

# Public Health and Pandemic Preparedness as National Priorities: Financing Resilient Systems in the United States

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## Abstract

Public health systems and pandemic preparedness are increasingly recognized as critical pillars of national security, economic stability, and global resilience. While recent crises, particularly COVID-19, have triggered unprecedented emergency spending, sustained investment in underlying public health infrastructure remains inconsistent. This paper argues that pandemic preparedness cannot be achieved in isolation and must be embedded within strong, continuously funded public health systems. Drawing on lessons from recent epidemics and evolving U.S. policy priorities, the study examines the economic, institutional, and systemic consequences of underinvestment in public health capacity. It proposes a policy-oriented financial framework that integrates sustainable financing, risk-informed investment, and system-level design to support resilient and adaptive health systems. Building on concepts of risk-tolerant financing, capability-oriented due diligence, and integrated financial system design, the paper advances a unified financing approach that reframes finance from a compliance-driven function to a strategic enabler of public health resilience. The findings highlight the necessity of long-term, system-based investment to strengthen preparedness and position public health as a continuous national and global priority.

**Keywords:** Pandemic Preparedness, Health System Financing, Global Health Security, Risk-Tolerant Investment, Public Health Infrastructure, Economic Resilience, Health Policy

## Introduction

The COVID-19 pandemic fundamentally reshaped global understanding of health security, demonstrating that infectious disease outbreaks are not only public health events but systemic crises with far-reaching economic and societal consequences. In the United States, the pandemic resulted in over one million deaths and triggered economic losses estimated in the trillions of dollars, alongside unprecedented federal relief spending (Cutler & Summers, 2020).

These impacts underscore a critical insight: pandemic preparedness is not a standalone capability, but a function of the strength, resilience, and sustainability of underlying public health systems.

Public health systems encompass surveillance, workforce capacity, laboratory infrastructure, data systems, and coordinated response mechanisms. These systems operate continuously, not only during crises, and form the foundation upon which effective pandemic response depends. However, despite their central role, such systems have historically faced chronic underinvestment, fragmented financing, and cyclical prioritization (World Health Organization, 2022).

In contrast, pandemic response funding tends to surge during emergencies, reflecting a reactive financing model that prioritizes crisis response over sustained preparedness. This misalignment creates a recurring cycle of under-preparedness, in which systems are temporarily strengthened during crises but weaken once immediate threats subside.

Recognizing these structural gaps, the U.S. government has increasingly positioned public health and pandemic preparedness as national priorities. The integration of preparedness leadership within national security frameworks, alongside sustained, though uneven, federal investment, reflects a broader shift toward treating health security as a core component of national resilience.

This paper argues that public health and pandemic preparedness must be jointly prioritized within sustainable financing frameworks, rather than addressed separately or episodically. The contribution of this paper is threefold. First, it examines lessons from past epidemics to identify systemic weaknesses in financing and preparedness. Second, it positions public health systems as the foundational enabler of pandemic preparedness. Third, it proposes an integrated financing approach, building on prior work on risk-tolerant financing (Khan, 2026a), capability-oriented due diligence (Khan, 2026b), and financial system design, to support resilient and adaptive health systems in the United States and globally

To illustrate the foundational role of public health systems, table 1 below summarizes key system components and their contribution to preparedness outcomes. (Table 1)

<b>Component</b>	<b>Function</b>	<b>Preparedness Impact</b>
Surveillance systems	Detect outbreaks early	Enables rapid response
Public health workforce	Manage response operations	Strengthens system capacity
Laboratory systems	Testing and diagnostics	Ensures accurate detection
Data systems	Real-time decision-making	Enhances coordination
Healthcare infrastructure	Treatment capacity	Reduces mortality

**Literature Review**

Pandemic preparedness and public health system resilience have received increasing attention in academic and policy discourse, particularly following major global health crises such as Ebola, H1N1, and COVID-19. A growing body of literature highlights that preparedness is not solely a function of scientific capability but is deeply influenced by the strength of underlying health systems and financing mechanisms (Abbas et al., 2023; Abbas et al., 2024).

Early work on pandemic preparedness emphasized the importance of global coordination and institutional reform, particularly in the aftermath of the Ebola outbreak. Suerie Moon et al. (2015) argue that fragmented governance and delayed response mechanisms significantly constrained the effectiveness of outbreak control, calling for structural reforms in global health systems.

Subsequent research has increasingly focused on the economic dimensions of pandemics, demonstrating the scale of potential losses associated with underinvestment in preparedness. David M Cutler and Lawrence H Summers (2020) estimate that the COVID-19 pandemic resulted in economic losses exceeding \$16 trillion in the United States alone, highlighting the substantial return on investment associated with proactive preparedness financing. Similarly, Victoria Y Fan et al. (2018) emphasize that pandemic risk represents a significant but often underestimated economic threat, reinforcing the need for sustained investment in health security.

Institutional reports from organizations such as the World Bank and World Health Organization further underscore the importance of sustainable financing mechanisms. These studies highlight that preparedness funding remains fragmented and reactive, often characterized by short-term allocations that fail to support long-term system strengthening (World Bank, 2022; WHO, 2022).

More recent literature has begun to explore innovative financing approaches, including risk-tolerant investment models and public-private partnerships. Initiatives led by the Coalition for Epidemic Preparedness Innovations demonstrate how flexible, milestone-based financing can accelerate vaccine development and improve responsiveness to emerging threats (CEPI, 2023).

Despite these advances, a key gap remains in the integration of financial strategy with broader public health system design. Existing studies tend to focus either on financing mechanisms or health system capacity, with limited attention to how these elements can be systematically aligned. This paper addresses this gap by proposing an integrated financial framework that connects financing models, institutional capacity, and system-level design to support resilient and adaptive preparedness systems.

#### *Lessons from Past Epidemics and Pandemics*

Public health emergencies over the past two decades demonstrate that pandemic preparedness is not determined solely by scientific capability, but by the strength, coordination, and financing of underlying public health systems. These events highlight the systemic nature of health crises and the extent to which weaknesses in infrastructure, governance, and financing can amplify their impact (World Health Organization, 2022; World Bank, 2022).

#### *COVID-19: A Systemic Stress Test of Public Health Infrastructure*

The COVID-19 pandemic functioned as a large-scale stress test of U.S. public health systems, exposing structural vulnerabilities that extended beyond healthcare delivery. Key challenges included:

- Fragmented and non-interoperable data systems, limiting real-time situational awareness and decision-making
- Insufficient workforce capacity, constraining the ability to manage surge demand
- Supply chain vulnerabilities, particularly in personal protective equipment and essential medical supplies
- Limited coordination across federal, state, and local agencies, leading to inefficiencies in response

These weaknesses were not novel; rather, they reflected long-standing underinvestment and fragmented financing structures. The scale of the crisis demonstrated that gaps in preparedness translate directly into system-wide disruption, affecting not only health outcomes but also economic stability and national resilience (Cutler & Summers, 2020).

*Economic and Systemic Impact of Pandemics (Table 2)*

Sector	Impact
Healthcare	System overload and resource shortages
Economy	GDP contraction and fiscal deficits
Workforce	Unemployment spikes and labor market disruption
Supply chains	Global disruptions and delays
Education	Long-term human capital loss

Source: World Bank (2022); IMF (2021)

*Impact of COVID-19 in the United States (Table 3)*

Indicator	Value	Source
Total deaths (U.S.)	1,000,000+	CDC
Peak unemployment rate	14.7% (April 2020)	U.S. Bureau of Labor Statistics
Federal relief spending	\$4.6–5 trillion	U.S. GAO
Estimated total economic impact	\$16 trillion	Cutler & Summers (2020)
Global GDP contraction	3.5% (2020)	IMF / World Bank

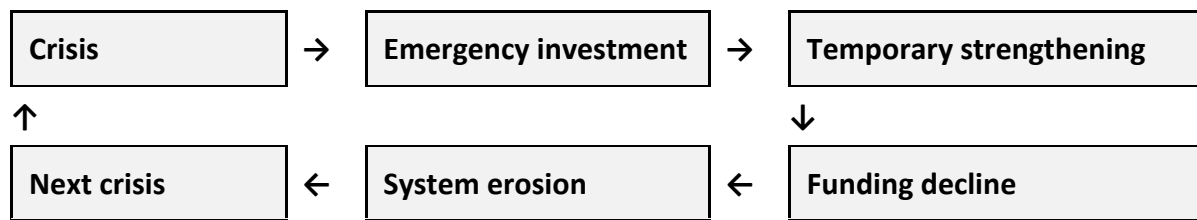
*Recurring Lessons from Ebola and H1N1*

Earlier outbreaks provide critical insights into the structural determinants of pandemic preparedness. The Ebola epidemic exposed significant deficiencies in global coordination, response speed, and health system capacity, particularly in resource-constrained settings. Similarly, the H1N1 pandemic highlighted limitations in surveillance systems, vaccine production capacity, and equitable distribution mechanisms (World Health Organization, 2016; World Bank, 2017).

Despite these lessons, investments in preparedness have largely remained short-term and reactive, with limited translation into sustained system strengthening. This pattern reflects a persistent disconnect between lessons learned and long-term financing strategies, resulting in repeated vulnerabilities across successive health emergencies.

*The Structural Cycle of Underinvestment*

A recurring cycle continues to characterize both global and U.S. preparedness systems, whereby periods of crisis-driven investment are followed by phases of declining funding and institutional erosion:



This cycle is driven by several structural factors:

- Political and budgetary short-termism, which prioritizes immediate response over long-term investment
- Challenges in quantifying the benefits of prevention, leading to under-prioritization in fiscal decision-making
- Competing funding priorities, particularly in the absence of immediate threats

As a result, preparedness systems remain structurally underfunded and insufficiently resilient, despite repeated evidence of their critical importance. Breaking this cycle requires a fundamental shift from episodic, crisis-driven financing toward continuous, system-based investment models, which embed preparedness within long-term fiscal and policy frameworks (World Bank, 2022).

## Public Health and Pandemic Preparedness as Strategic National Priorities in the United States

### *Public Health as Critical National Infrastructure*

Public health systems should be conceptualized as a foundational national infrastructure that underpins societal stability and economic continuity. Similar to transportation or energy systems, they provide essential, continuous functionality required for the effective operation of modern societies.

Core components include:

- Disease surveillance systems
- Laboratory networks
- Public health workforce
- Emergency preparedness and response capabilities

Weaknesses in any of these components reduce overall system resilience and compromise the ability to respond effectively to emerging health threats.

### *Pandemic Preparedness as National Security*

The integration of pandemic preparedness into national security frameworks reflects growing recognition of biological threats as strategic risks. Pandemics have the potential to:

- Disrupt critical infrastructure systems
- Undermine military readiness and operational capacity
- Trigger geopolitical and economic instability

This perspective elevates preparedness beyond the domain of public health policy, positioning it as a core element of national security strategy.

*Economic Stability and Fiscal Responsibility*

Pandemics impose substantial economic costs through:

- Reduced productivity and labor force disruption
- Increased healthcare expenditure
- Supply chain instability and global trade disruption

In contrast, sustained investment in preparedness provides:

- Cost avoidance through early intervention
- Reduced fiscal shocks during crises
- Accelerated economic recovery trajectories

Preparedness should therefore be understood as a preventive economic strategy, rather than discretionary or reactive spending.

To understand current U.S. commitments, below table 4 summarizes key public health preparedness investments and their strategic implications within the FY2026 budget framework

*U.S. Government Commitments to Public Health Preparedness: FY2026 (Table 4)*

<b>Initiative</b>	<b>FY2026 Status / Allocation</b>	<b>Strategic Role in Preparedness</b>	<b>Policy Implications</b>
<b>Centers for Disease Control and Prevention (CDC)</b>	\$4.2 billion (reduced from prior years)	Core agency for surveillance, epidemiology, and public health response	Reduction highlights vulnerability of preparedness systems to cyclical funding; underscores need for sustained, multi-year financing
<b>Global Health Funding</b>	Reduced and restructured under FY2026 proposal	Supports international health security, disease prevention, and capacity building	Declining investment risks weakening global preparedness; reinforces need for stable, long-term global financing commitments
<b>Administration for Strategic Preparedness and Response (ASPR)</b>	Maintains leadership role; subject to restructuring pressures	Coordinates national emergency preparedness, medical countermeasures, and response systems	Institutional role remains critical, but funding uncertainty limits operational effectiveness and long-term planning
<b>Strategic National Stockpile (SNS)</b>	\$1 billion allocation	Ensures availability of essential medical supplies during emergencies	Continued investment reflects importance of supply readiness; however, sustainability depends on broader financing integration
<b>Hospital Preparedness Program (HPP)</b>	\$307 million (largely level funding)	Strengthens healthcare system surge capacity and emergency response readiness	Flat funding limits expansion of system capacity; highlights need for scalable and adaptive financing models

The commitments presented in above table 4 highlight a fundamental tension within the U.S. approach to pandemic preparedness: while key institutional components remain in place, their financial foundations are neither stable nor strategically aligned with long-term

preparedness objectives. Despite the continued centrality of agencies such as the Centers for Disease Control and Prevention and the Administration for Strategic Preparedness and Response, the FY2026 budget landscape reflects a pattern of constrained or declining investment, particularly in core public health functions and global health engagement.

This dynamic underscores the persistence of cyclical and reactive financing, where funding expands during periods of crisis and contracts once immediate threats recede. The reduction in CDC funding, coupled with the restructuring of global health allocations, suggests that preparedness continues to be treated as a discretionary expenditure rather than a strategic public good. Such an approach is misaligned with the nature of pandemic risk, which is inherently uncertain, transboundary, and characterized by high-impact, low-probability events (World Bank, 2022).

Moreover, targeted investments, such as continued funding for the Strategic National Stockpile, reflect recognition of specific preparedness components, but also reveal a fragmented financing architecture. Investments are often siloed across programs, lacking the integration necessary to support system-wide resilience. For example, maintaining stockpiles without corresponding investments in workforce capacity, surveillance systems, and delivery infrastructure risks creating bottlenecks in deployment and utilization during emergencies.

The relatively flat funding for programs such as the Hospital Preparedness Program further illustrates the challenge of scaling capacity in line with evolving risks. Without mechanisms for adaptive and scalable financing, the health system remains constrained in its ability to respond to surges or invest proactively in resilience. This reinforces the need to move beyond static budget allocations toward dynamic financing models that can adjust to changing epidemiological and operational conditions.

Critically, the observed trends highlight a persistent gap between financial inputs and strategic intent. While U.S. policy frameworks emphasize preparedness and health security, resource allocation does not consistently reflect these priorities. Bridging this gap requires a reorientation of financial systems to support long-term planning, cross-sector coordination, and outcome-based investment. Integrating financial strategy into preparedness planning offers a pathway to address these structural deficiencies.

Finally, the reduction in global health funding raises broader concerns regarding the sustainability of international preparedness efforts. Given the interconnected nature of health threats, underinvestment in global systems ultimately amplifies domestic risk, undermining national preparedness. Strengthening global engagement through stable and predictable financing is therefore not only a matter of international solidarity, but also a strategic imperative for national security.

#### *Investment in Public Health as a Driver of Global Health Security and Innovation*

Investment in public health systems plays a critical role in strengthening global health security while simultaneously enabling scientific and technological innovation. Table 5 summarizes key areas of investment and their associated system-level benefits.

*Preparedness Investment and System-Level Benefits (Table 5)*

Investment Area	Benefit
Surveillance systems	Early detection of outbreaks
R&D funding	Faster innovation
Health systems	Reduced mortality
Global coordination	Reduced spread
Workforce development	Stronger response capacity

*Strengthening Global Health Systems*

Public health investment enhances global resilience by improving:

- Early detection of outbreaks
- Coordination of response efforts
- Capacity of health systems in low-resource settings

These investments reduce the likelihood of cross-border transmission and contribute to the protection of U.S. national interests (World Health Organization, 2022).

*Enabling Scientific and Technological Innovation*

Preparedness financing supports:

- Research and development
- Vaccine platform technologies
- Diagnostic and surveillance innovations

The rapid development of COVID-19 vaccines illustrates how sustained investment in research infrastructure enables accelerated innovation during crises. Coordinated financing and risk-sharing mechanisms, particularly those led by Coalition for Epidemic Preparedness Innovations, have demonstrated the potential to significantly reduce development timelines (CEPI, 2023).

*Enhancing System Resilience and Adaptability*

Robust public health systems improve:

- Speed and effectiveness of crisis response
- Continuity of essential health services
- Capacity to adapt to evolving and uncertain threats

Such resilience is essential in managing systemic uncertainty and mitigating the cascading effects of health emergencies.

*Economic Case for Pandemic Preparedness: Cost vs Response (Table 6)*

Category	Estimated Cost / Timeline	Source	Strategic Implication
Annual global pandemic preparedness investment required	\$10–15 billion	World Bank (2022); WHO (2022)	Modest, predictable investment can significantly reduce global risk
COVID-19 global economic impact	>\$10 trillion	Cutler & Summers (2020); World Bank (2022)	Cost of inaction vastly exceeds preparedness investment
U.S. federal emergency response spending (COVID-19)	\$5 trillion	U.S. Treasury; White House (2021)	Reactive spending is economically inefficient and unsustainable
Vaccine development timelines (traditional)	5–10 years	CEPI (2023)	Slow timelines limit responsiveness to emerging threats
COVID-19 vaccine development timeline	<1 year	CEPI (2023); WHO (2022)	Demonstrates potential of coordinated financing and innovation

The comparative analysis presented in table 6 provides a compelling economic rationale for reorienting pandemic financing from reactive expenditure toward proactive, sustained investment in preparedness. The estimated annual global requirement of approximately \$10–15 billion represents a relatively modest and predictable investment when contrasted with the extraordinary economic losses exceeding \$10 trillion associated with the COVID-19 pandemic (World Bank, 2022; World Health Organization, 2022). This disparity highlights a fundamental inefficiency in current financing approaches, where underinvestment in preparedness leads to disproportionately high downstream costs.

From a national perspective, the United States exemplifies this imbalance. Federal emergency spending reached approximately \$5 trillion, reflecting the scale of resources required to compensate for delayed investment in preparedness. Such reactive spending patterns are not only fiscally burdensome but also economically inefficient, as they divert resources from long-term productive investments and increase fiscal vulnerability.

The contrast in vaccine development timelines further reinforces this argument. Traditional development cycles of 5–10 years have historically constrained responsiveness to emerging threats. In contrast, the rapid development of COVID-19 vaccines in less than one year demonstrates the transformative potential of coordinated financing, risk-sharing mechanisms, and global collaboration, as exemplified by CEPI (2023). These findings illustrate how front-loaded and risk-tolerant investment strategies can significantly enhance system responsiveness.

Taken together, these findings suggest that the current model, characterized by episodic funding and reactive expenditure, is economically inefficient. A shift toward institutionalized, long-term financing frameworks is therefore both a public health necessity and a fiscally prudent strategy. By treating preparedness as a global public good, governments can mitigate

systemic risks, stabilize economies, and avoid the substantially higher costs associated with crisis response.

*Integrating Financial Strategy with Public Health and Preparedness*

This section advances the discussion from identifying systemic gaps to proposing a coherent and forward-looking financial architecture that aligns funding mechanisms with public health objectives. While traditional approaches have emphasized reactive disbursement and compliance-based oversight, there is a growing need to position financial systems as a core strategic pillar of preparedness, rather than a peripheral administrative function.

At its core, an effective preparedness financing framework must be proactive, flexible, and risk-tolerant. Pandemic threats are inherently uncertain, requiring financing models that can accommodate ambiguity, support early-stage innovation, and respond rapidly to emerging risks. This necessitates a shift from rigid, input-based budgeting toward adaptive financing frameworks that prioritize outcomes, scalability, and speed (World Bank, 2022).

A key component of this transformation is the alignment between scientific innovation and financial governance. Historically, promising research and development initiatives, particularly in low- and middle-income settings, have been constrained not by scientific limitations, but by weak financial systems, fragmented governance, and limited absorptive capacity. An effective financial architecture must therefore incorporate capacity-building mechanisms, ensuring that institutions are not excluded due to underdeveloped financial infrastructure, but are instead supported to meet fiduciary and operational standards (World Health Organization, 2022).

Another critical dimension is the strategic integration of public and private financing streams. Sustainable preparedness cannot rely solely on donor funding or government budgets; it must leverage blended finance models that crowd in private capital while safeguarding public health priorities. Instruments such as advance market commitments, milestone-based funding, and outcome-linked financing can align incentives across stakeholders and enable more efficient allocation of resources (Coalition for Epidemic Preparedness Innovations, 2023).

Equally important is embedding financial architecture within national and global governance structures. This includes strengthening coordination between ministries of health and finance, enhancing transparency in resource allocation, and ensuring that financial decision-making is informed by epidemiological evidence and risk assessments. At the global level, greater alignment across institutions is required to reduce duplication, harmonize funding criteria, and establish interoperable systems capable of rapid resource mobilization during crises.

Ultimately, integrating financial strategy with public health preparedness requires a fundamental paradigm shift, from viewing finance as a control mechanism to recognizing it as an enabler of resilience, innovation, and equitable access. By designing financial systems that are adaptive, inclusive, and strategically aligned with public health objectives, governments and global institutions can transition from reactive crisis management toward

anticipatory and sustainable preparedness models.

### *Risk-Tolerant Financing*

Traditional financing models are designed to minimize risk, emphasizing strict controls and predefined outputs. While effective in stable environments, such models are less suited to high-uncertainty contexts such as pandemic preparedness.

Risk-tolerant financing introduces a more adaptive approach by:

- Enabling investment in uncertain but high-impact areas
- Supporting early-stage research and innovation
- Facilitating rapid decision-making during crises

Importantly, risk tolerance does not imply reduced accountability. Rather, it requires:

- Clear governance frameworks
- Defined risk thresholds
- Continuous monitoring and evaluation mechanisms

In the context of public health, this approach enables investment in critical capabilities, including surveillance systems, research platforms, and emergency preparedness, where outcomes are inherently uncertain but strategically essential (World Bank, 2022).

### *Capability-Oriented Due Diligence*

Traditional due diligence often functions as a gatekeeping mechanism, prioritizing compliance and risk avoidance. This can inadvertently exclude organizations with strong technical capabilities but less developed financial systems.

A capability-oriented approach reframes due diligence as a tool for:

- Identifying gaps in partner capacity
- Supporting institutional strengthening
- Enabling participation of diverse and non-traditional actors

This perspective is particularly relevant in global health, where innovation frequently emerges from resource-constrained environments (Khan, 2026)

Key elements include:

- Risk-based assessments rather than binary pass/fail criteria
- Structured capacity-building plans
- Ongoing engagement and performance monitoring

This ensures that financial oversight acts as an enabler of programme delivery, rather than a constraint.

### *Financial System Design*

Preparedness requires more than individual financing tools; it requires integrated system design.

Current financing systems are often fragmented, characterized by:

- Multiple and overlapping funding streams
- Inconsistent governance structures
- Limited coordination across institutions

A systems-based approach integrates:

- Funding mechanisms

- Governance frameworks
- Operational delivery structures

Key features include:

- Adaptive funding architectures
- Real-time financial decision-making
- Alignment between financial and programmatic functions

Such integration ensures that financial systems operate as enablers of preparedness, rather than barriers to effective response (World Health Organization, 2024).

#### *Sustainable Financing as a Strategic Priority*

Preparedness financing must be sustained over time, rather than activated only during crises.

This requires:

- Long-term funding commitments
- Integration into national budgetary frameworks
- Alignment with broader development and resilience strategies

Preparedness should be recognized as:

- A global public good
- A national economic priority
- A core component of system resilience (World Health Organization, 2022)

#### *Integrated Financial Ecosystem*

The effectiveness of pandemic preparedness is significantly enhanced when disparate financing approaches are consolidated within a coherent and integrated financial ecosystem. Rather than functioning as isolated mechanisms, financial strategies must operate as interconnected components that collectively support innovation, institutional capacity, and long-term resilience.

An integrated financial ecosystem:

- Enables innovation through risk-tolerant and flexible financing
- Strengthens institutional capacity through capability-oriented due diligence
- Aligns financial and operational systems through integrated design
- Sustains investment through predictable and long-term financing

This integrated approach represents a fundamental shift in the role of finance, from a traditional emphasis on control and compliance toward a more strategic function as an enabler of system-wide resilience and innovation.

**Control and compliance**



**Strategic enabler of system resilience**

#### *Policy Implications for the United States*

Achieving a coherent and risk-tolerant financing framework for pandemic preparedness requires the United States to move beyond episodic funding cycles and fragmented institutional arrangements toward a systematic, integrated, and forward-looking policy approach. This transformation necessitates alignment across fiscal policy, public health infrastructure, and global engagement within a unified preparedness strategy (World Health Organization, 2022; World Bank, 2022).

### *Institutionalize Long-Term Financing*

A central challenge in U.S. preparedness has been the cyclical nature of funding, characterized by reactive surges during crises followed by prolonged periods of underinvestment. Evidence from recent global health emergencies demonstrates that such volatility undermines sustained capacity building and long-term system resilience (World Bank, 2022).

Addressing this challenge requires the adoption of predictable and sustained financing mechanisms that ensure continuity of preparedness efforts. This includes multi-year budget commitments extending beyond annual appropriations cycles, enabling long-term planning for research, stockpiling, and system strengthening. Such approaches are increasingly emphasized in global financing frameworks, which highlight stability and predictability as prerequisites for effective preparedness (WHO, 2022).

In parallel, the establishment of dedicated preparedness funding mechanisms—including contingency funds and permanent appropriations—would enable rapid mobilization of resources during emergencies. The experience of the Administration for Strategic Preparedness and Response underscores the importance of maintaining deployable funding streams capable of supporting both routine preparedness and emergency response (ASPR, 2023). These mechanisms must balance flexibility with accountability, ensuring transparent allocation and oversight.

### *Strengthen Public Health Infrastructure*

Sustained financing must be complemented by strategic investment in the foundational components of the public health system. Persistent gaps in workforce capacity, surveillance systems, and data infrastructure remain key vulnerabilities (WHO, 2022).

Investment in the public health workforce is critical to addressing shortages in epidemiology, laboratory science, and emergency response capabilities. Simultaneously, modernization of surveillance and data systems is essential to enable real-time monitoring, early detection, and evidence-based decision-making (World Bank, 2022).

Improving interoperability and coordination across federal, state, and local systems can significantly enhance response efficiency. Strengthening coordination mechanisms across agencies, including public health authorities, emergency management entities, and research institutions, will reduce fragmentation and improve overall system resilience (ASPR, 2023).

### *Align Financial and Operational Systems*

A critical barrier to effective preparedness lies in the disconnect between financial processes and operational realities. Traditional financial management approaches often prioritize compliance over responsiveness, limiting the ability of programs to adapt to rapidly evolving threats.

To address this, financial systems must be embedded within programme design and implementation, ensuring alignment between funding decisions and operational priorities. Integrating financial expertise into strategic planning processes can enable adaptive resource allocation, directing funding to areas of greatest need in real time (Coalition for Epidemic Preparedness Innovations, 2023).

Furthermore, there is a need to transition from rigid, input-based controls toward outcome-oriented performance frameworks. Such frameworks better capture the impact of preparedness investments while maintaining accountability. CEPI's use of flexible, milestone-based financing models demonstrates how innovation can be supported while effectively managing risk (CEPI, 2023).

#### *Enhance Global Engagement*

Pandemic preparedness is inherently global, and the effectiveness of U.S. efforts is closely linked to the resilience of health systems worldwide. Strengthening international engagement and financing for global health security is therefore a strategic imperative (WHO, 2022).

The United States should continue to support multilateral initiatives and global financing mechanisms that enhance preparedness in low- and middle-income countries. Investments in capacity building, particularly in surveillance, laboratory systems, and workforce development, can mitigate risks at their source and reduce the likelihood of cross-border transmission (World Bank, 2022).

In addition, deeper collaboration with international partners, including organizations such as CEPI, can accelerate the development and equitable distribution of vaccines, diagnostics, and therapeutics. Strengthening these partnerships ensures that innovation is aligned with global public health needs and that resources are deployed efficiently across borders (CEPI, 2023).

#### **Conclusion**

Pandemic preparedness is no longer a discrete policy concern but a core determinant of national resilience, economic stability, and global security. Evidence from recent crises, particularly COVID-19, demonstrates that reactive and episodic financing approaches are fundamentally inadequate to address the scale and complexity of contemporary health threats. Effective preparedness must therefore be embedded within strong, continuously funded public health systems that operate before, during, and beyond crises.

This paper has shown that the limitations observed during past pandemics are not solely the result of scientific or technical gaps but are deeply rooted in structural weaknesses in financing models and system design. Fragmented funding, rigid financial controls, and short-term investment cycles have constrained the ability of systems to respond adaptively under conditions of uncertainty. Consequently, even well-resourced systems have struggled to translate capability into timely and effective action.

By positioning public health systems as the foundation of preparedness, this study highlights the need to shift from crisis-driven response models to sustained, system-oriented investment strategies. Core infrastructure, including surveillance, workforce capacity, laboratory networks, and data systems, must be treated as essential national assets requiring continuous investment and strategic oversight.

The central contribution of this paper is the development of an integrated financial framework that combines risk-tolerant financing, capability-oriented due diligence, and system-level financial design within a sustainable funding model. This framework challenges

conventional approaches that view finance primarily as a control function, instead reframing it as a strategic enabler of resilience, innovation, and institutional capacity.

Risk-tolerant financing enables investment in uncertain but high-impact areas, particularly in early-stage research and preparedness capabilities. Capability-oriented due diligence expands participation by strengthening institutions rather than excluding them based on rigid compliance criteria. Integrated financial system design ensures alignment between funding flows, governance structures, and operational delivery, while sustainable financing embeds preparedness within long-term national and global priorities.

For the United States, adopting this approach requires institutionalizing multi-year financing commitments, strengthening coordination across federal and state systems, and aligning financial decision-making with public health objectives. It also necessitates sustained global engagement, recognizing that domestic resilience is intrinsically linked to the strength of international health systems.

More broadly, this paper contributes to the growing recognition that pandemic preparedness is a cross-sectoral policy priority, intersecting with national security, economic policy, and global development. The economic disruption caused by COVID-19 underscores the cost of underinvestment, while the rapid pace of scientific innovation demonstrates what is achievable when financing systems enable rather than constrain progress.

Ultimately, transitioning from reactive response to proactive preparedness requires a fundamental rethinking of how financing is structured and deployed. By integrating flexibility with accountability, and innovation with governance, policymakers can design financial systems that not only manage risk but actively reduce it.

Sustained investment in public health systems is therefore not optional, it is a strategic imperative. It represents one of the most effective mechanisms for safeguarding lives, protecting economies, and ensuring resilience against future global health threats.

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