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# Health workforce resilience in the age of polycrisis: A framework to support health workforce policy and planning

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ABSTRACT

*Background:* Many countries face prolonged health workforce crises, marked by shortages, maldistribution, skills mix imbalances and attrition. When workforces are overstretched, they become more vulnerable to external shocks and chronic strains, including infectious disease outbreaks, climate-related effects and political instability. This is particularly concerning as an emerging global "polycrisis" means such external pressures increasingly interact and amplify one another in unpredictable ways. Strengthening health workforce resilience must therefore become a priority for policy and planning.
*Objective:* To introduce a resilience lens for health workforce policy and planning.
*Methods:* This conceptual paper synthesises literature from health workforce and systems research, resilience, and complex adaptive systems theory, complemented by practical insights from workforce planning and governance.
*Results:* The paper introduces the Health Workforce Resilience framework, which illustrates how the multilevel nature of health workforce resilience connects individual health workers, teams and organisations, and the national health workforce level. It shows how shocks and long-term pressures ripple through these interconnected levels, affecting the capacity, composition, and performance of the workforce. Impacts and responses at one level can amplify or dampen effects at others. The framework highlights two critical interfaces: the workforce–community interface, capturing how societal, economic, and security conditions shape workforce motivation, performance, and retention, and the workforce–governance interface, reflecting how institutional arrangements, policies, and decision-making processes enable or constrain workforce system responses.
*Conclusions:* Adopting a resilience lens underscores the need to view workforce planning as a systems approach that emphasises anticipatory, needs-based planning and integrates political, social, and contextual realities to strengthen workforce resilience under pressure.

**Research in context**

**What is already known about the topic?**

Ebola and COVID-19 have exposed how vulnerable already-strained health workforces are to shocks, and how this can slow progress toward universal health coverage. While research on health systems resilience and on individual health worker resilience has grown, there has been limited synthesis of what workforce resilience entails.

**What does this study add to the literature?**

This paper defines health workforce resilience as the capacity of health workers, individually and collectively, and of the systems in which they operate to absorb, adapt, and transform in response to health, economic, political, and other societal shocks and chronic strains. It identifies the multilevel nature of resilience across individual health workers, teams and organisations, and the national health workforce, and introduces the Health Workforce Resilience framework showing how external shocks and pressures shape workforce responses through the workforce–community and workforce–governance interfaces.

**What are the policy implications?**

Adopting a resilience lens strengthens the case for a systems approach to workforce planning and highlights the need to

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consider future uncertainties within needs-based planning. It underscores the value of diverse evidence for decision making such as lived realities of health workers, political economy analysis for governance alongside epidemiological and demographic (workforce) data.

## 1. Background

Many countries are experiencing prolonged health workforce crises, characterised by persistent shortages of health workers, maldistribution, skills mix imbalances, and high attrition rates linked to factors including stress, remuneration, work pressure and working conditions [1,2]. Generally, these challenges are not triggered by a single acute shock and do not appear overnight. Rather, related challenges in health labour markets, workforce governance and financing gradually increase over time coalescing into an increasingly complex, multifaceted workforce crises [2]. When health workforces are already over-stretched, they also become more susceptible to various acute shocks and chronic strains that are external to the health workforce.

The West-African Ebola outbreak and COVID19 pandemic have been stark reminders of the threat such external shocks can pose to already vulnerable health workforces [3,4]. Yet there many different types of shocks and chronic strains that can threaten health workforces, and by extension progress towards Universal Health Coverage (UHC), in the years ahead. Both sudden (e.g., pandemics, eruptions of violence) and gradually mounting chronic strains (e.g., demographic shifts, impacts of climate change) have tangible effects on national health needs and inequities [5].

The structural vulnerability of many health workforces is particularly concerning given a growing body of scholarship warning of a broader global "polycrisis," in which political, economic, and environmental crises intersect and amplify one another in ways that are hard to clearly predict [6]. While vulnerabilities vary across contexts, no country is immune. For health workforce policymakers and planners, it is therefore essential to understand how diverse external pressures interact to shape workforce responses.

In this context, resilience could offer a useful lens for examining how workforces respond to external shocks and chronic strains, and for guiding efforts to support sustained functioning under pressure. However, applying resilience in workforce policy and planning would require a clearer and more operational understanding of what workforce resilience entails in practice. Establishing such a common understanding is critical to embedding resilience within national workforce strategies.

The aim of this paper is to develop such a conceptual understanding and introduce a framework that supports context-sensitive analysis of how external pressures shape workforce dynamics and system responses.

## 2. Methods

The paper draws on a purposive review of multidisciplinary literature spanning health systems and health workforce research, resilience (within and beyond the health sector), and complex adaptive systems theory. The search focused on publications from 2015 to 2025 in databases including PubMed and Google Scholar, supplemented with several earlier seminal theoretical papers on complex adaptive systems and policymaking. We included a range of source types (primary studies, conceptual papers, reviews, commentaries, and editorials). We included a range of source types (primary studies, conceptual papers, reviews, commentaries, and editorials).

The synthesis followed an iterative, interpretive process of literature mapping and integration, complemented by insights from the authors' experience in workforce planning and governance. The conceptual framework was subsequently developed and refined through iterative co-author discussions, drawing on these theoretical and experiential inputs to articulate the foundations of workforce resilience.

The paper develops and presents the proposed resilience lens as follows. First, it reviews insights from conceptual debates on health systems resilience and individual health worker resilience as a foundation for a comprehensive workforce resilience perspective. It then proposes a framing of health workforce resilience that clarifies how interconnected personal, team/organizational, and national workforce levels are affected by, and respond to, shocks and chronic strains. Drawing on Simkin et al. [7], who conceptualize the workforce as a complex adaptive system, the paper examines how internal dynamics and wider societal interactions shape resilience across these layers. To support policy and planning, it presents an analytical framework that maps how shocks, chronic strains, and long-term trends affect workforce resilience. Finally, the discussion reflects on the policy and planning implications of adopting a resilience lens.

## 3. Results

### 3.1. Characteristics of resilience

While literature exists on health systems resilience and on personal resilience of health workers, a conceptual gap remains in developing a comprehensive approach to health workforce resilience that bridges the two.

Resilience in the broader health systems literature is typically framed as the capacity of a system to absorb, adapt, and transform in response to shocks [8]. Burau et al. [9] highlight that the workforce's ability to absorb, adapt, and transform is integral to overall system resilience. Blanchet et al. [8] outline four interlinked dimensions that contribute to system resilience: (i) capacity to collect, integrate, and analyse diverse knowledge and information; (ii) ability to anticipate and cope with uncertainty and surprise; (iii) capacity to manage interdependence by engaging with multi-level dynamics and feedbacks; and (iv) capacity to build legitimate, socially accepted, and context-appropriate institutions.

Nuancing this shock-oriented view, Barasa et al. [3] emphasize *everyday resilience*, focussing on how systems sustain functioning under chronic strains. Moreover, they argue that analysis must consider both "hardware" (e.g., material resources) and "software" (e.g. adequate planning, governance practices and staff motivation). Viewing health systems as complex adaptive systems, resilience is emergent and dynamic, requiring strategies tailored to the intensity and nature of disturbances. Building on this, Thu et al. [10] conceptualize resilience as a process rather than a fixed state: a continuum where systems may perform strongly in some capacities and weakly in others. They stress that learning capacity, as an ongoing process, is as important as observable outcomes. Similarly, de Claro [11] calls for a long-term vision of resilience that moves beyond short-term response and recovery, positioning it as a principle for sustainability and transformation rather than a temporary coping mechanism, and noting that resilience is contingent on addressing equity.

A growing strand of literature focuses on the personal resilience of health workers, particularly after COVID-19, which highlighted the toll of heavy workloads, infection risks, and family concerns. Studies have examined coping mechanisms, social support, and other factors underpinning resilience [12–15]. Curtin et al. [13] identify themes contributing to resilience during the pandemic: moral purpose and duty; connections to peers, family, community and media; collaboration; organizational culture; individual character; and potential for growth. Insights from fragile and conflict affected settings further show how conflict worsens existing problems and creates additional, conflict-specific challenges which can affect personal resilience [16]. This includes the pluriform ways in which insecurity affects health workforce availability and performance [17], dynamics of displacement and migration [18] and the active targeting of health workers during armed conflicts [19].

### 3.2. How do external shocks and chronic strains impact the workforce?

We define health workforce resilience as the capacity of health workers, individually and collectively, and of the systems in which they operate to absorb, adapt, and transform in response to health, economic, political, and other societal shocks and chronic strains. This resilience manifests across multiple levels: the individual health worker (micro), the team or organisation (meso), and the national workforce (macro).

Fig. 1 depicts three interdependent workforce levels embedded in a wider systems context. These levels are represented as a coiled spring, illustrating how shocks and strains at one level can reverberate across other levels, while also allowing rebound and adaptation.

To make these interrelationships concrete, we briefly outline some examples from COVID-19. At the individual health worker (micro) level, health workers were affected both as professionals and as community members; a rapid systematic review after the first wave of the pandemic found that 20–40 % reported anxiety, depression, distress, or sleep problems [20]. Notably, causes included not only workload or infection risk, but also separation from loved ones and family concerns [13].

These individual impacts accumulate at the team and organisation (meso) level and impacted how hospitals responded to the pandemic. Dynamics at this level also affected resilience, with culture, management, and resourcing shaping how hospitals handled workloads and surge capacity [21]. While depicted in the figure as a single rotation of a spring, this level spans multiple layers, from facility teams to regional workforce bodies.

Understanding how the national health workforce (macro) level absorbed, adapted, and transformed during the pandemic requires looking beyond the aggregate capacity of meso-level organisations to the coordination and governance mechanisms that align them. At national level, HRH unit capacity and evidence-informed, multisectoral approaches shaped how well countries improved workforce availability and effectiveness during the pandemic, as shown for African countries [22].

Crucially, the same external shock does not land uniformly across the workforce system: its effects are level-specific and ripple both upward and downward. On the demand side, shocks can spike or shift service needs, as in the surge of hospitalizations during COVID-19′s first wave. On the supply side, they can alter the workforce's ability, composition, and performance through illness, redeployment, attrition, or changes in skill mix. Disruptions and responses at one level can amplify or dampen pressures at others: upstream enabling conditions (such as personal protective equipment availability, timely and fair pay, adequate staffing, and supportive supervision) shape frontline resilience [13], while bottom-up evidence and narratives from health workers can influence responsiveness and effectiveness of higher-level policymaking. Large-scale disruptions such as economic crises exert pressure from both directions. For example, high inflation may erode the purchasing power of health workers, forcing them to seek additional income, while budget cuts and hiring freezes simultaneously increase workloads and constrain salaries, compressing the "coiled spring" of the workforce system from both sides.

### 3.3. Resilience of the complex adaptive health workforce system

Like the shocks that impact the health workforce, the resilience-linked responses are best understood in the broader health workforce systems context. These responses visible at micro, meso, and macro levels are shaped by societal conditions and by the actions of multiple actors across the system; health workers, healthcare providers, and governance bodies interact to shape resilience features of the wider health workforce system.

Understanding how this system is structured, and how stakeholders behave within it, helps explain dynamics of resilience. Following Simkin et al. [7], the workforce can be conceptualised as a complex adaptive system where diverse, interdependent actors and institutions interact to produce outcomes that no single actor can fully control. It takes broad engagement of stakeholders to bring coordinated action to learn, adapt and self-(re)organise the system as a whole [22].

These dynamics of complex adaptive systems are evident when looking at health workforce systems in practice. Ministries of health may seek to play a stewardship role for the health workforce but are highly dependent on coordination and cooperation with a wide range of stakeholders — including ministries of finance, decentralized government bodies, private sector actors, and health worker unions—to develop and implement policies [24]. How health workforce systems respond to shocks depends in part on how different stakeholders are connected through institutions and governance: tightly coupled systems with high levels of stakeholder coordination may be able to mount more organised responses but risk becoming locked into a single course of action, while systems with loosely coupled actors may struggle to coordinate but allow greater space for context-sensitive local solutions [23,25]. Outcomes hinge on how health workers - as independent, if constrained, agents within this system - navigate and respond to the

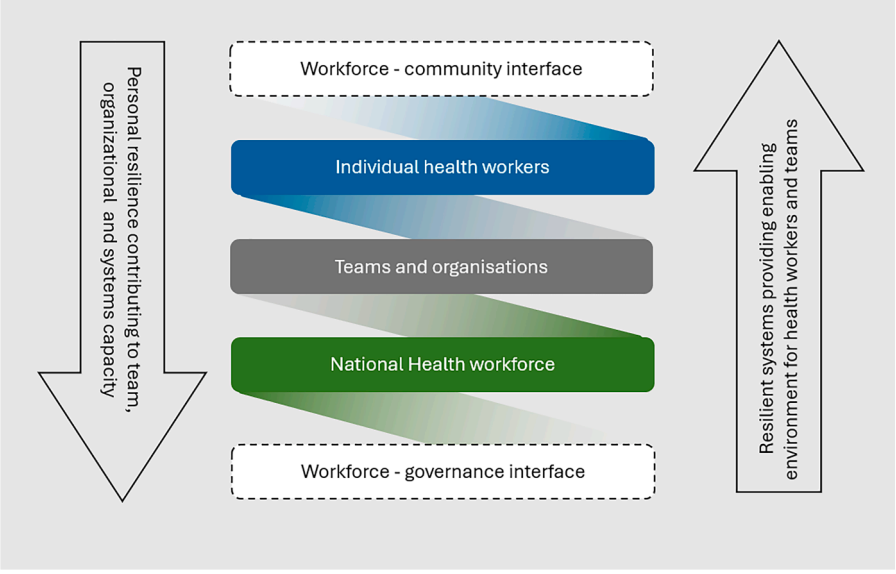


**Fig. 1.** Interdependent health workforce levels within a societal and health workforce systems context.

conditions shaped by policy decisions and broader system dynamics.

### 3.4. Health workforce resilience framework

We introduce the Health Workforce Resilience (HWR) framework to show how shocks and chronic strains affect the workforce and how resilience emerges in different systems. Because the Health Labour Market (HLM) framework is widely used in policy and planning, we deliberately build on its familiar elements. The HWR framework complements and extends the HLM framework by mapping the space of interactions between society, the workforce and the broader health workforce systems (governance) actors.

The HWR framework visualises entangled shocks and challenges, moving beyond a national lens to show how global, regional, and national dynamics affect health workforce realities and governance dynamics. In doing so, it broadens the HLM's core focus on supply–demand–need into a more context-sensitive approach that foregrounds political, systemic, and societal factors Fig. 2.

The outer layer lists systemic shocks and stresses arising at the global level. Positioned in the context of a global polycrisis, these systems pressures are interconnected and hard to disentangle [6]. The dynamics of these global systems level crises can have very clear effects at the various levels of the health workforce – with impacts mediated by societal context and the health workforce system (highlighted by the thunderbolt in the visual). For example, climate change shifts disease patterns, drives land loss and alters migration, with each adding pressure on systems and workers [26]. Macropolitical shifts can likewise significantly impact health workforce outcomes, for instance in the significant official development assistance cuts facing low- and middle income countries in the face of USAID being shuttered and prioritization of defence spending in Europe [27–29].

Migration dynamics are integral to health workforce resilience. Shaped by global shocks and slow-burn stresses such as macroeconomic crises and conflict, migration functions as a feedback loop that redistributes labour across systems. Because push–pull factors operate transnationally, resilience of sending and receiving contexts interconnect: alleviating shortages or bringing skills in one setting while depleting capacity or reshaping the skill mix in another [30].

At the core of the framework are key elements of the HLM: the education sector, the pool of health workers, and factors influencing performance. Building workforce resilience over the long term requires a dual focus: strengthening the current workforce while shaping future supply. This, in turn, entails sustained engagement with the education sector and training pipeline—including admissions, curricula, placements, accreditation, and the transition of graduates into practice—to respond to evolving needs, long-run trends, and future shocks. The pool of health workers is represented through the multilevel view of the workforce introduced earlier, highlighting individual health workers (micro), teams and organisations (meso), and the national health workforce (macro) levels. Given that the ultimate purpose of building health workforce resilience is to safeguard progress towards universal health coverage, the health labour market focus on factors shaping health worker performance remain crucial from a resilience lens as well.

Global-level system pressures do not generally act directly on the education sector or the pool of health workers; their effects, and the responses they elicit, are mediated by the societal context and the broader health workforce system within which the workforce operates. It is in this systems context that the core dimensions of (health) systems resilience, as articulated by Blanchet et al. [8], become conceptually relevant: integrating and analysing diverse knowledge; anticipating and coping with uncertainty; managing interdependencies across levels and feedbacks; and building legitimate, context-appropriate institutions. To examine how health workforce resilience dynamics manifest within a broader systems environment, the following sections focus on two key interfaces where these dynamics can be examined: the workforce–community interface and the workforce–governance interface.

### 3.5. Workforce - community interface

The workforce–community interface denotes the space where health workers engage with the societies in which they live and work. Much like social determinants of health shape individuals' health-seeking behaviors and outcomes, societal factors, positionality and interactions can enable or hinder health workers' performance. It is therefore important to consider how the societal context in which health workers operate can strengthen or weaken their resilience.

Here, the themes contributing to resilience as identified by Curtin et al. [13] become important lenses: moral purpose and duty; connections to peers, family, community and media; collaboration; organizational culture; individual character; and potential for growth. It also includes a wider range of factors influencing whether individuals choose to become and remain in position as a health worker: personal


**Fig. 2.** Health workforce resilience framework.

indicators, financial aspects, working and living conditions, contractual employment status (or volunteer status) and career and education related factors [31]. Many of these factors are influenced by broader social determinants such as norms (e.g., gender roles), trust in providers and system legitimacy, macro-economic opportunities, structural inequalities and socio-political unrest, especially relevant in the context of safety considerations for providers themselves, but also for their families and patients [32–34].

This interface is especially important for examining the resilience of individual health workers. A resilient workforce must be able to meet the varied needs of diverse populations, and a diverse workforce itself may be better suited to treat a pluriform population [32]. But this same diversity also underlines that there is no "average" health worker. Understanding resilience therefore requires attention to the specific circumstances, positionality, and intersectional identities that shape how different groups of workers experience opportunities and constraints. For instance, a young female graduate nurse receiving a low wage on a temporary contract sent to a remote area without family support faces challenges very different from those of a married male specialist nearing retirement in an urban hospital with opportunities for dual practice.

Different modes of interaction at the workforce–community interface shape health workers' (everyday) resilience:

- Communities as (future) workforce supply: The social status accorded to health workers, the extent to which roles are paid or rely on volunteerism, and the economic and social working conditions (including salary and benefits) all influence the attractiveness of health careers [31,34].
- Communities as hosts: local acceptance, sense of belonging and integration, housing, and security conditions affect motivation, retention, performance and safety of health worker [17,35,36].
- Communities as patients/users: perceptions of quality, affordability, and accessibility influence service use and the workforce's perceived legitimacy. In its most extreme case, patients' threats and violence against health workers can become more prominent in a context of crisis and uncertainty [37,38].
- Communities as co-governors/overseers: facility committees and civic groups can provide oversight, shaping local system functioning and, by extension, workforce planning and performance. However local power dynamics can also hinder health worker performance [39,40].
- Communities as taxpayers and political constituents: perceptions of workforce performance influence public support and political mandates for workforce investment [41].

What this interface makes especially clear is that interventions setting out to reinforce health workforce resilience are not just limited to traditional workforce planning – they span multisectoral governance domains (housing, infrastructure, security etc.) and involve many different governance levels to realise them, with specific importance of including the community level as a sphere of health systems governance [42].

### 3.6. *Workforce – governance interface*

The space where health workers and governance actors interact can be viewed as the workforce – governance interface. In their most tangible form, interactions within this interface include flows of evidence, policies and planning processes directly linking decisionmakers with the workforce.

Actions from governance actors can have intended and unintended effects shaping resilience factors at all levels of the health workforce. At the individual level, political decisions on public sector wages and the sensitivity of deployment practices to workers' needs directly shape health workers' positionality and their relationships with the communities they serve. At an organisational level, how decentralization in a system is organized affects the decision space and capacity of stakeholders to organize effective responses at regional and district level [43]. At the national level, the extent to which institutional capacity exists to prepare for and respond to acute crises depends not only on prioritisation and budget allocation, but also on the underlying governance arrangements. For instance, a clearly mandated and sufficiently empowered HRH unit at the centre of the Ministry of Health is often seen as a key prerequisite for effective stewardship [44]. Certain important political choices that impact health workforce resilience, including overall budget allocation, are generally taken at a higher level of political decision-making, including the important political trade-off between maintaining (costly) workforce buffers to absorb shocks versus maximizing cost-efficiency [11].

For governance stakeholders to formulate clear policy interventions they need to have a clear and comprehensive understanding of the resilience-linked challenges facing health workers. This understanding depends on the type, quality and timeliness of evidence, which in turn is dependent on staff and institutional capacity for data management and evidence informed decision making at all levels [44]. Building an enabling environment for workforce resilience requires a broad evidence-base for decision makers to understand many of the socially mediated challenges health workers face, and continuous evidence collection and analysis within a system under acute stress.

Crucially, the workforce–governance interface is not merely a technical arena where policies are designed and implemented based on evidence. Explaining whether, and how, policy options reach the agenda and are prioritised requires attention to the positions, interests, and power of health workforce stakeholders [45]. Understanding these political economy dynamics is key to assessing whether policies and planning interventions can create the enabling conditions needed to strengthen workforce resilience. The political economy of health workforce governance is increasingly recognized as a critical lens for strengthening workforce policy and planning, and the WHO now recommends it as a core component of any health labour market analysis [46]. A resilience perspective reinforces this need, as stakeholders' knowledge, interest, and power to influence workforce governance is itself highly mediated by the cascading effects of, and responses to, shocks and chronic pressures.

To understand how shocks shape policy making, Multiple Streams Theory [47] offers a useful lens: it conceptualizes major policy change as occurring when problems, policy solutions, and political will converge during critical windows of opportunity – often in the wake of large-scale disruptions. For example, the severe macroeconomic crisis in Greece after 2009 created a fiscal shock that drastically constrained public health budgets and staffing levels, prompting the government to implement wide-ranging workforce measures including wage cuts, hiring freezes, and reorganization of service delivery. While these conditions were highly adverse, they also opened a window of opportunity for policy making, as the government, amid pressure from the International Monetary Fund for structural reforms, used the crisis context to advance a new national health workforce strategy [41]. Looking at such cases highlights how shocks influence the decisions of health workforce governance actors and thereby shape the extent to which broader workforce systems can adapt and transform in different contexts.

## 4. Discussion

Planning for a resilient health workforce requires explicit attention to contextual factors and the adoption of a systems perspective. This aligns with an emerging literature that calls for moving beyond viewing workforce planning as a narrow, technical exercise reliant on quantitative tools. Instead, building a resilient workforce requires treating planning as a social, political, and economic exercise, using mixed-methods approaches to design interventions within a complex adaptive workforce system [7]

A resilience perspective emphasises anticipatory planning and

reinforces current moves towards needs-based workforce planning approaches [48] by making explicit the importance of not only current population health needs but also future demographic shifts, shocks, and systemic trends such as climate change. This further underscores the need for inter-sectoral collaboration, particularly between ministries of health, education, and labour, and provides added impetus to the long-term vision promoted in health labour market thinking, which remains underdeveloped in many contexts.

Adopting a resilience lens for planning also shifts attention to what should be the goals and methods of planning. Beyond surge capacity, this includes sustainable employment and retention as well as strengthening everyday resilience.

Given that applying a resilience lens makes the political nature of workforce planning even more evident, there are implications for how policy and planning processes are organised. This requires sensitivity to both political context and process design. Elements such as iterative planning, quick wins to maintain momentum, anchoring in broader health strategies, communication, and attention to the full policy cycle (including implementation, costing, and resource mobilisation) become central [41].

From an evidence perspective, quantitative workforce modelling remains valuable, but when planning places disproportionate weight on it, important systemic drivers, feedback loops and governance dynamics can be overlooked. Complementing quantitative analysis with qualitative insights into health workers' lived experiences can deepen understanding of challenges at the workforce–community interface. Moreover, political economy analysis can help clarify the workforce–governance interface, as workforce planning is inherently political and shaped by institutional processes [7,24]. However, broadening the range of evidence also raises practical challenges; balancing comprehensiveness with timeliness is essential to avoid an evidence–action gap.

Decentralized, locally informed planning could strengthen health workforce resilience by drawing on actors' proximity to frontline realities and capacity to tailor context-specific solutions. Proactive strategies to engage communities, such as recruiting locally, supporting training opportunities, and strengthening health system–community links through community-directed interventions, can further stabilize and improve workforce outcomes [49,50]

Effective planning depends on well-resourced HRH departments and a critical mass of planners and policymakers with HRH expertise at all levels. Building this capacity enables governments to analyse problems, design context-appropriate interventions, and strengthen stewardship while coordinating partners under national leadership [44,45].

## 5. Limitations

As a conceptual contribution, this paper does not provide a systematic mapping of all available evidence. The examples used in the framework are illustrative rather than exhaustive, intended to convey the types of shocks and chronic strains, interactions, and contextual dynamics that shape workforce resilience. Further research is needed to deepen understanding of workforce resilience across different contexts. We hope the framework presented here will help guide such inquiry and support planners navigating complex environments.

## 6. Conclusion

Adopting a resilience lens for health workforce policy and planning is critical in the uncertain times ahead. It directs efforts toward strengthening a workforce that can not only withstand shocks and chronic strains but also reinforce the robustness of health systems, ensuring they continue to function and improve under pressure. Such a focus emphasises the need to view workforce planning as a systems approach, one that highlights robustness, responsiveness to changing health needs, adaptability to systemic shifts, and transformative capacity for future challenges. In an era of global polycrisis, strengthening workforce resilience remains indispensable for safeguarding and advancing universal health coverage.

## Declarations

During the preparation of this work the author(s) used ChatGPT in order to improve the readability and language of the manuscript. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the published article.

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## CRediT authorship contribution statement

**Olivier Onvlee:** Writing – review & editing, Writing – original draft, Visualization, Methodology, Investigation, Conceptualization. **Eelco Jacobs:** Writing – review & editing, Writing – original draft, Investigation, Conceptualization. **Noor Tromp:** Writing – review & editing, Conceptualization. **Ajay Bailey:** Writing – review & editing, Supervision. **Marjolein Dieleman:** Writing – review & editing, Writing – original draft, Supervision, Investigation, Conceptualization.

## Declaration of competing interest

None.

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