforce. Efforts aimed at strengthening the resilience of healthcare systems must prioritise alleviating the burden on staff and ensuring they have the support and resources necessary to deliver safe, high-quality care.

In this chapter, we examine the state of the healthcare workforce in countries across EMEA, looking at issues ranging from staff-to-patient ratios, ageing workforces, staff burnout and occupational health and safety.

31 Michel JP, Ecarnot F. The shortage of skilled workers in Europe: its impact on geriatric medicine. *Eur Geriatr Med*. 2020;11(3):345-347. doi:10.1007/s41999-020-00323-0

Figure 5: Map showing overall 'healthcare workforce' Barometer scores at EMEA level

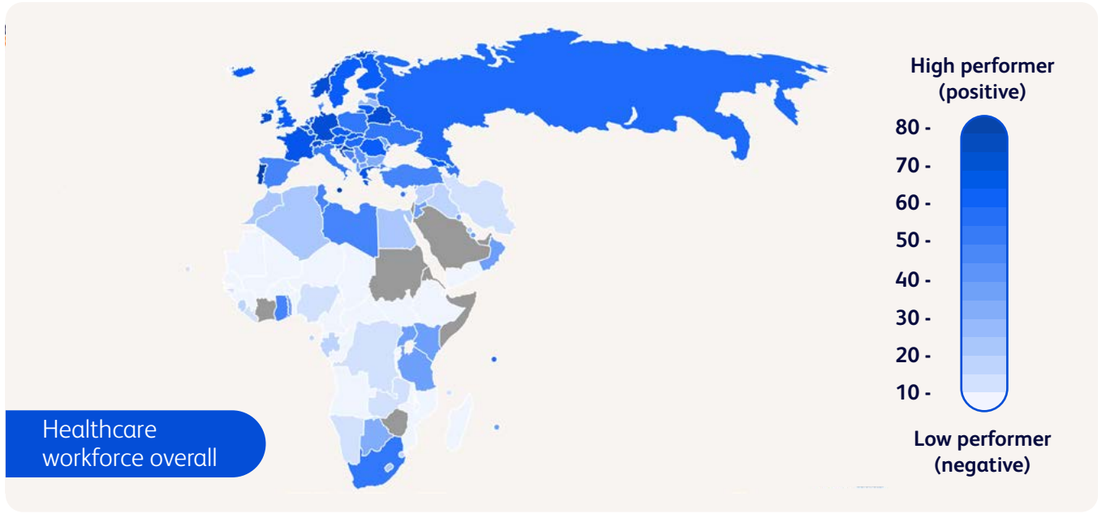


Table 5: Overall Barometer performance 'healthcare workforce' – selected countries (in ranking order)

Countries (in ranking order)	EMEA ranking (out of 100 countries)
1. Germany	4th
2. Ireland	7th
3. Switzerland	8th
4. France	9th
5. Belgium	10th
6. United Kingdom	13th
7. Sweden	14th
8. Netherlands	15th
9. Italy	28th
10. Poland	31st
11. Spain	35th
12. Denmark	36th

Disclaimer: For the BD Healthcare Resilience Barometer report, our primary objective was to provide a comprehensive view of healthcare systems' resilience across Europe, the Middle East and Africa (EMEA). To ensure the relevance and applicability of our findings, we consulted with a wide range of key opinion leaders across the region. During our interviews, it became apparent that while a broad overview is essential, there is also a need to delve deeper into regional performance and explore how challenges in patient safety, healthcare workforce and efficiency continue to impact the resilience of more advanced healthcare systems in Europe. The inclusion of figures focused on a select group of countries serves to enrich the analysis and provide deeper insights into regional healthcare dynamics.

Staff shortages and demographics

The issue of workforce shortages has been at the centre of discussions around healthcare resilience in recent years. The World Health Organisation's estimates show that by 2030, there could be a global shortfall of 18 million health workers, mostly in low- and lower-middle income countries.[32] While the challenges around workforce gaps existed before the pandemic, surveys of healthcare workers' associations have shown a significant increase in nurses who left the profession in 2020, as a result of the strain of COVID-19.[33]

The pressure on the healthcare workforce – and on individual workers – is exacerbated when staff-to-patient ratios are low within a healthcare setting.[34]

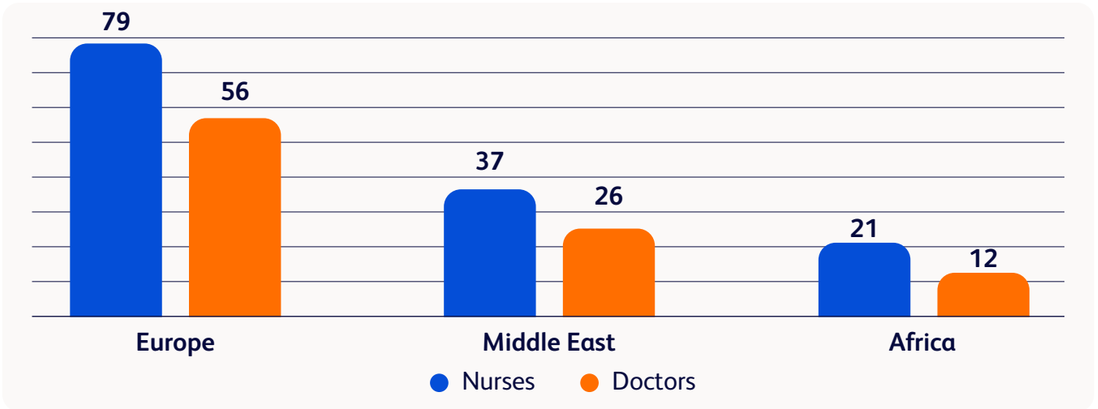
The findings of the BD Healthcare Resilience Barometer show that Europe far outperforms the Middle East and Africa when it comes to both nurse-to-patient and doctor-to-patient ratios in the healthcare system.

Figure 6: Staff-to-patient ratio (nurses/doctors) – Barometer scores by region

Source: Nursing and midwifery personnel (per 10,000) (WHO)

Medical doctors (per 10,000) (WHO)

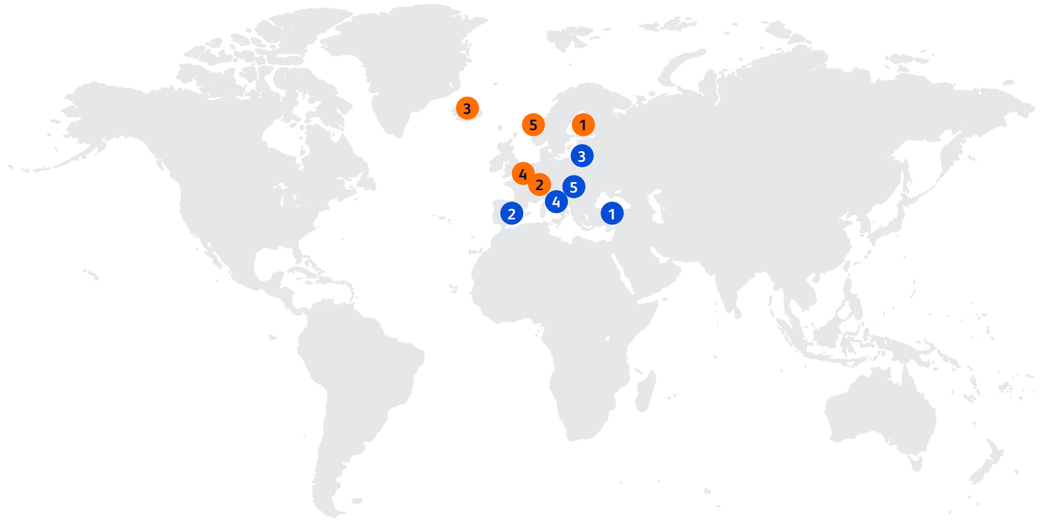
Barometer scale: 100: High performance (low staff-to-patient ratio (nurses/doctors)) – 0: Low performance (high staff-to-patient ratio (nurses/doctors))



To understand healthcare resilience challenges from a workforce perspective, it is also useful to look beyond the number of nurses and doctors available and understand how the ratio of nurses to doctors impacts care delivery. This ratio is important because having a sufficient number of nursing staff available to support physicians can positively impact both the efficient delivery of medical procedures and the opportunity for physicians to allocate their time optimally. Within the European region, the BD Healthcare Resilience Barometer shows disparities in country performance for this indicator (see top and bottom performing countries in Table 6).

Table 6: Nurse-to-doctor ratio – top 5 and bottom 5 performing countries (Europe)

Source: Ratio of nurses to doctors (OECD)



Top 5		Bottom 5	
1 Finland	4 Luxembourg	1 Turkey	4 Italy
2 Switzerland	5 Norway	2 Spain	5 Slovakia
3 Iceland		3 Latvia	

32 World Health Organisation. *Health workforce*. Accessed February 8, 2022. https://www.who.int/health-topics/health-workforce#tab=tab_1

33 International Council of Nurses (ICN). *The Global Nursing Shortage and Nurse Retention*, 2021. https://www.icn.ch/sites/default/files/inline-files/ICN%20Policy%20Brief_Nurse%20Shortage%20and%20Retention_0.pdf

34 Wang L, Lu H, Dong X, et al. The effect of nurse staffing on patient-safety outcomes: A cross-sectional survey. *J Nurs Manag*. 2020;28(7):1758-1766. https://doi.org/10.1111/jonm.13138

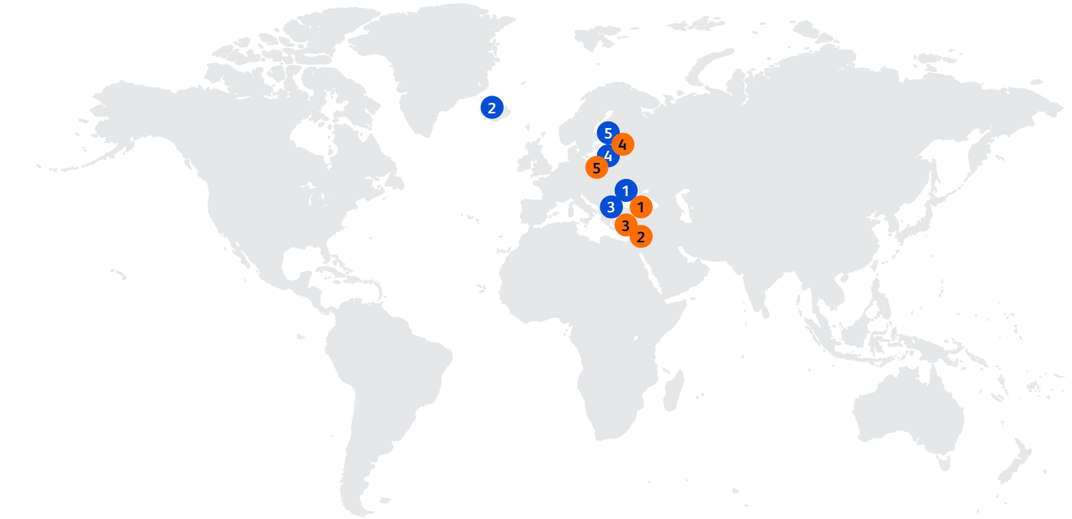
Delving into the demographics of the workforce is crucial for identifying areas where the risk of shortages is the highest and thereby enabling proactive interventions to ensure uninterrupted care provision in the course of the patient's care journey.

Data shows that with existing nursing shortages combined with the ageing of the nursing workforce and the growing COVID-19 effect, up to 13 million nurses could be needed to fill global shortages in the next few years.[35]
In Europe specifically, the growing proportion of healthcare workers aged over 55 means that the ageing of the workforce is a key concern that poses a threat to the sustainability and resilience of healthcare.[36]

As Table 7 illustrates, countries in South-Eastern Europe have the youngest nursing staff comparatively, while those further north face greater risks from an ageing workforce.

Table 7: Nurses aged above 55 – top 5 and bottom 5 performing countries (Europe)

Source: Nurses 55 and above (WHO)



Top 5		Bottom 5	
1 Turkey	4 Belarus	1 Moldova	4 Lithuania
2 Cyprus	5 Slovakia	2 Iceland	5 Latvia
3 Greece		3 Bulgaria	

35 International Council of Nurses (ICN). *The Global Nursing Shortage and Nurse Retention*, 2021. https://www.icn.ch/sites/default/files/inline-files/ICN%20Policy%20Brief_Nurse%20Shortage%20and%20Retention_0.pdf

36 World Health Organisation. *Health and care workforce in Europe: time to act*. Accessed November 18, 2022. https://www.who.int/europe/publications/i/item/9789289058339

Staff mental and physical wellbeing and safety

While having enough healthcare professionals is undeniably essential, the availability of staff in itself does not guarantee the resilience of the workforce. True resilience is dependent on the wellbeing of healthcare workers – both mentally and physically. From the emotional burden of caring for patients in distress to the physical demands of long hours and high-intensity work environments, and the risk of exposure to and manipulation of hazardous drugs, healthcare professionals face a myriad of challenges that can compromise their overall wellbeing[37] and – in turn – undermine their ability to provide optimal care to patients.[38,39]

Escalating workloads can lead to an increase in patient safety incidents,[40,41] which cause harm not only to the patients but to the healthcare professionals as well.[42] Patient safety adverse events have an often long-lasting emotional impact on healthcare workers.[43] Involvement in a patient safety incident is reported to result in a greater risk of burnout, excessive alcohol consumption, and problematic medication use among healthcare staff.[44]

The BD Healthcare Resilience Barometer shows that burnout is prevalent among healthcare staff across EMEA, and some Western European countries score particularly poorly on this measure (see figure 7).

37 Occupational Health and Safety Administration. *Healthcare*. https://www.osha.gov/healthcare

38 Hall, L, Johnson, J, Watt, I, Tsipa, A, O'Connor, B. *Healthcare Staff Wellbeing, Burnout, and Patient Safety: A Systematic Review*. PLOS ONE. https://doi.org/10.1371/journal.pone.0159015

39 Madsen MD, Cedergreen P, Nielsen J, Østergaard D. Healthcare professionals' perception of their working environment and how to handle mental strain. *Acta Anaesthesiol Scand*. 2023;67(7):979-986. doi:10.1111/aas.14249

40 Dall'Ora C, Ball J, Reinius M, Griffiths P. Burnout in nursing: a theoretical review. *Hum Resour Health*. 2020;18(1):41. Published 2020 Jun 5. doi:10.1186/s12960-020-00469-9

41 Madsen MD, Cedergreen P, Nielsen J, Østergaard D. Healthcare professionals' perception of their working environment and how to handle mental strain. *Acta Anaesthesiol Scand*. 2023;67(7):979-986. doi:10.1111/aas.14249

42 Madsen MD, Cedergreen P, Nielsen J, Østergaard D. Healthcare professionals' perception of their working environment and how to handle mental strain. *Acta Anaesthesiol Scand*. 2023;67(7):979-986. doi:10.1111/aas.14249

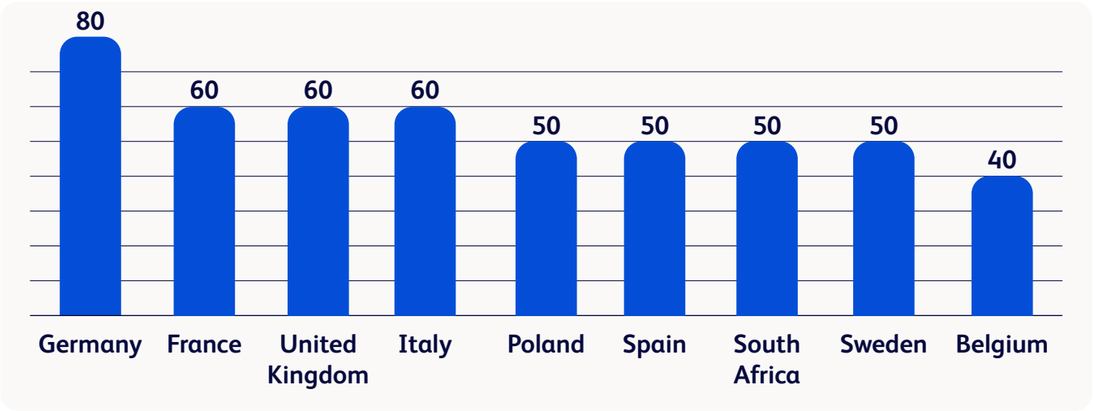
43 Ullström, S, Sachs, M, Hansson, J, Øvretveit, J, Brommels, M. Suffering in Silence: a qualitative study of second victims of adverse effects, 2014. *British Medical Journal*. https://qualitysafety.bmj.com/content/23/4/325

44 Van Gerven E, Vander Elst T, Vandenbroeck S, et al. Increased Risk of Burnout for Physicians and Nurses Involved in a Patient Safety Incident. Med Care. 2016;54(10):937-943. doi:10.1097/MLR.0000000000000582

Figure 7: Staff burnout – Barometer scores by country (selected EMEA countries)

Source: Havas Lynx - Healing the Healers (Point.1 data) (Havas Lynx) complemented by additional market research

Barometer scale: 100: high performance (low burnout rate) – 0: low performance (high burnout rate)



While high-intensity, fast-paced environments are a key factor in healthcare workers developing burnout, it is not only ICU staff who are affected. Research has found that over half (51 %) of pharmacists are also experiencing burnout.[45]

When considering the issues, such as preventable medication errors (discussed in Chapter 1 of this report), it becomes clear that building healthcare resilience requires a thorough understanding of the interconnected nature of staff wellbeing, patient safety and efficient care delivery.

As for the economic benefits of improving the wellbeing of healthcare staff, a US study has suggested that $4.6 billion in healthcare spending are estimated to be related to physician turnover and reduced clinical hours attributable to burnout.[46]

Occupational health and safety (OHS) policies are designed to deliver high-quality care effectively and sustainably. However, the BD Healthcare Resilience Barometer found that many countries lack comprehensive national policy instruments to address OHS within healthcare settings. Denmark, Finland, and Luxembourg are a few examples of European countries where such policies do not exist at a national level.

The introduction of formalised frameworks and regulations can help ensure that healthcare workers are not left vulnerable to preventable occupational hazards, and - importantly – create consistency and a culture of accountability across healthcare systems.

Protecting the wellbeing of the healthcare workforce can unlock a tremendous opportunity to foster resilience and sustainability within hospitals and healthcare systems at large.

By working collaboratively to prevent harm, attract new talent to the profession and mitigate the risk of shortages, the healthcare sector can enhance the continuity and quality of care for patients worldwide.

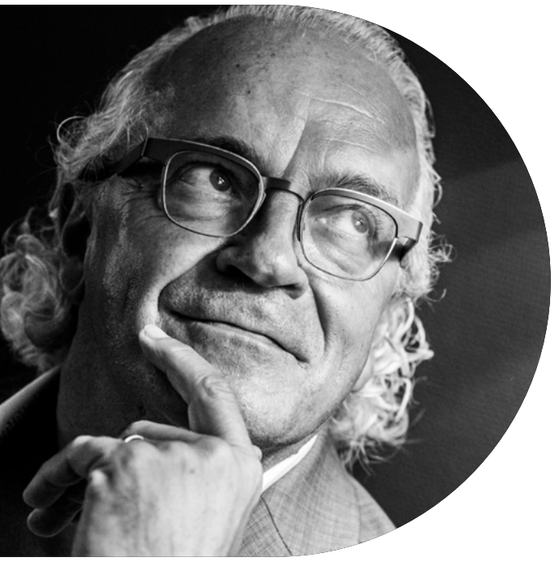
These initiatives, however, cannot exist in isolation. Rather, they need to be integrated with efforts aimed at improving patient safety and those enhancing operational efficiency – something we explore in the next chapter of this report.

Holistic approaches that recognise the interconnected aspects of healthcare resilience can pave the way for a more robust and sustainable future in healthcare delivery.

45 Dee, J, Dhuhaibawi, N, Hayden, J. A systematic review and pooled prevalence of burnout in pharmacists. *Int J Clin Pharm 45*, 1027–1036 (2023). https://doi.org/10.1007/s11096-022-01520-6

46 Chan, S, Shanafelt, T, Sinsky, C, et al. Estimating the Attributable Cost of Physician Burnout in the United States, 2019. *Ann Intern Med*. https://doi.org/10.7326/M18-1422

Key opinion leader perspective



> **It is the sum of a series of small and large actions which can create an intangible culture of appreciation in a hospital.**

Marc Noppen
CEO at University Hospital UZ Brussels, Belgium

With around two decades of experience as the CEO of a university hospital and a background in clinical and interventional pulmonology, Marc Noppen shares his vision for building resilience in the healthcare system. He discusses evolving approaches to building a healthy workforce culture and how MedTech can support the patient-provider relationship.

Workforce: overwhelmed and under-appreciated

For Marc Noppen, the greatest challenge to healthcare resilience lies in the state of the workforce. Discussing the post-pandemic capacity issues in healthcare systems globally, he says that most efforts to build resilience fail due to "a schism between the acute need for a robust workforce and the number of skilled professionals who are available – and willing – to work under the current circumstances." He observes that an ageing population coinciding with the restricted inflow of new doctors as well as the age-outflow and task multiplication of nursing staff is resulting in a higher percentage of the workforce feeling overwhelmed, taking sick leave or leaving their jobs. "The shortage of personnel leads to increased waiting lists, ward closures, and increased pressure on the remaining workforce, which becomes a vicious cycle" - Noppen explains.

Building a robust workforce, however, does not simply mean retaining a sufficient number of staff. Noppen emphasises that the sustainability and resilience of any healthcare organisation depend on the leadership's ability to prioritise and improve the wellbeing of the workforce and the culture of operations. "We have to lead by example and show appreciation in how we relate to people" - he says. "It is the sum of a series of small and large actions which can create an intangible culture of appreciation in a hospital that can help build a sustainable, resilient healthcare system" - Noppen adds. Noppen further observes that people who work in healthcare are largely motivated by intrinsic factors that are built on a foundation of autonomy, mastery and purpose – and a resilient culture must therefore reflect these qualities.

Health for sustainability

Noting that Belgium's healthcare system remains volume-driven, with fee-for-service as the main mechanism for reimbursement and financing, Noppen emphasises that a switch in focus is required, and the primary objective of healthcare should be to support people in retaining good health and preventing illness. "As it stands, the Belgian system benefits financially from its hospitals being at capacity. This is not sustainable in the long-term, and we need to reframe how we think about the purpose of healthcare" - he says.

Noppen is enthusiastic about the introduction of AI and generative AI to healthcare. "I truly think it will be a game-changer in easing the workload for doctors and nurses." He adds that examples of generative technology, such as genAI-supported speech-to-text systems, can play a key role in the automation of various workflows. "That it can record patient consultations removes much of the process for doctors and, allows them much more time to interact with their patients."

Key opinion leader perspective

Industry can often provide alternative viewpoints and feedback that helps healthcare providers implement improvements and develop more resilient strategies for patient care.

Healthcare workforce expert, France

This KOL perspective captures an interview with a healthcare workforce expert. With over a decade of experience as a hospital director in France, they offer insight into how to provide effective care to both patients and healthcare workers. In our conversation, they discuss the importance of culture as a central element at all levels of an organisation, as well as how the adaptability of the healthcare system can support workers' wellbeing.

Ecosystem-driven decision-making

Culture, the healthcare workforce expert believes, is an essential component of a well-functioning healthcare system. "A resilient workforce is one that is able to adapt to changing conditions on a daily basis – and this is the mission that has to be placed at the centre of an organisation's culture." They state that this requires management of healthcare providers to have a thorough and accurate understanding of their organisation's ecosystem. "Leaders can only make effective management decisions if they know what is going on in their organisation, where the inefficiencies are, and which areas are under-resourced" - they explain.

However, they argue that culture is something that needs to be ingrained at all levels of the organisation. "We need to cultivate a culture of resilience in the healthcare system, and all levels of staff must be involved." Emphasising the importance of motivating the workforce, they note that staff need to understand "not just what the issues are, but how those problems can be solved and why." Linking challenges with individual perspectives can encourage proactive problem-solving, they add.

The expert notes that resilience needs to be understood holistically and can only be achieved through collaboration with other stakeholders such as local councils, policymakers, and industry. "Sharing best practice is vital" - they argue. Highlighting the benefits of industry partnerships specifically, they point out that "industry can often provide alternative viewpoints and feedback that helps healthcare providers implement improvements and develop more resilient strategies for patient care."

Prioritising workforce wellbeing

Discussing the state of today's healthcare workforce, they note that organisations' policies need to be adapted to reflect the changing needs of their staff. "Ageing workforce, of course, is a key challenge that we are facing. Leaders tend to think that there is nothing they can do about this – but that is not the case." They propose that hospitals could introduce mentorship programmes, where each younger worker is assigned to an older partner who can help them with their progression and development. "This would be a win-win situation because the older workforce can train a new generation of professionals whose support they can then rely on" - they explain.

Touching briefly on the impact of the pandemic on the healthcare workforce, they speak about the mental health aspect – albeit from a unique perspective. While the issue of healthcare workers' burnout has been widely talked about in the past four years, they highlight a different challenge that stems from the reorganisation of workflows in hospitals. "The pandemic necessitated a shift towards more independent work. We are truly starting to see the negative impact of this isolation on staff wellbeing" - they explain. "Efficiency must, of course, be a primary consideration, but if we want to prevent burnout, I believe that we have to try and bring back some of the old ways of working that are more collegiate."

Key opinion leader perspective

> **Technology presents endless opportunities for the future of healthcare, but the pace at which medical technology is evolving can be difficult to keep up with.**

Dr Jose Luis Cobos Serrano

Vice President III of General Nursing Council of Spain and Member of the Board of Directors of the International Council of Nursing (ICN), Spain

Dr Jose Luis Cobos Serrano holds three decades of experience as a healthcare professional in Spain and has also held high-level positions in healthcare organisations in which he has been responsible for matters such as training and quality assurance. In this conversation, Dr Cobos Serrano outlines the importance of providing comprehensive training for the healthcare workforce to enable them to effectively leverage innovations offered by the MedTech industry.

Empowering the workforce

Most of the discussions around healthcare resilience, Dr Cobos Serrano argues, are centred around the need to strengthen and replenish the healthcare workforce. However, he believes that an important point that is often overlooked is the fact that having a robust workforce is not in itself enough to ensure that healthcare organisations operate more efficiently. “Workforces often don’t have the flexibility to actually embrace and utilise the latest innovation” - Dr Cobos Serrano points out.

“Technology presents endless opportunities for the future of healthcare, but the pace at which medical technology is evolving can be difficult to keep up with” - he explains, adding that funding in healthcare organisations should be allocated not only to procure cutting-edge MedTech devices, but also to ensuring that the workforce is trained to use these technologies confidently. “To prevent the health system from stagnating, we need to empower those delivering care to evolve with it.”

Sharing responsibility

A prominent challenge currently facing the healthcare workforce, according to Dr Cobos Serrano, is that society is asking more of its healthcare professionals. He says, “In the past, healthcare professionals were expected to adopt a paternalistic approach to providing care but now face more demand from patients and communities.” As an integral component of healthcare resilience, Dr Cobos Serrano is concerned for the wellbeing of the workforce – both physical and mental.

“It is not the sole responsibility of the workforce to improve healthcare provision” - he argues, stating that essential to the resolution of these issues are the various stakeholders influencing the healthcare system. To build a competent and qualified workforce, Dr Cobos Serrano calls on private healthcare managers and administrators to conduct efficient recruitment with sufficient funding to ensure those who are hired are retained and suitable to action the long-term improvements required for the system. He concludes by calling on policymakers and politicians to fulfil their respective roles and responsibilities by ensuring budget to finance public awareness campaigns.

Key opinion leader perspective

Ana Nicholls
Director of Industry Analysis at The Economist Intelligence Unit (EIU), U.K.

Ana Nicholls specialises in global economic development and is an expert on government industrial and business policy, working closely with clients in the healthcare and automotive sectors. In this conversation, Nicholls offers a macroeconomic perspective to the future of sustainable healthcare, touching on topics such as workforce continuity and health expenditure.

Healthcare workers in high demand

Nicholls sees the skyrocketing demand for skilled healthcare workers to be one of the greatest healthcare resilience challenges globally. She cautions that "countries are now in global competition for healthcare workers. On the one hand, ageing populations mean that many countries are desperately trying to get healthcare workers to come and care for their elderly. And you've got developing countries on the other hand that need workforce to develop their healthcare systems." Nicholls observes that this competition translates into developing countries having to introduce measures and incentives to try to keep their healthcare workers at home, while developed countries are attempting to poach them.

> **Countries are now in global competition for healthcare workers.**

Nicholls believes that more efficient cooperation could play a key role in alleviating pressures through demonstrating a practical effort to share workers and, thus, strengthen healthcare resilience across regions. She points to an example of a U.K. foreign aid programme in which the U.K. will provide training, including skills exchanges, to healthcare workers from Africa. Nicholls argues that similar programmes could help to reduce the competition for healthcare workers, for example if developed countries offered training on condition that trained staff work in both the host country and their own country in future. "It would be really helpful if there was much more of this kind of joined up thinking about international healthcare careers."

Stabilising healthcare expenditure

Nicholls explains that healthcare spending globally has been transformed over the last 4 years. "A huge amount of funding was allocated to 'COVID-19 care' which left non-COVID-19 care as an afterthought." This, she says, has resulted in unstable funding across various areas of clinical care, particularly in the face of the rise of inflation. From a spending allocation perspective, Nicholls argues that while investing in innovation to develop treatments for less prevalent medical issues such as orphan diseases is important, this does not address the more general need for robust healthcare provision across the broader population.

When considering value-based healthcare, Nicholls calls for greater consensus and clarity about the value attached to the product based on individual patient outcomes, and the value the product brings to society as a whole. She believes that establishing clear priorities can help create more sustainable healthcare systems in the long-term. Nicholls concludes the discussion by referencing data from the World Health Organisation showing that over 90% of the population now live in areas in which air pollution exceeds the WHO limit.[47] With this in mind, she calls for healthcare providers to recognise their responsibility in becoming as environmentally aware as possible and committing to reducing healthcare waste.

47 World Health Organisation. *Billions of people still breathe unhealthy air: new WHO data*; 2022. https://www.who.int/news/item/04-04-2022-billions-of-people-still-breathe-unhealthy-air-new-who-data

Chapter 3
Efficiency

Building healthcare resilience – why processes matter

Resilient healthcare can only be achieved if all parts of the system are working optimally and with the same mission. In the previous chapters, the spotlight was rightly cast on the two primary actors in the healthcare system – the patients and the healthcare workers. However, there is an important and often overlooked component yet to be addressed.

This chapter is dedicated to exploring the processes that shape the efficiency of healthcare delivery across the EMEA region. As OECD data shows that "a significant share of health spending (…) is, at best ineffective, and, at worst, wasteful",[48] this year we take a closer look at this topic, mapping out where the systemic inefficiencies occur.

Rising inflation is affecting health spending across EMEA,[49] with the demand for care leading already high operational costs to soar. The limitations to spending, as a result, are having a knock-on effect on healthcare systems' resilience.

These limitations directly impact issues of healthcare workers' pay, the daily operating costs and the financial prospect of introducing new technologies and efforts towards improving sustainability.

An overview by the European Commission explains that national health systems throughout Europe are trying to secure equal access to essential, high-quality care while protecting their long-term sustainability. And, with that, governments are intent on identifying ways in which they can improve their healthcare system's efficiency while addressing this dual challenge.[50]

The indicators underpinning the scores in this section of the BD Healthcare Resilience Barometer were selected carefully to provide a detailed picture of efficiency. Foremost among these is healthy life expectancy (HALE), but we also look at more specific metrics like the average length of hospital stay, which reflects the efficacy of treatments and the overall quality of care. Preventable deaths are also a key indicator of how well the healthcare system is fulfilling its intended purpose.

The challenge of environmental sustainability

Finally, we explore the challenges around environmental sustainability in healthcare. With healthcare's climate footprint equivalent to 4.4% of global net emissions,[51] there is a clear imperative to adapt processes wherever possible to minimise waste and reduce the environmental impact of operations.

If left unchecked, the pollution and environmental hazards produced by healthcare will continue to contribute to the health problems of the very populations it seeks to serve.

The BD Healthcare Resilience Barometer shows that improving efficiency is key to fostering resilience and preparing the healthcare system to perform well during times of strain.

Our conversations with healthcare experts have revealed that recognising opportunities for MedTech in improving system efficiency can build resilience and enable the system to remain robust during times of strain

(see page 64 for the perspective of Professor Pascal Verdonck).

Identifying the source of inefficiencies can pave the way towards improving the financial structure of the system to reduce waste. In turn, this ensures healthcare spending is being utilised in the best possible way and in the interests of workers and patients.

48 Organisation for Economic Co-operation and Development (OECD). *Tackling Wasteful Spending on Health*. Published online 2017. https://doi.org/10.1787/9789264266414-en

49 World Bank. *Inflation, consumer prices (annual %)*. https://data.worldbank.org/indicator/FP.CPI.TOTL.ZG?view=map

50 European Commission. *Tools and methodologies to assess the efficiency of health care services in Europe: an overview of current approaches and opportunities for improvement*; 2019. Accessed July 28, 2022. https://ec.europa.eu/newsroom/sante/items/650120

51 Health Care Without Harm. *Health care climate footprint report*; 2019. https://noharm-global.org/sites/default/files/documents-files/5961/HealthCaresClimateFootprint_092319.pdf

Financial and operational challenges

Figure 8: Map showing overall 'efficiency' Barometer performance at an EMEA level

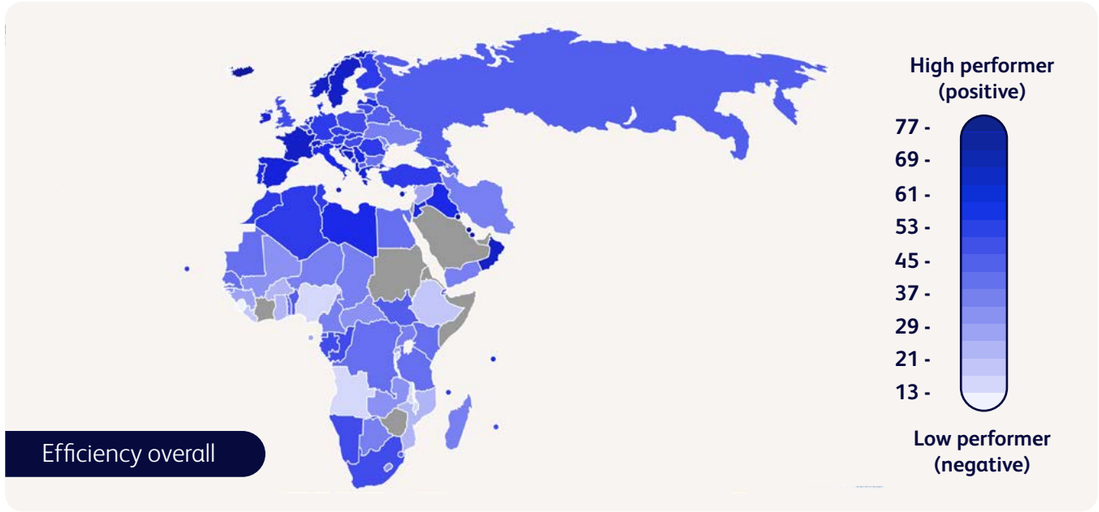


Table 8: Overall Barometer performance 'efficiency' – selected countries (in ranking order)

Countries (in ranking order)	EMEA ranking (out of 100 countries)
1. France	6th
2. Switzerland	11th
3. Sweden	12th
4. Spain	14th
5. Ireland	15th
6. Denmark	18th
7. Italy	22nd
8. Netherlands	24th
9. Germany	42nd
10. United Kingdom	43rd
11. Belgium	45th
12. Poland	53rd

Disclaimer: For the BD Healthcare Resilience Barometer report, our primary objective was to provide a comprehensive view of healthcare systems' resilience across Europe, the Middle East and Africa (EMEA). To ensure the relevance and applicability of our findings, we consulted with a wide range of key opinion leaders across the region. During our interviews, it became apparent that while a broad overview is essential, there is also a need to delve deeper into regional performance and explore how challenges in patient safety, healthcare workforce and efficiency continue to impact the resilience of more advanced healthcare systems in Europe. The inclusion of figures focused on a select group of countries serves to enrich the analysis and provide deeper insights into regional healthcare dynamics.

Across the three clusters in the BD Healthcare Resilience Barometer, the availability of resources to allocate to healthcare provision is still greatest in European countries, followed increasingly closely by the Middle East, with Africa lagging behind.

However, Europe in particular has been grappling with growing inflation over recent years, which has posed significant challenges to the effective utilisation of budgets in healthcare institutions. When looking at government healthcare spending per capita, Switzerland and Norway perform best among all countries in the BD Healthcare Resilience Barometer. These countries, with their strong currencies, remain more resilient in the face of the inflation that has affected the rest of the Euro region.

The BD Healthcare Resilience Barometer scores show that inflation is less of an immediate challenge in the Middle East, with Gulf Nations being able to leverage the resources available to invest in healthcare and increase the quality of patient care to gradually catch up to – and in certain cases, surpass – the European standards.

When we look at HALE, Europe is the best-performing of the three sub-regions, with regional scores mirroring the level of healthcare funding available.

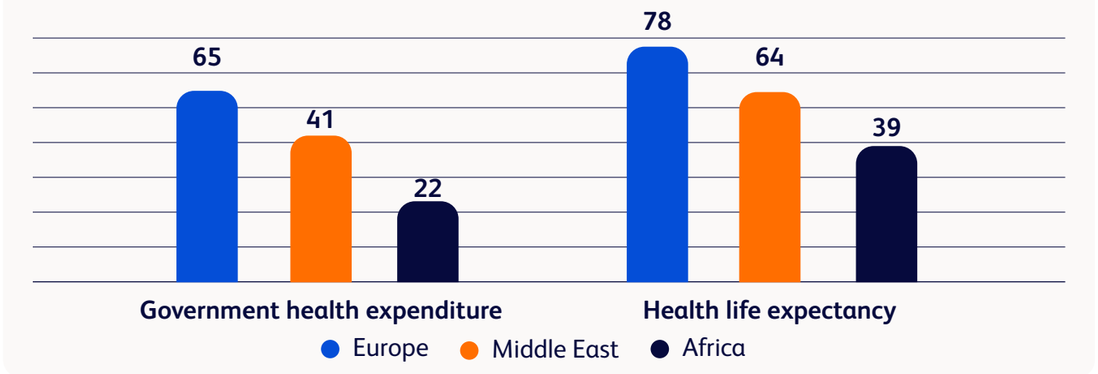
Figure 9: Healthcare expenditure & Healthy Life Expectancy, average scores by region

Source 1: Domestic general government health expenditure by Health Care Functions (WHO)

Barometer scale: 100: high performance (low health expenditure) – 0: low performance (high health expenditure)

Source 2: Healthy Life Expectancy (HALE) at birth (years) (WHO)

Barometer scale: 100: high performance (High HALE) – 0: low performance (low HALE)



When it comes to preventable deaths, the healthcare systems of Western and Northern European countries demonstrate better efficiency, while Eastern European nations struggle to reduce the number of avoidable deaths occurring.

Table 9: Preventable deaths – top 5 and bottom 5 performing countries (Europe)

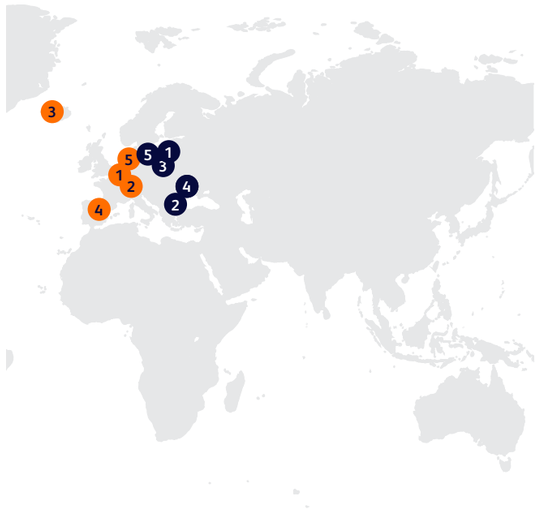
Source: Potential years of life lost (OECD)

Top 5

1. Luxembourg
2. Switzerland
3. Iceland
4. Spain
5. Netherlands

Bottom 5

1. Latvia
2. Bulgaria
3. Lithuania
4. Romania
5. Poland



A closer look at efficiency outcomes reveals that major European countries like Italy, Germany, and Portugal are performing poorly on the average length of hospital stay. This points to the need for better alignment of the various factors that influence length of stay, not limited to patient management and treatment administration.

Table 10: Length of stay – top 5 and bottom 5 performing countries (Europe)

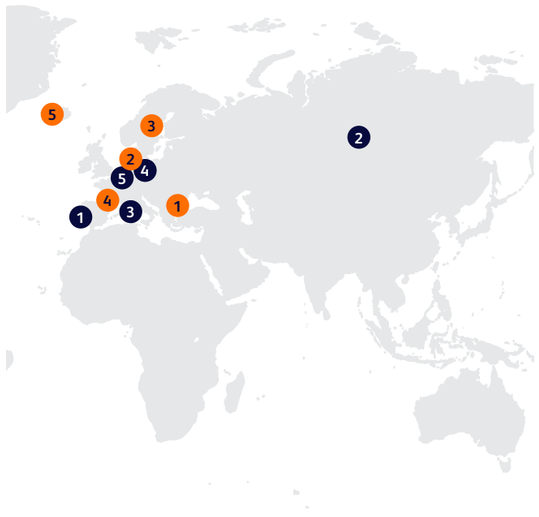
Source: Health care use - length of hospital stay (acute care) (OECD)

Top 5

1. Bulgaria
2. Netherlands
3. Sweden
4. France
5. Iceland

Bottom 5

1. Portugal
2. Russia
3. Italy
4. Germany
5. Luxembourg

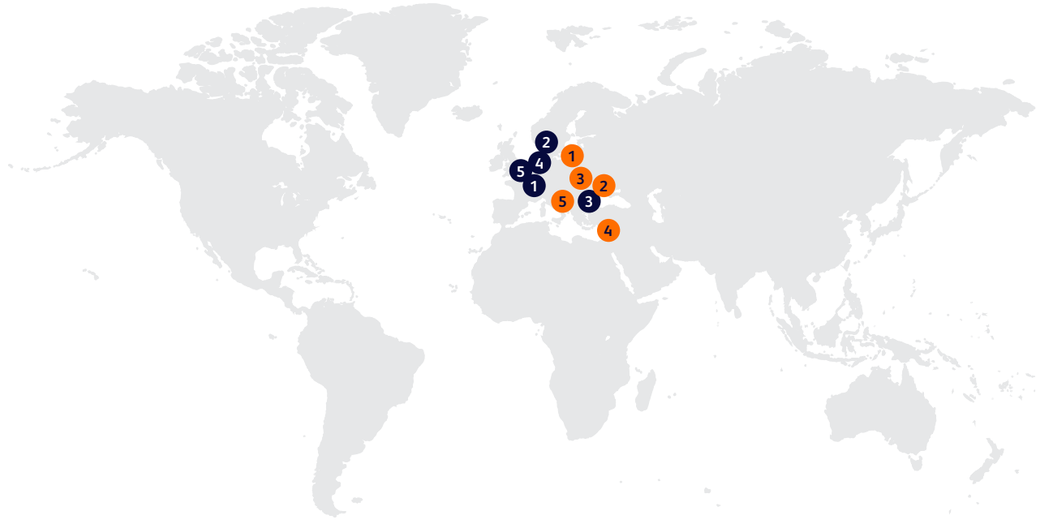


Environmental sustainability emerges as a key concern

With the size and scale of the healthcare structures of European countries, environmental sustainability emerges as a key concern. Countries that generally perform well in the BD Healthcare Resilience Barometer – such as Denmark, or Switzerland – score poorly when it comes to their healthcare system's contribution to the national CO2 footprint. In contrast, the best-performing countries on this measure are almost all Eastern European nations with a lower level of healthcare funding.

Table 11: Healthcare emissions % of national footprint – top 5 and bottom 5 performing countries

Source: Healthcare as % of national footprint (WIOD)



Top 5

1. Lithuania
2. Romania
3. Slovakia
4. Cyprus
5. Croatia

Bottom 5

1. Switzerland
2. Denmark
3. Bulgaria
4. Netherlands
5. Belgium

It is clear that for developed countries, the next big challenge is simultaneously serving patient demand while also developing strategies for minimising the amount of waste that is generated by the system and optimising the use of healthcare resources to ensure sustainability.

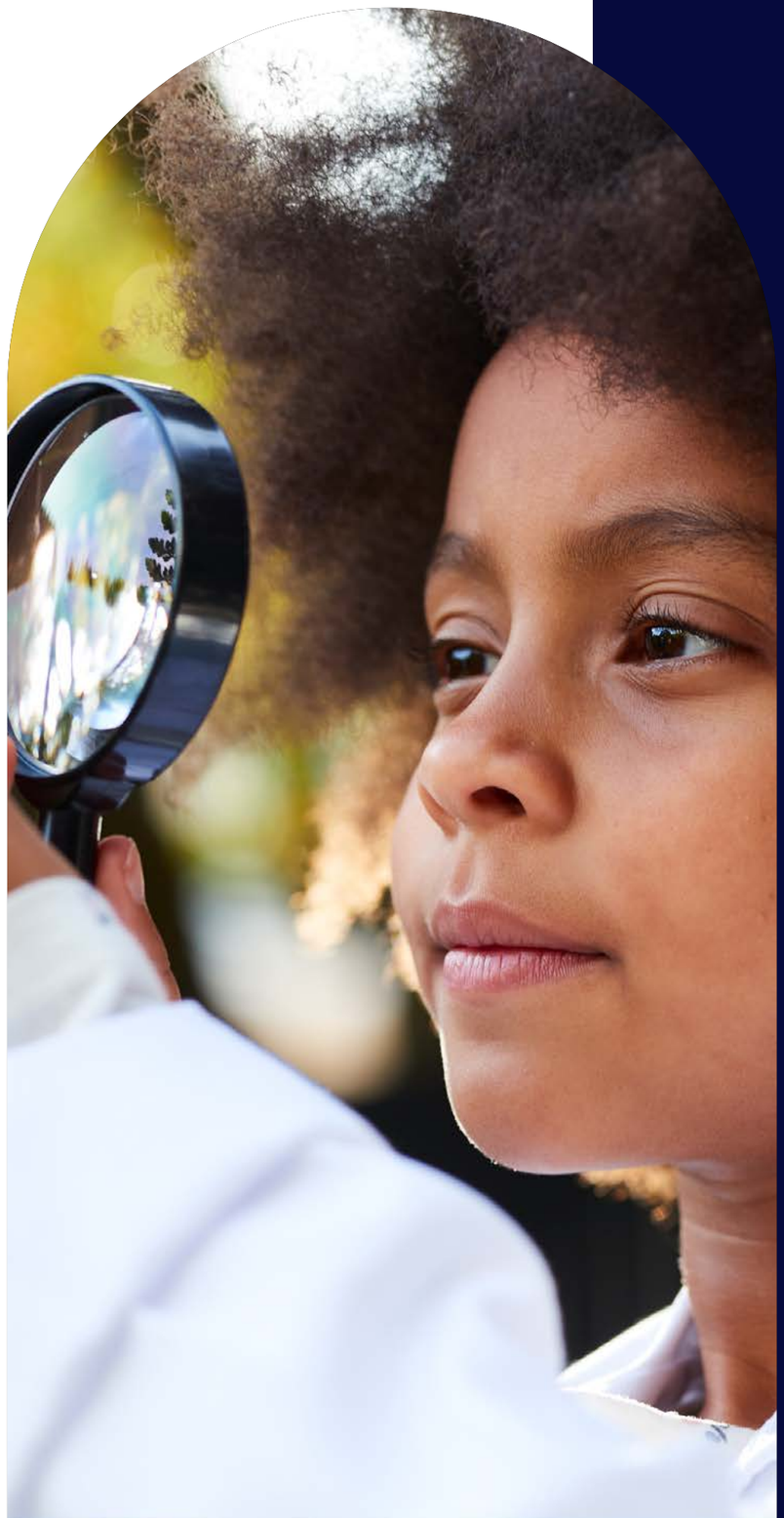
Efficiency and sustainability in healthcare – looking ahead

In the face of a growing demand for care globally – coupled with inflationary pressures and limited funding – healthcare institutions today are stretched to breaking point. The data in the BD Healthcare Resilience Barometer shows that the efficiency of healthcare systems is influenced by a variety of financial, operational, clinical, and technological factors, as well as by human factors.

Against this backdrop, we see that healthcare management often finds it challenging to allocate resources, capacity, or bandwidth to seemingly peripheral concerns like the environmental footprint of operations. However, it is within the complexity of these challenges that lies the potential for innovative, whole-system solutions.

By considering environmental sustainability as an integral part of healthcare efficiency, the sector can develop comprehensive strategies that leverage the right technology to address not only operational challenges but also alleviate the strain on the healthcare workforce, enabling the delivery of high-quality, safe patient care while causing less damage to the environment.

Building resilient healthcare systems requires collective efforts from stakeholders at every level. In the following, final section of this report, we outline the steps policymakers, researchers, healthcare providers and industry can take to reshape healthcare systems and make them more resilient in the face of the challenges of today and those of the future.



Key opinion leader perspective

Healthcare resilience is about developing and putting in place systems that mean you are able to withstand a wide range of shocks that could occur over the long-term.

Lord James O'Shaughnessy
Member of U.K. House of Lords, Senior Partner at Newmarket Strategy, Member of Board of Trustees at Health Data Research U.K. (HDR U.K.) and Author of U.K. Review of Commercial Clinical Trials

As a key figure in the U.K. healthcare sector, Lord James O'Shaughnessy holds various roles with responsibility over issues such as driving access to innovation and developing effective health policy. In this conversation, Lord O'Shaughnessy speaks about the issues affecting U.K. healthcare resilience and government strategies for building a future-proof health system.

Community and resilience

Throughout the conversation, Lord O'Shaughnessy draws attention to the potential impact of community in improving healthcare resilience. Citing alarming recent data about tooth decay among children[52] as an example, he observes that despite the growing focus on prevention in the U.K. over recent years, the responsibility of individuals in taking care of their own wellbeing is still often overlooked. Lord O'Shaughnessy points out that help and guidance from a trusted individual within one's community can play a key role in incentivising people to look after their health.

With this in mind, Lord O'Shaughnessy references the sense of community that grew during the pandemic, with people helping each other with shopping and everyday tasks, and suggests that the collective community effort that took place then could now offer support to those experiencing mental health issues.

Rather than replacing expert guidance, Lord O'Shaughnessy believes that community support is an important complementary "mechanism which helps address mental health and other health challenges and build resilience."

Accelerating the uptake of MedTech

Emphasising the importance of technology innovation in healthcare, Lord O'Shaughnessy highlights screening programmes as one of the U.K.'s great success stories and a prominent example of tech-enabled care that contributes to resilience in the form of preventative healthcare. From a policy perspective, while he expresses positive sentiment about the introduction of the Medical Technology Strategy, Lord O'Shaughnessy recognises that the fact that MedTech is not routinely evaluated by the National Institute for Health and Care Excellence (NICE) is often viewed as a reimbursement challenge to hospitals. "This means that the U.K.'s adoption and uptake of MedTech is slower than it should be, and it is the patient who, ultimately, bears the impact" - he says.

Lord O'Shaughnessy stresses the importance of protecting the technology budget in the interest of the long-term resilience of the NHS. He believes that doing so will protect and invest in the productivity of the system, particularly for the workforce – "so that the average person working in the NHS over time is using better and better tools, increasing operational efficiency to a higher and higher level. This, unfortunately, is not the case today" - he adds. Lord O'Shaughnessy also emphasises the need to allow for the capacity to run the existing and new approaches simultaneously for a time to enable the transition to occur. "Healthcare resilience is about developing and putting in place systems that mean you are able to withstand a wide range of shocks that could occur over the long term" – he concludes.

52 NHS Confederation. NHS Confederation responds to data showing more than 100000 children have been hospitalised with tooth decay since 2018. https://www.nhsconfed.org/news/nhs-confederation-responds-data-showing-more-100000-children-have-been-hospitalised-tooth

Key opinion leader perspective

> **Healthcare should not make people sick - and healthcare systems do that by causing harm to the environment.**

Daniel Eriksson

Founder of Nordic Centre for Sustainable Healthcare (NCSH), Sweden

With more than two decades of experience in the sustainable healthcare sector, and the Founder of NCSH, Daniel Eriksson has a deep understanding of how sustainability can transform the healthcare sector. In this conversation, he offers his insight into how pioneering activity in the Nordics and Netherlands is carrying over into other countries.

There is no resilience without sustainability

Beginning the conversation with his own definition of healthcare resilience, Eriksson states that resilience is "the ability to adapt in the face of adverse circumstances, such as a strike, a war, a changing climate or a pandemic." He believes that sustainability is critical to achieving true resilience. "A good example of this is when hospitals and care providers have their own energy sources and are able to access energy when the primary source is compromised" - Eriksson explains.

Eriksson notes that the most convincing argument for sustainability may differ depending on the unique challenges of each hospital department and stakeholder group within healthcare. "Cost-effectiveness or efficiency are likely to be most useful arguments to use when persuading the finance division, while for healthcare workers, the argument is that healthcare should not make people sick - and healthcare systems do that by causing harm to the environment" - he points out.

Eriksson stresses that there is no one, finite solution to improving sustainability. The NCSH, he mentions, makes sure to emphasise that the process is one of continuous improvement over a significant period. "In many countries, environmental regulatory standards and impact assessments differ between hospitals and change annually, and therefore, a flexible and continuously adaptable approach is needed."

Exporting sustainable healthcare innovation

Eriksson notes that the significant amount of innovation in sustainability emerging from the Nordics and Netherlands has historically lacked recognition by other countries. In recent years, to better promote the endeavours of NCSH, the organisation has implemented various initiatives to advertise the work and encourage other healthcare systems to implement sustainable mechanisms. This has included a report series available in English called Nordic Know-How. "Our mission is to get people in other countries who are looking to improve the sustainability of their systems to be able to build on existing solutions, instead of reinventing the wheel."

Discussing the role of businesses, Eriksson recommends that they remain solution-focused and evolve their ideas each year as much of the climate impact from healthcare comes from the supply chain. "Companies will not survive the next ten years if they do not take sustainability seriously." Eriksson points out that while healthcare organisations need to be open to implementing innovation, the success of building sustainable systems will depend on a variety of other factors including energy suppliers, waste companies, and the decisions made by policymakers and legislators.

Key opinion leader perspective

You need to connect with the patient to effectively integrate the care around them, and, in this sense, technology will help towards value-based care.

Professor Pascal Verdonck

Professor of Biomedical Engineering and Medical Technology at Ghent University, Chairman of the Board at Artvelde University of Applied Sciences and Chairman at National Committee of Biomedical Engineering, Netherlands

Through his background in biomedical engineering and decades spent working across the healthcare system, in this conversation Professor Pascal Verdonck offers his perspective on the current impact and potential of MedTech in facilitating healthcare efficiency and resilience in Belgium.

Opportunities for MedTech

Professor Verdonck credits the utilisation of technology as an integral initial step towards changing the healthcare system. Particularly when addressing the issue of waste, he says that technology can help ensure patients receive the correct treatment and care at the appropriate time. Speaking of the inspiration he has found from the healthcare systems of other E.U. countries, Professor Verdonck names Portugal as a system that he is impressed with due to its increased investment in IT, less fragmentation in the health continuum and fewer silos which facilitate waste reduction – "It's not only about democratic leadership but also having the common vision and the will to change the system."

Prominent examples of MedTech that Professor Verdonck feels are heading in the right direction include the data generated by wearable and insideable technology, which can assist in facilitating prevention, early detection and follow-up information when used at the correct time.

Facilitating value-based care

In the context of value-based care, Professor Verdonck separates technology in this domain into three categories – digitalisation and optimisation (surgeons supported by robot assistance, for example), mobile technology, such as wearables and insideables, and data science in the forms of AI and VR. Perhaps the most important type of technology required for all of these to function effectively, however, is connection. "A reliable connection is essential to ensure the receipt of the data produced and this will act as an incentive and a driver for the use of technology before getting the value out of it." Professor Verdonck elaborates, "you need to connect with the patient to effectively integrate the care around them" and, in this sense, technology will help towards value-based healthcare.

When wrapping up the conversation, Professor Verdonck takes the time to comment on the role of patients in making the most of these technological opportunities to further the healthcare system, stating that "changing consumer attitudes towards the healthcare system, as well as the attitudes of the organisers of the system so that they are parallel, will facilitate more respect from consumers to adapt and change their behaviours."

Key opinion leader perspective

Sustainable health is about improving health and wellbeing for all while staying within planetary boundaries.

Professor Tobias Alfvén

Professor / Paediatrician – Karolinska Institutet; President – Swedish Society of Medicine, Sweden

With a career in child health, Professor Tobias Alfvén's research explores challenges in global public health and the impact of access inequities on health outcomes. In this interview, he talks about the different strategies required to improve the resilience of healthcare systems in high-income and in low-income countries.

Social determinants of health in focus

Professor Alfvén starts the conversation by highlighting that the socio-economic context in a given country can pose significant limitations to building resilience in healthcare. "There is a very clear correlation between economy and health outcomes" – he points out. "Reducing global health issues like child mortality can only be achieved if we address poverty and inequality." Professor Alfvén notes that in order to create healthy communities for children to grow up in, policies must look at the social determinants of health – including education, water and sanitation, climate and the food environment.

Professor Alfvén explains that social determinants can affect child health negatively even in affluent parts of the world. "In many high-income countries, families would have the means to raise their children in a healthy way, but the poor 'health' of the city can be a barrier to this. If parents feel that the neighbourhood is not safe, they will drive their children to school, they will want them to stay at home – which contributes to the child obesity issue we see in various regions". Professor Alfvén believes that policies aimed at creating safe and clean environments should be a fundamental part of building healthcare resilience.

What sustainable health means in practice

Citing statistics around the healthcare sector contributing to 4 % of the global carbon footprint,[53] Professor Alfvén emphasises that a multi-sectoral approach is required to understand how this climate impact can be reduced at a global level. "It is not enough to just talk about this with healthcare management – we need economists, environmentalists, urban planners, the food sector and a range of other stakeholders involved in designing effective policies" – he says.

Professor Alfvén claims that using the UN 2030 Agenda and the Sustainable Development Goals is a good framework for thinking about social determinants of health and building resilience in care provision. He argues that many definitions of sustainable health are focused on a single, specific aspect instead of looking at the big picture. "Put simply, sustainable health is about improving health and wellbeing for all while staying within planetary boundaries." Professor Alfvén concludes by stating that healthcare resilience does not only come from healthcare providers doing a better job, but instead from stakeholders working together to create the right conditions for healthcare providers to do their job.

53 Karliner, J, Slotterback, S, Boyd, R, Ashby, B, Steele, K, Wang, J. Healthcare's climate footprint: the health sector contribution and opportunities for action; September 2020. *Research Gate*. http://dx.doi.org/10.1093/eurpub/ckaa165.843

Key opinion leader perspective

> **With a really vibrant MedTech and life sciences sector, we have a phenomenal opportunity to be adopting great innovation and spreading best practice.**

Charlotte Pickles

Director of Reform Think Tank, U.K.

With half a decade spent as the Director of Reform Think Tank, Charlotte Pickles holds valuable insight into the status of the U.K. healthcare system. In this conversation, she discusses the importance of self-sufficiency for healthcare organisations, and opportunities for leveraging innovation to promote preventative care.

Making healthcare systems less vulnerable

For Pickles, building resilience in healthcare must start with taking steps to reduce the external dependencies of the system. She notes that in the U.K., the current level of reliance on manufacturers outside the U.K. poses significant risks to the stability of healthcare provision. “We need to establish domestic supply chains to reduce this vulnerability” - Pickles says. She notes that particularly given the volatile geopolitical landscape, the ability to procure and provide key products domestically is more important than ever. Pickles argues that the government has a key role to play in facilitating the shift to in-country manufacturing.

“The government needs to be a better partner to industry and ensure that the U.K. is seen as a good place to invest in manufacturing of the products we rely on.”

Another key challenge Pickles highlights is the U.K.’s overly hospital-centric healthcare model. “When you compare a lot of international healthcare systems, we in the U.K. are an outlier with a particularly hospital-centric model” - she explains. Pickles argues that more resources should be channelled towards early intervention, GP practices and community care settings. She believes that a change in focus would simultaneously result in greater opportunities for promoting preventive health. “We have a system that is geared towards the providers, and not the patients” - Pickles points out. Emphasising the role of patient empowerment, she says that “healthcare needs to be about conversations to understand the patient as a whole, support them to make healthier lifestyle choices and make the most of new technologies to self-monitor their condition.”

Technology and efficiency

Ending the conversation on an optimistic note, Pickles says that there are plenty of opportunities the U.K. healthcare system can leverage to become more resilient than it currently is. “With a really vibrant MedTech and life sciences sector, we have a phenomenal opportunity to be adopting great innovation and spreading best practice” - she argues, adding that “the U.K. is world-leading in this type of innovation.” Pickles says that a key objective should be to integrate more productivity-boosting technologies including automation of processes, and smarter analysis of data to create a more efficient patient flow.

“There are all sorts of technology – sensors, monitors – that can be deployed into people’s homes, enabling patients to self-manage their conditions” - Pickles adds. She mentions that there is also significant progress being made around personalised medicine, with the U.K. leading the way in genomics. The challenge, Pickles notes, will be to effectively deploy these innovations at scale within the NHS. To fully utilise these opportunities, says Pickles, requires a consensus from a sufficient number of voices consisting of politicians, trusts, and interest groups from within the NHS to use their voice and demonstrate their commitment to change. “It’s going to require some really honest conversations and a willingness to actually try and be a bit more radical about how we do things” - she concludes.

Key opinion leader perspective

We have to protect healthcare professionals' time to allow them to spend time with patients and share decision making.

Professor Hamish Laing

Professor of Enhanced Innovation, Engagement and Outcomes, Swansea University, and Director of the Value-Based Health and Care Academy, U.K.

With decades of experience in academia and research across the healthcare sector in Wales, Professor Hamish Laing contributes to the discussion of the future of sustainable healthcare in which he expresses his views on the role of value-based care in achieving sustainable healthcare delivery.

Retaining humanity in healthcare

Professor Laing explains that strain of the last few years has had a significant impact on job satisfaction among the healthcare workforce. He reports, "Work should be fulfilling, but a lot of my colleagues are saying it's just a drudge now to go to work - and they're looking at doing something else." The recognition that the supply of healthcare workers does not sufficiently meet the growing patient demand has revealed space for technological innovation, as Professor Laing highlights that "the potential for robotic process automation and other digital technology to relieve the existing force's workload."

However, he stresses the importance of achieving a balance between implementing the technology while also retaining the value of the human element when providing care. "I think that healthcare is a human business, and it is about relationships and there is a concern that we think we can do it all with technology and lose that human touch."

Professor Laing notes the additional risk of implementing technology is that the increased capacity among the workforce will simply be filled with more volume rather than more value. "We have to protect healthcare professionals' time to allow them to spend more of it with patients and in share decision-making."

How Value-Based Healthcare contributes to sustainability

Throughout the discussion, Professor Laing promotes the role of Value-Based Healthcare in ensuring a sustainable healthcare system, especially in reducing waste. He explains that there is a strong correlation between Value-Based Healthcare and green health programmes because "for every appointment that wasn't necessary that someone's driven to, for every procedure that doesn't meet their needs, for every medicine that people are prescribed and don't take and has to be destroyed, every test that has to be repeated because you can't find the last one" – all of these things, he states, are, not only very low value, but are resulting in significant carbon waste as well.

Regarding the impact of ever-evolving technology on environmental sustainability, Professor Laing criticises digital technologies that become obsolete after three or four years due to a lack of software updates. "It shouldn't be acceptable that we are throwing away a perfectly good device because there isn't a software update for it. I think there is a real role for MedTech to help us to reduce the environmental footprint of their devices, and also the carbon footprint of the health provider." When concluding the discussion, Professor Laing addresses the potential challenge of how the changes implemented to reduce the environmental impact of healthcare will be perceived by patients. He speculates that it will need to be made clear that these changes are required to ensure the sustainability of the system, rather than to disrupt the provision of continuous care.

Key opinion leader perspective

It’s critical to find low-impact economic solutions, because there may be better ways to use our resources.

Dr Fabrizio d’Alba

National President of Federsanitá, Italy

Thanks to his role in Federsanità, Dr d’Alba provided his point of view on the efficiency of the Italian healthcare system. In this conversation, Dr d’Alba discusses potential improvements to the system and how we can better meet the needs of our most vulnerable citizens.

How should our health systems adapt?

In his definition of health resilience, Dr d’Alba emphasises the the importance of adaptability in three key areas: the national health system, professionals, and citizens. Taking a solution-focused approach to problems impacting the healthcare system globally, he believes the solution lies “in the realm of change, innovation, and system engineering.”

Firstly, he believes that it is necessary to identify the source of the problem, from which diagnostic and therapeutic solutions can be developed and delivered. To improve the system in Italy, Dr d’Alba talks about the need to optimise integration and service delivery. As a result, this would improve patient care pathways, requiring questions about organisational processes and how services are delivered at the local level. He also talks about the push for primary care reform within the Italian health system. For Dr d’Alba, there is a need for better organisation facilitated by new professional roles, such as management engineers and logistics experts, and a digital management process.

Regarding the sustainability of the health system, Dr d’Alba says there is a link between health and where you live and work. Referring to the link between health outcomes and integrated policies, he says that “it would be useful to be able to quantify economic returns to better understand the link between welfare and health systems.” Dr d’Alba adds that it might be worth considering new places of health care delivery, but he is realistic about this prospect due to affordability issues. “It’s critical to find low-impact economic solutions, because there may be better ways to use our resources.”

Providing performance to the most vulnerable

Ultimately, Dr d’Alba emphasises that a healthcare system must be evaluated based on its ability to care for the most vulnerable people, i.e., those with disabilities or mental health issues. In times of change, he says, it’s the responsibility of politicians to be more pragmatic in their choices about how to provide care and what resources are available: “It’s an allocative choice.”

In concluding the conversation, Dr d’Alba emphasises the need to recognise and prioritise the collective goal of the national health system in Italy, putting aside individual aspirations, to improve outcomes for citizens, especially the most vulnerable.

Key opinion leader perspective

Sustainable health systems should be based on a set of universal values and expectations.

Dr Paolo Petralia

National Vice President at FIASO, Italy

As a stakeholder of the Italian Federation of Health and Hospital Authorities (FIASO), Dr Petralia holds valuable insights into the barriers and opportunities related to building resilience in the healthcare sector. In this conversation, he offers his perspective on the role of collective responsibility and the importance of consistent values in healthcare.

Health promotion and collective commitment

Discussing strategies for building stronger health systems, Dr Petralia begins by emphasising that a greater focus on health promotion and preventive measures must be an integral part of efforts to improve its sustainability. “As resources become increasingly insufficient to cover the ever-increasing costs of health services, preventing people from falling ill is the most effective investment strategy at our disposal,” he says. Dr Petralia refers to the One Health framework, which encourages a holistic approach to healthcare and involves increasing efforts to engage citizens and promote a sense of health empowerment. “Beyond the duty to care for each and every one, we must strive to ensure that people as far as possible live in conditions of well-being, as well as the absence of disease,” he said.

Dr Petralia believes that it must be a widespread responsibility to bring about a change in the Italian healthcare system and notes that the modification of existing methods and objectives and the transition to a more sustainable model will require individual actions that will turn into collective responsibility. “Sustainable health systems should be based on values and expectations of equity and universality in order to be sustainable,” explains Dr Petralia. “Across Italy, standards of patient care and the enforceability of essential levels of care should be aligned and patients should have the same opportunities to be taken care of and cared for,” he adds.

System-wide harmonisation

Dr Petralia stresses the need to ensure adequate governance of the system, which includes the definition and dissemination of systems of rules that are consistent with each other and can be applied with ease. Harmonisation is needed at three levels: between the central and regional levels, between the regional and corporate levels, and within the companies themselves with the various stakeholders. “The harmonisation of approaches is essential to make the various components of the social and health system work together,” says Dr Petralia.

Importantly, health resilience cannot be achieved without “recognising and addressing limiting factors, including gaps in economic resources, human capital and the regulatory apparatus”. Dr. Petralia concludes by stating that “building resilience means above all recognising that we are not just users, but active protagonists in the construction of a new health system.”

Going forward – recommendations

Prioritise patient safety throughout the entire care journey

Ensure that patient safety remains at the forefront of all healthcare practices, leading to enhanced operational efficiencies and improved outcomes for patients.

Address workforce shortages and burnout

Implement strategies to alleviate workforce shortages and mitigate burnout, to optimise existing resources and improve operational efficiency.

Promote a holistic approach to understanding healthcare resilience

Recognise the interconnectedness of patient safety, workforce wellbeing and system efficiency and implement comprehensive strategies to address challenges in these areas, fostering a virtuous cycle with benefits for all stakeholders involved.

Recognise the role of environmental sustainability in building resilience

Emphasise the importance of building sustainable healthcare systems – both in terms of lowering carbon emissions and preserving continued access to safe, high-quality care for future generations.

Encourage collaboration across healthcare stakeholders

Foster collaboration among policymakers, regulators, healthcare providers, funders, insurers, patients and industry to develop innovative solutions that allow healthcare systems to adapt to the evolving needs of society.

Appendix

Table 12: Full indicator descriptions & sources

Primary and secondary data sources			
Indicator group	**Indicator**	**Full description**	**Source**
Patients	Adverse effects of medical treatment	Adverse effects of medical treatment – Deaths (per 100,000)	IHME, Global Burden of Disease Study
Patients	Complications following therapeutic procedures	Complications following therapeutic procedures*	IHME, Global Burden of Disease Study
Patients	AMR-related deaths	AMR Deaths	IHME, Global Burden of Disease Study
Patients	Sepsis	Sepsis ASIR per 100,000	Lancet Publication
Patients	HAI prevalence	Estimation of number of patients with at least one HAI on any day	ECDC
Patients	SSI prevalence	Surgical site infections (composite)	ECDC
Patients	HAI guidelines	Hospitals reporting guidelines for HAI prevention	ECDC
Patients	HAI surveillance	Hospitals reporting surveillance as part of HAI prevention strategies	ECDC
Patients	Universal health coverage	UHC Service Coverage Index (SDG 3.8.1)	WHO Global Health Observatory
Healthcare workers	Staff-to-patient ratio (nurses)	Nursing and midwifery personnel (per 10,000)	WHO Global Health Observatory
Healthcare workers	Staff-to-patient ratio (doctors)	Medical doctors (per 10,000)	WHO Global Health Observatory
Healthcare workers	Ratio of nurses to doctors	Ratio of nurses to doctors (OECD)	OECD

Primary and secondary data sources			
Indicator group	**Indicator**	**Full description**	**Source**
Healthcare workers	Nurses aged above 55	Nurses 55 and above Havas Lynx – Healing the Healers (Point.1 data)	WHO
Healthcare workers	Staff burnout	Ratio of nurses to doctors (OECD)	Havas Lynx and additional market research
Healthcare workers	Occupational health and safety policy	Existence of national policy instruments for occupational health and safety for health workers	WHO Global Health Observatory
Efficiency	Inflation	Inflation, consumer prices (annual %)	World Bank
Efficiency	Length of stay	Health care use – Length of hospital stay (acute care)	OECD
Efficiency	Health expenditure	Domestic general government health expenditure by Health Care Functions	WHO Global Health Expenditure Database
Efficiency	Healthy Life Expectancy	Healthy Life Expectancy (HALE) at birth (years)	WHO Global Health Observatory
Efficiency	Preventable deaths	Potential years of life lost	OECD
Efficiency	Health care % of national footprint	Health care % of national footprint	Health Care with No Harm – World Input-Output Database (WIOD) European Environmental Agency
Efficiency	Healthcare footprint per capita	Health care footprint per capita (tCO2e/capita)	Health Care with No Harm – World Input-Output Database (WIOD) European Environmental Agency

Table 13. Full list of stakeholders interviewed

Name	Country	Title & organisation
Dr Eva Marie Castro	Belgium	Head of Quality Department at RZ Tienen
Pascal Verdonck	Belgium	Professor of Biomedical Engineering and Medical Technology at Ghent University
Denis Herbaux	Belgium	CEO of Platform for Continuous Improvement of Quality of Care and Patient Safety / Plateforme pour l'Amélioration continue de la Qualité des soins et de la Sécurité des patients (PAQs)
Dr Ilke Montag	Belgium	Chairman of Board of Directors at The Institute
Marc Noppen	Belgium	CEO of UZ Brussels
Dr Ron Daniels	U.K.	CEO of Sepsis Trust
Lord James O'Shaughnessy	U.K.	Member of U.K. House of Lords
Charlotte Pickles	U.K.	Director at Reform Think Tank
Stefan Krojer*	Germany	Founder of Future Hospital Purchasing / Zukunft Krankenhaus-Einkauf (ZUKE Green)
Dr Ruth Hecker	Germany	Chairwoman of Patient Safety Action Alliance and University Hospital Essen (AöR)
Daniel Eriksson	Sweden	Founder of Nordic Centre for Sustainable Healthcare (NCSH)
Tobias Alfvén	Sweden	Clinical Professor of Global Child Health at Karolinska Institute
Dr Maria Cruz Martín Delgado	Spain	Head of Department Intensive Medicine at Hospital Universitario 12 Octubre Madrid
Dr Jose Luis Cobos Serrano	Spain	Vice President III at General Nursing Council of Spain
Dr Fabrizio d'Alba	Italy	National President of Federsanitá
Dr Paolo Petralia	Italy	General Manager at ASL4 Chiavarese (Liguria, Italy) and National Vice President at FIASO
Ana Nicholls	U.K.	Director of Industry Analysis at Economist Intelligence Unit
Professor Hamish Laing	U.K.	Professor of Enhanced Innovation, Engagement and Outcomes at Swansea University
Dr Neda Milevska Kostova	North Macedonia	Chair of the International Alliance of Patient Organisations (IAPO)

* KOL perspective to be included in BD Healthcare Resilience Barometer Germany report

Barometer scoring sytem

Classification

In the BD Healthcare Resilience Barometer, each country received an aggregated resilience score between 0-100, which is a composite measure calculated as an average of resilience scores across the three thematic areas: patients, the healthcare workforce, and efficiency.

Indicator-level score allocation

For each of the individual resilience indicators, we converted the raw data point into a 1-10 scale, to standardise and allow for comparability. Scores between 1-10 were multiplied by 10 and presented on a 0-100 scale in the Barometer to allow for the use of whole numbers for country and regional averages.

This involved creating individual ranges per indicator, where the aim was to create a range that allowed for a good distribution of the data points from each EMEA country, aiming for a normal distribution bell curve, whilst still maintaining a standard range size where possible.

For some indicators, achieving this distribution of data across the 1-10 range was not possible given the performance levels of the different countries included within the Barometer. This is because the data naturally clusters heavily by region, with European countries scoring near the top of the ranges, and African countries scoring nearer the bottom of ranges for most indicators.

Interpreting the Barometer scores

As the original data points the Barometer relies on are defined on different scales and measurements, the 0-100 scoring system was created to allow us to classify and interpret the data from the various sources in a standardised manner.

According to this unified system, 100/100 is the best possible score across all indicators. As the table of classification in the above section shows, a higher score is always more positive, as it indicates a higher level of healthcare resilience in a country.

To support the interpretation of the charts and tables throughout the report, the below two examples illustrate the framework used in the standardisation process.

Indicator 1: AMR-related deaths (IHME)

For this indicator, the higher prevalence of AMR-related deaths is converted into a lower (weaker) Barometer score, while a lower prevalence is converted into a higher (stronger) score on the 0-100 scale in the Barometer. In other words, a low score on AMR-related deaths in the Barometer does not mean that the prevalence of AMR-related deaths is low. It means that the country performs weakly on the AMR deaths measure.

Original value (death rate per 100,000)	Barometer score assigned
<18	100
>162	10

Indicator 2: Staff to patient ratio – Nurses (WHO)

In this case, the original dataset shows the number of nurses per 10,000 population in each country. A higher number of nurses is better from a healthcare perspective, therefore a higher number of nurses is translated into a higher score on the Barometer, and a lower number of nurses translated into a lower score on the 0-100 scale.

Original value (number of nurses per 100,000)	Barometer score assigned
<10	10
>115	100

The scale of 0 (weak) to 100 (strong) is included in each table in this report as a reminder of how the scores should be interpreted by the reader.

Table 14: Barometer scoring system per indicator

Indicator	Source	Original scale unit of measurement	Barometer score assigned
Adverse effects of medical treatment	IHME, Global Burden of Disease Study	Death rate per 100,000	<0.25 = 100 >14 = 10
Complications following therapeutic procedures	IHME, Global Burden of Disease Study	Prevalence rate per 100,000	<10 = 100 >70 = 10
AMR-related deaths	IHME, Global Burden of Disease Study	Death rate per 100,000	<18 = 100 >162 = 10
Sepsis	Lancet	Sepsis ASIR per 100,000	<100 = 100 >2000 = 10
HAI Prevalence	ECDC	%	<1 = 100 >9 = 10
HAI - SSI Prevalence	ECDC	% of SSIs per 100 operations	<1.2 = 100 >10.80 = 10
HAI - Guidelines	ECDC	Number of hospitals	<10 = 10 >90 = 100
HAI - Surveillance	ECDC	Number of hospitals	<9.5 = 10 >85.50 = 100
Universal Health Coverage	WHO Global Health Observatory	Average cover of essential services	<40 = 10 >87.50 = 100
Staff to patient ratio (Nurses)	WHO Global Health Observatory	Number of nurses per 10,000	<10 = 10 >115 = 100
Staff to patient ratio (Doctors)	WHO Global Health Observatory	Number of doctors per 10,000	<8 = 10 >72 = 100
Ratio of nurses to doctors	OECD	Ratio	<4.5 = 100 >40.50 = 10
Nurses aged 55 or above	WHO	%	<4.5 = 10 >40.50 = 100
Staff burnout	Havas Lynx	Custom calculation	<6.7 = 100 >13.2 = 10
Occupational health and safety policy	WHO Global Health Observatory	WHO Global Health Observatory Existence of national policy instruments for occupational health and safety for health workers	<1 = 10 >9 = 100
Inflation	World Bank	Annual % measured by consumer price index	<2 = 100 >18 = 10
Length of stay	OECD	Average number of days spent in hospital	<4 = 100 >7.20 = 10
HC % of health expenditure (per capita)	WHO	Domestic general government expenditure per capita (US$)	<50 = 10 >8800 = 100
Healthy Life Expectancy	WHO Global Health Observatory	Average number of years	<50 = 10 >74 = 100
Preventable deaths	OECD	Summary measure of premature mortality which may be preventable	<950 = 100 >8550 = 100
Health care % of national footprint	Health Care with No Harm - World Input-Output Database (WIOD) European Environmental Agency	%	<0.7 = 10 >6.30 = 100
Healthcare footprint per capita	Health Care with No Harm - World Input-Output Database (WIOD) European Environmental Agency	tCO2e per capita	<0.09 = 100 >0.81 = 10

Table 15: 2024 BD Healthcare Resilience Barometer overall score per country

List of countries (100)	Region	2024 BD Healthcare Resilience Barometer overall score
Albania	Europe	54
Algeria	Africa	54
Angola	Africa	33
Austria	Europe	63
Azerbaijan	Europe	54
Bahrain	Middle East	63
Belarus	Europe	63
Belgium	Europe	57
Benin	Africa	36
Bosnia and Herzegovina	Europe	55
Botswana	Africa	46
Bulgaria	Europe	51
Burkina Faso	Africa	27
Burundi	Africa	33
Cameroon	Africa	39
Cape Verde	Africa	50
Central African Republic	Africa	29
Chad	Africa	28
Comoros	Africa	44
Congo (Democratic Republic of the)	Africa	42
Congo (Republic of the)	Africa	45
Croatia	Europe	65
Cyprus	Europe	63
Czechia	Europe	57
Denmark	Europe	62
Djibouti	Africa	43
Egypt	Africa	47
Equatorial Guinea	Africa	46
Estonia	Europe	54
Eswatini (Swaziland)	Africa	42
Ethiopia	Africa	35
Finland	Europe	66
France	Europe	69
Gabon	Africa	47
Georgia	Europe	54
Germany	Europe	64
Ghana	Africa	44
Greece	Europe	56
Guinea	Africa	29
Guinea-Bissau	Africa	34
Hungary	Europe	57
Iceland	Europe	69
Iran	Middle East	46
Iraq	Middle East	47
Ireland	Europe	63
Italy	Europe	62
Jordan	Middle East	59
Kenya	Africa	49
Kuwait	Middle East	67
Latvia	Europe	49
Lesotho	Africa	36
Liberia	Africa	36
Libya	Africa	59
Lithuania	Europe	58
Luxembourg	Europe	58
Madagascar	Africa	39
Malawi	Africa	35
Mali	Africa	29
Malta	Europe	60
Mauritania	Africa	42
Mauritius	Africa	51
Moldova	Europe	46
Montenegro	Europe	60
Morocco	Africa	47
Mozambique	Africa	34
Namibia	Africa	46
Netherlands	Europe	61
Niger	Africa	32
Nigeria	Africa	29
North Macedonia	Europe	55
Norway	Europe	76
Oman	Middle East	63
Poland	Europe	57
Portugal	Europe	63
Qatar	Middle East	65
Romania	Europe	63
Russia	Europe	54
Rwanda	Africa	39
Sao Tome & Principe	Africa	43
Senegal	Africa	41
Serbia	Europe	56
Seychelles	Africa	63
Sierra Leone	Africa	28
Slovakia	Europe	61
Slovenia	Europe	56
South Africa	Africa	58
South Sudan	Africa	35
Spain	Europe	58
Sweden	Europe	70
Switzerland	Europe	74
Syria	Middle East	42
Tanzania	Africa	46
Togo	Africa	45
Tunisia	Africa	58
Turkey	Europe	59
Uganda	Africa	49
Ukraine	Europe	53
United Kingdom	Europe	60
Yemen	Middle East	40
Zambia	Africa	42

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