Health System Models under Pressure: A Comparative Assessment of Saturation and Collapse Risks through the SEA Framework

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Abstract

Health systems worldwide are increasingly exposed to cumulative pressures, including demographic transitions, workforce shortages, fiscal constraints, technological expansion, and recurrent public health shocks. Although the concept of health system resilience has received growing attention, the processes through which health systems approach saturation and potential systemic collapse remain insufficiently understood. Traditional classifications of health systems such as Beveridge, Bismarck, national health insurance, and market-oriented models have mainly been evaluated through indicators of efficiency, equity, and quality, with less emphasis on structural vulnerability and the accumulation of systemic stress.

This study aims to comparatively assess major health system models from the perspective of saturation dynamics and collapse risk using the Stability–Efficiency–Adaptability (SEA) framework. A conceptual comparative analysis was conducted through an integrative review of literature on health system performance, governance, resilience, and systems thinking. Institutional characteristics of major health system models were examined across the three SEA dimensions: stability, efficiency, and adaptability.

The findings suggest that resilience and collapse risk depend less on institutional typology and more on maintaining balance among these three dimensions. Tax-funded systems tend to offer high stability but may face rigidity, social insurance systems show efficiency and adaptability but encounter governance complexity, while market-oriented systems demonstrate innovation but greater financial vulnerability and inequality. Maintaining equilibrium among SEA dimensions is therefore essential for preventing systemic saturation and strengthening health system resilience.

Keywords: Health systems; system resilience; system saturation; healthcare collapse; SEA framework; health policy; comparative health systems.

1. Introduction

Health systems represent one of the most complex institutional structures within modern societies. They are responsible not only for the delivery of medical services but also for managing financial resources, coordinating multiple actors, and responding to changing population health needs. Over the past decades, significant improvements in life expectancy and health outcomes have been achieved worldwide, largely due to advances in medical technologies, public health interventions, and the development of organized health care systems (Sarfati et al., 2024). At the same time, these systems have become increasingly complex and resource-intensive, absorbing substantial portions of national economies. In many OECD countries, health expenditure now exceeds 9% of gross domestic product, placing growing pressure on government budgets and health policy frameworks (Joumard et al., 2010).

Despite achievements, health systems across the world are increasingly exposed to sustained structural pressures. Demographic aging, the rising prevalence of chronic diseases, technological expansion, workforce shortages, and recurring public health crises are collectively challenging the capacity of health systems to maintain stable and effective service delivery (Chuang & Hu, 2025; Kolivand et al., 2025). The COVID-19 pandemic further highlighted the vulnerability of even highly developed health systems,

demonstrating that systemic stress can rapidly escalate when institutional capacity, governance coordination, and resource allocation become misaligned (Zhao et al., 2023).

In response to these challenges, the concept of health system resilience has gained growing attention within health policy and health systems research. Resilience generally refers to the capacity of health systems to absorb shocks, adapt to changing conditions, and maintain essential functions during crises (Fridell et al., 2020). Recent literature has emphasized that resilience is not merely the ability to recover from external shocks but also involves adaptive governance, institutional learning, and coordinated system responses across multiple components of the health system (Copeland et al., 2023; Belloni et al., 2025). Several frameworks and indicators have been proposed to measure resilience, including governance, financing, service delivery, and workforce capacity (Fleming et al., 2022; World Health Organization, 2024).

However, while resilience has become a central concept in health systems research, the opposite process namely systemic saturation and potential health system collapse remains less theoretically developed. Many health systems experience prolonged periods of internal stress that extend beyond episodic crises. These pressures can accumulate gradually through financial constraints, workforce erosion, governance fragmentation, and declining social trust, eventually pushing systems toward saturation and functional breakdown (Hojabri & Manafi, 2026). Understanding how such pressures accumulate and interact within institutional structures remains an important research gap in the literature.

Health systems differ significantly in their institutional design. Comparative studies commonly classify systems into several major models, including Beveridge (tax-funded national health service systems), Bismarck (social insurance systems), national health insurance models, and market-oriented systems (Or et al., 2009; van der Zee & Kroneman, 2007). Each of these institutional arrangements reflects distinct governance mechanisms, financing structures, and service delivery configurations. Previous research has demonstrated that no single system model consistently outperforms others across all performance indicators, suggesting that institutional effectiveness depends largely on policy settings, governance quality, and contextual factors (Joumard et al., 2010; Tikkanen et al., 2020).

While these typologies provide useful frameworks for understanding differences in system performance, they do not fully explain how health systems respond to sustained structural pressures or how they may approach saturation and collapse. Health systems are inherently complex adaptive systems in which multiple components interact dynamically, and small imbalances in one dimension may produce cascading effects throughout the system (Emami et al., 2023; Thelen et al., 2023). Consequently, evaluating system vulnerability requires analytical approaches that go beyond static institutional classifications.

To address this gap, the present study adopts the Stability–Efficiency–Adaptability (SEA) framework as an analytical lens for examining the vulnerability of health systems to saturation and collapse. The SEA framework conceptualizes health system performance through three fundamental dimensions: institutional stability, operational efficiency, and adaptive capacity. Stability reflects the ability of institutions to maintain structural coherence and governance legitimacy; efficiency captures the capacity to utilize resources effectively in producing health outcomes; and adaptability represents the system's ability to learn, adjust policies, and respond to changing conditions.

From this perspective, health system collapse is not typically the result of a single catastrophic event but rather a gradual outcome of sustained imbalance across these dimensions. Persistent financial pressure may erode efficiency, governance fragmentation may weaken stability, and failure to adjust policies or institutional arrangements may diminish adaptability. When such imbalances accumulate, health systems may enter a phase of systemic saturation, characterized by declining responsiveness, reduced service capacity, and increasing institutional strain.

Building on this conceptual foundation, this study aims to comparatively examine major health system models through the lens of the SEA framework. Specifically, it seeks to identify structural strengths, vulnerabilities, and potential pathways through which different institutional arrangements may experience saturation and increased collapse risk. By integrating insights from comparative health system research,

resilience literature, and systems thinking approaches, the study contributes to a deeper understanding of how institutional design interacts with systemic pressures to shape the long-term stability and sustainability of health systems.

2. Literature Review

The literature on health systems has traditionally focused on performance, financing, equity, and institutional design, but in recent years increasing attention has been directed toward resilience, systemic stress, and the risk of collapse. Early comparative work on health system models emphasized differences in financing and governance arrangements, particularly between Beveridge-type national health service systems and Bismarck social insurance systems. These studies generally concluded that no model consistently outperforms the others across all dimensions of performance. For example, Or et al. (2009) argue that the nature and intensity of health reforms are largely shaped by each country's underlying social security model and conclude that no system type performs systematically better than another, partly because of variation in governance and organizational design within each model.

Similarly, van der Zee and Kroneman (2007), comparing National Health Service and Social Security Health systems across 17 European countries, found that social insurance systems performed somewhat better on some health outcomes and public satisfaction, while NHS systems demonstrated stronger cost containment, again suggesting trade-offs rather than categorical superiority.

This comparative perspective was reinforced by broader institutional analyses such as the OECD volume Health Care Systems: Efficiency and Policy Settings, which explicitly states that no type of health care system is superior to others and argues against "big bang" reforms that attempt to replace one system model with another. Instead, the OECD emphasizes the importance of policy settings, institutional details, and within-model adaptation in shaping system performance. (Joumard et al., 2010)

The Commonwealth Fund's International Profiles of Health Care Systems (2020) further shows that real-world systems are rarely pure types; instead, contemporary health systems are hybrids that combine tax financing, insurance arrangements, public stewardship, and private provision in different configurations. Together, these studies suggest that typology remains useful as an analytical starting point, but that static institutional classification alone cannot explain how systems behave under sustained pressure.

A second major strand of the literature has moved beyond typology toward systems thinking. The WHO's Systems Thinking for Health Systems (2009) Strengthening was foundational in this shift, arguing that health systems should not be understood as linear delivery machines but as interconnected systems whose building blocks are dynamically linked. The report explicitly presents health systems as composed of interdependent elements and emphasizes that interventions can have system-wide effects beyond their immediate targets.

More recent work has extended this insight. Thelen et al., (2023) in developing the Systems Thinking for Health Actions framework, identify six core characteristics of systems thinking in health, including understanding interconnections, feedback, leverage points, dynamic behavior, and the use of mental and simulation models. Their work highlights the gap between the theoretical language of systems thinking and its practical application in health policy. Emami et al. similarly argue that health systems require dynamic and systemic analysis of components and causal relationships, and they attempt to identify the comprehensive dimensions of the system through a scoping review.

This body of literature is important because it shows that vulnerabilities in health systems often emerge from interactions among governance, workforce, financing, and service delivery rather than from isolated failures. The growing literature on health system resilience builds on this systems perspective. Fridell et al. note that health systems are based on multiple functions that must work together continuously and warn that, if a system cannot withstand pressure from a shock, it may cease to function or collapse. Their review

found no single agreed description of health system resilience, but frequently identified terms such as shock, adapt, maintain, absorb, respond, change, and learning. Leadership and governance emerged as particularly important.

Copeland et al., (2023) in a scoping review of empirical studies and reviews, show that the health systems resilience literature has grown rapidly, especially since 2018, and that most studies focus on external shocks or hospital crises rather than slow-moving systemic degradation. Fleming et al. also find that resilience research has relied heavily on metrics and indicators, particularly quantitative indicators mapped to WHO health system functions, but they identify substantial variation in what is measured and how resilience is operationalized across high-income countries.

The WHO's 2024 guidance on Health System Resilience Indicators responds to this problem by offering an integrated package for measuring and monitoring resilience at country level and explicitly frames resilience as something that should be tracked systematically rather than assumed.

Despite this expansion, an important limitation of the resilience literature is that it remains far more developed than the literature on health system collapse. Belloni et al. observe that health system resilience is usually defined as the capacity of a system to continue performing fundamental functions during acute disruptive events, but they also note that the relationships among governance, shocks, and resilience remain undertheorized.

Poroes et al. (2023) similarly argue that the COVID-19 era exposed major limitations in existing frameworks for assessing health system performance throughout crises, prompting them to develop an adapted conceptual framework linking performance and resilience over time. Zhao et al. (2023) propose a resilience evaluation system based on government governance, health financing, health service provision, and health workers, demonstrating that resilience can be operationalized comparatively across countries. Chuang and Hu (2025), using 17 indicators across governance, health systems, and economic domains, also show that health system resilience can be assessed comparatively and that governance, workforce support, and equitable resource allocation are central determinants. Yet even in these studies, resilience is generally treated as the desired counterpoint to shock rather than as one end of a continuum that may also include saturation and collapse. That gap is where the emerging literature on system saturation and collapse becomes particularly relevant. Sarfati et al. (2024) explicitly warn of the possibility of a global health care systems collapse under conditions of resource depletion, rising technological dependence, and unsustainable expansion, suggesting that systemic breakdown is not only a low-income or fragile-state phenomenon but a broader structural risk. The review of 32 performance evaluation and excellence models shows that most frameworks concentrate on performance improvement, quality, and strategic management; however, none explicitly evaluate health systems from the perspective of systemic saturation, collapse risk, or adaptive failure.(Hojabri et al ; 2013)

Hojabri and Manafi (2025) go further by conceptualizing healthcare system collapse as a saturation-driven process rather than a sudden event. In their framework, collapse results from sustained imbalance across the dimensions of Stability, Efficiency, and Adaptability (SEA), with adaptability loss emerging as a system-level outcome of cumulative stress. They identify seven core determinants of collapse and propose early warning KPIs aligned with the SEA framework. This is particularly important because it shifts the analytical focus from episodic shock response to the progressive erosion of system capacity under persistent internal pressure.

The literature therefore points to a progression in health systems scholarship. First, comparative studies established that health system models differ in institutional logic and performance trade-offs, but that no single model is universally superior. Second, systems thinking literature demonstrated that health systems must be understood as interconnected and dynamic rather than static and linear. Third, resilience scholarship emphasized absorption, adaptation, maintenance of function, and learning, especially in response to shocks. What remains less developed, however, is a framework that integrates these strands to explain how different institutional models may move from stress to saturation and from saturation toward collapse.

The SEA framework addresses this gap by offering a structure through which health systems can be assessed not only in terms of resilience but also in terms of vulnerability. Stability captures institutional coherence, legitimacy, and the ability to preserve functional order. Efficiency concerns the use of resources to sustain service delivery and outcomes under pressure. Adaptability refers to policy learning, governance flexibility, and the ability to reconfigure system responses as conditions change. When these dimensions remain balanced, systems may absorb stress and maintain resilience; when imbalances accumulate, systems may enter saturation, manifested in declining responsiveness, workforce exhaustion, governance friction, and service overload; when deterioration continues, collapse becomes a plausible outcome.

Accordingly, the present study builds on the comparative literature on health system models, the systems thinking tradition, and the resilience literature, while extending them through the SEA perspective. Its contribution lies in examining how major health system models such as Beveridge, Bismarck, national health insurance, market-based, and hybrid systems may differ not only in performance characteristics but also in their exposure to stress accumulation, their adaptive limits, and their pathways toward saturation and collapse. In this sense, the article aims to move beyond the question of which system performs best and toward the more urgent question of which systems remain sustainable under prolonged structural pressure, and why.

The SEA Framework

The analysis of health system sustainability requires conceptual frameworks capable of capturing both structural characteristics and dynamic responses to systemic pressures. Existing literature on health systems has provided important insights into institutional typologies, governance structures, and resilience mechanisms. However, these frameworks generally focus on system performance or crisis response and do not fully address the processes through which health systems accumulate stress and approach systemic saturation.

Systems thinking literature has emphasized that health systems should be understood as complex and interconnected structures in which governance, financing, service delivery, and workforce components interact dynamically (World Health Organization, 2009; Thelen et al., 2023). These interactions mean that disturbances in one component may propagate through the entire system. Similarly, resilience studies highlight the ability of health systems to absorb shocks, adapt to disruptions, and maintain essential functions during crises (Fridell et al., 2020; Copeland et al., 2023). Despite these advances, much of the literature focuses on shock response and recovery, while less attention has been given to long-term structural stress accumulation and potential system collapse.

To address this analytical gap, this study employs the Stability–Efficiency–Adaptability (SEA) framework, originally developed by Manafi as a general model for analyzing system sustainability and structural imbalance. The SEA framework conceptualizes organizational and systemic sustainability through the interaction of three fundamental dimensions: stability, efficiency, and adaptability (Manafi, 2025, 2026). Rather than being specific to the health sector, the model was designed as a broader analytical structure for understanding how complex systems maintain balance under pressure.

Within the context of health systems research, the SEA framework has been applied as an analytical tool to examine the processes through which sustained internal pressures may lead to systemic saturation and collapse. Hojabri and Manafi utilized this framework in healthcare system analysis to conceptualize collapse not as a sudden event but as a progressive outcome of accumulated imbalance across the three SEA dimensions (Hojabri & Manafi, 2026).

In the SEA framework, Stability refers to the structural coherence and governance integrity of a system. In health systems, this dimension includes institutional legitimacy, policy coordination, regulatory effectiveness, and public trust. Weak governance or institutional fragmentation can undermine stability and create systemic vulnerability.

Efficiency relates to the capacity of the system to utilize resources effectively in producing desired outputs. In health systems, efficiency involves the allocation of financial resources, workforce utilization, and service delivery performance. Rising healthcare costs and inefficient resource allocation have been identified as major pressures affecting system sustainability.
Adaptability represents the ability of the system to learn, reform, and adjust policies in response to changing environmental conditions. Adaptive capacity is closely linked to institutional learning, policy flexibility, and innovation. Health systems lacking adaptive capacity may struggle to respond to demographic changes, technological developments, and evolving disease burdens.

According to the SEA framework, system sustainability depends on maintaining balance among these three dimensions. When this balance is preserved, systems are capable of absorbing pressures and maintaining operational stability. However, when imbalances accumulate such as declining efficiency due to financial strain, weakening stability due to governance fragmentation, or reduced adaptability due to institutional rigidity the system may enter a stage of saturation, characterized by declining responsiveness and growing operational strain.

If these pressures continue to intensify without structural adaptation, systemic capacity may progressively deteriorate, eventually leading to system collapse, defined as the inability of the system to maintain its essential functions or coordinate its core components effectively (Hojabri & Manafi, 2026).

In this study, the SEA framework is therefore employed as an analytical lens rather than as a descriptive model of health systems. The framework is used to comparatively examine how different health system models such as Beveridge, Bismarck, national health insurance, and market-oriented systems may differ in their structural balance between stability, efficiency, and adaptability. By applying the SEA framework to the comparative analysis of health system models, the study seeks to identify potential structural vulnerabilities, stress accumulation pathways, and risks of systemic saturation.

3. Methodology

This study adopts a conceptual comparative research design to examine the vulnerability of different health system models to systemic saturation and collapse. Rather than relying on primary empirical data, the study integrates insights from existing health systems literature, resilience frameworks, and systems-thinking approaches to develop a structured analytical assessment of institutional models.Conceptual research designs are widely used in health systems research when the objective is to synthesize theoretical perspectives and develop analytical frameworks for understanding complex institutional dynamics. In the context of health systems, such approaches are particularly valuable because these systems are composed of multiple interacting components whose behavior cannot be fully understood through isolated quantitative indicators alone (World Health Organization, 2009; Emami et al., 2023).

Accordingly, this study employs a comparative analytical approach, examining how different institutional health system models may exhibit varying levels of stability, efficiency, and adaptability when subjected to sustained systemic pressures.The analytical framework of the study is based on the Stability–Efficiency–Adaptability (SEA) model, originally developed by Manafi as a general framework for analyzing systemic sustainability and structural imbalance (Manafi, 2025). Within the health sector, the SEA model has been applied as an analytical tool to explore the mechanisms through which health systems accumulate stress and may progress toward saturation and eventual collapse (Hojabri & Manafi, 2026).The SEA framework conceptualizes system sustainability through three interconnected dimensions:

Stability: Institutional coherence, governance capacity, and structural integrity of the system.
Efficiency: Effective allocation and utilization of resources in achieving health outcomes and sustaining service delivery.

Adaptability: The ability of the system to learn, reform policies, and adjust institutional arrangements in response to changing conditions.

Within this analytical structure, health system sustainability is interpreted as the outcome of a balanced interaction among these three dimensions. Persistent imbalance across the SEA dimensions may lead to cumulative systemic stress, eventually resulting in system saturation and potential collapse.The primary unit of analysis in this study is the institutional model of health systems. Based on established comparative literature, the analysis considers five major health system arrangements:

1. Beveridge systems (tax-funded national health services)
2. Bismarck systems (social insurance-based systems)
3. National health insurance systems
4. Market-oriented systems
5. Hybrid systems

These categories reflect widely recognized typologies used in comparative health systems research (Or et al., 2009; Tikkanen et al., 2020).The study relies on a targeted literature synthesis of key sources addressing health system governance, resilience, performance, and systems thinking. Sources include:

- Comparative studies of health system models
- Health system resilience literature
- Systems thinking frameworks in health policy
- Conceptual analyses of system sustainability and collapse

These sources provide the theoretical and analytical basis for evaluating institutional characteristics and identifying potential stress accumulation pathways in health systems.

Analytical Procedure

The analysis proceeds in three main stages:

1. Identification of Institutional Characteristics

First, the structural characteristics of each health system model are identified based on existing comparative literature. These characteristics include governance structure, financing mechanisms, service delivery arrangements, and institutional coordination.

2. SEA-Based Evaluation

Second, each health system model is evaluated according to the three SEA dimensions. This step examines how institutional arrangements influence:

- governance stability
- resource efficiency
- adaptive capacity

This evaluation allows for the identification of structural strengths and vulnerabilities associated with each system type.

3. Identification of Saturation and Collapse Pathways

Finally, the analysis explores potential pathways through which sustained imbalance across SEA dimensions may lead to systemic saturation and increased collapse risk. Particular attention is given to long-term structural pressures such as fiscal stress, workforce shortages, governance fragmentation, and declining institutional adaptability.

Methodological Limitations

As a conceptual comparative analysis, this study does not attempt to measure system performance using quantitative indicators or country-level datasets. Instead, it focuses on developing a theoretical framework for understanding systemic vulnerability across institutional health system models. While this approach allows for a deeper conceptual understanding of system dynamics, future research could extend the SEA framework through empirical validation using cross-country datasets and health system performance indicators.

4. Results

Comparative Assessment of Health System Models through the SEA Framework

Applying the SEA framework to the comparative analysis of major health system models reveals important differences in how institutional structures influence systemic stability, efficiency, and adaptability. The findings suggest that health system sustainability is not determined solely by the institutional model itself but rather by how effectively the system maintains balance across the three SEA dimensions. Comparative health systems literature has consistently shown that different models embody distinct institutional logics in governance, financing, and service delivery. For example, tax-funded systems typically emphasize universal access and centralized governance, while social insurance systems rely more heavily on pluralistic governance and negotiated coordination among stakeholders (Or et al., 2009; van der Zee & Kroneman, 2007). These structural differences influence how systems respond to fiscal pressures, workforce shortages, and changing health demands. From the perspective of the SEA framework, these institutional arrangements generate varying strengths and vulnerabilities across the dimensions of stability, efficiency, and adaptability. See Table 1.

Table 1: SEA-Based Comparative Characteristics of Health System Models

Health System Model	Stability	Efficiency	Adaptability	Overall, SEA Balance
Beveridge	High institutional coordination	Moderate cost efficiency	Moderate adaptability	Stable but potentially rigid
Bismarck	Moderate stability	High efficiency	High adaptability	Balanced but complex
National Health Insurance	High stability	High efficiency	Moderate adaptability	Relatively balanced
Market-oriented	Low stability	Variable efficiency	High adaptability	Dynamic but unstable
Hybrid systems	Variable	Variable	High	Context-dependent

Stability Patterns across Health System Models

The analysis indicates that Beveridge-type systems tend to demonstrate relatively high institutional stability due to centralized governance structures and strong public stewardship. These characteristics enable coordinated decision-making and clear regulatory authority, particularly during large-scale health crises. However, high levels of centralization may also reduce flexibility in policy adaptation, potentially limiting responsiveness under rapidly changing conditions. In contrast, Bismarck-type systems rely on multiple insurance funds and decentralized governance arrangements. While these systems may exhibit greater institutional complexity, they often benefit from distributed decision-making and stakeholder negotiation mechanisms that allow for policy adjustments and operational flexibility (Or et al., 2009).Market-oriented systems, on the other hand, frequently display lower structural stability due to fragmented financing arrangements and uneven access to health services. These characteristics can amplify systemic vulnerabilities when financial pressures increase or when demand for services rises sharply.

Efficiency Dynamics

Efficiency represents a critical dimension of system sustainability, particularly given the rapid growth in healthcare expenditure observed across OECD countries. Rising costs associated with population ageing, technological innovation, and expanded service utilization have placed increasing pressure on public budgets and health policy frameworks (Joumard et al., 2010). Social insurance systems often demonstrate relatively strong efficiency in service delivery due to competition among providers and negotiated reimbursement mechanisms. However, these advantages may be offset by administrative complexity and coordination challenges. Single-payer national health insurance systems can benefit from reduced administrative overhead and stronger purchasing power, allowing governments to negotiate prices and control costs more effectively. Nevertheless, efficiency gains may be constrained if demand increases faster than system capacity.

Market-based systems frequently generate high levels of innovation and service responsiveness, yet they also tend to experience cost escalation and inequalities in access, which may undermine overall system sustainability.

Adaptability and Institutional Learning

Adaptability reflects the ability of health systems to adjust policies and institutional arrangements in response to evolving environmental conditions. This capacity is closely linked to institutional learning, governance flexibility, and the ability to integrate new knowledge into policy processes (Fridell et al., 2020). Systems characterized by pluralistic governance arrangements, such as Bismarck-type systems and hybrid models, may demonstrate greater adaptability because multiple actors participate in policy negotiation and reform processes. However, this flexibility can also create coordination challenges if governance structures become fragmented.

Centralized systems may respond effectively to immediate crises but may face greater challenges when structural reforms are required over longer time horizons.

System Saturation Patterns

A key finding of the SEA-based analysis is that systemic stress tends to accumulate gradually through imbalances across the three SEA dimensions. When financial pressures reduce efficiency, governance fragmentation weakens stability, or rigid institutional structures limit adaptability, the system may enter a phase of system saturation.

System saturation is characterized by several observable conditions, including:

- increasing service demand exceeding system capacity
- workforce fatigue and staffing shortages
- policy delays or governance bottlenecks
- growing service backlogs and waiting times

These patterns have been documented in multiple health system contexts and are often associated with prolonged structural pressures rather than sudden shocks. See Table 2.

Table 2. SEA Imbalance and Health System Saturation Pathways

SEA Dimension Imbalance	Structural Pressure	System Response
Stability decline	Governance fragmentation	Policy coordination failures
Efficiency decline	Fiscal pressure and resource shortages	Reduced service capacity
Adaptability decline	Institutional rigidity	Delayed reforms

Pathways toward System Collapse

The final stage identified in the analysis involves the potential transition from systemic saturation to system collapse. Within the SEA framework, collapse is understood not as a sudden catastrophic event but as the progressive erosion of system functionality resulting from sustained imbalance across the three dimensions (Hojabri & Manafi, 2026). Collapse occurs when the system loses the capacity to coordinate its institutional components effectively and can no longer maintain essential health services. Indicators of such deterioration may include widespread service disruption, severe workforce depletion, and breakdowns in governance coordination. See Table 3.

Table 3 SEA-Based Collapse Pathways

SEA Dimension Failure	Collapse Trigger	System Outcome
Stability breakdown	Governance crisis	Institutional fragmentation
Efficiency collapse	Severe financial strain	Service failure
Adaptability loss	Policy rigidity	System stagnation

The comparative analysis demonstrates that health system sustainability depends less on institutional typology alone and more on the ability of systems to maintain balance across the SEA dimensions. Different models exhibit different strengths and vulnerabilities, but none are inherently immune to systemic saturation. The findings therefore suggest that maintaining equilibrium between stability, efficiency, and adaptability is a critical condition for preventing long-term systemic deterioration.

Risk Assessment of Health System Models under the SEA Framework

To address the risk dimension of this study, the SEA framework was used to identify structural vulnerabilities and risk exposure across major health system models. Risk in this context refers to the

probability that structural pressures affecting stability, efficiency, or adaptability may lead to systemic saturation and eventually increase the likelihood of health system collapse.

The analysis reveals that different institutional arrangements generate distinct risk profiles. These risks are not limited to financial instability but also include governance fragmentation, workforce depletion, institutional rigidity, and declining public trust. Such factors interact with the SEA dimensions and may gradually erode system capacity. See Table 4.

Table 4. Risk Assessment of Health System Models using the SEA Framework

Health System Model	Key Risks	Structural Vulnerabilities	Potential Opportunities
Beveridge	Fiscal pressure, capacity constraints	Centralized bureaucracy, limited flexibility	Strong coordination and universal coverage
Bismarck	Institutional fragmentation, rising insurance costs	Complex governance structures	High adaptability through stakeholder negotiation
National Health Insurance	Demand pressure, budget limits	Dependence on central financing	Strong cost control and coverage
Market-based	Financial instability, inequality of access	Fragmented coverage and high costs	High innovation and service diversity
Hybrid systems	Governance complexity	Policy inconsistency	Flexibility in institutional design

SEA-Based Risk Dynamics

The results indicate that health system risks often emerge when structural pressures disproportionately affect one or more SEA dimensions.

- Stability risks are frequently associated with governance fragmentation and declining institutional legitimacy.
- Efficiency risks arise from fiscal pressures, inefficient resource allocation, or rapidly increasing healthcare costs.
- Adaptability risks emerge when institutional rigidity prevents policy reform or learning from emerging challenges.

When these risks accumulate over time, systems may experience increasing operational strain and eventually enter a phase of systemic saturation.

Early Indicators of System Saturation

The SEA-based analysis also identifies several early indicators of saturation that may signal increasing systemic risk:

- persistent workforce shortages
- rising waiting times and service backlogs
- fiscal pressure on public health budgets
- policy reform delays
- declining institutional trust

Such indicators may function as early warning signals of systemic stress and can provide policymakers with opportunities for timely intervention before system deterioration accelerates.

By incorporating risk assessment into the SEA framework, the analysis demonstrates that different health system models exhibit distinct risk configurations. While some systems are more vulnerable to fiscal pressures, others face governance complexity or adaptability constraints.

Consequently, the sustainability of health systems depends not only on institutional design but also on the ability to monitor emerging risks and maintain balance across the SEA dimensions.

SEA-Based Risk Matrix for Health System Saturation and Collapse

The SEA-based risk matrix provides a structured analytical tool for assessing the vulnerability of different health system models to systemic stress. The matrix evaluates risks according to three key dimensions derived from the SEA framework: stability, efficiency, and adaptability.

Each dimension represents a potential pathway through which structural pressures may accumulate and eventually lead to system saturation or collapse.

Risk levels are classified into three categories:

- Low Risk: The institutional structure mitigates or absorbs pressure effectively.
- Moderate Risk: Structural vulnerabilities exist but may be managed through policy adaptation.
- High Risk: The system is structurally exposed to pressures that may significantly increase the probability of saturation or collapse.

Table5. SEA-Based Risk Matrix for Health System Models

Health System Model	Stability Risk	Efficiency Risk	Adaptability Risk	Overall Saturation Risk
Beveridge (Tax-funded)	Low–Moderate	Moderate	Moderate–High	Moderate
Bismarck (Social insurance)	Moderate	Low–Moderate	Low	Moderate
National Health Insurance	Low	Moderate	Moderate	Low–Moderate
Market-oriented systems	High	High	Low–Moderate	High
Hybrid systems	Moderate	Moderate	Moderate	Moderate

Interpretation of the Risk Matrix

A. Beveridge Systems

Beveridge-type health systems, typically financed through taxation and administered by centralized public authorities, generally demonstrate relatively strong institutional stability due to clear governance structures and unified financing mechanisms. This structure reduces coordination failures and supports universal coverage.

However, these systems may experience efficiency pressures when demand for services grows faster than available resources. Fiscal constraints and limited capacity expansion can lead to long waiting times and service bottlenecks. In addition, centralized governance structures may limit adaptability when structural reforms are required, particularly in rapidly evolving health environments.

Consequently, Beveridge systems generally face moderate saturation risk, primarily driven by capacity constraints and policy rigidity.

B. Bismarck Systems

Bismarckian systems are characterized by multiple insurance funds and decentralized governance arrangements involving employers, insurers, and healthcare providers. This pluralistic structure often increases operational efficiency and allows for flexible negotiation mechanisms among stakeholders.

However, the presence of multiple institutional actors may generate governance complexity and coordination challenges. While these systems demonstrate strong adaptability due to distributed decision-making processes, institutional fragmentation may create moderate stability risks.

Overall, Bismarck systems tend to demonstrate moderate systemic risk, although their adaptability often helps mitigate long-term saturation pressures.

C. National Health Insurance Systems

National health insurance systems combine centralized financing with mixed provider structures. This model often benefits from strong cost-control mechanisms and administrative simplicity, which contribute to relatively stable governance arrangements.

Nevertheless, heavy reliance on centralized financing may expose these systems to fiscal pressures if healthcare expenditures rise significantly. Adaptability may also be constrained when policy reform requires major institutional restructuring.

Despite these limitations, national health insurance systems typically demonstrate relatively low to moderate saturation risk due to balanced institutional characteristics.

D. Market-Oriented Systems

Market-oriented health systems rely heavily on private insurance markets, competition among providers, and decentralized financing structures. While this model may encourage innovation and service diversity, it also introduces substantial structural vulnerabilities.
Fragmented coverage arrangements and unequal access to care can generate systemic instability, particularly during economic downturns or public health crises. Cost escalation and administrative fragmentation may also undermine efficiency.
As a result, market-oriented systems typically display the highest risk of systemic saturation and collapse, especially when governance coordination and universal coverage mechanisms are weak.

E. Hybrid Systems

Most contemporary health systems represent hybrid arrangements that combine elements of multiple institutional models. These systems often benefit from flexibility and adaptability but may also experience governance complexity and policy inconsistency.
Because hybrid systems vary significantly in their institutional design, their risk exposure is highly context-dependent. In many cases, hybrid systems demonstrate moderate risk across all SEA dimensions, reflecting both their flexibility and their structural complexity.

Analytical Implications

The SEA-based risk matrix highlights that health system vulnerability is not determined solely by institutional typology but rather by the balance among stability, efficiency, and adaptability. Systems that maintain equilibrium across these dimensions are more capable of absorbing structural pressures and preventing saturation.Conversely, persistent imbalances within the SEA dimensions may gradually erode system capacity, leading to operational strain and increasing the probability of systemic collapse.

5. Discussion

The findings of this study highlight that the sustainability of health systems cannot be adequately understood through institutional typologies alone. While comparative health system research has traditionally focused on structural differences between Beveridge, Bismarck, national health insurance, and market-oriented systems, the results of this study suggest that institutional design is only one part of the broader dynamics influencing system sustainability. Instead, the interaction between institutional structure and systemic pressures plays a decisive role in determining whether health systems remain resilient or gradually move toward saturation.
The comparative analysis conducted through the SEA framework demonstrates that different health system models exhibit distinct configurations of strengths and vulnerabilities across the dimensions of stability, efficiency, and adaptability. These findings are broadly consistent with previous comparative research, which has shown that no single health system model consistently outperforms others across all performance indicators (Joumard et al., 2010; Or et al., 2009). For example, tax-funded systems often demonstrate strong institutional coordination and universal coverage, while social insurance systems tend to benefit from pluralistic governance and adaptive policy negotiation mechanisms.
However, the results also indicate that each model contains structural vulnerabilities that may increase exposure to systemic pressures. In centralized systems, policy rigidity and fiscal constraints may limit adaptive capacity, particularly when demographic pressures or technological expansion increase demand for services. In decentralized insurance-based systems, governance fragmentation and institutional complexity may weaken stability and coordination. Market-oriented systems, while often associated with innovation and service diversity, may experience significant instability when financial pressures, inequalities in access, or fragmented coverage arrangements emerge.
These findings align with the broader systems thinking literature, which emphasizes that health systems should be understood as interconnected and dynamic structures rather than static institutional arrangements (World Health Organization, 2009; Thelen et al., 2023). Structural pressures affecting one component of the system such as financing, workforce capacity, or governance may propagate through other components, generating cumulative stress across the system. Consequently, the sustainability of health systems depends

not only on institutional arrangements but also on the system's capacity to maintain balance among its core functional dimensions.

The SEA framework provides a useful analytical lens for examining these dynamics. By focusing on stability, efficiency, and adaptability, the framework highlights how structural imbalances may gradually accumulate and lead to systemic saturation. Unlike many resilience frameworks that emphasize short-term responses to shocks, the SEA perspective draws attention to the long-term processes through which health systems experience progressive deterioration under sustained pressure.

The results also suggest that system saturation represents a critical intermediate stage between resilience and collapse. Saturation occurs when system capacity becomes increasingly constrained, resulting in observable conditions such as service backlogs, workforce exhaustion, fiscal pressure, and policy stagnation. If these pressures persist without structural adaptation, system functionality may gradually deteriorate.

This interpretation is consistent with emerging research on systemic vulnerability in health systems, which emphasizes that collapse is rarely caused by a single event but rather by the accumulation of multiple pressures across institutional, financial, and operational domains (Sarfati et al., 2024; Hojabri & Manafi, 2026). The SEA-based risk matrix presented in this study therefore provides a conceptual tool for identifying early warning signals of systemic stress and assessing the relative exposure of different institutional models to saturation dynamics.

From a policy perspective, these findings highlight the importance of strengthening adaptive capacity within health systems. Institutional learning, governance flexibility, and the ability to implement timely policy reforms are essential for maintaining system balance and preventing the escalation of structural pressures. Monitoring indicators related to workforce capacity, fiscal sustainability, service accessibility, and governance coordination may help policymakers detect emerging risks before systemic deterioration accelerates.

6. Conclusion

This study examined the vulnerability of different health system models to systemic saturation and collapse using the Stability–Efficiency–Adaptability (SEA) framework as an analytical lens. The analysis demonstrates that health system sustainability cannot be explained solely by institutional typology. Instead, the long-term stability of health systems depends on the ability to maintain balance among the three core dimensions of stability, efficiency, and adaptability.

The comparative assessment indicates that each institutional model possesses specific strengths but also structural vulnerabilities that may expose systems to systemic pressures. Centralized systems may face rigidity and capacity constraints, decentralized insurance-based systems may encounter governance fragmentation, and market-oriented systems may experience financial instability and inequalities in access.

The findings further suggest that systemic collapse is rarely the result of sudden shocks alone. Rather, collapse tends to emerge gradually through processes of systemic saturation in which pressures accumulate across governance, financial, and operational dimensions of the system. Recognizing these dynamics is essential for developing effective strategies to strengthen health system resilience.

By applying the SEA framework to the comparative analysis of health system models, this study contributes to the literature by providing a structured approach for understanding how institutional design interacts with systemic pressures. The framework also offers a conceptual basis for identifying early warning indicators of system saturation and assessing potential collapse risks.

Future research may extend this analysis by empirically testing the SEA framework using cross-country health system indicators and longitudinal datasets. Such research could provide valuable insights into the dynamics of systemic stress and help policymakers develop evidence-based strategies for safeguarding the sustainability of health systems in an increasingly uncertain global health environment.

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7. References

1. Belloni, G., Monod, S., Poroes, C., Bühler, N., Avendano, M., & Wernli, D. (2025). Health systems governance, shocks and resilience: A scoping review of key concepts and theories. *BMJ Global Health, 10*, e017358. https://doi.org/10.1136/bmjgh-2024-017358
2. Chuang, Y.-H., & Hu, J.-L. (2025).Comparative assessment of health systems resilience: A cross-country analysis using key performance indicators. *Systems, 13*(8), 663. https://doi.org/10.3390/systems13080663
3. Copeland, S., Hinrichs-Krapels, S., Fecondo, F., Ralon Santizo, E., Bal, R., & Comes, T. (2023).A resilience view on health system resilience: A scoping review of empirical studies and reviews. *BMC Health Services Research, 23*, 1297. https://doi.org/10.1186/s12913-023-10022-8
4. Emami, M., Haghdoost, A. A., Yazdi-Feyzabadi, V., & Mehrolhassani, M. H. (2023). Identification of key components in health systems using a systems thinking approach: A scoping review. *Medical Journal of the Islamic Republic of Iran, 37*, 47. https://doi.org/10.47176/mjiri.37.47
5. Fallahnezhad, M., Langarizadeh, M., & Vahabzadeh, A. (2024).Key performance indicators of hospital supply chain: A systematic review. *BMC Health Services Research, 24*, 1610. https://doi.org/10.1186/s12913-024-11954-5
6. Fleming, P., O'Donoghue, C., Almirall-Sanchez, A., Mockler, D., Keegan, C., Cylus, J., Sagan, A., & Thomas, S. (2022).Metrics and indicators used to assess health system resilience in response to shocks to health systems in high-income countries: A systematic review. *Health Policy, 126*, 1195–1205.
7. Fridell, M., Edwin, S., von Schreeb, J., & Saulnier, D. D. (2019). Health system resilience: what are we talking about? A scoping review mapping characteristics and keywords. International journal of health policy and management, 9(1), 6.
8. Hojabri, R., & Manafi, M. (2026).An early warning framework for healthcare system collapse. *Journal of Saturation Studies, 1*(1).
9. Hojabri, R., Manafi, M., Eftekhar, F., Ghassemzadeh, H., Sharifi, M., & Kaliannan, M. (2013).Effective methods for health care organizations: An evaluation of excellence models. *African Journal of Business Management, 7*(27), 2665–2674.
10. Joumard, I., Hoeller, P., André, C., & Nicq, C. (2010).*Health care systems: Efficiency and policy settings.* OECD Publishing. https://doi.org/10.1787/9789264094901-en
11. Kolivand, P., Arabloo, J., Saberian, P., Dorooudi, T., Rajaie, S., Karimi, F., Raei, B., Behzadifar, M., Parvari, A., Ehsanzadeh, S. J., Homayoun, S., Salehbeigi, S., Namdar, P., & Azari, S. (2025).Health systems performance in health outcomes, health financing and COVID-19 pandemic: Lessons from 31 countries. *PLOS ONE, 20*(10), e0334693. https://doi.org/10.1371/journal.pone.0334693
12. Manafi, M. (2025).Orientation note: Saturation, collapse, and the Rosetta Stone Model. Manafi Institute for Saturation Studies. https://manafi-institute.de/Resources
13. Manafi, M. (2026). The Theory of Saturation, Collapse Model, and Rosetta Stone Model: A Unified yet Modular Meta-Framework. Journal of Saturation Studies, 1(1), 10-19.
14. Or, Z., Cases, C., Lisac, M., Vrangbæk, K., Winblad, U., & Bevan, G. (2009). *Are health problems systemic? Politics of access and choice under Beveridge and Bismarck systems.* IRDES Working Paper.
15. Poroes, C., Seematter-Bagnoud, L., Wyss, K., & Peytremann-Bridevaux, I. (2023). Health system performance and resilience in times of crisis: An adapted conceptual framework. *International Journal of Environmental Research and Public Health, 20*, 6666. https://doi.org/10.3390/ijerph20176666
16. Sarfati, M., Senequier, A., Bihouix, P., Marrauld, L., & Manet, R. (2024).Preventing a global health care systems collapse through low-tech medicine. *Journal of Global Health, 14*, 03035. https://doi.org/10.7189/jogh.14.03035
17. Thelen, J., Sant Fruchtman, C., Bilal, M., Gabaake, K., Iqbal, S., Keakabetse, T., Kwamie, A., Mokalake, E., Mupara, L. M., Seitio-Kgokgwe, O., Zafar, S., & Cobos Muñoz, D. (2023).Development of the systems thinking for health actions framework: A literature review and a case study. *BMJ Global Health, 8*, e010191.
18. Tikkanen, R., Osborn, R., Mossialos, E., Djordjevic, A., & Wharton, G. (2020). *International profiles of health care systems 2020.* The Commonwealth Fund.
19. van der Zee, J., & Kroneman, M. W. (2007).Bismarck or Beveridge: A beauty contest between dinosaurs. *BMC Health Services Research, 7*, 94.
20. World Health Organization. (2009).*Systems thinking for health systems strengthening.* WHO Press.
21. World Health Organization. (2024).*Health system resilience indicators: An integrated package for measuring and monitoring health system resilience in countries.*
22. Zhao, L., Jin, Y., Zhou, L., Yang, P., Qian, Y., Huang, X., & Min, M. (2023).Evaluation of health system resilience in 60 countries based on their responses to COVID-19. *Frontiers in Public Health, 10*, 1081068.

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