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Advancing healthcare foresight: insights from the 'National Ambulance Service 2040' project

Tamás Kristóf[1*], Bertalan Meskó[2,3] and Gábor Csató[4]

Abstract

Healthcare systems face escalating long-term uncertainty due to technological advancement, demographic shifts, and heightened social demands, yet foresight is still insufficiently employed within mission-critical healthcare institutions. This article contributes to futures studies by providing a comprehensive empirical case of applied, participatory, and normative foresight conducted within a national ambulance service. Drawing on the 'National Ambulance Service 2040' project in Hungary, the findings indicate how classic foresight methods – STEEP analysis, scenario development, futures wheel, and visioning – can be systematically combined and embedded in organizational decision-making under real-world constraints. The case demonstrates how foresight enhances anticipatory capacity building, strategic sensemaking, and normative alignment within a high-pressure public service context. Methodologically, the article advances applied futures studies by evidencing the complementarity of foresight tools and by highlighting the performative role of visioning as a governance and mobilization mechanism. Substantively, the findings show that foresight can be both cost-effective and impactful in publicly funded, resource-constrained healthcare systems. By extending healthcare foresight into the largely unexplored domain of emergency medical services, the article positions healthcare as a fertile site for methodological advancement in futures studies. The article also offers policy-relevant insights into anticipatory governance, workforce readiness, and the ethical incorporation of artificial intelligence in healthcare.

Keywords Medical futures studies, Healthcare foresight, STEEP analysis, Scenario analysis, Futures wheel, Visioning

Introduction

The World Futures Studies Federation (WFSF) convened its 26th World Conference from 29 to 31 October 2025 in Cape Town, South Africa. The conference sought to create a platform for examining the essence of 'Thriving Together'. It explored the essential inquiry regarding our response, and the long-term strategies, values, and transformations necessary to thrive together. 'Thriving Together' extended a collective invitation to envisage and collaboratively construct futures in which individuals, groups, and societies transcend mere survival to achieve sustainable flourishing. The state-of-the-art situation and the future directions of medical futures studies,

*Correspondence:
Tamás Kristóf
tamas.kristof@uni-corvinus.hu
[1]Institute of Entrepreneurship and Innovation, Corvinus University of Budapest, Fővám Tér 8., Budapest 1093, Hungary
[2]The Medical Futurist Institute, Fém Utca 2,, 2040 Budaörs, Hungary
[3]Kálmán Laki Doctoral School of Biomedical and Clinical Sciences, University of Debrecen, Debrecen 2040, Hungary
[4]National Ambulance Service, Markó Utca 22., Budapest 1055, Hungary

which are the focus of this article, were presented and discussed within the 'Sectoral Innovations' session of the conference.

Futures studies and healthcare possess shared objectives. According to the seminal work of Bell [3], the principal objective of futures studies is to sustain and improve human welfare. The primary goal of futures studies is therefore to foster a more sustainable, equitable, and preferred future for all individuals. While, the objectives of healthcare for human welfare encompass achieving universal health coverage [20], ensuring equitable access to quality care [5], promoting health equity [21], enhancing public health [40], empowering individuals through health literacy [42], and establishing resilient systems for health emergencies [11], ultimately striving for healthier, longer, and more fulfilling lives for all, devoid of preventable suffering and financial distress.

Foresight as a practical futures field is recognized not as a predictive endeavor but as a reflexive, normative, and participatory practice designed to enhance societal capacity to engage with uncertainty [36]. According to Slaughter [34], futures work primarily involves cultivating foresight capability, enabling individuals and institutions to systematically explore possible futures, challenge prevailing assumptions, and make more informed decisions in the present. From this viewpoint, healthcare constitutes a notably significant application domain due to its ethical implications, systemic complexity, and exposure to long-term socio-technical change.

Anticipatory governance-oriented approaches have long been fundamental to futures studies. Futures practices acquire legitimacy not solely via technical sophistication, but through their ability to reveal values, negotiate preferred futures, and promote collective ownership of enduring change [19]. In healthcare foresight, where futures are intricately linked to moral responsibility, professional identity, and public trust, this orientation is crucial.

Despite the growing utilization of foresight tools in healthcare settings, less focus has been directed towards the reflexive underpinnings of anticipatory practice. Slaughter [35] emphasizes the necessity of second-order futures work, urging a critical analysis of the construction of futures, the prevailing assumptions, and the dynamics of power within foresight processes. Fergusson et al. [10] underscored the significance of methodological transparency and reflexivity in preserving the integrity of futures practice. Addressing these issues in healthcare foresight is an opportunity not only to improve sectoral outcomes, but also to advance futures methodology.

The future of medicine and healthcare has recently garnered significant attention from the life science community due to remarkable technological advancements in healthcare, the cultural shift in digital health altering traditional roles of patients and medical professionals, and the increasing necessity to prepare for critical changes in the healthcare ecosystem, as evidenced by the COVID-19 pandemic. The paradigm shift in digital health has revolutionized healthcare delivery, medical practice, and the responsibilities of patients and healthcare professionals, together with the cultural aspects of care in the 21st century, stimulating heightened discourse over the future.

Although futures studies and healthcare may and should thrive together, evidence indicates that medical and healthcare professionals have intermittently employed the principles and methodologies of futures studies in their practice. Despite the plethora of emerging futures methods that could potentially benefit medicine and healthcare, healthcare foresight has evolved in a fragmented and uneven manner, with applications distributed across public health, medical innovation, health systems planning, and technology assessment [23, 24, 29]. Conversations regarding the future of medicine and healthcare frequently depend on the subjective viewpoints of major opinion leaders rather than on future strategies, policies, visions, and scenarios based on recognized futures methods [25].

Prior emergency medical systems (EMS) foresight efforts in the United States [8], in the United Kingdom [18], and in the Netherlands [39] have highlighted the growing importance of anticipatory governance, people-centered emergency care, and technological transformation in the sector. While a limited number of foresight-oriented studies have examined ambulance and paramedic futures [28], empirical case studies of participatory foresight embedded within national ambulance organizations remain rare.

This article represents one of the first documented foresight case studies focusing specifically on a national ambulance service worldwide. The National Ambulance Service in Hungary is among the largest emergency medical and ambulance organizations in Central Europe, employing almost 9,000 personnel. The entire leadership team of the National Ambulance Service participated in the futures workshops to directly influence their decision-making.

The findings indicate how structured foresight methods – such as scenario analysis, futures wheel, and vision writing – can be directly applied within a critical, time-sensitive, and operationally intensive healthcare system. This study illustrates the feasibility of providing an applied, participatory foresight case within one of the most operationally complex domains of healthcare.

Furthermore, the case underscores the cost-efficiency and strategic leverage of foresight in publicly funded, resource-constrained healthcare settings. In medium-developed countries where innovation needs to be both

frugal and scalable, foresight methods provide low-cost but high-impact tools for capacity building, staff retention strategies, and technology adoption roadmaps. This contributes to the existing literature on the role of foresight in governance, while extending it to an under-explored sector and domain.

Beyond its empirical contribution, this study advances futures methodology by demonstrating how integrated foresight toolsets can be operationalized within operationally intensive healthcare system to support anticipatory governance, strategic sensemaking, and organizational alignment under real-world constraints.

The article is organized in the following manner. The *literature review* section assesses contemporary research trends and gaps in the domain of healthcare foresight. This article concentrates on scientific journal articles published between 2024 and 2025, as a review article by Meskó et al. [26] has already thoroughly examined the relevant literature up to 2023. The *case study* section presents the details of the 'National Ambulance Service 2040' project. The project is evaluated by examining its origins, objectives, stakeholders, processes, methods, outcomes, impacts, and lessons learned. Finally, the *conclusion* section delineates the contributions, implications, and limitations of the project, while also articulating future research directions.

Literature review

While healthcare foresight has often been characterized as fragmented or underutilized, it is important to recognize that applications of futures methods in health and healthcare date back several decades. Earlier traditions of health futures and vision-oriented foresight emerged through the work of scholars and institutions such as *Trevor Hancock*, *Clement Bezold*, the Institute for Alternative Futures (IAF), and the World Health Organization (WHO), particularly in relation to preferable futures, public health transformation, and anticipatory governance [4, 16, 17]. Since the 1990s, futures methods have been applied in areas including health systems reform, public health planning, mental health, digital health, and medical technology assessment [7, 14, 41]. Nevertheless, these efforts have often remained fragmented across domains and institutions, with relatively limited methodological consolidation within healthcare foresight as a distinct field.

Within futures studies, healthcare represents a domain characterized by profound uncertainty, ethical complexity, and rapid socio-technical transformation, yet it has historically occupied a less consolidated position within methodological and theoretical futures research. A comprehensive scoping review by Meskó et al. [26] confirms that while futures and foresight approaches have been applied sporadically in healthcare, their use has often remained instrumental, fragmented, and weakly theorized. Nevertheless, the review also signals a turning point: foresight is increasingly recognized as a strategic capability informing national healthcare strategies, policies, innovation agendas, sustainability transitions, managing and training healthcare staff, and reforming the healthcare system. This dual condition – growing recognition alongside conceptual underdevelopment – provides an important point of departure for recent scholarship.

Research published in scientific journals between 2024 and 2025 reflects a notable evolution in how healthcare foresight is framed within futures studies. Rather than treating foresight solely as a forecasting or planning tool, recent studies increasingly position it as a systemic, collaborative foresight practice. At the organizational level, healthcare systems are conceptualized as complex adaptive systems in which uncertainty, non-linearity, and path dependency constrain traditional planning approaches. Empirical evidence from Alajrab et al. [1] demonstrates that strategic foresight capabilities among healthcare leaders are significantly associated with perceived service quality and artificial intelligence (AI) adoption, suggesting that foresight functions not merely as anticipation, but as a mechanism of organizational sensemaking and strategic alignment.

A second prominent strand of the recent literature emphasizes human agency and capability-building as central to future-oriented healthcare transformation. Rogayan [32] argues that futures thinking must be institutionalized within health education, recruitment, and licensure frameworks to cultivate anticipatory competence among healthcare professionals. Giunti et al. [13] identifies essential competencies such as complex adaptive systems thinking, patient-centeredness, and technological adaptability, along with mindsets centered on sustainability and prevention-focused care. This argument is extended by Eidgahi et al. [9], who propose a phased foresight model for medical universities that integrates stakeholder participation and real-world challenges. Similarly, Burns et al. [6] employ strategic foresight workshops to explore alternative futures for physician–scientist training, illustrating how foresight can surface emergent competency regimes rather than extrapolate existing ones.

From a methodological perspective, recent healthcare foresight studies highlight increasing pluralism and sophistication. Scenario planning, cross-impact analysis, morphological analysis, and normative backcasting are frequently combined to address long-term uncertainty and value-laden decision contexts. Ghasab et al. [12], for example, employ a multi-method futures framework to construct alternative futures for the internationalization of medical universities, while Rees et al. [31] advocate

normative backcasting as a corrective to technocratic workforce modelling.

Technological futures constitute a dominant cross-cutting theme, particularly in relation to AI, digital health, and data-intensive infrastructures. Conceptual contributions by Almusayhili et al. [2] and Sargsyan et al. [33] extend foresight methodology by integrating AI and machine learning into anticipatory processes, enabling continuous feedback, adaptive learning, and dynamic horizon scanning. At the same time, critical futures scholarship cautions against deterministic narratives. *Tucker* et al. [38] show how global health foresight exercises strategically privilege 'weak AI' narratives that foreground governance, ethics, and institutional feasibility over speculative or existential imaginaries – illustrating foresight's role not only in anticipating futures but in actively shaping legitimate future trajectories.

Applied studies further exemplify how healthcare foresight intersects with service delivery, infrastructure, and patient experience. Participatory scenario planning in chronic care digitalization [30], foresight-informed design of technology-integrated inpatient environments [37], decentralized biobanking ecosystems explored through backcasting [15], and metaverse-enabled scanning practices [43] collectively illustrate the expansion of foresight into socio-material, experiential, and ethical domains.

Spatial and infrastructural futures represent an additional, though less theoretically integrated, dimension. Jevtic et al. [22] argue that hospital architecture must anticipate demographic, technological, and societal shifts, reinforcing the need for foresight approaches that bridge policy, technology, and the built environment. Such contributions underscore the growing recognition that healthcare futures are not solely institutional or technological, but deeply embedded in physical, organizational, and cultural contexts.

Recent calls to action by Meskó et al. [27] consolidate these developments by urging healthcare institutions to embed futures thinking across organizational levels, moving from ad hoc projects toward sustained anticipatory governance.

Despite clear advances, the reviewed literature reveals a persistent gap at the intersection of futures methodology and healthcare application. First, while foresight methods are increasingly employed, they are often reported instrumentally, with limited reflexive discussion of epistemological assumptions, methodological integration, or the implications of normative choices. Second, participatory and normative approaches are frequently advocated but inconsistently operationalized, resulting in foresight outputs that are weakly connected to decision-making, governance, or long-term institutional transformation. Third, technological augmentation of foresight (e.g., AI-supported scanning and scenario analysis) remains insufficiently theorized in terms of how it reshapes anticipatory practice, power relations, and legitimacy in healthcare contexts.

Case study – the 'National Ambulance Service 2040' project

The National Ambulance Service is a state-funded budgetary agency. It is the sole ambulance service in Hungary responsible for emergency care outside of hospitals and the on-call family physician system. Boasting a workforce of nearly 9,000 and a total of 2.3 million patient care cases annually, it is the preeminent healthcare institution in the country.

The initiative emerged in response to an increasing awareness within the leadership of the Hungarian National Ambulance Service that their previously implicit or informal future assumptions were no longer sufficient to navigate a rapidly changing healthcare landscape. The organization encountered heightened pressure from multiple directions: disruptive technological innovations (particularly AI and automation), shifting demographic trends, climate-related operational challenges, and evolving public expectations around accessibility and compassion in emergency care. Lastly, a critical element is the constantly growing patient demand for emergency care witnessed globally.

Simultaneously, there was a noticeable absence of a cohesive, long-term vision that addressed the future on a scientific level, which would have served as a framework for strategic planning and workforce development. The leadership recognized the necessity to realign the organization's futures thinking in response to these factors and to adopt a proactive stance instead of a reactive one. Furthermore, the National Ambulance Service, as the sole national provider of the pre-hospital emergency care in Hungary, sought to keep pace with the global trend of healthcare foresight, which has gained momentum in recent years across hospital systems, public health agencies, and health ministries. The futures workshops addressed internal uncertainty and external complexity, offering a structured opportunity to explore alternative futures and identify the necessary capacities for navigating them effectively.

Backgrounds, objectives, and stakeholders of the project

In May 2025, a series of futures workshops were conducted in Budapest, concentrating on exploring potential futures and developing a new vision for the Hungarian National Ambulance Service by 2040. The project was commissioned by the general director of the National Ambulance Services, thus all participants actively engaged in the workshops and contributed to shared outputs intended to inform strategic decision-making.

The project was led by an experienced medical futurist, co-author of this article, with an established track record of conducting healthcare foresight and futures-methods workshops nationally and internationally. The project included ten meticulously selected participants embodying essential leadership and expert positions within the organization. The participants were the general director, medical and operational executives (emergency medical technician, ambulance driver, paramedic, emergency physician, etc.), the head of communications, the legal director, an Information Technology (IT) systems specialist, an AI and data strategist, and a patient representative. The group's diversity facilitated a comprehensive exploration of strategic challenges and opportunities through structured futures methods, including scenario analysis, futures wheel mapping, and vision writing.

The initiator of the project was appointed to the present role in 2017. Even at that time, he was regarded as the inaugural digitally native general director of the National Ambulance Service. He is committed that the future of emergency services in Hungary must be both sustainable and dynamically developing. He has developed a fully digital patient care system within the ambulance service. Alarms are dispatched to the tablets of the ambulance crews, who use them to complete patient documentation. Upon the patient's transfer, all documentation is uploaded to the national health cloud. Subsequently, both the patient and the attending physician can promptly access all pertinent details of the care provided. During on-site care, ambulance personnel have access to the patient's prior medical records stored in the national health cloud. The objective for 2040 is to establish a modern, patient-focused and data-driven emergency care system where technological innovations serve human life as the ultimate value, rather than existing as ends in themselves. The foundation for this trajectory has been established in recent years. Nearly 5 million digital data sets are examined daily from emergency units utilizing Business Intelligence (BI) and AI algorithms to ensure efficient and safe patient care. By 2040, rescue management is anticipated to employ AI, real-time data communication, digital/AI-driven triage, drone-assisted equipment delivery, and a fleet of autonomous electric and alternative-fuel vehicles to facilitate faster, more accurate, and more efficient assistance.

The Hungarian National Ambulance Service is inherently innovative that has persisted from its inception to save people's lives. It is asserted that via ongoing training, professional innovation, and social collaboration, they are developing an ambulance service equipped to meet the challenges of the forthcoming decades, deserving of its international role and the trust of the Hungarian people. As it has for the prior 138 years. It is the responsibility to shape the future of the patients and colleagues, thus impacting the entire Hungarian society.

The objective of the workshops was to collaboratively contemplate the future of the National Ambulance Service with a sufficiently varied cohort of participants. 2040 was an ideal target year as it is far enough to prevent participants' current mindset from being constrained by immediate issues, yet close enough to avoid the formulation of unrealistic future visions. At the outset of the workshops, participants were informed that all perspectives held equal weight, with particular emphasis on the representation of the patient's perspective.

The objectives of the futures workshops were well-articulated and appropriately tailored to the context, striking a balance between imaginative exploration and strategic relevance. By explicitly emphasizing the equal value of all perspectives – including the patient's – the project ensured broad stakeholder alignment and buy-in. These objectives effectively met stakeholders' requirements by addressing both the leadership's need for long-term direction and participants' expectations for a participatory, inclusive process. The anticipated outcomes of each phase – such as co-created scenarios, futures wheel, and a shared vision – were clearly aligned with the organization's strategic planning needs. Overall, the research design proved effective, as the structured use of multiple foresight methods fostered deep engagement and produced actionable insights that are already informing internal policy and organizational development.

Initially, participants received extensive training on the fundamental principles and methodologies of futures studies. Participants recognized that foresight employs methods that facilitate the exploration and formulation of possible, probable, preferable, and plausible futures. These methods have been integral to business and economic discourse for decades; yet their use in healthcare and medicine has only recently emerged on a global scale.

Participants were provided with a concise overview of the common mistakes individuals commit in such workshops. Inter alia, the peril of uncritical optimism and the technological and cultural blind spots were discussed. The latter emphasizes that when delineating the future of technological evolution, it is easy to fall into the trap of overlooking cultural changes. This is equally true in reverse. The objective was not to predict the future, but to articulate a vision that would assist both present and future leadership of the organization.

Process, methods, and results of the project

The conceptual model for this foresight process was designed to balance structured analysis with collaborative creativity. The process commenced with a Social, Technological, Economic, Environmental, and Political (STEEP) analysis to establish a shared understanding

of the broader forces shaping the future of emergency care, followed by scenario development to explore plausible futures based on key uncertainties and drivers. The futures wheel deepened the analysis by examining the second- and third-order consequences of a critical technological milestone (AI integration). The process concluded with a vision writing exercise that facilitated the translation of foresight insights into a narrative to inform strategy and communication. These methods were selected for their accessibility, complementarity, and proven relevance in public-sector foresight. Feedback from participants confirmed that the methods were engaging, understandable, and useful, with numerous individuals expressing gratitude for the clarity they provided to strategic dilemmas. Figure 1 illustrates the utilized foresight process.

The foresight process generated multiple forms of qualitative data, including structured workshop notes, visual artefacts (e.g., scenario matrices, STEEP mappings, and futures wheel diagrams), and synthesized outputs documented in real time by facilitators. These materials were consolidated into a comprehensive post-workshop report, which served as the primary analytical corpus for this study.

The analysis followed an iterative qualitative synthesis approach. First, outputs from each foresight method were categorized into thematic domains (e.g., technological, organizational, societal, and governance-related factors). Second, key drivers, uncertainties, and recurring patterns were identified through facilitated group discussions and validated by participants during the workshops. Third, these elements were synthesized into higher-level

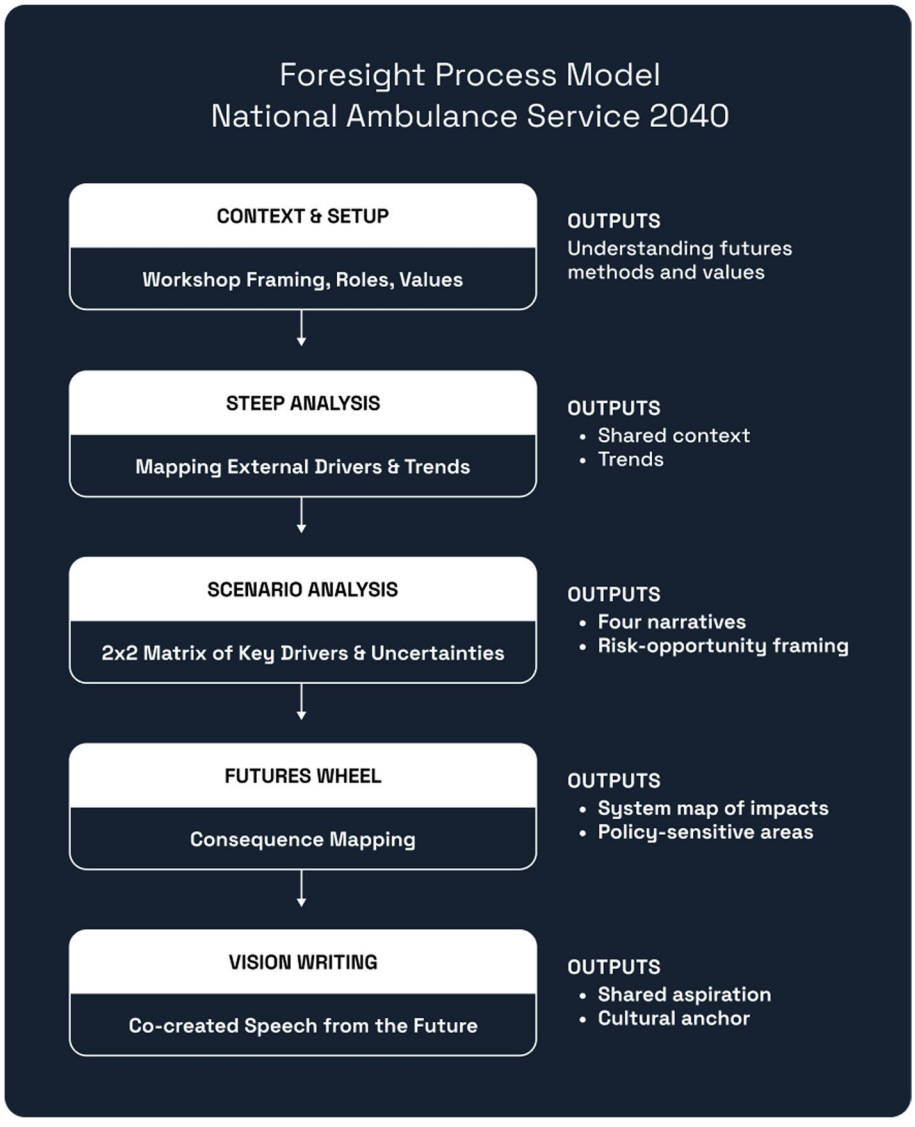

Fig. 1 The process of the foresight project. Source: own work

insights concerning strategic challenges, capability requirements, and future development pathways.

Agreement among participants was achieved through deliberative discussion and iterative refinement rather than formal quantitative measures. This approach is consistent with participatory foresight practices, where consensus emerges through structured dialogue and collective sensemaking rather than statistical aggregation.

Results of the STEEP and scenario analysis

The futures workshop series commenced with a STEEP analysis to delineate the principal macro-environmental factors influencing the future of ambulance services in Hungary. The issues of aging and declining rural populations, health literacy, and expectations for patient-centered care were emphasized as social factors. Technological trends mainly encompassed AI integration, wearable data, and fully autonomous fleets. Economic factors predominantly addressed European Union (EU) funding cycles and prospective efficiency improvements caused by AI. Environmental issues focused on climate change and the transition to green fleets. As political factors, participants highlighted centralized healthcare governance, unpredictable regulation, and the role of the EU in shaping national strategies. Figure 2 encapsulates the STEEP factors identified by participants.

The aforementioned factors were analyzed in subsequent workshops. This established a shared basis for reasoning, enabling participants to comprehend the complex ecosystem in which the service functions and where long-term strategies and vision should be formulated. This activity anchored the workshops in contemporary trends and uncertainties, establishing a common basis for scenario development. This guaranteed that ensuing scenarios, decisions, and visions were realistic and relevant.

After conducting the STEEP analysis, participants pinpointed a key driver and a critical uncertainty to function as the axes of the scenario matrix. The key driver

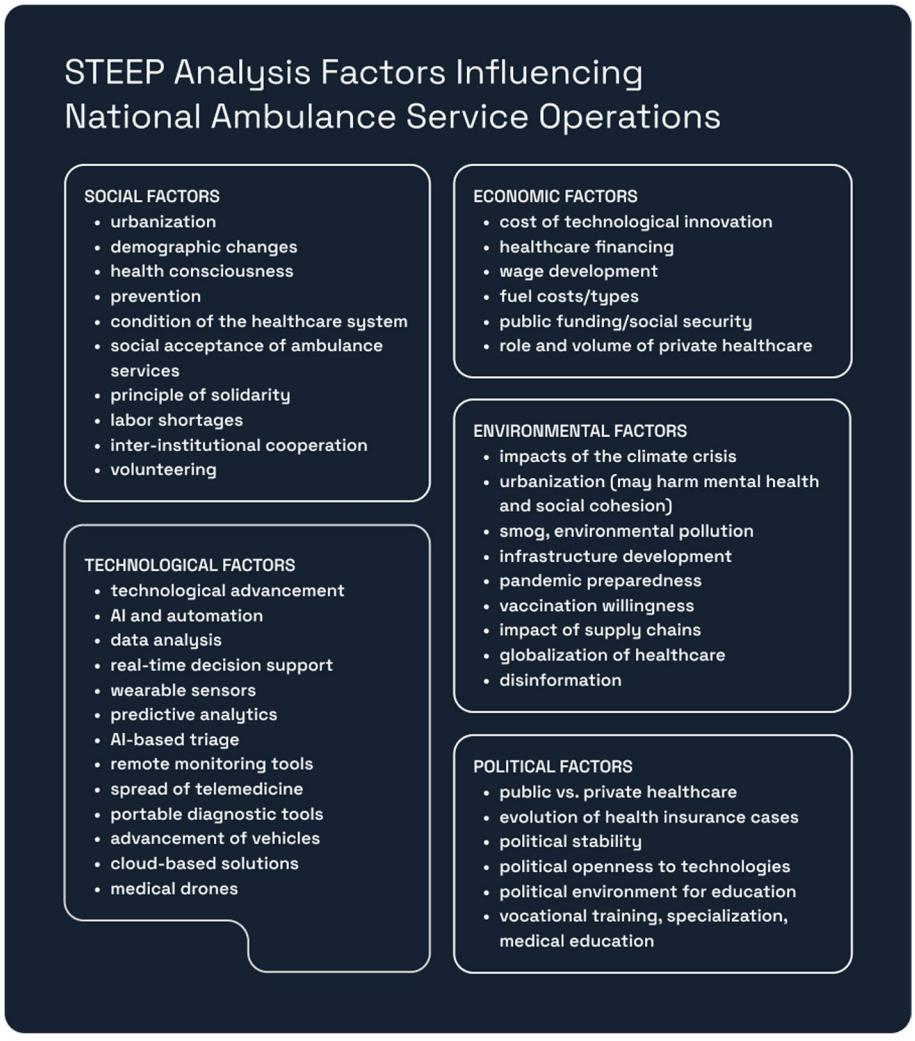

Fig. 2 Results of the STEEP analysis. Source: own work

identified was the level of AI integration within ambulance service operations, signifying the most transformative force shaping the future of emergency response. The major uncertainty pertained to the volume of emergency cases, which could vary significantly based on socioeconomic, demographic, environmental, and healthcare system factors. The two dimensions – AI integration (low vs. high) and case volume (low vs. high) – constituted the basis for four distinct scenarios for 2040, each presenting a plausible yet divergent perspective on the organization's future. The fundamentals of the four scenarios can be summarized as follows.

1. *High-tech renaissance (High AI, High case volume):* The ambulance service thrives technologically, utilizing advanced tools and predictive analytics. Personnel engage in ongoing reskilling, and the responsibilities of paramedics evolve to be multifaceted. Cultural opposition to technology adoption persists as an issue, necessitating strategic change management.
2. *Emergency protocol (Low AI, High case volume):* A reactive, resource-constrained system influenced by crises, characterized by the persistence of outdated technologies and an overwhelmed operational capacity. This future indicates a lack of modernization, resulting in burnout and inefficiency.
3. *AI robot pilot (High AI, Low case volume*): A golden era of digital transformation characterized by the utilization of AI and automation to diminish caseloads via prevention and prediction. The workforce prioritizes quality and specialized treatment, while patient trust in the system increases through seamless, technology-enhanced encounters.
4. *Low-tech balance (Minimal AI, Low case volume):* A stable but unchanging environment. Human-centered care is emphasized, although lacks significant innovation. The organization risks falling behind globally, with a culture dominated by workers resistant to technological upskilling.

These scenarios served not as predictions but as frameworks for exploring consequences, values, and preparedness pathways. In the upcoming workshop, participants collaboratively crafted the narrative elements of scenarios for the future of the National Ambulance Service, influenced by a distinct driving force (funding for technological development: high vs. low) and a key uncertainty (the disparity between case numbers and capacity: large vs. small). It enabled the anticipation of possible changes and facilitated proactive adaptation. Participants were able to think comprehensively and develop adaptable, future-oriented strategies in the face of complex problems and uncertain circumstances.

It was important to emphasize that there was no good/desired or bad/avoidable scenario, and the vision was not formulated based on these ideas. The goal is that whatever future unfolds in practice, the National Ambulance Service will be strategically prepared for it. The four scenarios displayed in Fig. 3 demonstrate that the future of the National Ambulance Service is influenced simultaneously by technological opportunities, the social environment, and the human factor.

The 'Emergency protocol' and 'Low tech balance' scenarios highlight that if significant technological advancements are lacking or unexpected crises dominate, the emergency services could become primarily reaction-based, with the strain on human capacity becoming a

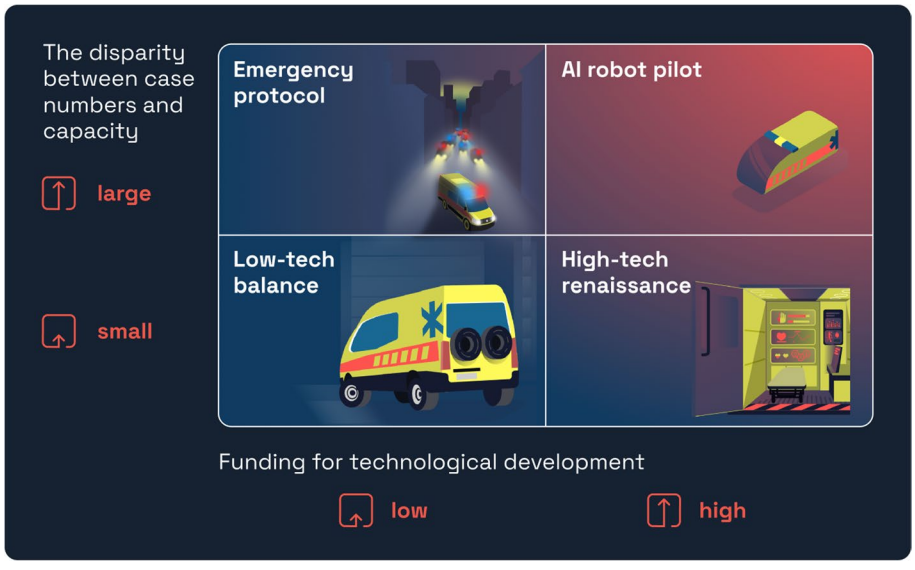

Fig. 3 The employed scenario logic. Source: own work

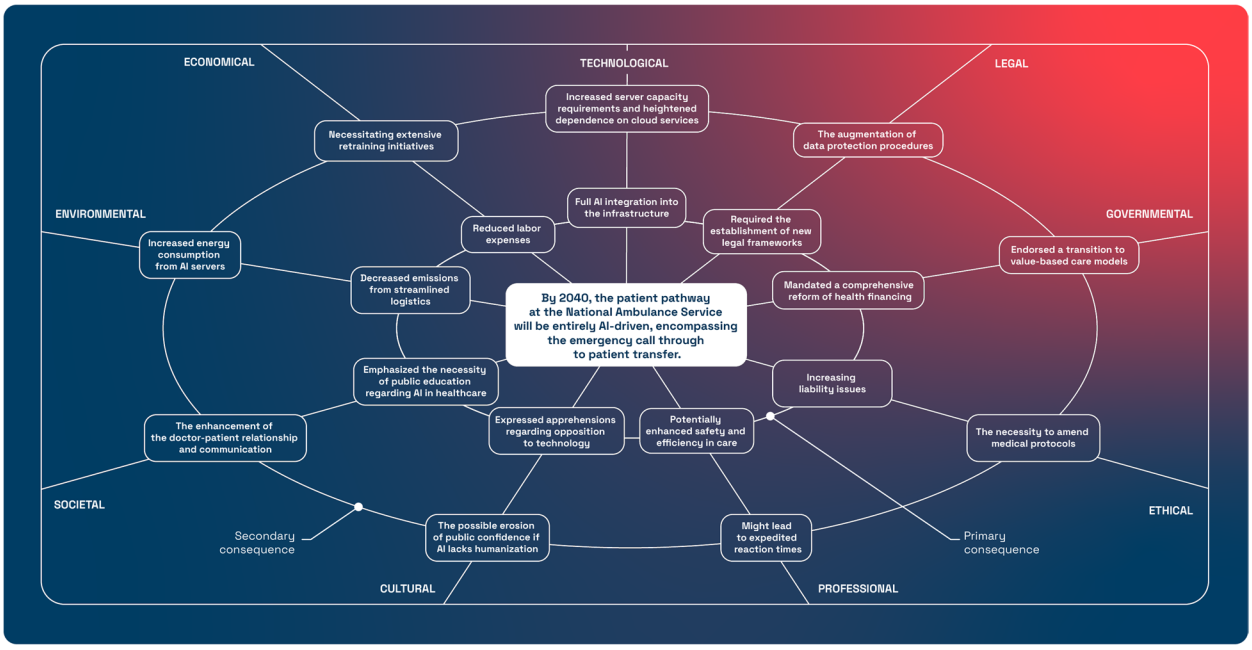

Fig. 4 The developed futures wheel. Source: own work

critical point. The resilience of the National Ambulance Service is decreasing. In such cases, the emphasis is placed on the flexible and humane utilization of existing resources, which, while providing a sense of security, can pose serious sustainability challenges in the long term in terms of workforce retention. In contrast, the 'High tech renaissance' and 'AI robot pilot' scenarios highlight that the proactive application of technological innovations (whether AI, portable diagnostic devices, or AI algorithm-based rescue management and decision support) can open up new professional perspectives for the organization. Based on these scenarios, the future paramedic could transform into a technocratic comrade, which – in addition to integrating new technologies – requires highly interdisciplinary competencies. Nonetheless, this also presents the difficulty of ensuring ongoing staff retraining and managing cultural resistance to technology.

The scenarios indicate that the primary challenge for the future National Ambulance Service will be achieving a balance among the pace of technological advancement, public trust, and the ongoing retraining of personnel.

Results of the futures wheel analysis

Subsequently, the workshops progressed with a futures wheel analysis, a method extensively utilized across various corporate, policy, strategic, and social domains, and lately adopted in healthcare environments.

The most challenging step throughout the group exercise was defining the central event. Participants selected a milestone they considered both achievable and desirable, which would significantly influence the overall functioning of the National Ambulance Service and its role within Hungarian healthcare: *By 2040, the patient pathway at the National Ambulance Service will be entirely AI-driven, encompassing the emergency call through to patient transfer.*

The futures wheel was developed to examine the secondary and tertiary consequences of the central event serving as a pivotal milestone (see Fig. 4). The analysis covered various domains:

- *Technological:* Resulted in increased server capacity requirements and heightened dependence on cloud services.
- *Governmental:* Mandated a comprehensive reform of health financing and endorsed a transition to value-based care models.
- *Legal:* Required the establishment of new legal frameworks and the augmentation of data protection procedures.
- *Societal:* Emphasized the necessity of public education regarding AI in healthcare and the enhancement of doctor-patient relationship.
- *Cultural:* Expressed apprehensions regarding opposition to technology and the possible erosion of public confidence if AI lacks humanization.
- *Environmental:* Indicated both advantages (decreased emissions from streamlined logistics) and hazards (energy consumption from AI servers).
- *Ethical:* Raised questions of liability and the necessity to amend medical protocols.

- *Economic:* Reduced labor expenses while necessitating extensive retraining initiatives.
- *Professional:* Facilitated expedited reaction times and potentially enhanced safety and efficiency in care.

The futures wheel emphasized that the success of AI depends not just on technical feasibility but also on societal acceptance, policy adjustment, and proactive workforce development.

The futures wheel suggests that the incorporation of AI technology will fundamentally transform the operations, infrastructure, and services of the National Ambulance Service, hence affecting the entire healthcare system. The comprehensive integration of AI necessitates not only technology development but also substantial investments and strategic foresight, especially in augmenting server capabilities and cloud-based services. Nonetheless, reskilling the workforce and establishing legal and ethical parameters will pose significant challenges. This underscores that the advancement of the existing technology infrastructure must be prioritized for the National Ambulance Service to effectively navigate future changes.

A crucial conclusion is that social and cultural factors must be actively addressed due to the AI-driven transformation. Extensive social education and awareness among patients will be essential for the effective integration of technology. Concurrently, since the significance of patient-doctor communication escalates, the enhancement of human resources and soft skills must be incorporated into training programs immediately. To mitigate resistance and distrust, proactive communication strategies are essential, highlighting that AI augments patient safety and reinforces human care, rather than supplanting human connection.

The establishment of an ethical and legal framework is also of paramount importance. The implementation of AI underscores the necessity of delineating responsibilities, hence requiring the establishment of novel professional and ethical standards. Consequently, it is advisable to commence preparations for the impending enforcement of data management regulations, enhancing data security, and explicitly delineating responsibilities, while engaging ethics committees, legal professionals, and healthcare executives, as this will serve as a critical foundation for acceptance and societal trust in AI-based systems.

Results of the visioning exercise

The series of futures workshops concluded with a visioning exercise. It not only offered a definitive framework for strategic planning but also aimed to serve as a motivating and unifying catalyst to emotionally engage individuals, fortify a collective identity, and mitigate inherent reluctance to change. Moreover, a collaboratively developed and shared vision mitigates uncertainty and assists organizational members in aligning their everyday operations with long-term objectives.

Participants imagined a keynote speech delivered by the general director in the Parliament of Hungary in 2040 to celebrate the Ambulance Day. The speech commemorated 153 years of uninterrupted national service, emphasizing technological advancement and persistent human values. Prominent themes encompassed:

- The transition from horse-drawn carriages to autonomous ambulances, epitomizing advancement.
- The total digitization and environmental metamorphosis of operations (e.g., five years of paperless functioning, diminished ecological footprint).
- Effective workforce reskilling post-automation.
- The incorporation of AI in anticipatory response systems, decreasing average response time for critical cases to under 10 min nationwide.
- A reaffirmation that, although technology supports the mission, human empathy and professional identity are paramount.

This story established a preferred future in which the National Ambulance Service serves as a global benchmark for innovation and resilience, grounded on trust and tradition.

A key lesson derived from the vision articulated in the general director's speech is that technological development, regardless of its speed and intensity, only transforms into a genuine source of organizational strength when human values are upheld and deliberately cultivated. The speech unequivocally indicates that the cornerstone of the National Ambulance Service's success is not merely innovation, but also the unwavering camaraderie, empathy, and sense of mission that endure despite technological progress, and are anticipated to persist until 2040.

The vision clearly states that, in preparing for the future, it is essential to adopt new technology while simultaneously addressing the problems posed by the evolving labor market and society. The emphasis on retraining and staff reskilling, alongside the pursuit of paperless processes, can exemplify best practices for other organizations. All factors indicate that sustainability, social responsibility, and the optimization of human potential can serve as a competitive advantage in an increasingly technologized world. The vision posits that technological change serves not as an end, but as a means to fulfill the objectives of the National Ambulance Service. The future will be governed by organizations that can flexibly adapt to changing situations while adhering to their core values and people-centric approach. The National Ambulance Service may exemplify this if decision-makers and

management undertake tangible actions to actualize this vision commencing now.

Outcomes, impact, and learning of the project

The outcomes of the project indicated that the National Ambulance Service should undertake immediate efforts to effectively address future challenges. The organization must further develop its digital infrastructure while simultaneously improving workforce digital literacy. They should equip the entire organization for unprecedented technical developments. Decisions must be based on real-time, reliable data; therefore, the vehicle fleet should be upgraded with environmentally friendly and rapidly responding equipment. They must also equip colleagues with new competencies in technology, communication, and psychology. These trainings need to commence tomorrow to ensure the organization is prepared for prompt transformation. AI, predictive analytics, and automated processes will not replace humans; nonetheless, they will significantly improve the efficiency of rescue operations. The future National Ambulance Service should be flexible, resilient, data-driven, and focused on individuals, therefore they must initiate and progress towards this objective today.

The foresight project yielded concrete and actionable outcomes for the National Ambulance Service, highlighting the urgent need to advance the organization's digital infrastructure, improve digital literacy across staff levels, and introduce new competencies in communication, psychological resilience, and technology adoption. The results were disseminated internally via a written report and integrated directly into strategic planning processes, ensuring their practical use. The report was disseminated to the public and placed in a time capsule to be housed at the official museum of the National Ambulance Service for future generations. As a first step, several of their lawyers began AI training last year to keep this expertise internally, thereby enhancing both employee security and patient data protection. Furthermore, they revised their organizational and operational regulations and established a Data Science and Artificial Intelligence Department.

Feedback from participants indicated that the outcomes were relevant, robust, and satisfying, inspiring trust and aligning with stakeholder expectations. The participatory design of the workshop contributed significantly to these results, as the co-creative nature of the scenarios, futures wheel, and vision writing helped translate abstract challenges into shared priorities. Follow-up activities are already underway, including internal discussions on training programs and digital modernization.

The project also helped catalyze anticipatory capacity within the organization by giving legitimacy to long-term thinking and providing practical tools for shaping institutional futures. Given the modest financial investment, the foresight initiative revealed high cost-effectiveness – a particularly valuable attribute in a resource-constrained public health context. Finally, the narrative and visual elements of the scenarios and future vision were engaging and inspiring, leaving a lasting impact on participants' imagination. The project offered important insights into how foresight methods can be made accessible and high-impact within life-critical public service and highlighted the importance of linking futures thinking to organizational identity and values. These lessons will inform the design of future foresight initiatives in similarly complex, high-pressure healthcare systems.

The foresight process also generated several methodological insights relevant for futures practitioners. First, participants engaged most effectively when foresight methods were introduced sequentially, allowing gradual familiarization rather than simultaneous methodological complexity. Second, scenario development initially posed challenges, as participants tended to default to linear projections; facilitation was required to encourage nonlinear and divergent thinking. Third, the futures wheel proved particularly effective in revealing systemic interdependencies and second-order consequences, although defining the central event required careful guidance. Fourth, the visioning exercise demonstrated strong integrative and motivational value, translating analytical outputs into a shared and actionable narrative.

These observations suggest that the success of foresight processes in operational environments depends not only on method selection but also on facilitation design, sequencing, and the ability to connect analytical insights with institutional culture.

Conclusion

This article aimed to analyze the meaningful application of structured foresight methods inside a mission-critical healthcare organization, utilizing the 'National Ambulance Service 2040' project as an in-depth case study. This approach enhances both academic futures studies and healthcare policy by illustrating the integration of participatory, normative, and reflexive foresight into real-world decision-making environments marked by operational intensity, uncertainty, and public accountability.

This study provides empirical evidence to the ongoing discussions about the practical significance and methodological rigor of applied foresight from the viewpoint of futures studies. Although futures studies has consistently highlighted the significance of inclusive futures processes, there is a paucity of empirical evidence illustrating how these concepts are implemented inside organizations tasked with delivering life-critical public services. This article illustrates that classic futures methods – when

judiciously integrated – can facilitate long-term strategic orientation while maintaining methodological rigor, by elucidating the design, implementation, and results of a foresight process inside a national ambulance service.

The primary contribution is demonstrating the complementarity of foresight tools. The sequential incorporation of STEEP analysis, scenario development, futures wheel, and visioning enabled participants to move from macro-environmental awareness to systemic consequence exploration and, finally, to normative alignment around a preferred future. Instead of regarding these methods as interchangeable or standalone techniques, the case illustrates how their combined use enhances anticipatory capacity by concurrently addressing contextual, strategic, systemic, and cultural dimensions of the future. This contributes to futures methodology by providing an empirically substantiated instance of method integration under real organizational constraints.

The study also enhances futures scholarship by illustrating that visioning serves as more than only a communicative exercise. The collaboratively developed future narrative functioned as a governance and mobilization tool, translating abstract foresight discoveries into a collective sense of purpose that aligns with organizational identity and values. This finding substantiates claims in futures studies that highlight the performative and normative aspects of futures work, especially in institutional contexts where legitimacy and trust are critical.

Moreover, the project exemplifies second-order futures practice by overtly questioning underlying assumptions on technology, human roles, and organizational resilience. Participants were encouraged through structured reflection to envision alternate futures and critically examine their views regarding development, efficiency, and care. This study illustrates how healthcare organizations can effectively advance reflexive futures work, portraying healthcare not only as an application domain but also as a contributor to futures theory and practice.

This study provides insights pertinent to healthcare leadership and public policy, in addition to its academic contributions. Emergency medical services function at the intersection of technological innovation, workforce sustainability, public trust, and ethical responsibility. The findings indicate that foresight enables leaders to transcend reactive responses to present demands by articulating and jointly negotiating long-term assumptions.

The 'National Ambulance Service 2040' project illustrates that foresight methods are feasible, cost-effective, and impactful, even in publicly funded, resource-limited healthcare systems. The minimal financial commitment needed for the workshops significantly contrasts with the strategic value produced, such as a clearer long-term vision, improved internal alignment, and tangible contributions to strategic planning. This contradicts the notion that foresight is an exclusive privilege of well-resourced businesses or governmental policy entities, indicating that it can serve as an effective governance instrument at the organizational level.

Policy-relevant implications also emerge from the way in which technological futures – especially those related to AI – were addressed. Instead of framing AI as an unavoidable or solely technological remedy, the foresight process revealed the social, cultural, ethical, and legal contexts necessary for the legitimization of AI-enabled emergency care. This underscores the significance of anticipatory governance approaches that combine technology assessment with workforce development, public communication, and regulatory preparedness. For policymakers, the case highlights that preparing for digital transformation in healthcare requires coordinated action across multiple domains, rather than relying just on isolated technological investments.

The participatory design of the foresight process has implications for organizational legitimacy and trust, both within and outside the organization. Incorporating diverse leadership roles and a patient representative, the project cultivated shared ownership of future visions and mitigated the risk of foresight outputs being viewed as top-down or technocratic. This indicates that participatory foresight may enhance democratic accountability and societal confidence in publicly supported healthcare facilities, a matter of growing significance amid rapid technological advancements.

Although the study offers valuable insights, certain limitations must be acknowledged. First, the research is based on a unique case study, hence limiting generalizability. However, the extensive empirical detail provides analytical depth and facilitates theoretical transferability instead of representativeness. Second, participation in the foresight process was predominantly at the leadership and expert level. Although this approach aligned with the project's strategic objectives, future projects could benefit from a broader involvement of frontline personnel to obtain additional viewpoints. Third, the assessment of outcomes inherently pertains to a short-term perspective. The immediate effects on strategic thinking and organizational alignment are apparent, although the long-term impact of the foresight process on decision-making, performance, and resilience remains empirically unassessable. Fourth, the findings are influenced by the Hungarian contextual, cultural, organizational, and regulatory framework, potentially restricting their direct applicability in other settings. These limitations define the analytical boundaries of the study rather than weaknesses of the research design.

The case study opens several promising avenues for future research at the intersection of futures studies and healthcare. Comparative analyses of ambulance services

or emergency medical systems in various country contexts could enhance comprehension of how governance frameworks and cultural influences affect foresight results. Longitudinal research examining the impact of foresight-generated visions on decision-making over time would provide valuable evidence concerning the sustainability and efficacy of anticipatory interventions.

Methodologically, further experimentation is necessary to integrate digital and AI-supported foresight tools with participatory processes, specifically to investigate their impact on power dynamics, legitimacy, and inclusion. Additionally, more critical research is needed on whose futures are emphasized in healthcare foresight and how marginalized voices might be more systematically integrated. Ultimately, linking foresight processes to quantifiable indicators of organizational resilience, workforce sustainability, or service quality would help bridge the gap between anticipatory practice with evaluative policy research.

Overall, this article demonstrates that healthcare foresight, when grounded in established futures methods and tailored to organizational contexts, can yield significant strategic insights while contributing to the development of futures studies. This study establishes a national ambulance service as both a topic and a venue for futures studies, emphasizing the importance of healthcare as a rich area for methodological innovation, normative contemplation, and policy-relevant foresight. In an era of accelerating uncertainty and technological advancement, such integrative approaches will be essential for creating resilient, humane, and future-oriented health systems.

Abbreviations

AI	Artificial Intelligence
BI	Business Intelligence
EMS	Emergency Medical Systems
EU	European Union
IAF	Institute for Alternative Futures
IT	Information Technology
STEEP	Social, Technological, Economic, Environmental, and Political
WFSF	World Futures Studies Federation
WHO	World Health Organization

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Data availability
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Declarations

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The authors declare that they have no competing interests.

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