Building resilient health systems: a proposal for a resilience index

Margaret E. Kruk, Emilia J. Ling, Asaf Bitton, Melani Cammett, Karen Cavanaugh, Mickey Chopra, Fadi el-Jardali, Rose Jallah Macauley, Mwihaki Kimura Muraguri, Shiro Konuma, Robert Marten, Frederick Martineau, Michael Myers, Kumanan Rasanathan, Enrique Ruelas, Agnès Soucat, Anung Sugihantono, Heiko Warnken

Standfirst: Health system resilience begins with measurement of critical capacities ahead of crisis.

Introduction

The 2014 West Africa Ebola epidemic shone a harsh light on the health systems of Liberia, Sierra Leone, and Guinea. While decades of domestic and international investment had contributed to substantial progress on the Millennium Development Goals, [1,2] national health systems remained weak and unable to cope with the epidemic. Routine care of the population also deteriorated during the outbreak. [1-4,] Surveillance systems did not function effectively, allowing Ebola to spread within and between the countries. Global institutions were slow to respond to the crisis, squandering an opportunity to stem its course.[5-7]

Since the Ebola epidemic, diverse panels of experts have pointed to political and technical deficiencies in multilateral organizations in tackling health crises.[8-11] These reports have noted that the first line of defense against future pandemics is an effective national health system. They have also called for better measurement of public health capacity and investments to build resilient health systems—systems that can withstand health shocks while maintaining routine functions. [12] The issue of how global bodies can support countries in withstanding future health shocks is playing out now in the WHO Director General elections, with several candidates making health system resilience part of their election planks.

Based on recent literature, this paper defines health system resilience as "the capacity of health actors, institutions, and populations to prepare for and effectively respond to crises; maintain core functions when a crisis hits; and, informed by lessons learned during the crisis, reorganize if conditions require it."[13] Health system resilience is relevant in all countries facing health shocks—whether sudden (Ebola, earthquakes, terror attacks, refugees), slower moving (new pathogens such as Zika becoming endemic or epidemiologic transition) or the more chronic 'everyday' shocks and stresses that characterize even times of seeming calm (drug shortages, loss of key health personnel, micro-outbreaks of endemic diseases). Yet, while health system resilience has been defined and widely discussed, there is debate about whether the concept has something truly new to add to the discussion on health system strengthening, and how resilience can be best built and measured.

In this paper, we argue that the concept of resilience adds substantial value to health systems, can be measured, and should be a national and international priority. We first discuss recent critiques of the concept of health system resilience to health system strengthening. We then briefly outline three case studies from Lebanon, Liberia, and

Indonesia that demonstrate how health systems have improved resilience in response to crisis. Lastly, we propose measures of health system resilience for use by countries.

As shown in Figure 1, resilient health systems—health systems that are equipped to respond to shocks—are aware, integrated, diverse, self-regulating, and adaptive. These features do not arise in a vacuum; they require a foundation of strong local and national leadership, a committed health workforce, sufficient health system infrastructure and global support. The last point is especially worth emphasizing: resilience is not self-sufficiency. Crises do not respect geopolitical boundaries and thus resilience requires thoughtful interconnectedness or "smart dependency."

The value and critiques of the concept of resilient health systems

While the construct of resilience has been widely used in diverse fields, including ecology, engineering, and psychology, it is relatively new to health. [14-18] With a plethora of frameworks and catchphrases crowding the global health lexicon, there are legitimate questions about the value added by the concept of 'resilient' health systems. We identify three contributions of the concept of resilience to the health systems field:

First, resilience emphasizes the functions health systems need (Figure 1) to respond and adapt to health shocks, introducing a dynamic dimension into more static health system models, such as the WHO's building blocks framework.[19] A rigidity of mission characterizes the operations of many health systems, whose ethos and organization is better suited to yesterday's disease burden than tomorrow's, focusing mostly on episodic care, unequipped to provide advanced care for infections, longitudinal care for a broad spectrum of chronic diseases, or emergency care needed to respond to the rising tide of injuries. Resilience demands flexibility in the functions and organization of the health system, which can help the system cope with surges in demand during crisis and adapt to changing epidemiology and population expectations of care.

Second, the concept contributes useful new ideas to health systems from other sectors that have long thought about resilience. For example, other sectors have developed solutions for supply chains and logistics to respond to surges in demand that may be relevant. Concepts such as cost-effective redundancy[20] and slow-fast variables, [21] commonplace in engineering or ecology could provide good models for the health system. Building trust and promoting meaningful community engagement, have been systematically studied in other fields such as environmental sustainability and political science, but have not been well operationalized in health systems science.[22-24] Resilience draws on complex systems notions identified as important in health systems but rarely acted upon, such as the interconnectedness of health and non-health actors and the importance of feedback loops.[25]

Finally, the concept of resilience helps bridge disparate health and development agendas, such as Universal Health Coverage, the Global Health Security Agenda, and the Sustainable Development Goals thus lending fresh impetus to the need to invest in health systems. [26-29] It identifies the immediate and longer-term payoffs of well functioning, responsive, and adaptable health systems and highlights the unacceptable costs of inaction. By containing outbreaks, returning to baseline function faster, and mitigating

other shocks, resilient health systems can contribute to economic stability—an example of a resilience dividend. [30] Conversely, inaction will result in lost lives, diminished livelihoods, and damaged economies in the affected country and globally—the latter on the order of US$60 billion each year from potential pandemics. [31] The recognition that health systems are the front line for dealing with the next big threat to global health security amplifies the urgency of health system strengthening and draws in new actors and ideas.

This notwithstanding, the rising attention to resilience in global health has prompted several critiques of the concept. One is that the concept of resilience is an imposed, technocratic solution that obscures the socioeconomic and political factors that lead to an inadequate response to shocks. These factors may include unfavorable trade terms, weak citizen engagement, and chronic health system deficiencies. [32-35] This critique suggests that value judgments about what constitutes resilience for whom be made explicit. The latter point is particularly salient: ordinary individuals may lack power that precludes them from shaping the health system response or holding it to account and the process of building resilience should enhance that power.

There are also concerns about short-term timeframes for action when problems are multifactorial, and a paradoxical push for national self-reliance when threats readily cross borders.[33] While these concerns highlight the potential for resilience to be used as shorthand for a narrow preparedness agenda, we do not believe they accurately represent the meaning of health system resilience as intended here. Building resilience is much more than preparedness; it involves investments in institutions, preconditions (like an effective health workforce) and other so-called "slow variables." and requires. We reject the notion that resilience calls for communities to shoulder crises alone and call instead for meaningful government engagement with communities to ensure responsive health services that people trust and want to use.[13] We also agree that imposed technocratic solutions will not bring about needed change and that the particular arrangements needed to promote resilience have to emerge from the country's context. The cases below highlight several of these features. Building resilience should be integrated with existing efforts to strengthen health systems and its success should be judged on equitable health gains rather than the security of wealthy nations.

Resilience in action: three case studies

We present three case studies in which several of the authors were centrally involved, where a range of large health shocks have contributed to improved health system resilience: chronic system dysfunction aggravated by a population influx in Lebanon, sudden and severe outbreak shock in Liberia, and repeated, anticipated disaster shocks in Indonesia.

These case studies illustrate how central real-time awareness and self-regulation are to resilience. Awareness is the capacity to detect and interpret local warning signs and quickly call on health and non-health partners for support. Liberia's initial paralysis during the Ebola epidemic was in large part caused by poor understanding and appreciation of disease severity and spread—at all levels from local to global. Self-regulation is the ability to isolate threats and maintain core functions under stress. While

Ebola Treatment Units are a classic example of self-regulation (in Liberia's case, these came too late to mitigate spread), Lebanon's emergency vaccination and surveillance efforts, and Indonesia's regional crisis mitigation centers can also be seen as "homeostatic" innovations for containing health threats. Indonesia's case also shows the value of learning and adaptation: the crisis mitigation centers arose from experience of poor coordination in past tsunamis in anticipation of future similar catastrophic weather events. In each of these case studies, most elements of resilience emerged after crisis rather than ahead of crisis. As we note below, future research should consider how the elements of resilience perform when adopted ex ante.

The value offered by diverse health care providers that can coordinate with each other is seen in the case of Lebanon, which is now hosting 1.8 million refugees from Syria increasing its population by over 30%.[36] To meet the challenge of much larger numbers of people seeking care, the Ministry of Health has expanded the primary care base as an efficient approach to tackling multiple health needs of both refugees and citizens. This has been done in part through consultation and contracting with private sector providers, including faith-based providers; an example of integration among diverse health actors who in the past may not have worked together.

Integration also draws attention to the key mediating role that broader state-society relations play during crises, including the recognition of people as producers of their health and thus as co-architects of an effective crisis response. Involving people and communities in crafting a response to health crises depends on—and is a potential means of strengthening—government accountability to its citizens. Stronger mechanisms for state-society partnerships allow government officials to weave the experience, expectations and capabilities of affected people into the containment strategy for a more powerful and empathetic response. Identifying ways to work effectively with local leaders was a critical lesson from Liberia during the 2014-2015 Ebola epidemic. Community leaders were critical forces in case finding, community mobilization, and other epidemic control measures.

Measuring resilience capacity: a proposal for a Resilience Index

Recent international panels reviewing the Ebola experience have called for measurement of health system resilience capacity ahead of crises.[31,37,38] Building on the conceptual framework described earlier, we have outlined a set of preliminary measures of national health system resilience (Table 1). They include existing health system and preparedness metrics (e.g., from the International Health Regulations, the Global Health Security Agenda, and the Sustainable Development Goals), relevant measures from non-health fields, and new proposed measures that require further development and testing. This proposed Resilience Index balances slow (e.g., availability of district health staff with public health training) and fast (e.g., provisions to reallocate money in emergencies) drivers of resilience, thus bridging health system and preparedness agendas. In contrast to traditional health security frameworks, many of our indicators reflect characteristics of "everyday" resilience; they not only encourage daily function but also proactively reduce the likelihood of rising system threats. The index can thus inform development of national health plans. It can also expose gaps in function and measurement capacity where regional and global cooperation can contribute.

The Index does not prescribe national benchmarks. Given the heterogeneity of health systems and national contexts, benchmarks for resilience indicators should be set within countries to accommodate the local context. The next step would be to review and extend this list as needed, and to develop and validate indicators for the new measure constructs, with input from community leaders and non-health sector actors. While the index is meant to be prospective (used in advance of a crisis), some proposed measures include routinely collected service delivery and quality indicators that over time can indicate the "slope" of resilience (the extent and speed with which a system returns to baseline or better after a shock). Finally, the validity of the Resilience Index should be tested against actual performance in recent health shocks in several settings.

Conclusion

Before the failure of health systems during the Ebola outbreak is forgotten, we need to consider how to make health systems more resistant to crises and more flexible in their response. The concept of resilience adds dynamism and urgency to the longstanding work of health system strengthening and provides an opportunity to learn from other sectors. Country experiences as varied as Lebanon, Liberia and Indonesia demonstrate how resilience can be built after health crises. Proposed measures of health system resilience can improve our assessment of countries' progress in building resilience and indicate areas for action. We hope implementation of these ideas can energize policymakers and ultimately benefit families and communities in times of crisis and beyond.

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Author contributions

MEK conceived the idea and structure of this paper and wrote the first draft with assistance from EJL. All authors contributed intellectual content, edited the manuscript, and approved the final version for submission.

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Exhibits

Box 1. Integrated approaches to care for diverse needs: working with non-state actors during the Syrian refugee influx in Lebanon

Since the beginning of the Syrian civil war in 2011, Lebanon has experienced an unprecedented influx of refugees, increasing its population by 1.5 million, or 30%. [36] The Syrian crisis still persists today, placing continued strain on Lebanon's health system. Lebanon's health system has demonstrated resilience by rapidly mobilizing and expanding its diverse primary care service delivery capacity in the public and private sectors.

Initial refugee health relief focused on short-term assistance delivered via multiple organizations.[39,40] The fragmentation of early relief efforts motivated the Ministry of Public Health to established a steering committee to streamline relief funding and encourage transparency and accountability across international and national health actors.[41]

Primary health care grew to be the central platform for the response. In 2015, the Government of Lebanon and its multi-sectoral partners (including UNHCR, UNDP, World Bank, and NGOs) established 20 new public health centres and directly supported 100 private health centres, increasing primary care capacity by 40%.[42] Covered services include non-communicable disease screening, nutrition services, and mental health support.[42,43] Additions to the epidemiological surveillance system improved the health system's ability to detect emerging diseases, contributing to the country's quick response to arising polio threats.[44]

Despite early successes in primary care, access to Lebanon's secondary and tertiary health care system continues to be a challenge for refugees.[42,43] Recent estimates suggest that approximately 26% of the refugee population requires secondary health care, however 23% of those requiring secondary services are unable to access care, primarily due to high fees (71%). [45] Financial assistance for the costs of care is limited to specific conditions, and requires co-payment, which contributes to substantial financial burdens for refugees.[42,43,46]

Box 2. Continuous adaptation to build awareness: Engaging and communicating with communities during Liberia's Ebola crisis

At the peak of the 2014 Ebola epidemic, Liberia reported 300 to 400 new Ebola cases each week and had the highest incidence of Ebola deaths of the affected West Africa nations. [47] Meanwhile, non-Ebola patients were neglected – health facilities lacked testing and isolation capacity and thus turned down patients who appeared sick. [48] Some facilities simply stopped providing services altogether. Urban and rural communities resisted surveillance and disease control efforts, some believing Ebola was purposely introduced by the government and foreign institutions to gain profits from emergency response activities. [48-50] Trust was further eroded by inadequate responses from Ebola Task Forces and help hotlines when neighbors fell ill.[49]

Gradually, Ebola Treatment Units (ETUs) opened and health facilities resumed services. At the same time, The Ministry of Health and partner NGOs first launched a

series of public health messages beginning with "Ebola kills", intended to emphasize the gravity of the epidemic.[51] While intended to emphasize the gravity of the epidemic, this approach backfired. Communities reasoned that if Ebola was universally fatal, sick family members should avoid ETUs and instead should die at home, supported by family.[51] Public messaging gradually evolved to messages like "the earlier you report Ebola, the more likely you are to survive". Traditional leaders were enlisted to support community training in all 88 counties and spread messages in local dialects.[52]

To improve effectiveness of the epidemic response, communities were directly engaged in surveillance. In West Point, Monrovia's largest slum, community and traditional leaders were assembled to discuss concerns and propose a locally driven solution for Ebola surveillance.[48,53] Community leaders were assembled to discuss concerns and propose locally acceptable surveillance methods for the densely populated area. A system for active case finding was developed. Along with psychosocial support workers, active case finders helped identify potential Ebola cases, reduce caregiver transmission, and promote burials by trained 'safe and dignified' burial teams. Leaders recruited community volunteers to complete Ministry-led surveillance training with 152 active case finders and 15 psychosocial support workers deployed.[53]

Box 3. Learning how to self-regulate: Coordinating multiple actors during natural disasters in Indonesia

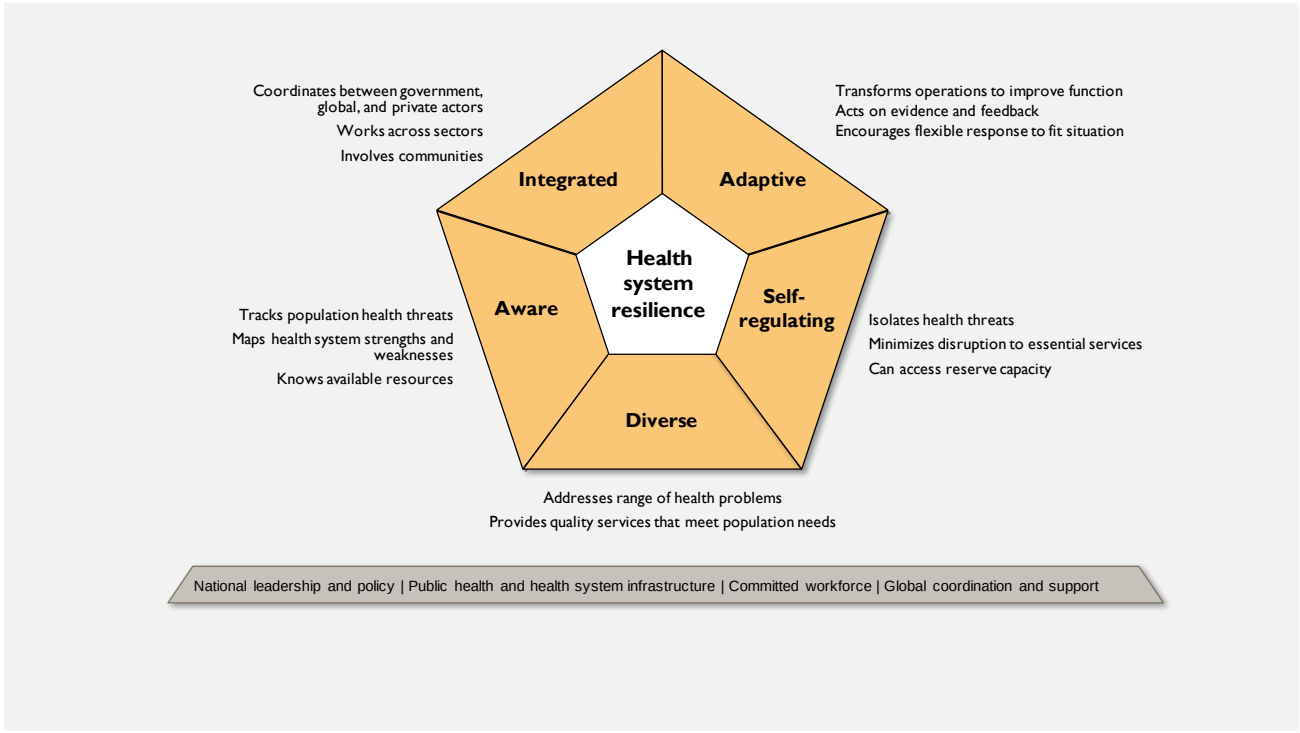
Spread across three major geologic fault lines, Indonesia experiences periodic earthquakes and tsunamis. Each recent disaster has tested the health system and led to progressive adaptation. The 2004 Indian Ocean tsunami, triggered by a massive undersea earthquake, devastated the province of Aceh.[54] Overnight, 106 health facilities in Aceh were damaged or destroyed and more than half the health workforce was displaced from their homes or killed. [55,56] Government struggled to organize a response and assistance was further delayed by security concerns: Aceh had been the site of recent battles between government and the guerilla separatist group, the Free Aceh Movement (GAM), delaying a national response and blocking NGO aid. [57,58] As aid eventually arrived, provision was chaotic with duplication of efforts in some areas and gaps in services in others. It took two weeks to establish a disaster coordination centre, and nearly one month for the Aceh health system to resume function.

Two years later during the 2006 Yogyakarta earthquake, the national response was remarkably different. In a show of support, the President of Indonesia temporarily relocated his office to Yogyakarta hours after the earthquake to support the National Disaster Management Agency emergency efforts.[59] While 67 of 115 health centers in Yogyakarta were damaged or severely destroyed, domestic health teams were quickly mobilized to the disaster site overnight to provide emergency relief. [60,61] The response to this earthquake—both more efficient and more locally driven than that for the 2004 tsunami—was informed by lessons learned from Aceh and the absence of conflict in the area.

Learning from these experiences, Indonesia established nine regional crisis mitigation centres in 2009.[62] Strategically located in disaster-prone areas, these centres are proactively equipped with staff, vehicles, and emergency supplies, and perform community outreach with local health facilities in between natural disasters, teaching

basic first-aid and natural disaster response. [63,64]

Figure 1: Resilient Health System Framework



Note: Figure adapted from Kruk et al [13]

Table 1: Preliminary Resilience Index

Character-istics*	Aims	Measures	Rationale
Aware	Know health system capacity	**1.** Distribution of health system assets and weaknesses [a]	Real-time geo-registry of HWs, supplies, and facilities (including NGOs, private, etc. operations) can realistically gauge available national capacities
		2. Health service utilization trends	Routine health monitoring helps system detect service fluctuations and accurate assessments of crisis impact, and rate of return to baseline after a shock;
	Know risks and population	**3.** Presence of active epidemiologic surveillance system [a,b]	Routine surveillance is necessary to detect disease threats and trigger mitigation mechanisms
		4. Functioning civil registration and vital statistics system	Basic knowledge on population demographics is important for estimating health threats and trends, and understand crisis impact
	Communicate	**5.** Resilience "rolodex" of decision makers [a]	Point persons across sectors must be immediately accessible for communication, decision making, and sounding alarms
		6. Breadth of functioning communication channels [a]	Communities must be able to notify and sound alarms – this requires an environment of free speech and freedom of press and functioning, open platforms for timely communication (hotlines, community committees, social media)
Diverse	Effectively respond to range of health needs	**7.** Scope of health services available in primary care [c]	Including services that respond to population health needs and expectations in basic primary care package will promote routine health system utilization and confidence in the health system.
		8. Quality of care for sentinel conditions in basic package [c]	Health outcomes, health care utilization during crisis, and trust in health authorities require competent and respectful care
	Adequately finance health system; prevent financial harm	**9.** Financing of health care: adequacy of government health expenditure and financial protection [c]	Total health system funding must be sufficient to support functioning services; financing systems should aim to reduce catastrophic and impoverishing health spending. [65-68]
Self-regulating	Isolate threat and maintain core function	**10.** Memorandums of understanding (MOUs) with non-state providers	Establishing agreement about roles for private providers –not for profit and for profit- in crisis expands service provision in emergencies and may promote collaboration in times of calm
		11. Database of service delivery alternatives for affected and unaffected populations [a]	A routinely updated global, open access library of service delivery models tested and deemed effective in past crises promotes inter-country learning and lowers redundant reinvention and perpetuation of failed ideas
	Leverage outside capacity	**12.** Collaboration agreements with regional and global actors	Agreements on nature of collaboration (timing, type of support, roles/responsibilities) during emergencies is a form of smart dependency and contributes to a faster, more effective response [30]

Integrated	Coordinate with non-health actors (e.g., education, transport, police, media, private enterprise)	**13.** Existence of a national emergency coordination system and leader(s) [a]	Ready coordination systems encourages fast decision making and implementation, curbing potential effects of emergencies
		14. Frequency of joint planning sessions and drills [a]	Rehearsal of preparedness plans and regular collaboration establishes norms of inter-sectoral teamwork
		15. Process for development of a One Health strategy [b]	Acknowledging human ties to the environment and other species encourages an inclusive understanding of public health vulnerabilities
	Engage citizens and communities to build trust	**16.** Index of Ministry of Health and government responsiveness to community need	Quick action in responding to community needs can foster population trust and promote containment of health shock
		17. Population trust in health system	Trust in government and in the health system is essential to effective service delivery and for acceptance of government messages in crises—this is true in government-run and mixed provider health systems [69,70]
		18. Platforms for dialogue with community leaders	Regular input about health system functioning from citizens will improve emergency planning and establish communication channels for routine and emergency needs
		19. In-country social scientists with experience working with Ministry of Health	Tapping experts in sociology, anthropology, and related disciplines strengthens understanding of key social structures in crisis response, local health determinants and the local appropriateness and acceptability of interventions.
	Link health care provision to public health	**20.** Availability of district health staff with public health training [b]	Public health staff serve to promote public health practices and act as sentinels for potential outbreaks connecting local clinics to surveillance and monitoring system
	Coordinate primary and referral care	**21.** Agreement on roles and referral protocols for facilities	Defined agreements on role of primary and referral facilities reduce confusion and service delay; streamlines service delivery for patients
Adaptive	Shift resources to meet need	**22.** Formal provisions to reallocate funds in emergency	Flexible spending of funds—national and international—speeds up and better targets emergency response in fast changing situations
	Promote rapid local decision making	**23.** Management capacity of district/local health teams [c]	For decentralized responses, local health teams must be able to interpret local data and local leaders must be able to make quick and sound operational decisions
		24. Agreements on delegation of authority and funding in crises	Pre-crisis agreements permitting local decision making in crisis with sufficient support hasten response time to evolving challenges
	Evaluate to improve	**25.** Mechanisms for and capacity to track progress and evaluate health system performance in crisis and in times of calm[b]	Rigorous monitoring during crisis and independent evaluation post-crisis permits course-correction and points to needed reforms. National capacity for data use and, more broadly, a culture of open inquiry and evaluation need to be built in times of calm to deliver during a crisis.

* Characteristics are inter-related and interdependent. They should not be treated as a à la carte menu; rather decision-making and coordination should occur across these characteristics.

[a, b, c] indicate concepts similar to proposed IHR, GHSA or SDG indicators, respectively

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