

Strengthening Health Systems to Overcome Respiratory Infectious Diseases in Indonesia: A Comprehensive Review

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Abstract: Respiratory infectious diseases (RIDs) remain a persistent public health challenge in Indonesia, a vast archipelago with complex healthcare delivery and marked regional inequities. The COVID-19 pandemic revealed critical weaknesses in the country's surveillance systems, diagnostic capacity, and outbreak response, underscoring the urgent need for stronger pandemic preparedness and a transition from a reactive, crisis-driven model to a proactive, prevention-focused health system. This study synthesizes existing literature, policy documents, and recent evaluation reports to assess Indonesia's health system performance in RID management and to identify evidence-based priorities for reform. The analysis is structured around five health system components: (1) surveillance and early warning, (2) diagnostic and laboratory capacity, (3) healthcare workforce, (4) public health infrastructure and primary care, and (5) governance and financing. Indonesia demonstrates important strengths, including a nationwide network of more than 10,000 Primary Health Centers (Puskesmas) and proven vaccination campaign capacity. However, significant gaps persist: during COVID-19, Early Warning Alert and Response System (EWARS) reporting completeness dropped from 75% to 53%, rural and remote areas remain underserved by diagnostics, and health workforce distribution continues to be inequitable. Priority reforms include scaling up point-of-care diagnostics across all Puskesmas, integrating fragmented surveillance platforms through *SatuSehat*, empowering community health workers with digital tools, and ensuring sustainable financing for preparedness. Medium-term strategies focus on workforce redistribution and the establishment of regional health security centers, while long-term priorities emphasize predictive health intelligence, resilient supply chains, and nationwide facility upgrades. Building a resilient, prevention-oriented system will require sustained political commitment, innovative financing, and cross-sectoral collaboration, positioning Indonesia not only to strengthen domestic health security but also to serve as a regional leader in epidemic preparedness.

Keywords: respiratory infectious diseases, health system strengthening, pandemic preparedness, surveillance systems, Indonesia

Introduction

Respiratory infectious diseases (RIDs) continue to pose one of the most pressing global health security threats due to their potential for rapid spread and severe social and economic disruption.¹ Indonesia, the world's fourth most populous country and home to more than 17,000 islands, faces unique challenges in preventing and managing RIDs.^{1,2} Its vast geography, wide socioeconomic disparities, and highly decentralized health governance structure create a complex environment that amplifies the risks associated with respiratory disease outbreaks.^{2,3}

The COVID-19 pandemic served as a critical stress test, exposing systemic weaknesses in Indonesia's capacity for surveillance, diagnostics, and outbreak response.³ With nearly 6.8 million confirmed cases and its deepest economic recession since the Asian financial crisis, Indonesia's experience underscored both the devastating consequences of pandemic threats and the urgent need for structural reform.^{4,5} Recent surveillance data (2024–2025) highlight that while influenza continues to follow seasonal trends, surveillance gaps remain particularly acute in remote and underserved regions.^{1,4}

Despite important progress in health system development — including the expansion of universal health coverage through the *Jaminan Kesehatan Nasional* (JKN) program and the establishment of over 10,000 Primary Health Centers (*Puskesmas*) — Indonesia's approach to epidemic preparedness remains largely reactive.^{6,7} Surveillance remains fragmented across more than 40 national systems that use inconsistent methods, creating information silos and limiting situational awareness.⁶ These structural weaknesses reflect not only resource constraints but also governance and coordination challenges between national and subnational levels.^{2,6}

Although several disease-specific reviews and policy assessments exist, few studies have systematically examined Indonesia's RID preparedness through a comprehensive health systems lens.^{6,8,9} This review addresses that gap by synthesizing available evidence to evaluate Indonesia's strengths and vulnerabilities in RID management and by outlining evidence-based recommendations for future reform. The review is structured around five core health system domains: (1) surveillance and early warning systems, (2) diagnostic and laboratory capacity, (3) healthcare workforce, (4) public health infrastructure and primary care, and (5) policy governance and financing. The conceptual framework guiding this analysis is shown in [Figure 1](#) and is developed by synthesizing and organizing concepts from relevant prior studies.^{6,8–11} By situating Indonesia's experience within both domestic lessons learned and emerging global best practices, this paper provides a roadmap for transforming the country's reactive crisis-driven response into a proactive, prevention-focused system capable of withstanding future respiratory disease threats.

Overview of the Indonesian Health System

Indonesia's health system operates through a complex, tiered decentralized model that reflects both the geographical realities of an archipelagic nation and the country's commitment to regional autonomy following political decentralization reforms.^{12,13} The foundation of this system rests on approximately 10,212 Primary Health Centers (*Puskesmas*), which serve as the cornerstone of community-based healthcare delivery.¹⁴ These facilities function as comprehensive health hubs, providing services ranging from preventive care and health promotion to basic curative services and surveillance activities.¹⁵ Above this primary level, the system includes district hospitals, provincial hospitals, and national referral centers, creating a hierarchical referral network designed to ensure appropriate care at each level.¹⁶

The governance structure involves multiple stakeholders with often competing priorities and jurisdictions.¹⁷ The Ministry of Health sets national policies and standards, while 34 provincial governments and 514 district/city governments maintain responsibility for implementation and resource allocation.^{17,18} This decentralized approach, while fostering local ownership, has created significant coordination challenges during health emergencies. Recent evaluations of the Early Warning Alert and Response System (EWARS) reveal that reporting completeness dropped from 75% in

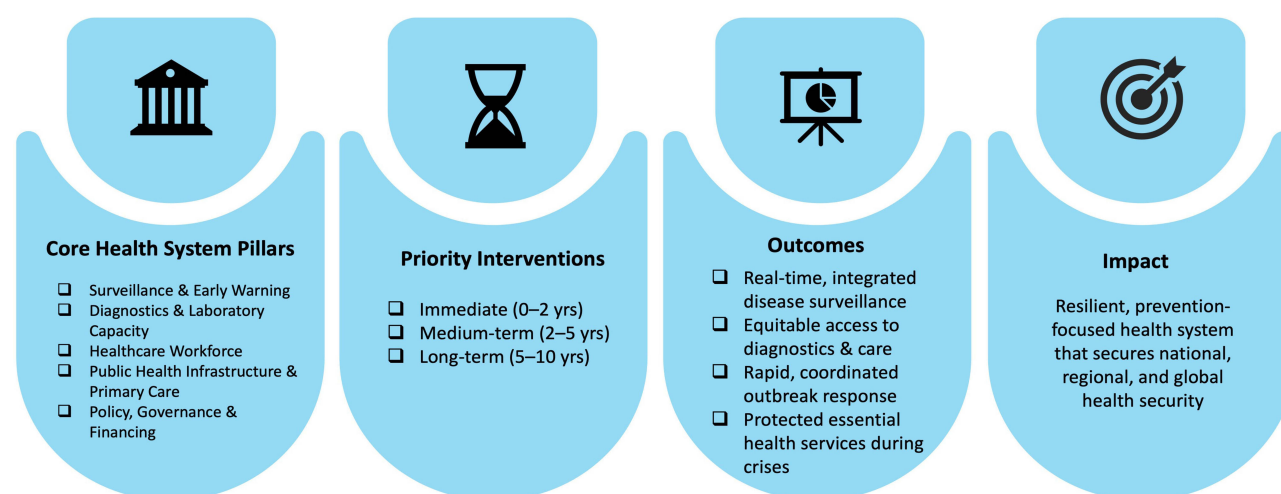


Figure 1 Framework for strengthening Indonesia's health system for respiratory infectious disease preparedness.

2019 to 53% in 2020, with timeliness falling to 34%, largely attributed to COVID-19's disruption of routine surveillance activities.^{19,20}

These coordination challenges are rooted in Indonesia's broader decentralization reforms. Indonesia's decentralized health governance system emerged from post-Suharto reforms in 1999, formalized through Laws No. 22/1999 and 25/1999, which devolved substantial authority for primary care, hospitals, and workforce management to district and municipal governments beginning in 2001.²¹ While this shift aimed to promote equity and local responsiveness, it also introduced coordination challenges and contributed to the uneven administrative capacity and resource allocation that continue to affect health system performance today.^{21,22}

The private healthcare sector plays an increasingly prominent role, particularly in urban areas, with many facilities operating outside the formal surveillance network.²³ Recent efforts to integrate private sector reporting through applications like WiFi TB have shown promise, with mandatory TB case notification expanding to include private providers.²⁴ However, systematic integration of private facilities into national surveillance systems remains incomplete, creating blind spots in disease monitoring and outbreak detection capabilities.^{1,24}

Indonesia's health financing operates through multiple streams including out-of-pocket payments, government budgetary allocations, social health insurance (JKN), and external financing.²⁵ Despite increases in public health spending, total health expenditure remains at 3.1% of GDP, significantly below global benchmarks and particularly low compared to other lower-middle-income countries.²⁶ This level of public investment is also low relative to several Southeast Asian peers, many of which allocate a higher proportion of national income to health system strengthening and epidemic preparedness, further underscoring Indonesia's structural financing constraints.²⁷ This financing constraint directly impacts the system's capacity for sustained investment in surveillance infrastructure, laboratory networks, and emergency preparedness.^{17,26}

Core Pillars of Health System Strengthening

Enhancing Disease Surveillance and Early Warning Systems

Indonesia has expanded its surveillance landscape in recent years, yet fundamental challenges remain in achieving an integrated, real-time monitoring system.⁶ The Early Warning Alert and Response System (EWARS), implemented across more than 10,000 health facilities, continues to rely heavily on manual reporting, resulting in delays and underreporting, especially in remote areas.^{6,20} These weaknesses became more apparent during the COVID-19 crisis, when the system struggled to cope with the surge in cases and response actions were often delayed, underscoring its vulnerability under pressure.²⁰ Fragmentation across platforms further complicates information sharing between facilities and across administrative levels, weakening the feedback loop necessary for timely public health action.

Digitalization initiatives, including integration of multiple surveillance platforms into the *SatuSehat* system, represent important progress, but adoption remains uneven: only about one-third of secondary hospitals and fewer than half of referral hospitals currently use electronic medical records.²⁸ Community-based surveillance (CBS) and mobile health technologies are promising but underutilized.²⁹ Given Indonesia's >100% mobile phone penetration, SMS-based reporting tools and mobile apps for community health workers could substantially enhance early detection and reporting.³⁰

Despite these national-level digital integration efforts, practical challenges at the local level continue to limit the effectiveness of platforms such as *SatuSehat*.³¹ Many district and subdistrict health facilities face significant technical capacity gaps, including limited digital literacy among staff and insufficient training on new reporting systems.³² Infrastructure constraints—such as unreliable internet connectivity, inconsistent access to electronic devices, and frequent power disruptions—further restrict full adoption, particularly in remote and rural areas.^{32,33} Additionally, cultural and organizational factors, such as resistance to workflow changes and varying levels of trust in digital technologies, often slow the transition from manual to electronic reporting.³⁴ Addressing these local implementation barriers is essential for ensuring that digital integration efforts translate into meaningful improvements in surveillance and early warning capabilities.

To move toward resilience, Indonesia should adopt a hybrid model that integrates facility-based reporting with CBS and digital solutions, while expanding inter-sectoral linkages through systems such as SIZE Nasional,³⁵ which already connects human, animal, and environmental health data.

Improving Diagnostic and Laboratory Capacity

Diagnostic capabilities remain highly uneven across Indonesia's geography.³⁶ While urban centers possess well-equipped laboratories, rural areas often lack even basic rapid antigen testing, delaying both clinical care and surveillance data collection. The laboratory network also suffers from weak integration, inconsistent sample referral pathways, and gaps in quality assurance.^{36,37}

In addition to system-wide laboratory strengthening, the integration of simple and accessible clinical biomarkers can enhance Indonesia's diagnostic readiness, particularly in resource-limited settings. Evidence from recent studies highlights the utility of markers such as the hemoglobin–albumin–lymphocyte–platelet (HALP) score, C-reactive protein/albumin ratio, and platelet/lymphocyte ratio (PLR) in predicting mortality among high-risk groups, including geriatric patients. This study demonstrated that these low-cost biomarkers were significant predictors of mortality in elderly individuals admitted to a respiratory intensive care unit.³⁸ Incorporating such biomarkers at primary care facilities and district hospitals could improve early risk stratification, clinical decision-making, and patient triage during respiratory infectious disease outbreaks, particularly where advanced diagnostics are limited.

Promising reforms are underway, including the planned *One Health Laboratory Network* under the Pandemic Fund, which seeks to integrate human and animal health laboratories, expand biobanking capacity, and standardize diagnostic protocols.^{39,40} However, implementation is in its early stages.

Priority actions include deploying point-of-care (POC) diagnostics^{41,42} to all *Puskesmas*, with a focus on multiplex platforms capable of detecting influenza, COVID-19, and other common pathogens. Establishing regional diagnostic hubs connected through robust referral networks would help overcome logistical barriers in underserved provinces.⁴³ These efforts must be coupled with national quality assurance programs and integration of diagnostic data into surveillance platforms to ensure both reliability and utility.

Strengthening the Healthcare Workforce

Indonesia's health workforce has grown in density from 43.1 per 10,000 population in 2019 to 54.2 in 2023, surpassing the SDG minimum threshold.⁴⁴ However, this progress masks wide inequities: remote and rural areas continue to face critical shortages despite national improvements. Factors such as limited professional incentives, poor living conditions, and few career opportunities undermine retention outside urban centers.^{44,45}

The government has introduced reforms, including Law No. 17 of 2023,⁴⁶ to expand public health roles for professionals, but implementation challenges remain. A largely untapped asset is Indonesia's approximately one million community health workers (*kaders*), who have demonstrated value in disease prevention and outbreak response. Their contribution, however, is constrained by volunteer status, variable training, and weak integration into formal surveillance systems.⁴⁷

To strengthen this pillar, Indonesia should implement comprehensive retention packages for professionals in underserved regions, including housing subsidies, education benefits, and structured career pathways.⁴⁸ The *kader* program should be formalized with standardized respiratory disease training, dedicated funding, and integration into digital reporting systems. Finally, regional training hubs and telemedicine-supported consultation networks could help reduce isolation and build ongoing capacity.^{48,49}

Investing in Public Health Infrastructure and Primary Care

The resilience of Indonesia's system ultimately depends on robust infrastructure at the primary care level. While the *Puskesmas* serve as the frontline of respiratory disease response, many lack adequate isolation facilities, ventilation systems, oxygen supply, and infection prevention and control measures.⁵⁰ COVID-19 exposed these deficiencies, forcing many facilities to curtail services and highlighting vulnerabilities in medical supply chains, particularly for PPE, oxygen, and essential medicines.^{50,51}

Strengthening this foundation requires systematic upgrading of *Puskesmas* to include negative-pressure rooms, reliable power systems, and improved water, sanitation, and hygiene (WASH) facilities. Parallel investments in regional medical supply hubs, automated inventory management, and partnerships with private logistics providers could reduce disruptions during future crises.^{52,53}

Policy, Governance, and Financing

Fragmented governance and limited financing undermine Indonesia's pandemic preparedness.³⁷ The Ministry of Health sets national policy, but decentralized implementation across 34 provinces and 514 districts often results in inconsistent responses. During COVID-19, this fragmentation caused delays in reporting and resource mobilization.^{37,51}

Although recent policies, such as the 2022 Decree on Prevention and Control of Zoonoses and Emerging Infectious Diseases,⁵⁴ mark progress, coordination remains limited. Financing also falls short: health expenditure stands at only 3.1% of GDP, far below global benchmarks.²⁶ Most emergency funding is reactive, mobilized during crises rather than invested sustainably in preparedness.²⁵

Priority reforms include establishing dedicated legislation for health emergency preparedness with guaranteed budget allocations, creating multi-sectoral coordination councils at all administrative levels, and expanding public-private partnerships for surveillance and supply chains. Innovative financing options — such as catastrophe bonds, pandemic trust funds, and results-based financing — could provide sustainable resources while incentivizing prevention over crisis-driven responses.

Challenges and Gaps in the Indonesian Context

Despite important progress in expanding health coverage and infrastructure, Indonesia faces persistent cross-cutting challenges that hinder effective management of respiratory infectious diseases. These challenges extend beyond individual health system pillars and reflect deeper structural, geographical, and socioeconomic realities.

Geographical and Infrastructure Disparities

Indonesia's archipelagic geography creates unprecedented challenges for equitable healthcare delivery and coordinated disease surveillance.³⁷ Recent studies of healthcare access in rural areas reveal that geographical isolation remains the primary barrier to effective health system performance, with some communities requiring days of travel to reach the nearest hospital.⁵⁵ The COVID-19 pandemic exacerbated these disparities, with remote areas experiencing delayed intervention implementation and higher case fatality rates due to limited access to critical care facilities.^{30,55}

The geographical challenges are compounded by significant variations in digital infrastructure availability.³⁰ While urban areas benefit from robust internet connectivity and digital health platform access, rural and remote areas often lack reliable internet access necessary for real-time surveillance reporting and telemedicine consultations.⁵⁶ Recent assessments indicate that successful digital health interventions require careful consideration of local infrastructure limitations and cultural factors to ensure sustainable implementation.^{30,56}

Socioeconomic and Cultural Barriers

Socioeconomic factors profoundly influence both disease susceptibility and health system responsiveness in Indonesia.⁵⁷ Recent studies demonstrate that poverty, limited education, and informal employment create multiple barriers to accessing healthcare services and complying with public health measures.^{57,58} Community health worker experiences during COVID-19 revealed significant challenges in overcoming misinformation, cultural resistance to new health technologies, and community mistrust of government health initiatives.^{30,57} Health literacy also varies widely across Indonesia's diverse population, with language differences and entrenched cultural beliefs shaping perceptions of illness and patterns of healthcare-seeking behavior.^{59,60}

These sociocultural dynamics directly affect the uptake of respiratory disease prevention and control measures.⁵⁹ In many communities, reliance on traditional healers, stigma associated with respiratory symptoms, and hesitancy toward digital or formal health services have limited engagement with surveillance systems and early care-seeking.^{59,61}

Addressing these barriers requires culturally tailored risk communication, community-led outreach, and strategies that are responsive to local norms and beliefs to improve compliance and strengthen public health responsiveness.

Governance and Coordination Challenges

Indonesia's decentralized governance structure, while promoting local autonomy, creates significant coordination challenges during health emergencies.¹⁷ Recent evaluations of EWARS implementation reveal that regulatory fragmentation between national, provincial, and district levels leads to inconsistent data collection standards, delayed reporting, and fragmented response protocols.⁶² The lack of unified command structures during emergencies has resulted in delayed decision-making and resource deployment.⁶³

The proliferation of multiple health information systems with limited interoperability creates additional regulatory challenges. Recent efforts to integrate systems through *SatuSehat* represent important progress, but technical, legal, and governance barriers persist.⁵¹ Data privacy concerns, varied procurement standards, and limited technical capacity at local levels continue to hinder comprehensive system integration.⁶⁴

Lessons Learned from Past Outbreaks

The resilience of a health system is most visible during crises. Indonesia's experience with past outbreaks — particularly COVID-19, the long-running tuberculosis (TB) program, and the implementation of One Health initiatives — provides critical lessons on both vulnerabilities and pathways for strengthening preparedness against respiratory infectious diseases.

COVID-19 Pandemic Response: Successes and Failures

The COVID-19 pandemic exposed systemic weaknesses while also demonstrating Indonesia's capacity for rapid mobilization.³⁷ On the positive side, the national vaccination campaign highlighted remarkable logistical capabilities.² Through coordinated efforts involving the Ministry of Health, the military, and local governments, Indonesia achieved high vaccine coverage in urban areas and successfully rolled out mass campaigns despite its geographical complexity.^{2,51}

However, the initial pandemic response revealed fundamental weaknesses in testing, contact tracing, and surveillance.³⁷ Routine surveillance systems such as EWARS were severely disrupted, with reporting completeness dropping from 75% to 53%.²⁰ Timeliness fell even further as resources were diverted to COVID-19 case management. These disruptions underscored the need for automated, interoperable systems that can maintain essential functions during emergencies.^{19,20}

COVID-19 also highlighted the fragility of essential service delivery. TB control programs, maternal health services, and immunizations were all disrupted, sometimes with long-term consequences.⁶⁵ The lesson is clear: preparedness planning must include continuity strategies to safeguard routine services during outbreaks.

Tuberculosis Control Program: Lessons for Digital Integration

Indonesia's TB control program offers valuable insights into how digital platforms can strengthen disease management and reporting.⁶⁶ The nationwide rollout of the TB Information System (*SITB*) from 2017 to 2020 demonstrated the feasibility of implementing a standardized digital platform across thousands of *Puskesmas*.^{67,68} Integration with JKN claims data and hospital management systems improved case detection and reduced underreporting, showing that rapid scale-up of digital tools is possible when political will and resources align.^{66,67}

At the same time, *SITB* illustrates persistent challenges: data quality varied between facilities, analytical capacity at the local level remained limited, and integration with other health information systems was incomplete.^{67,68} These lessons emphasize that digitalization requires not only technology but also investments in training, capacity building, and governance structures to ensure sustainability.

One Health Implementation: Opportunities and Complexity

Indonesia has also made strides in adopting the One Health approach for zoonotic and emerging infectious disease surveillance.³⁵ The development of *SIZE Nasional*, which integrates surveillance data across the Ministries of Health,

Agriculture, and Environment, represents a promising step toward cross-sectoral collaboration.^{35,69} Joint outbreak investigations and improved data sharing further demonstrate the potential for stronger epidemic intelligence.^{11,35,69}

Yet the experience also reveals the complexity of sustaining cross-sectoral collaboration. Differences in reporting standards, data privacy concerns, and institutional silos continue to limit the system's effectiveness. Political commitment and clear governance frameworks are needed to ensure that One Health initiatives translate into actionable intelligence for respiratory infectious diseases.

Synthesis of Lessons

Taken together, these experiences highlight three critical lessons for Indonesia's future pandemic preparedness:

1. *Surge capacity and automation are essential.* COVID-19 showed that manual, fragmented systems cannot withstand the pressures of a nationwide outbreak. Digital integration and automated reporting are necessary to preserve surveillance during crises.
2. *Continuity of essential services must be protected.* Outbreak response cannot come at the expense of routine programs such as TB control, maternal health, and immunizations. Dual-track planning is essential to prevent long-term setbacks.
3. *Cross-sectoral collaboration is possible but requires governance.* Both TB integration and One Health initiatives prove that large-scale coordination can work in Indonesia, but only with sustained political support, standardized protocols, and dedicated financing.

These lessons point to a broader conclusion: Indonesia's health system has the capacity to innovate and scale up solutions rapidly, but fragility arises from fragmentation, underinvestment, and uneven implementation. Building resilience will require consolidating these lessons into long-term, system-wide reforms.

Integrated Framework: Recommendations, Implementation, and Monitoring for RID Preparedness

Indonesia's experience with COVID-19, tuberculosis control, and the implementation of One Health underscores the need to transition from a predominantly reactive, crisis-driven system toward a proactive, prevention-oriented model of preparedness. Strengthening respiratory infectious disease (RID) preparedness requires a sequenced approach that not only addresses immediate system gaps but also establishes the foundations for medium- and long-term resilience. This transformation must be underpinned by sustainable financing, governance innovations, and multi-sectoral collaboration.

Integrated Approach

The integrated framework presented here synthesizes evidence-based recommendations, phased implementation strategies, and monitoring mechanisms into a single coherent plan. Its primary purpose is to align strategic objectives with operational feasibility and accountability. Specifically, it articulates:

1. What needs to be achieved through targeted interventions;
2. How these interventions should be implemented, including sequencing and responsible actors; and
3. How progress should be assessed, using measurable indicators and transparent reporting systems.

By integrating these elements, the framework ensures that reforms are not only well-conceived but also actionable and evaluable. The phased structure—comprising foundation (0–2 years), scaling and integration (2–5 years), and optimization and leadership (5–10 years)—allows for the prioritization of urgent interventions while maintaining a trajectory toward systemic transformation and regional leadership in health security (see Table 1). To complement Figure 1, Table 1 summarizes the sequenced priority actions across the five core health system pillars in alignment with this phased approach.

Table 1 Phased Interventions and System-Wide Enablers for Respiratory Infectious Disease (RID) Preparedness

Phase/Timeline	Priority Actions	Lead Actors	Expected Outcomes
Phase 1 (Immediate) – Foundation (0–2 years)	• Deploy multiplex point-of-care diagnostics across all <i>Puskesmas</i> • Integrate EWARS, SITB, and SIZE Nasional into the <i>SatuSehat</i> platform • Equip and train community health workers (<i>kaders</i>) with digital reporting tools • Conduct national simulation exercises to test coordination	MoH; Provincial and District Health Offices; Community Health Worker Associations	• Accelerated case detection and reporting • Real-time integrated surveillance • Enhanced frontline response capacity • Tested coordination mechanisms
Phase 2 (Medium-term) – Scaling and Integration (2–5 years)	• Implement workforce redistribution and retention programs with incentives and career pathways • Scale interoperable digital platforms with AI-enabled outbreak prediction • Develop universal health emergency insurance integrated with JKN	MoH; Ministry of Finance; Local Governments; BPJS (JKN)	• More equitable workforce distribution • Regional surge capacity • Predictive outbreak detection • Financial risk protection during pandemics
Phase 3 (Long-term) – Optimization and Leadership (5–10 years)	• Develop predictive health intelligence systems integrating environmental, social, and health data • Upgrade all health facilities to meet RID preparedness standards (isolation, oxygen, laboratory capacity) • Establish resilient supply chains and regional stockpiles	MoH; National Disaster Management Agency (BNPB); ASEAN Secretariat	• Proactive early warning capability • Nationwide resilient infrastructure • Reliable access to critical supplies
Cross-Cutting (Financing and Governance)	• Establish a dedicated Pandemic Preparedness Trust Fund • Expand public–private partnerships for diagnostics, laboratories, and logistics • Introduce results-based financing tied to preparedness performance	MoH; Ministry of Finance; Private Sector; Development Partners	• Predictable and sustainable financing • Stronger multi-sectoral collaboration • Incentives for prevention-oriented governance

Monitoring and Accountability Framework

Effective implementation requires systematic monitoring and evaluation to ensure that progress is both measurable and transparent. The monitoring framework is organized around five domains—surveillance, diagnostics, workforce, emergency response, and overall system resilience—each with defined indicators, targets, and measurement frequencies (see [Table 2](#)). Importantly, monitoring processes should not be confined to governmental institutions alone; active engagement of civil society and community actors is essential to uphold transparency and accountability.

By aligning phased reforms with measurable outcomes, Indonesia can gradually move beyond fragmented, reactive crisis management toward a proactive, prevention-oriented health system. Achieving these goals will depend on sustained political commitment, predictable financing, and strong multi-sectoral coordination across all levels of government. Importantly, the benefits of such an integrated approach extend beyond national boundaries, positioning Indonesia to play a pivotal role in regional epidemic preparedness and response.

Table 2 Key Indicators for Monitoring Respiratory Infectious Disease (RID) Preparedness in Indonesia

Domain	Indicator	Target	Measurement Frequency
Surveillance	Completeness and timeliness of EWARS reporting	>95% within 24 hours	Quarterly
Diagnostics	Proportion of <i>Puskesmas</i> with point-of-care diagnostic capacity	100% by 2027	Annual
Workforce	Urban–rural health worker density gap	<20% by 2030	Annual
Emergency Response	Median time for first response deployment	<48 hours nationwide	Annual simulation exercises (drills)
System Resilience	Composite resilience index (infrastructure, workforce, supply chains, financing)	≥80/100 by 2030	Independent evaluation every three years

Conclusion

Indonesia's health system possesses important foundations for managing respiratory infectious diseases, including a wide network of *Puskesmas*, proven capacity for mass vaccination, and growing digital health infrastructure. Yet the COVID-19 pandemic exposed critical weaknesses in surveillance, diagnostics, workforce distribution, infrastructure, and governance. Beyond identifying these vulnerabilities, this review highlights three strategic priorities for strengthening preparedness: improving automation and interoperability by integrating fragmented surveillance platforms into *SatuSehat*; advancing equity and workforce retention through targeted redistribution and incentive packages; and positioning Indonesia for stronger regional leadership through investments in predictive intelligence, resilient infrastructure, and health diplomacy. Immediate investments in point-of-care diagnostics, digital integration, and community health worker empowerment can deliver rapid gains, while medium-term reforms in workforce redistribution, regional health security hubs, and sustainable financing are essential for structural resilience. Over the longer term, predictive intelligence systems, resilient infrastructure, and regional health diplomacy will position Indonesia as both a national and regional leader in epidemic preparedness. The transformation required is ambitious but achievable. Success will depend on sustained political leadership, predictable financing for preparedness, strong multi-sectoral collaboration, and community trust. Indonesia now has a critical window of opportunity: COVID-19 lessons remain fresh, momentum for health reforms is high, and digital technologies are expanding rapidly. By seizing this moment, Indonesia can build a resilient, prevention-oriented health system that protects its population and strengthens regional and global health security. Incremental change will not suffice—comprehensive transformation is essential.

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