Building a resilient healthcare system in Bulgaria using an adapted ” Four Generic Futures” approach

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European healthcare systems, including Bulgaria’s, face compounding challenges that threaten their long-term sustainability and social impact. Rising costs, growing burdens of non-communicable diseases (NCDs), and workforce shortages are converging with rapid demographic aging, placing significant strain on healthcare infrastructure and budgets. Thus the rising share of healthcare expenditure in GDP is a growing concern for many economies. If this trend continues, healthcare will consume an ever-larger portion of national income, crowding out other critical investments like education, infrastructure, and could jeopardize the European green transition.

In Bulgaria, these issues are especially pronounced. Bulgaria’s healthcare system will undergo unprecedented stress, driven by demographic changes, the rising burden of non-communicable diseases, and structural inefficiencies. As one of the EU countries with the highest rates of preventable mortality, largely due to cardiovascular disease, cancer, and diabetes, the nation faces a pressing need to reimagine its healthcare delivery model. The aging population further exacerbates the issue, with projections indicating that by 2040, more than 30% of Bulgarian citizens will be over the age of 65. Combined with persistent financial constraints, critical workforce shortages, and fragmented digital infrastructure, these challenges threaten the long-term sustainability and equity of healthcare provision. For countries such as Bulgaria rising health expenditure places a heavy burden on government budgets. Governments must either raise taxes or increase borrowing, reduce spending on healthcare or cut spending in other essential areas such as social services, defense, or education. Reducing spending on healthcare is critical, but if it is not done through efficiency gains it will only lead to the hollowing out of the quality of the health care system and create greater polarization as more affluent individuals move towards private healthcare services. A core issue in Bulgaria’s healthcare system is underfunding, which leads to resource shortages, disparities in service quality and high out-of-pocket expenses (OOP). Bulgaria has one of the highest out-of-pocket healthcare expenditures in the EU, more than double the EU average. As health care cost keep rising as a share of GDP it presents an ever-growing problem and a slow-moving crisis. For Bulgaria’s healthcare system to be resilient efficiency improvements and innovation must be prioritized.

The rise of digital health services and the increasing recognition of the unsustainability of current healthcare models are driving a global transition toward more personalized and integrated care. By emphasizing preventive services, early interventions, and tailored treatments Bulgarians can achieve better health outcomes, while healthcare systems enhance their efficiency and overall effectiveness. Smoking, unhealthy diets, alcohol consumption and low physical activity are responsible for nearly half of all deaths in Bulgaria. The smoking rates are the highest in the EU. Expanding preventive healthcare initiatives, such as lifestyle interventions, early disease screening, and vaccination programs can significantly reduce the prevalence of chronic diseases like diabetes, cardiovascular conditions, and cancer. Another critical efficiency driver is the integration of digital health solutions. Bulgaria is already well underway with integrating digital solutions, but much remains to be done. The Bulgarian healthcare systems still suffer from bureaucratic redundancies and fragmented data management, leading to unnecessary expenses.

This extended abstract presents strategic policy and system-level recommendations for transforming Bulgaria’s healthcare system into a resilient, prevention-oriented, and digitally enabled model. The work is grounded in the FutuResilience project, funded under Horizon Europe, which seeks to

strengthen Europe's ability to withstand and adapt to crises through innovative, science-based policy co-creation labs. In Bulgaria, this approach is operationalized through the BAPEMED Lab, which applies foresight tools to test and refine health policy strategies under multiple plausible futures. Although developed in a national context, the recommendations have broad relevance for other EU countries facing similar structural and systemic healthcare challenges.

The policy vision centers on building adaptive health systems capable not only of responding to acute crises such as pandemics, but of addressing long-term, slow-burning vulnerabilities, such as the persistent rise in healthcare costs. Over the past five decades, healthcare expenditure as a percentage of GDP has steadily increased across many countries. If left unchecked, this trend may displace critical investments in education, defense, or climate adaptation, becoming a systemic enabler of future crises. The need for fundamental reform is clear.

To meet this challenge, Bulgaria must strengthen cross-sectoral governance and break down siloes between ministries and institutions. Current fragmentation across health, education, digital, and economic policy domains impedes coordinated action and policy coherence. A national governance framework aligned with the European Health Data Space (EHDS) is essential to ensure strategic alignment, transparency, and continuity beyond short-term political cycles. The establishment of a multi-stakeholder governance network could help identify synergies and dependencies, ensure that decisions are grounded in evidence, and build the social trust required for sustained reform.

Modernizing Bulgaria's health information systems is another critical pillar. Although the National Health Information System exists, its limited interoperability undermines continuity of care and data-driven decision-making. A next-generation system must adopt unified technical and semantic standards across all healthcare providers, public and private, from primary to specialized care. Such a system should support bidirectional data flows, enabling patients and clinicians alike to contribute to and benefit from secure, real-time information access. Robust data governance frameworks must also be implemented to protect privacy while enabling health data to be securely shared with research institutions and innovation actors for secondary use.

The COVID-19 pandemic underscored that technological infrastructure alone does not guarantee resilience. Effective systems require integration of early warning and epidemic intelligence mechanisms that draw on structured, standardized data from diverse sources. AI-enabled detection tools, environmental data integration, and centralized dashboards can enable health authorities to identify risks early and respond rapidly. Strengthened surveillance capacity must be coupled with clear communication protocols, simulation-based training, and support systems for frontline healthcare professionals.

The Bulgarian healthcare workforce presents both a major challenge and a crucial opportunity. Persistent shortages, particularly due to emigration, and a growing digital skills gap, especially among older populations, have slowed the adoption of digital tools. Future resilience depends on cultivating an agile, tech-literate, and well-supported workforce. New educational tracks in digital health, informatics, and AI-assisted care are needed, building on initiatives such as the SUSA Project, which is developing dozens of bachelor's and master's programs in digital health across the EU. Continuous professional development, including reskilling and upskilling for current staff, must be accompanied by institutional support, mental health services, and fair remuneration to ensure workforce resilience. Innovative methods such as simulation environments using augmented reality and AI for emergency care scenarios can provide flexible, scalable training pathways.

The transformation of healthcare delivery must be both technology-centered and people-driven. Bulgaria has made early progress in leveraging digital health tools, with promising initiatives like the AI Factory and Project Veles. However, these innovations must be scaled through a structured ecosystem that supports rapid development, testing, and deployment. Establishing regional digital health hubs, expanding public-private partnerships, and ensuring sustainable financing for digital innovation can accelerate uptake and adaptation. Living labs embedded within healthcare settings provide an environment for iterative innovation and evidence-based scaling.

A foundational shift from reactive treatment to proactive prevention is imperative. The Bulgarian National Health Strategy 2030 already outlines this priority, but significant acceleration is needed. Nationwide preventive health campaigns, supported by predictive analytics and digital screening tools, can increase early detection and reduce long-term care costs. Community engagement through digital platforms can enhance health literacy and promote behavior change. Additionally, remote monitoring systems and telehealth infrastructure must be expanded and reimbursed to support prevention-focused, decentralized models of care. Legislative adjustments to enable these reimbursement models will be essential for system-wide adoption.

These changes must be supported by a vibrant national innovation ecosystem. Digital health innovation is often hampered by fragmented funding pathways, lack of scale, and unclear intellectual property frameworks. Bulgaria should prioritize the creation of health technology clusters that support joint ventures between academia, industry, and healthcare institutions. Incentives for innovation procurement, mentorship programs for health entrepreneurs, and integration with EU-wide networks will help bring locally relevant solutions to market.

Taken together, these strategic pillars, governance reform, interoperable health information systems, early warning capacities, workforce development, digital innovation, and preventive care, form a coherent roadmap toward healthcare resilience. While the focus here is Bulgaria, the proposed framework is broadly applicable across the EU. Countries with similar levels of digital health maturity and shared demographic pressures can adapt these strategies to suit national contexts while aligning with common goals under the EHDS and Horizon Europe frameworks.

Success will require political leadership that transcends electoral cycles, a commitment to public trust-building, and meaningful collaboration across sectors.

Methodological Background:

The collapse of the healthcare system was identified early on as a plausible and highly disruptive future crisis To explore this, the Copenhagen Institute for Futures Studies (CIFS) applied Dator's Four Futures framework as a conceptual lens for structured exploration of alternative societal pathways. The Four Generic Futures model, publshed in 1979 by Jim Dator of the University of Hawaii at Manoa is a model of change in social systems which examines 4 different archtypes futures. The method has since been regarded as a foundational model in futures studies. Dator collects these images of the future from a diverse range of sources including Sci Fi litterature.

The 4 generic futures are as follows:

- Continued Growth: Current trends continue eg. economic growth, technological progress and globalization. Dator show how this is often the default assumption in mainstream planning and policy.
- Collapse: A scenario in which a system (society, economy, or environment) undergoes a significant breakdown due to resource depletion, economic crises, war, or ecological disaster (Malthus curse). This is a favorite theme of Sci Fi: “The day after tomorrow”, “Terminator” etc.
- Discipline: A future shaped by societal constraints. A typical example is the degrowth movements.
- Transformation: A radical shift, typically driven by technological breakthroughs or paradigm shifts, leading to a fundamentally new way of organizing society.

Dators 4 futures is more desriptive, than prescriptive and provide a sensemaking and conversational tool that can be used to uncover hidden assumptions enabling stakeholders to reflect on the embedded values, and systemic logics within each future. To explore the use of the tool for a more prescriptive purpose, specifically in the context of resilience, CIFS build on this conceptual foundation and developed 3 scenario variations focused specifically on the future of healthcare in Bulgaria.

These scenarios integrated 3 major sources of uncertainty: the role of artificial intelligence, the pace and severity of climate change and the role of private sector in the future Bulgarian healthcare sytem.

In total 4 scenarion was developed: A surpirse free crisis scenario and 3 variations scenarios.

- A) Same old same old: (Surprice free scenario): General acceptance of the status quo, with skepticism towards rapid changes or reforms. Prevailing distrust in the political system, contributing to a passive approach to healthcare improvements. This scenario is similar to Dators *Collapse* scenario. If business as usual continues a collapse will happen.
- B) Private Sector Dominance: Growing acceptance of private sector solutions. Access to high-quality care depends significantly on personal financial means.
- C) Climate- centric governanc: Public sentiment shifts from scepticism towards healthcare reform to a deep concern over the escalating impact of climate change. The healthcare system’s ability to adapt is severely tested
- D) AI-Driven Healthcare Transformation: AI is having a significant uptake in society bringing with it both opportunities and threats.

The recommendations in this brief stem from exploring policies across the 4 different scenarios. The aim of which was to test and develop policies and the initial steps in a roadmap that could make out the back bone of Dators *Transformation* scenario. Yet, instead of it being descriptive, refering to embedded pictures of the future, being prescriptive, charting the road ahead toward a prevention-oriented, technology-enabled healthcare systems that enhance societal resilience in the face of future challenges.

References

Dator, J. (2009). *Alternative futures at the Manoa School*. *Journal of Futures Studies, 14*(2), 1–18.