BEYOND COVID-19:
Strengthening Pandemic Preparedness in Malaysia

Policy Recommendations Whitepaper

Pfizer

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Executive Summary

Respiratory disease outbreaks impose substantial burdens on healthcare systems and societies. Over the last three decades, respiratory outbreaks like SARS, MERS, H1N1 influenza, have served as a barometer of the resilience of health systems. Each outbreak records the measure of a health system's ability to control, prevent and limit the spread of the disease. Each outbreak also gauges the strength of the policy and governance architecture to limit the impact of an outbreak on the economy and people's lives.

More than any other disease in recent history, the COVID-19 pandemic has tested the limits of healthcare systems, governments and communities to function effectively. Though not the first major health crisis for many countries, the unprecedented scale and magnitude of COVID-19 demanded urgency, agility and comprehensive action that extended beyond the capabilities of most health systems. In short, it required a whole-of-government and whole-of-society response. COVID-19 put into sharp relief that pandemic preparedness is not a luxury, but a necessity. With COVID-19 transitioning to a less-lethal endemic state, public and political interest has waned significantly. Valuable lessons learned from the global pandemic risk being shelved as papers instead of being translated to policies and practice. However, the sobering history of infectious respiratory disease outbreaks point to the inevitability of another pandemic. The question isn't "if" but "when."

This paper urges the government to seize the current interpandemic window (the period between outbreaks) to systematically assess the successes, failures, and learnings from Covid-19 that can be tangibly incorporated into Malaysia's next National Action Plan for pandemic preparedness.

Grounded in the World Health Organization's Preparedness and Resilience for Emerging Threats (PRET) framework1 (Figure 1), the paper outlines key recommendations categorized according to the framework's five "C"s:

These recommendations leverage insights from global and national reports, including the Position Paper on Covid-192 published by The Academy of Sciences Malaysia's Special Interest Group on COVID-19, World Health Organization guidance, and in-depth consultations with Malaysian leaders and experts at the forefront of the response.

1 World Health Organization. (2023). *Preparedness and resilience for emerging threats module 1: Planning for respiratory pathogen pandemics*. Geneva: World Health Organization. Licence: CC BY-NC-SA 3.0 IGO.

2 ASM Special Interest Group on COVID-19. (2021). *Position Paper on COVID-19.* Academy of Sciences Malaysia. https://www.akademisains.gov.my/position-paper-on-covid-19/

Beyond the PRET framework, the paper introduces five “enablers” for successful implementation:

- Robust and clear policy and legislation
- Formalized coordination and collaboration mechanisms
- Strategic partnerships across public, private and non-profit sectors
- Strengthened healthcare workforce and infrastructure development,
- Digitalization initiatives that amplify and enhance preparedness efforts.

By implementing the recommendations detailed below and investing in the critical enablers, Malaysia can bolster its resilience and effectively respond to future public health emergencies.

Community Protection

1. Strengthen community involvement in pandemic regulations and interventions through inclusive whole-of-government and whole-of-society approaches
2. Establish a platform/mechanism to receive feedback from community
3. Conduct regular tabletop exercises to delineate responsibilities of stakeholders
4. Encourage formulation of plans for communal settings
5. Ensure public communications prioritize scientific evidence
6. Utilize diverse dissemination channels to amplify public messaging

Collaborative Surveillance

1. Establish a common surveillance platform for monitoring respiratory pathogens across human, animal, and environmental health sectors
2. Expand the network of National Public Health Laboratories
3. Establish multidisciplinary rapid response teams and implement mechanisms for early detection
4. Develop or update national testing strategies and ensure access to WHO collaborating centers or reference laboratories
5. Enhance policymakers' understanding of the significance and implications of collaborative surveillance

Emergency Coordination

1. Update national policy and legislative changes through an inclusive governance structure
2. Implement an overarching national ethics framework and research agenda for future pandemic outbreak investigation and response mechanisms.
3. Explore public-private partnerships through a whole-of-society approach to leverage resources
4. Utilize the FAIR (Findability, Accessibility, Interoperability and Reuse) Framework to synchronize data sharing and coordination between MOH and hospital networks
5. Secure adequate multi-year budget and resources, contingency funds and other funding mechanisms
6. Invest in attracting and retaining a strong healthcare workforce
7. Engage in regional and bilateral cooperation and agreements to mitigate risks for supply chain disruptions, inability to access countermeasures, and surveillance.
8. Establish independent Scientific Advisory Group of Experts (SAGE) for public health emergencies

Access to countermeasures

1. Establish legislation to control prices and improve access to PPE and other medical products
2. Encourage localization of PPE production, procurement and sourcing
3. Prioritize medical countermeasures for stockpiling
4. Ensure the timely adoption of the MyAP-AMR 2022-2026
5. Set up oversight mechanisms to follow through on the National Vaccine Development Roadmap.

Clinical care

1. Prepare a plan to mobilize non-clinical personnel to conduct specialized training
2. Establish a national IPC taskforce to disseminate and implement guidelines and protocols
3. Create a single authority/agency for dissemination of information to healthcare professionals
4. Integrate AI-powered solutions for healthcare delivery, contact tracing and recommendations for isolation/ quarantine

Figure 1: Summary of Recommendations, structured around the WHO PRET's five components for health emergency preparedness, response and resilience

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List of Abbreviations

AI	Artificial Intelligence
AMR	Antimicrobial Resistance
APSED	Asia Pacific Strategy for Emerging Diseases
IHR	International Health Regulations
ILI	Influenza-like Illness
MySED	Malaysia Strategy for Emerging Diseases and Public Health Emergencies
NDVP	National Deployment and Vaccination Plans
NGO	Nongovernmental organization
NSC	National Security Council
PPE	Personal Protection Equipment
PRET	Preparedness and Resilience for Emerging Threats
PSHM	Public and Social Health Measures
SAGE	Independent Scientific Advisory Group of Experts
SARI	Severe Acute Respiratory Infection
WHO	World Health Organization

Section 01

Introduction

Malaysia's Commitment to Pandemic Preparedness

Malaysia has long recognized the ever-present threat posed by emerging respiratory and other infectious diseases. The emergence of successive outbreaks of infectious diseases throughout the past three decades have shaped Malaysia's approach to pandemic preparedness. Outbreaks like Nipah (1997), anthrax (2001), SARS (2003), highly pathogenic avian influenza (HPAI) (2004), pandemic influenza (2009), MERS-CoV (2014), and Zika (2016) have contributed significantly to the Malaysia's public health approach to mitigate the impact of future outbreaks, including those related to antimicrobial resistance (AMR). The country maintains a pandemic preparedness strategy grounded in scientific evidence, national experience, and global guidance.

Malaysia committed to implementing the International Health Regulations (IHR) (2005), which sets out glrobal guidelines to prevent, protect and control the spread of disease. Since its enforcement in June 2007 as an international legal instrument, Malaysia has consistently adhered to the IHR core capacity requirements. This includes implementing robust monitoring and surveillance activities for influenza (Malaysia Influenza Surveillance Protocol - MISP) and emerging infectious diseases like novel influenza virus subtypes, MERS-CoV, and Zika virus.

Beyond the IHR regulations, Malaysia has also aligned its pandemic preparedness strategy to the Asia Pacific Strategy for Emerging Diseases (APSED)[3] framework, a tool developed by the Southeast Asia (SEARO) and Western Pacific (WPRO) regional offices of the WHO to serve as a shared framework across the Asia region. Based on the APSED, Malaysia introduced the Malaysia Strategy for Emerging Diseases and Public Health Emergencies (MySED)[4]. This strategy aimed to bolster the country's preparedness and response capabilities for public health emergencies. MySED had been further revised with the MySEDII (2017-2021)[5], aligning its scope with the National Security Council (NSC) Directive No. 20 on Policy and Mechanism of National Disaster Management and Relief. Currently, MySEDII is the prevailing guidance although it has been due for renewal since 2021.

The strength of Malaysia's pandemic preparedness strategy was highlighted in the WHO's Joint External Evaluation of IHR core capacities of Malaysia: Mission report (2019)[6]. This report highlighted Malaysia's well-developed health security system and its high level of achievement in fulfilling IHR requirements. Notably, the evaluation commended Malaysia's performance in policy, governance, coordination, communication and advocacy, surveillance and monitoring, and evaluation. However, the unprecedented scale and speed of the COVID-19 pandemic exposed gaps between Malaysia's pandemic preparedness strategy and its real-world implementation. This presented a public health crisis that stretched response capabilities beyond Malaysia's – and most other - healthcare systems worldwide.

3 World Health Organization Regional Office for the Western Pacific. (2017). *Asia Pacific Strategy for Emerging Diseases and Public Health Emergencies (APSED III): Advancing implementation of the International Health Regulations (2005).* https://www.who.int/publications/i/item/9789290618171

4 *Malaysia Strategic Workplan for Emerging Diseases (MySED Workplan) 2012-2015.* Ministry of Health Malaysia.

5 *Malaysia Strategy for Emerging Diseases and Public Health Emergencies (MYSED) II Workplan (2017-2021).* Ministry of Health Malaysia.

6 World Health Organization. (2020). *Joint external evaluation of IHR core capacities of Malaysia: Mission report, 21-25 October 2019.* https://iris.who.int/handle/10665/336716

Public health systems struggled under the surge in cases, requiring rapid increases in testing and contact tracing. Authorities were compelled to rapidly improvise new protocols to manage the spread of the disease. Hospitals, overwhelmed by patients, were stretched beyond capacity and created makeshift wards to meet the growing demand. Beyond the burden on the health system, COVID-19 quarantine and movement restrictions (commonly known as "lockdowns") crippled economic activity across sectors.

Since COVID-19, there has been a series of reports and reviews[7] evaluating Malaysia's pandemic preparedness, but translating these learnings into improved policies and practice remains a work-in-progress. As public and political attention is diverted to a myriad of other – important societal and economic issues, Malaysia may miss the critical interpandemic phase (i.e. the period between pandemics) to implement necessary reinforcements to its pandemic preparedness strategy.

7 ASM Special Interest Group on COVID-19. (2021). *Position Paper on COVID-19*; World Bank Group Partnership on COVID-19 Preparedness and Response. (2023). *Country Case Study: Malaysia (https://thedocs.worldbank.org/en/doc/87b5ed4c9067a8838e783c9ad68a4829-0070012023/original/Malaysia-case-study.pdf)*

The WHO PRET Framework: A Brief Overview.

In response the global learnings from Covid-19, The World Health Organization (WHO) launched the Preparedness and Resilience for Emerging Threats (PRET) initiative in April 2023.

PRET represents a significant shift from organizing national responses focused on a specific pathogen to a "hazards-based" approach. This approach considers more broadly on pathogens with similar transmission patterns such as respiratory, arboviruses, foodborne, etc. Beyond examining the epidemiology of disease, the framework also prioritizes community inclusivity, equity, and protection as core elements of its public health response. The PRET initiative is comprised of a series of modules, the first of which is entitled "Module 1: Planning for Respiratory Pathogen Pandemics."

PRET Module 1 is firmly anchored in existing global health instruments; including the twelve core capacities of the International Health Regulations (IHR 2005), as reflected in Table 1. Further strengthening this foundation, World Health Assembly resolutions WHA58.13 and WHA74.7 empower the WHO to provide technical guidance and assistance to countries for pandemic preparedness.

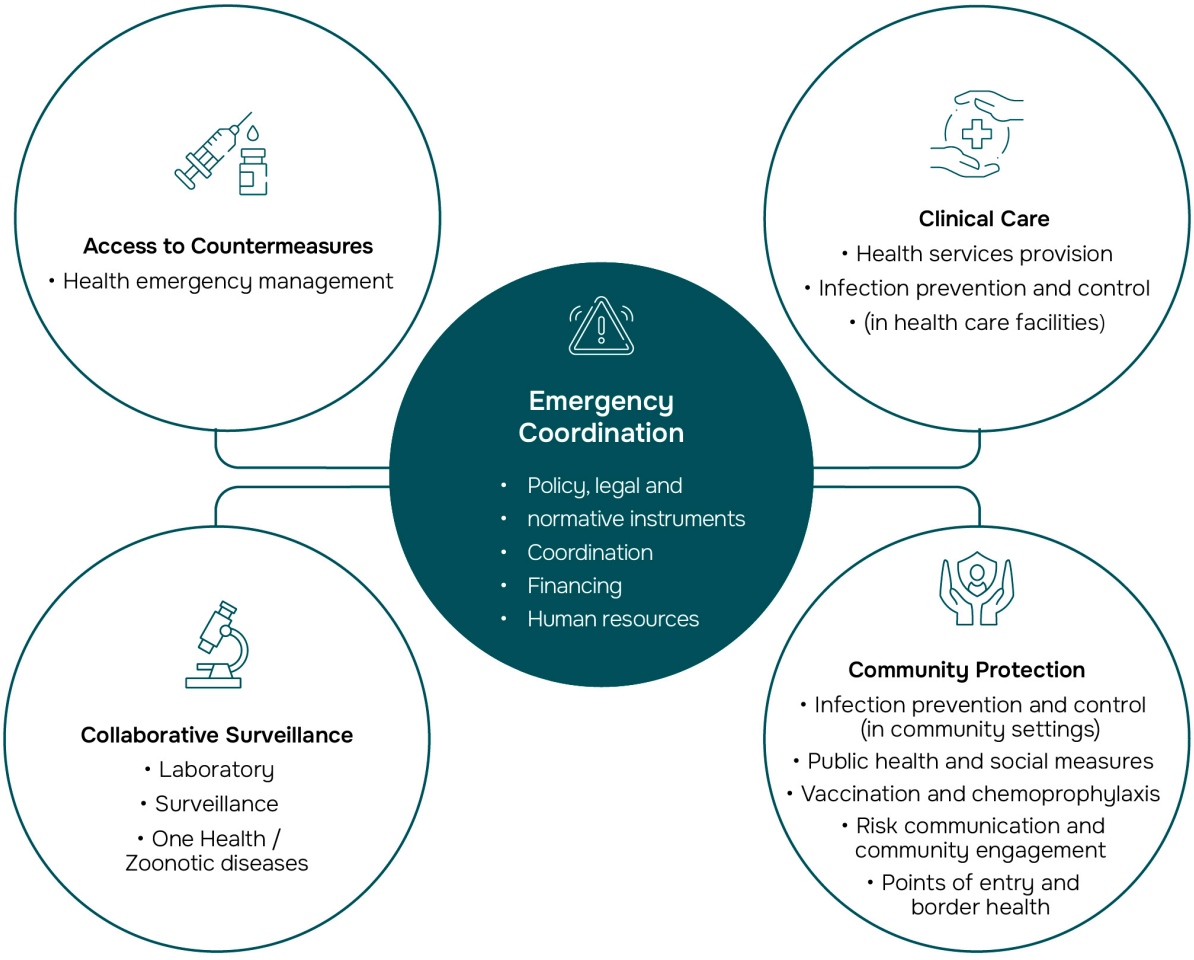


Figure 2: Five components for health emergency preparedness, response and resilience, mapped to the IHR components; adapted from WHO[8]

8 ASM Special Interest Group on COVID-19. (2021). *Position Paper on COVID-19.*

Implementation of the WHO PRET Framework

The foundation of the PRET Module 1 is built on twelve core capacities of the IHR (as outlined in Figure 1), which are encapsulated within the five overarching pillars below:

Emergency Coordination: This pillar focuses encompasses broad IHR governance capacities such as: (a) policy, legal, and normative instruments (, (b) multisectoral coordination, and (c) long-term financing. This pillar encourages countries to have a sound national action plan and emergency response framework, a trained workforce, and operational readiness embedded within their preparedness plans.

Collaborative Surveillance: This pillar emphasizes the development of interconnected surveillance systems and laboratory capacities

Community Protection: This pillar emphasizes the importance of community involvement and inclusiveness during the development and implementation of pandemic preparedness systems. It builds on IHR core capacities that emphasize on public and social health measures (PSHM) and community empowerment.

Clinical Care: This pillar provides guidance to meet the additional demands of a health emergency alongside routine healthcare services. IHR core capacities also specify the need for scaling heath service provisions, protecting patients and healthcare workers, and controlling the spread of disease within the healthcare system.

Access to Countermeasures: This pillar emphasizes the need for equitable access to countermeasures during pandemics through pre-negotiated benefit-sharing agreements, technology transfer, scalable manufacturing, and coordinated procurement and supply chains. The IHR core capacities recommend maintaining technical and operational readiness of incident management teams through periodic exercises. It also recommends streamlining regulatory systems and ensuring access to therapeutics, vaccines, and diagnostics, while highlighting the importance of a strong vaccine delivery system and effective supply chain management.

Table 1: Implementation of the WHO PRET Framework, in alignment with the IHR core capacities

Alongside the PRET module, the WHO issued a call to action for collective commitment to achieve progress on pandemic preparedness by December 2025. This call-to-action urges countries to:

✓	Recognize the risk of future respiratory pandemics by updating preparedness plans that affirm priority actions based on the PRET framework
✓	Improve coordination, cooperation, and connectivity between stakeholders by conducting joint exercises, sharing information, and developing equitable systems
✓	Ensure pandemic preparedness plans are adequately funded and monitored

Aligning Action with Strategy: Core Approach of the Paper

This paper proposes recommendations for each pillar of the PRET framework by:

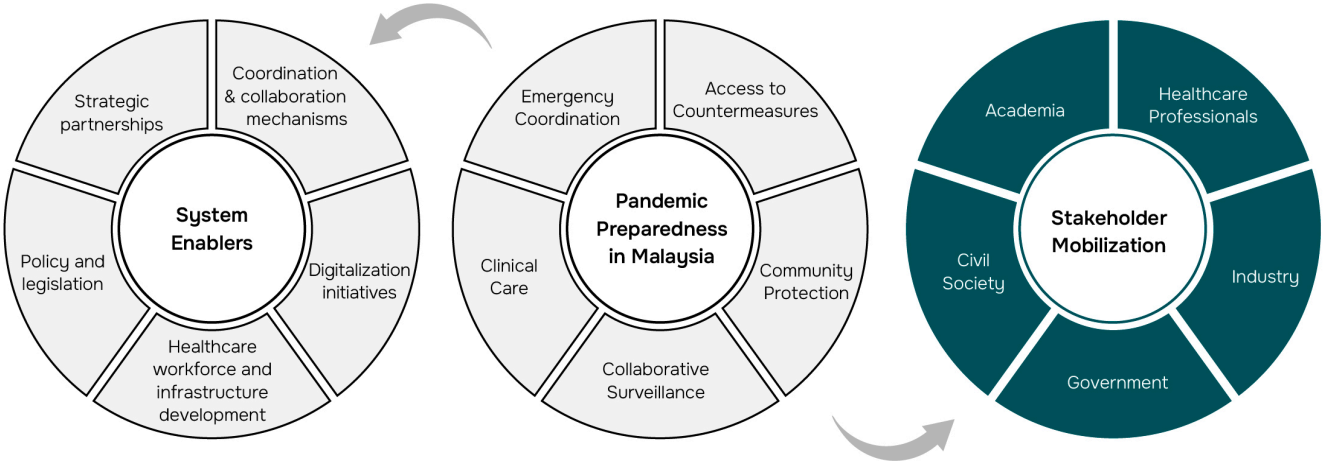
01	Proposing specific actions
02	Assessing stakeholder roles
03	Identifying system enablers

For the recommended actions to be implemented successfully, collaboration between key stakeholders (government, academia, industry, civil society, and healthcare professionals) is needed. Furthermore, ensuring the effective functioning of key system enablers - such as policy and legislation, coordination and collaboration mechanisms, strategic partnerships, strengthening healthcare workforce and infrastructure and digitalization - can support effective implementation of the recommended actions,

Figure 3: Approach for strengthening pandemic preparedness

Engaging Stakeholders for Effective Action

Each of the five pillars within the PRET framework relies heavily on the active participation of key stakeholders.



The COVID-19 Position Paper suggested a "Quadruple Helix Model"[9] as a framework for collaboration for the prevention, control and management of infectious diseases. Developed in the 2000s, the model promotes innovative collaboration between four actors – government, academia, industry, and civil society. This approach has several benefits, such as enhanced problem-solving by combining different perspectives and expertise; innovation through knowledge exchange and resource sharing; sustainable solutions by integrating social and environmental considerations into decision making; and increased public trust through open communication and engagement with civil society. In this paper, we have added healthcare professionals (HCPs) as a distinct and critical category of stakeholders who directly provide health services in the public and private sectors.

GOVERNMENT

Policymakers, public health authorities, regulatory bodies, and funding agencies

Government is the central authority that leads overall emergency response efforts, including the development of national preparedness plans, the allocation of resources, and the enactment of relevant policies and legislation.

Governments must also prioritize the development of resilient healthcare systems, including suitable infrastructure, skilled healthcare workforce, and advanced surveillance systems and data analytics capabilities essential for a successful public health response. Furthermore, the ability to effectively communicate risk and coordinate with diverse stakeholders is essential for public trust and cooperation.

ACADEMIA

Universities, research institutions, and other knowledge producers

Academia contributes valuable scientific expertise through basic, clinical, qualitative, and operational research. Academic experts are well-positioned to reinforce and shape public health programs through research and development.

Within the context of pandemic preparedness, academia plays a critical role in surveillance to predict and prepare for the next possible pandemic. Academia can also significantly contribute to public understanding of pandemics and complement government efforts by debunking misinformation and providing accurate information. Moreover, local academia can work with other national and international research institutions, universities and civil society organizations to share knowledge and data that can prevent, control, and otherwise manage outbreak at a global scale. By working together, these entities can promote a better coordinated global response.

INDUSTRY

Pharmaceutical companies, biotechnology companies, technology companies

Industry stakeholders are essential for the translation of science into commercially available medical countermeasures and other supporting services that are needed for the functioning of health systems. Pharmaceutical, biotechnology, medical devices, and healthcare supply manufacturers develop, produce, and distribute countermeasures such as personal protective equipment, diagnostic tests, laboratory equipment, machines, and drugs comprise a significant part of healthcare delivery. With the COVID-19 pandemic causing global shortages of medical supplies, there is an urgency to work with industry stakeholders to strengthen domestic manufacturing capacity, strengthen supply chains, and develop agreements on stockpiling for emergencies.

Technology companies have also worked closely with government and healthcare institutions to develop innovative digital solutions that improve efficiency and coordination of outbreak responses. Partnerships with technology companies led to the adoption of mobile contact tracing applications, electronic dashboards tracking outbreak clusters and vaccination coverage, digital inventory monitoring pharmaceutical and medical device logistics, and telehealth services increasing access to care.

CIVIL SOCIETY

Non-profit organizations,community groups, the public

Civil society organizations play a vital role in community outreach, education, resource mobilization, and ensuring the needs of the community are addressed. They are uniquely positioned to bridge the gap between the government and the people through public advocacy that highlights societal needs and concerns. In particular, civil society organizations often reinforce the importance of equitable healthcare access, particularly for vulnerable populations. On the ground, civil society organizations lead community engagement efforts to promote health awareness and literacy. Many also drive initiatives for resource mobilization to fund health campaigns or to help individuals pay for their care.

HEALTHCARE PROFESSIONALS

Physicians, pharmacists, nurses, allied health professionals, community health workers

Healthcare workers directly deliver healthcare services for the population. Healthcare workers deliver services in both the public sector (e.g. government-funded clinics and hospitals) as well as the private sector (e.g. independent physician practices, privately-owned hospitals). The healthcare worker to population ratio is an important indicator of the ability of health systems to meet the health needs of a population. Moreover, a well-trained workforce, with access to sufficient resources and supported by quality infrastructure, are essential to ensure timely diagnosis, treatment, and management of diseases, preventing complications, and improving patient outcomes.

Critical Enablers for Effective Implementation

The successful implementation of the recommendations outlined in this paper hinges on the effective functioning of five key enablers: policy and legislation, coordination and collaboration mechanisms, strategic partnerships, healthcare workforce and infrastructure development, and digitalization initiatives. Critical enablers are often overlooked in their importance, but can be decisive on the success or failure of recommended actions.

Policy and Legislation

While most policies and laws extend beyond the scope of general health systems, understanding the implications of these policies on public health and safety is important. Robust legal and policy frameworks that provide clarity, flexibility, and transparency are essential for tackling both known and emerging threats.

A robust legal foundation for public health provides clarity and assigns responsibility for coordination among the various sectors and agencies involved in preparedness and response efforts. Agencies can be legally mandated to lead and coordinate responses to respiratory pandemics. Laws may also be passed to facilitate access to healthcare services in emergency situations, such as the creation of regulatory pathways to facilitate the importation of medical countermeasures and mechanisms for telehealth consultations.

Coordination and collaboration mechanisms

Coordination and collaboration mechanisms efficiently reinforce each stakeholder's efforts as part of a larger pandemic response. Effective coordination can help all stakeholders understand one another's roles, and by doing so, prevent duplication of efforts, while ensuring that all needed actions are carried out. Collaboration mechanisms ensures that stakeholders develop an understanding on how to work with one another effectively while working towards a common goal or outcome.

Strategic partnerships

Strategic partnerships have the potential to increase the impact of each stakeholder when they effectively leverage each partner's competencies and resources. For example, government partnerships with private sector health providers can help public entities better manage health system capacity constraints during a pandemic. University-pharmaceutical partnerships can accelerate the commercialization of newly developed medical countermeasures. By partnering with civil society organizations, governments may increase the success of outreach in communities and rapid deployment of public health measures.

Healthcare workforce and infrastructure development

Investing in healthcare workforce and infrastructure does not only strengthen the delivery of health services today, but also ensures that health systems remain resilient in times of crises. As technologies rapidly develop, both systems and personnel must continuously evolve to effectively utilize new capabilities. Strengthening the healthcare workforce should focus on establishing pathways for continuous skills upgrading, interdisciplinary training, and incentive programs for recruitment and retention. Additionally, healthcare infrastructure needs to be regularly reviewed and adapted to ensure that facilities are well-equipped and maintained, with access to modern medical technologies to improve patient care.

Digitalization initiatives

Technological readiness of health systems has become fundamental to pandemic preparedness and response. The COVID-19 pandemic catalysed the rise of digital tools to prevent and manage the spread of infection, increase information sharing, and aid clinical and policy decisions. Scaling up digital infrastructure, application, and training will be essential to enhancing pandemic preparedness. This includes investing in robust digital health platforms, ensuring interoperability between systems, and providing comprehensive training for healthcare professionals to effectively use these technologies.

Section 03

Methodology

This section outlines the research methods employed to gather data and inform the recommendations presented in this paper. The data gathered from these various sources, encompassing the literature review, stakeholder consultation, and expert interviews, was subsequently used to identify key themes, challenges, and opportunities for strengthening Malaysia's pandemic preparedness strategy.

LITERATURE REVIEW

The literature review encompassed global reports by leading organizations, namely the G20 High Level Independent Panel on Financing the Global Commons for Pandemic Preparedness and Response (July 2021)[10], the Asian Development Bank's "Responding to the COVID-19 Pandemic: Leaving No Country Behind" (2021)[11], and The Lancet Commission on "Lessons for the future from the COVID-19 pandemic" (October 2022)[12]. Additionally, the review included reports specific to Malaysia's pandemic preparedness and response to COVID-19, namely the Academy of Sciences Malaysia's "Position Paper on COVID-19 (2021)[13], the World Bank's "Country Case Study: Malaysia Knowledge Generation and Exchange Related to Preparedness and Response to the COVID-19 Outbreak" (September 2023)[14], and an independent review on "COVID-19 and migrants: lessons for pandemic preparedness from the Malaysian experience" (November 2023)[15].

STAKEHOLDER CONSULTATION WORKSHOP

A joint industry-academia stakeholder consultation workshop was held on April 5, 2024, to gather first-hand insights that complement the literature review. This workshop was organized by Crowell Global Advisors (authors of this paper), Monash University, and the Academy of Sciences Malaysia, supported by Pfizer. The workshop brought together 38 key experts from diverse sectors, including government, academia, and civil society/ professional bodies. Anchored on the World Health Organization's (WHO) Preparedness and Resilience for Emerging Threats (PRET) initiative, the workshop solicited reflections and recommendations from participants to strengthen Malaysia's pandemic preparedness and health systems resilience for future crises. C&M International also conducted two in-depth interviews to gain further insights from key experts who were not able to attend the workshop.

10 *A Global Deal for Our Pandemic Age. (2021).* G20 High Level Independent Panel on Financing the Global Commons for Pandemic Preparedness and Response.

11 Asian Development Bank, United Nations, & United Nations Development Programme. (2021). *Responding to the COVID-19 Pandemic: Leaving No Country Behind.* Asian Development Bank. https://doi.org./10.22617/SPR210111-2

12 Sachs, J. D., Karim, S. S. A., Aknin, L., et. al. (2022). The Lancet Commission on lessons for the future from the COVID-19 pandemic. *The Lancet, 400*(10359), 1224–1280. https://doi.org/10.1016/S0140-6736(22)01585-9

13 *Id* at 1.

14 Selvarajah, S., & Nordin, A. A. (2023). *Country Case Study: Malaysia.* The World Bank.

15 Verghis, S. (2023). COVID-19 and migrants: Lessons for pandemic preparedness from the Malaysian experience. *Globalization and Health, 19*(1), 92. https://doi.org/10.1186/s12992-023-00988-9

Section 04

Recommendations

PILLAR 1

Emergency Coordination

PILLAR 2

Collaborative Surveillance

PILLAR 3

Community Protection

PILLAR 4

Clinical Care

PILLAR 5

Access To Countermeasures

"Coordination between public and private sector would flow faster if we have a clear idea about the strengths of the public sector and the private sector. Having a plan in advance that clearly outlines which services should be taken up by which sector will ensure smoother coordination during the next pandemic"

Participant

Emergency Coordination is the foundational component of pandemic preparedness and response planning. It encapsulates the other four pillars of the PRET framework and delineates the relevant policy and legal frameworks, a plan for financial and resource mobilization, and the government's immediate actions during a public health crisis. The WHO recommends that governments conduct a self-assessment of capabilities across national/subnational actors, partners, and other stakeholders to create plans that are reflective of capacity. The creation and deployment of such plans should be centered around cross-sector collaboration in pandemic preparedness, and by extension broader disaster management efforts.

Workshop participants identified several issues related to emergency coordination at the outset of the pandemic. Unclear central authority and guidance resulted in weak coordination and information sharing within government agencies and between government and external stakeholders. For instance, the lack of a centralized inventory management system resulted in suboptimal resource distribution: some healthcare facilities faced shortages of PPE and testing kits, while others had an excess of supplies. Participants expressed that such wasted resources and delayed access to services could be overcome with better information management systems. Participants also noted the insular approach to the pandemic response with the government taking on all responsibilities of the response rather than leading an inclusive approach that fully leveraged the competencies and perspectives of academia, industry, civil society, the military, and local communities.

Despite the initial challenges posed by COVID-19, the government swiftly recognized and addressed the shortcomings by establishing a centralized coordination council, led by the National Disaster Management Agency with the Ministry of Health as an advisor. This initiative enabled the government to mount a well-coordinated response during the subsequent waves of the pandemic.

Moving forward, participants recommended strengthened leadership, coordination, and better division of labour based on core competencies of stakeholders. These steps could help to ensure clear and consistent communication and policies from government agencies as the ultimate authority, better harness research insights from academia, accelerate commercialization and access to medical countermeasures and other technologies from industry, and ensure community access to healthcare services and protection of rights in partnership with civil society. A coordinated response across society will decrease the reliance on any one stakeholder.

RECOMMENDATIONS FOR EMERGENCY COORDINATION

01	Update national policy and legislative changes through an inclusive governance structure that involves stakeholders outside the MOH from the beginning. As policies are drafted, revised, and implemented into practice, communication with the public is essential to build trust and maintain transparency.
02	Implement an overarching national ethics framework and research agenda to prepare for future pandemic outbreak investigation and response mechanisms, in coordination with universities, research organizations, and industry.
03	Explore public-private partnerships through a whole-of-society approach to leverage resources and avoid duplication of efforts.
04	Utilize the FAIR (Findability, Accessibility, Interoperability, and Reuse) Framework[16] and other centralized planning/prioritization systems to synchronize data sharing and coordination between the MOH and hospital networks.
05	Secure adequate multi-year budget and resources, national contingency funds, and other funding mechanisms for pandemic preparedness and response, including investing in research, development and innovation efforts for vaccines, treatments, and diagnostics.
06	Invest in attracting and retaining a strong healthcare workforce and developing resources for managing rising demand in health services and reduce dependency on foreign workers.
07	Engage in regional and bilateral cooperation and agreements as part of pandemic preparedness to mitigate Malaysia's risks for supply chain disruptions, inability to access countermeasures, and surveillance efforts.
08	Establish an Independent Scientific Advisory Group of Expert (SAGE) during the early onset of Public Health Emergencies.

16 Wilkinson, M., Dumontier, M., Aalbersberg, I., et al. (2016). The FAIR Guiding Principles for scientific data management and stewardship. Sci Data, 3, 160018

Roles of Stakeholders for Emergency Coordination

GOVERNMENT

Policymakers, public health authorities, regulatory bodies, and funding agencies

Central Authority

The Government of Malaysia is the main authority and convener in emergency public health preparedness and response. Traditionally, the Ministry of Health or a special task force appointed by the head of state functions as the lead entity during public health crises. The government must draw upon its range of functions to aggregate, coordinate and deploy resources, while mitigating broader economic and societal repercussions.

> ***"The governance structure needs to be more inclusive. It must not only include the Ministry of Health but also representatives from academia, armed forces, private practitioners, non-governmental organizations, hospitals, local councils, civil societies, etc. These entities can help policymakers make informed decisions and make policymaking more inclusive and representative of the wider demographic."***
>
> *Participant*

> ***"The MOH has their own exercise, the military has their own exercise, but there isn't a common and uniform exercise at the national level. However, in reality, all agencies need to respond together in a uniform manner. We need to have regular exercises at the national level with appropriate feedback mechanisms."***
>
> *Participant*

Policy and legal foundation

The government establishes the legislative and policy foundation and is best positioned to continuously adapt and disseminate national policies and protocols to mitigate emerging public health threats. By enacting or revising legislation and policies during the interpandemic period, government entities can create emergency mechanisms that can be activated quickly when needed.

Public stewardship

In the absence of leadership and information, the scale and severity of a public health crisis can rapidly increase. Clear, timely and consistent communication from the government and engagement with communities are critical to gain the trust and cooperation of the public. The government should utilize trusted communication channels to disseminate official information clearly, as well as involving the voices of respected leaders.

National capacity building

The government is responsible for building the capacity of the national response to a health emergency, scaling up research and development capabilities as well as financial resources accordingly. The government can support ongoing research efforts by academia and put into place enabling regulatory policies that accelerate the commercialization and deployment of new technologies by industry.

To bolster national capacity, the government is responsible for co-ordinating across the Ministry of Health, Ministry of Defence, National Security Council, Ministry of Science, Technology and Innovation (MOSTI), and other key agencies and hold joint simulation exercises addressing pandemic response.

International coordination

Beyond national responsibilities, the government can also mitigate risks through international cooperation with other countries, multilateral organizations, and other expert bodies to exchange knowledge and strengthen its own capacity to respond to a pandemic. Engaging in diplomacy for pandemic preparedness, the government can negotiate with trading partners to secure resources and support, both in preparation for and in the response to a public health emergency.

ACADEMIA

Universities, research institutions, and other knowledge producers

Local academia has nuanced knowledge of regional health systems and community dynamics. Leveraging their expertise can help ensure that preparedness plans are tailored to the Malaysian population. Partnerships with international academia can facilitate knowledge sharing and collaborative research on worldwide disease transmission patterns that may have local relevance. In addition to providing innovation through R&D, academic institutions pave the way for the education and training of healthcare workers, instructing the workforce who will face future pandemics, as well as providing continuous education to prepare current healthcare workers for current and emerging risks.

With increasing use of digitization in healthcare, academia also has an important role to play in the consideration of data protection and best uses of new technologies in coordinating emergency responses. In this capacity, academia can play an advisory role to inform both governments and industry usage of data and technologies to ensure best practices and unlock the potential benefits by doing so. Additionally, academia can utilize historical data to conduct an analysis of past responses, identifying successes and failures in national emergency coordination efforts to inform future planning and improvements.

INDUSTRY

Pharmaceutical companies, biotechnology companies, technology companies

The role of industry in emergency coordination is predominately associated with ensuring adequate provision of resources, which can be mobilized and allocated accordingly in collaboration with the government. This includes the production of medical supplies, including vaccines, personal protective equipment (PPE), and medical technical equipment such as ventilators, as well as facilities for the national distribution of these materials. By collaborating with governments and civil society, industry players can improve the equitable and efficient distribution of necessary supplies to populations in need. Such complex logistics require coordinated planning ahead of time, as learned from COVID-19, to ensure sufficient capacity as well as funding that can be quickly mobilized.

As demonstrated during COVID-19, the role of the healthcare industry is critical in adapting business operations such as typical product testing and trial timelines in coordination with public health priorities to meet urgent needs. Assisted by capital, networks, existing supply chains and resources, industry is uniquely positioned to accelerate responses in an emergency, particularly in filling gaps where government responses may be delayed or restricted by funding or policy requirements. In addition to funding, public-private partnerships can drive innovation and technology adoption, reinforcing academic research and expediting developments that are critical in an emergency response.

CIVIL SOCIETY

Non-profit organizations, community groups, the public

Civil society organizations play an important role in emergency coordination, by working directly with communities. Furthermore, the work of NGOs and other parts of civil society is often facilitated by government funding, as well as by industry backing. Given the variety of stakeholders they interact with, civil society organizations are uniquely positioned to provide feedback and highlight concerns on stakeholder collaboration to inform the effectiveness of efforts. Civil society can leverage resources of both the government and industry, to strengthen the impact of community initiatives, working to benefit a larger segment of the population.

HEALTHCARE PROFESSIONALS

Physicians and community health workers

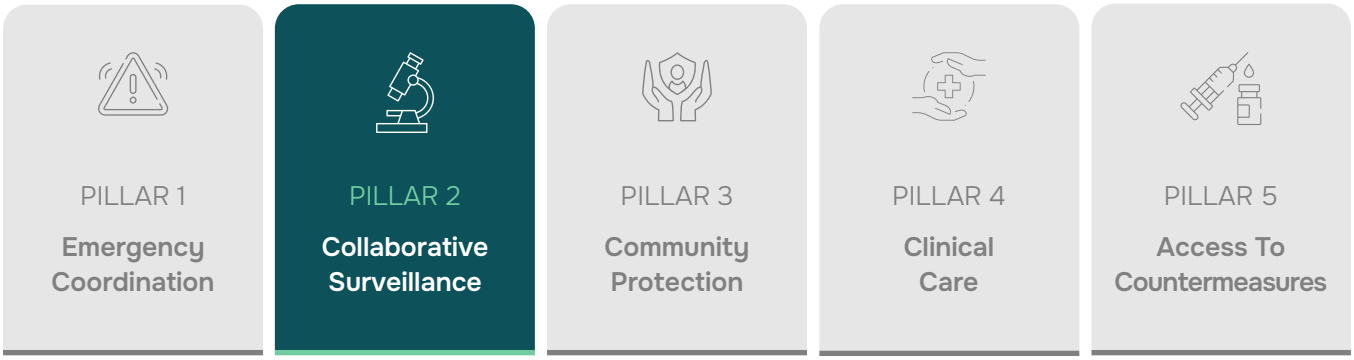
"During COVID-19 there was a huge opportunity to leverage general practitioners as there are 8000 GP clinics in the country and they operate at a community level, within a 2km radius. Despite this, due to gaps in the policy and poor communication within the MOH, we were not able to fully utilize this resource."

Dr. Thirunavukarasu Rajoo
Honorary Secretary General, Malaysian Medical Association

The lifeblood of the primary healthcare system, private practitioners and public healthcare providers represent the first line of responders to a public health emergency. Community healthcare professionals (HCP) are responsible for triaging and organizing follow-up from hospital care in turn limiting the risk of overwhelmed hospitals. Community HCPs are well positioned to transmit operational information on outbreaks to inform public health measures. The government should embed HCPs in the national pandemic planning process, mobilizing and granting them priority access to PPEs, vaccines, and other medical countermeasures to deploy within the primary healthcare system.

Table 2: At-a-glance: Emergency coordination recommendations

Recommendations	Primary Stakeholders	Key Enablers
Update national policy and legislative changes through an inclusive governance structure that involves stakeholders outside the MOH from the beginning. As policies are drafted, revised, and implemented into practice, communication with the public is essential to build trust and maintain transparency.	• Government	Policy & Legislation
Implement an overarching national ethics framework and research agenda to prepare for future pandemic outbreak investigation and response mechanisms, in coordination with universities, research organizations, and industry.	• Government • Academia • Industry	Policy & Legislation Coordination & Collaboration Partnerships
Explore public-private partnerships through a whole-of-society approach to leverage resources and avoid duplication of efforts.	• Government • Industry	Coordination & Collaboration Partnerships
Utilize the FAIR (Findability, Accessibility, Interoperability, and Reuse) Framework and other centralized planning/ prioritization systems to synchronize data sharing and coordination between the MOH and hospital networks.	• Government • Academia • Healthcare Professionals	Coordination & Collaboration Partnerships Healthcare Workforce & Infrastructure Digitalization
Secure adequate multi-year budget and resources, national contingency funds, and other funding mechanisms for pandemic preparedness and response, including investing in research and innovation to develop vaccines, treatments, and diagnostics.	• Government • Industry • Academia • Civil society	Partnerships Healthcare Workforce & Infrastructure
Invest in attracting and retaining a strong healthcare workforce and developing resources for managing rising demand in health services and reduce dependency on foreign workers.	• Government • Healthcare Professionals	Coordination & Collaboration Partnerships
Engage in regional and bilateral cooperation and agreements as part of pandemic preparedness to mitigate Malaysia's risks for supply chain disruptions, inability to access countermeasures, and surveillance efforts.	• Government	Coordination & Collaboration Partnerships Healthcare Workforce & Infrastructure Digitalization
Establish an Independent Scientific Advisory Group of Expert (SAGE) during the early onset of Public Health Emergencies.	• Government • Academia • Civil society	Partnerships Healthcare Workforce & Infrastructure



"While emphasis is placed on working collaboratively with labs, there are many other types of surveillance as well. We should also focus on training communities to be on the alert. We can learn from countries less resourced than us – countries in Africa and how their communities were trained to alert the authorities about the Ebola outbreak."

Participant

Collaborative surveillance involves continuous monitoring of pathogens by establishing capacities and systems across multiple stakeholders and jurisdictions. Strong systems of collaborative surveillance allow scientists, policymakers and healthcare workers to formulate timely response plans, diagnostic strategies, and emerging evidence for the development of effective control, management, and treatment of disease. By incorporating collaborative surveillance in the pandemic preparedness framework, the government can ensure informed decision-making and transparent information sharing at the national and sub-national levels.

In Malaysia, the Ministry of Health (MOH) has existing surveillance systems and laboratory networks in place, such as th *Severe Acute Respiratory Infection* (SARI) system and the *Influenza-like Illness* (ILI) system. However, the information gathered by these systems were not shared across three levels – to government agencies outside of the MOH, between regional and national levels within the MOH, and between public and private sectors. Without clear protocols and guidelines in place, there was hesitation amongst laboratories – both at the regional and national levels, and in the public and private sectors – to share information with one another. Overall, this led to geographical disparities in detection, investigation, and response between regions with strong surveillance systems and those without. In addition, workshop participants reiterated the findings in the COVID-19 position paper that the pandemic exposed the limited capacity and funding for One Health surveillance, particularly at the human-animal interface. To this end, participants stressed the need to strengthen the One Health approach to surveillance, integrating local, regional, and global systems.

Moving forward, participants emphasized the importance of strengthening the One Health approach to surveillance by integrating local, regional, and global systems, to establish clear protocols and facilitate seamless information sharing across all levels and sectors involved in surveillance. Additionally, they stressed the importance of ensuring a uniform response across regions. By investing in surveillance infrastructure, geographical disparities can be mitigated, leading to a more effective and cohesive response to future pandemics.

RECOMMENDATIONS FOR COLLABORATIVE SURVEILLANCE

01	Establish a common surveillance platform for monitoring various respiratory pathogens across human, animal, and environmental health sectors and for facilitating timely information sharing among diverse agencies.
02	Expand the network of National Public Health Laboratories focusing on improving the equitable distribution of services across the country,
03	Establish multidisciplinary rapid response teams and implement mechanisms for early detection, sampling, verification, investigation, risk and severity assessment, and evaluation of detected respiratory pathogen events.
04	Develop or update national testing strategies and ensure access to WHO Collaborating Centres or reference laboratories for: a. research on priority respiratory pathogens; b. adequate mechanisms for sensitive and specific diagnostic assays; and c. sustaining genomic sequencing and bioinformatics capacities.
05	Enhance policymakers' understanding of the broader significance and implications of collaborative surveillance to promote better adherence to the WHO surveillance guidelines during public health emergencies.

Roles of Stakeholders for collaborative Surveillance

GOVERNMENT

Policymakers, public health authorities, regulatory bodies, and funding agencies

To ensure effective monitoring, the Government must implement policies that support collaborative surveillance efforts aligning national strategies with international guidelines. Moreover, the Government should take the lead to develop or reinforce a nationwide surveillance platform for timely information sharing among various agencies. The Government can build the surveillance platform based on existing models like the Pathogens Portal[17] and adapt it to the local context. A common platform will not only create integrated information flow between systems and laboratories but also help reduce geographical disparities in response mechanisms.

For effective rapid response in collaborative surveillance efforts, the Government must bolster research, investigation, and testing capabilities by establishing rapid response teams comprising experts from diverse fields including epidemiology, public health, laboratory sciences, and emergency response. Further, these teams should be adequately funded, trained, and equipped to be able to swiftly implement mechanisms for early detection. Moreover, the Government should allocate sufficient funding for surveillance activities and the expansion of testing capacities, prioritizing One Health surveillance efforts aimed at monitoring wildlife, farm animals, domestic pets, and wastewater to mitigate the risk of spillover infections.

ACADEMIA

Universities, research institutions, and other knowledge producers

Academia can provide scientific expertise and conduct research to improve the understanding of respiratory pathogens, their transmission dynamics, and the effectiveness of surveillance strategies. They must actively work towards identifying innovative approaches for detection, verification, investigation, sampling, and evaluation of respiratory pathogen events. Academicians can further contribute by developing new diagnostic tools, surveillance methods, and risk assessment models.

Despite the importance of surveillance systems to pandemic preparedness, these systems tend to be underfunded and not well understood. Academia can generate the evidence-base and communication strategies to educate the policymakers on the public health, societal, and economic value of surveillance systems.

"Researchers could help the government and its related agencies in combating against the invisible viruses. MOH and any responsible agencies in charge of the data should be more open and transparent in sharing the relevant data with pertinent researchers."

Position Paper on COVID 19, page 69
ASM Special Interest Group on COVID-19 [18]

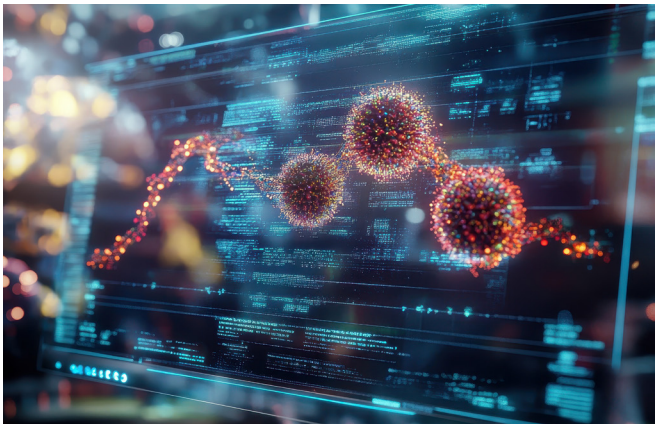
17 Swedish Pathogens Portal *(access date)*, SciLifeLab Data Centre, version (version number) from (Asian Development Bank et al., 2021), RRID:SCR_024866.

18 ASM Special Interest Group on COVID-19. (2021). *Position Paper on COVID-19*. Academy of Sciences Malaysia. https://www.akademisains.gov.my/position-paper-on-covid-19/

INDUSTRY

Pharmaceutical companies, biotechnology companies, technology companies

The government can partner with technology (e.g. big tech) industry players and leverage their expertise to develop and improve the reach, responsiveness, and accuracy of surveillance platforms. This includes designing software applications, data analytic tools, and communication systems tailored to the needs of public health agencies, ensuring that the technology is scalable and interoperable. Digitalizing surveillance operations will help in enhancing data collection, integration, and cross-sectional analysis across human, animal, and environmental health sectors.



CIVIL SOCIETY

Non-profit organizations, community groups, the public

Civil society organizations can engage in public awareness campaigns and policy dialogues to promote a better understanding of surveillance implications and its role in safeguarding public health and economic resilience. They should also engage with marginalized populations and vulnerable communities to ensure their voices are heard and their needs are addressed.

Further, civil society organizations can empower local communities to participate in surveillance efforts and respond effectively to public health threats. This includes providing training on disease prevention, outbreak detection, and emergency response procedures. They should also facilitate information exchange and collaboration between communities and formal health systems to strengthen surveillance resilience. One stakeholder participant raised the importance of training farmers and agricultural workers to alert health authorities on zoonotic events as part of an early warning system.

"Except for the early phase of Movement Control Order, mobilization of volunteers in [surveillance, monitoring, and community engagement] was not sustained thereafter. As a result, as the number of cases in community increases, the public health functions for early detection and early isolation is compromised. The community at large has not been engaged effectively to support the public health functions."

Position Paper on COVID 19, page 31
ASM Special Interest Group on COVID-19[19]

19 ASM Special Interest Group on COVID-19. (2021). *Position Paper on COVID-19.* Academy of Sciences Malaysia. https://www.akademisains.gov.my/position-paper-on-covid-19/

HEALTHCARE PROFESSIONALS

Physicians and community health workers

Community health workers work mostly directly with patients, and thus are often among the first to identify surges in patient numbers and anomalies in disease cases. Several workshop participants recommended enhanced training of community healthcare workers and physicians on different surveillance methods. Government agencies, civil society groups, and industry partners can each play a role in the training of healthcare providers to collect community-level findings that can complement the data collected by government and academia. This will allow researchers to better identify trends from early warning systems at a community level.

Table 3: At-a-glance: Collaborative surveillance recommendations

Recommendation	Primary Stakeholders	Key Enablers
Establish a common surveillance platform for monitoring various respiratory pathogens across human, animal, and environmental health sectors and for facilitating timely information sharing among diverse agencies.	• Government • Industry • Academia • Civil Society • Healthcare Professionals	Coordination & Collaboration Partnerships Healthcare Workforce & Infrastructure Digitalization
Expand the network of National Public Health Laboratories focusing on improving the equitable distribution of services across the country,	• Government • Industry • Civil Society	Policy & Legislation Coordination & Collaboration Partnerships Healthcare Workforce & Infrastructure
Establish multidisciplinary rapid response teams and implement mechanisms for early detection, sampling, verification, investigation, risk and severity assessment, and evaluation of detected respiratory pathogen events.	• Government • Academia	Coordination & Collaboration Partnerships Healthcare Workforce & Infrastructure
Develop or update national testing strategies and ensure access to WHO Collaborating Centres or reference laboratories for: a. research on priority respiratory pathogens; b. adequate mechanisms for sensitive and specific diagnostic assays; and c. sustaining genomic sequencing and bioinformatics capacities.	• Government • Academia	Policy & Legislation Coordination & Collaboration Partnerships Healthcare Workforce & Infrastructure
Enhance policymakers' understanding of the broader significance and implications of collaborative surveillance to promote better adherence to the WHO surveillance guidelines during public health emergencies.	• Government • Academia • Civil Society	Coordination & Collaboration

PILLAR 1

Emergency Coordination

PILLAR 2

Collaborative Surveillance

PILLAR 3

Community Protection

PILLAR 4

Clinical Care

PILLAR 5

Access To Countermeasures

"One of the fundamental things we realized was with respect to de-jargonizing science. The experts were using technical terms that were not easy to interpret and understand for the people. When the fact sheet on how to properly dispose masks gained widespread attention, we realized that it's not just about the technical details but how we engage the community and make the information accessible to them."

Participant

Community protection places value on engaging with communities to foster trust, co-create interventions, and build partnerships for pandemic prevention and control. It brings to the forefront, the critical role communities and governments can play together in ensuring that response measures are culturally appropriate. This WHO advocates for special care and attention to high-risk groups and vulnerable populations, ensuring their needs are met. It also stresses the importance of tailoring actions to local contexts, customs, and concerns to empower communities. Such empowerment is particularly essential for effective infodemic management.

During the workshop, several participants expressed that governments did not actively involve communities in the national response during COVID-19. Low health literacy among the population hindered understanding of scientific and public health information and led to vaccine hesitancy. Communication efforts were predominantly one-way from governments to communities, with limited direct interaction with communities to address their concerns and rights. Moreover, the underutilization of digital technologies for community engagement was noted as a missed opportunity. Despite widespread access to digital tools among Malaysians, there was insufficient effort to leverage these platforms to disseminate accurate information and support public health efforts.

Moving forward, proactive community engagement including involving faith and other community leaders, bidirectional communication efforts, and the use of digital technologies will be essential for effective pandemic response and management. Community engagement through an official channel is especially crucial in curbing misinformation and disinformation in the current digital world. Listening to feedback, inputs, and concerns of the community can help policymakers implement measures that bring about positive health outcomes. Community involvement across different stages of the preparedness plan ensures that their interests, concerns, and needs are served.

RECOMMENDATIONS FOR COMMUNITY PROTECTION

01	Strengthen community involvement in pandemic regulations and interventions through an inclusive whole-of-government and whole-of-society approach, keeping in mind the needs of the vulnerable communities like the disabled and the marginalized.
02	Establish a platform or mechanism to receive comments from the community.
03	Conduct regular tabletop exercises to discuss a framework for delineating the responsibilities of various stakeholders within the community during public health emergencies.
04	Encourage the formulation of comprehensive pandemic preparedness plans for various communal settings such as childcare facilities, educational institutions, and workplaces.
05	Ensure that public communications prioritize scientific evidence while transparently acknowledging the limitations of available information. This approach shall foster public trust and empower individuals to make informed decisions.
06	Utilize diverse dissemination channels such as radio talk shows and podcasts to amplify messaging, provide the public with a nuanced understanding in an accessible manner, and for countering the spread of misinformation.

Roles of Stakeholders for Community Protection

GOVERNMENT

Policymakers, public health authorities, regulatory bodies, and funding agencies

The government should actively engage with community leaders, members, and vulnerable groups through regular consultations and crisis simulation scenarios. Such engagements can inform and incorporate community perspectives into pandemic preparedness plans. It is crucial to empower communities by clearly delineating their roles and responsibilities in these plans, ensuring they have the information and resources to make informed decisions and take action when necessary.

Communication to the communities should be based on the tenets of transparency, openness, and simplicity. Government agencies, such as the Malaysian Communication & Multimedia Commission, could serve as trusted sources of information, delivering messages based on scientific evidence while transparently acknowledging the limitations of available data. Government agencies can also collaborate with non-governmental organizations (NGOs) to enhance grassroots initiatives aimed at educating communities during outbreaks. Participants emphasized the need for public messaging to be clear and simple to understand to build public trust and empower individuals to make informed decisions.

> ***"Community-centred approaches bring together the knowledge, expertise and assets of local communities and key stakeholders to develop acceptable, feasible and relevant preparedness and response actions."***
>
> *Epidemic and Pandemic Preparedness and Prevention World Health Organization* [20]

20 World Health Organization. (2023). *Global Research and Innovation for Health Emergencies: Building the world's resilience against future outbreaks and pandemics.* https://cdn.who.int/media/docs/default-source/documents/r-d-blueprint-meetings/global-research-and-innovation-for-health-emergencies_report-2023.pdf?sfvrsn=9341366_2

ACADEMIA

Universities, research institutions, and other knowledge producers

Academia can provide evidence from behavioural and social sciences to support government led community engagement efforts. They can conduct research and develop tools for effective public health messaging and counter the spread of misinformation. Beyond communication, local implementation research will also be important to adapt health interventions to be delivered in a culturally sensitive and appropriate manner.

INDUSTRY

Pharmaceutical companies, biotechnology companies, technology companies

Digital technology can directly work with or complement government's efforts to engage with communities by providing technological solutions and digital platforms that facilitate communication. This includes the development of mobile applications, online forums, and interactive tools that deepen community engagement while providing important data back to policymakers about the effectiveness of public health strategies.

Private sector industries can also contribute resources and support services to bolster community engagement efforts. This may involve providing funding, in-kind donations, or technical assistance to NGOs, government agencies, and community-based organizations working on the front lines of pandemic response.

CIVIL SOCIETY

Non-profit organizations, community groups, the public

Civil society organizations should advocate for inclusive decision-making processes and facilitate community engagement initiatives. By representing the interests of marginalized and vulnerable populations, civil society can ensure that pandemic preparedness plans are responsive to the diverse needs of communities. One workshop participant pointed out the importance of embedding behavioural science, social science, and religious perspectives in the public health response and to inform policy decision-making, a role which civil society organizations can play in collaboration with government. They can also work alongside government bodies to amplify messaging, combat misinformation, and foster trust and cooperation among stakeholders.

Civil society organizations can provide health literacy training to equip individuals with the knowledge and skills needed to understand public health information, critically evaluate sources of information, and actively participate in pandemic response efforts. By empowering communities with accurate and accessible health information, civil society can help build resilience and promote collective action in the face of public health threats.

"Community empowerment plays an important role in case detection, contact tracing and ensuring the community's compliance to pandemic SOP. Malaysia should have learned from our successful neighbour, Thailand in mobilising 1 million volunteers and the use of Information Communication Technology (ICT) in contact tracing and monitor and tracking patients under investigation."

Position Paper on COVID-19, page 31
ASM Special Interest Group on COVID-19 [21]

HEALTHCARE PROFESSIONALS

Physicians and community health workers

Healthcare providers also play an important role in providing trusted health information and dispelling misinformation. They can amplify public health recommendations and directives while addressing common misconceptions, such as those surrounding vaccinations and popular, but unscientific, treatment methods and bogus cures. General Practitioners (GPs), in particular, were instrumental in limiting the impact of COVID-19 and fostering trust within the community. Moving forward, GPs should leverage their trusted voices to build confidence, combat misinformation, and continue to disseminate accurate information to their patients.

> ***"It is necessary to counter fake news in a speedy and efficient manner – we should call it out and inform the community on where they can get the right information."***
>
> *Participant*

Additionally, healthcare providers can collaborate with faith leaders and community leaders to ensure accurate information reaches broader audiences. Lastly, healthcare providers must approach this topic with empathy to build trust with the community for effective communication.

Table 4: At-a-glance: Community protection recommendations

Recommendation	Primary Stakeholders	Key Enablers
Strengthen community involvement in pandemic regulations and interventions through an inclusive whole-of-government and whole-of-society approach, keeping in mind the needs of the vulnerable communities like the disabled and the marginalized.	• Government • Civil Society	Coordination & Collaboration Partnerships
Establish a platform or mechanism to receive comments from the community.	• Government • Industry	Coordination & Collaboration Partnerships Digitalization
Conduct regular tabletop exercises to discuss a framework for delineating the responsibilities of various stakeholders within the community during public health emergencies.	• Government • Civil Society • Healthcare Professionals	Coordination & Collaboration
Encourage the formulation of comprehensive pandemic preparedness plans for various communal settings such as childcare facilities, educational institutions, and workplaces.	• Government • Civil Society	Policy & Legislation
Ensure that public communications prioritize scientific evidence while transparently acknowledging the limitations of available information. This approach shall foster public trust and empower individuals to make informed decisions.	• Government • Academia • Civil Society	Coordination & Collaboration
Utilize diverse dissemination channels such as radio talk shows and podcasts to amplify messaging, provide the public with a nuanced understanding in an accessible manner, and for countering the spread of misinformation.	• Government • Civil Society • Healthcare Professionals	Coordination & Collaboration Partnerships

PILLAR 1

Emergency Coordination

PILLAR 2

Collaborative Surveillance

PILLAR 3

Community Protection

PILLAR 4

Clinical Care

PILLAR 5

Access To Countermeasures

"COVID, Ebola, and other diseases highlighted how important to integrate pre-hospital, hospital, and post-hospitalization populations to ensure that the [clinical] care journey is what we look at and not just silos. Evaluating novel interventions, processes of care, and other care strategies along the way... how we give oxygen, who we give oxygen to cannot be overstated in its importance."

Prof (Dr.) Srinivas Murthy at WHO Global Research & Innovations Forum
Clinical Associate Professor, University of British Columbia[22]

Pandemic preparedness in the realm of clinical care encapsulates the provision of health services and prevention of infection in healthcare facilities. It focuses on scalable clinical care and prioritizes the safety and protection of healthcare workers and patients during heightened demand in emergencies. As part of clinical care, The WHO advocates for long-term investments in strengthening health systems to detect, prevent, and respond to emergencies.

Few healthcare systems are built to withstand daily influx of patients in crisis conditions at the scale of COVID-19. Malaysia faced the healthcare demands of the pandemic while simultaneously facing existing shortages in workforce, medicines, diagnostics, and overall weakened capacity. Vulnerable populations experienced the greatest consequences of clinical care inequities as existing disparities in an emergency were exacerbated. In addition, participants observed that there was limited coordination between primary healthcare and tertiary hospitals to triage and deliver care, as well as a lack of clear clinical guidance, which negatively affected the delivery of clinical care.

22 Murthy, S. (2023). *Session 2: Can innovation help improve the standard of clinical care everywhere? - Delve into the role of innovation in enhancing global clinical care standards and ensuring equitable care* [Video]. World Health Organization. https://www.who.int/news-room/events/detail/2023/10/23/default-calendar/global-research-and-innovations-forum--building-the-world-s-resilience-against-future-outbreaks-and-pandemics

By formulating a detailed plan for clinical care during health emergencies and establishing a national infection prevention and control (IPC) taskforce to lead and supervise guidelines and protocols, Malaysia can better prepare for future pandemics and ensure effective healthcare delivery. Additionally, investing in advanced medical technologies and infrastructure such as AI-powered solutions for healthcare delivery can help strengthen the efficiency of healthcare provision. Such proactive measures will not only safeguard public health but also enhance the resilience of Malaysia's healthcare system against future pandemics.

RECOMMENDATIONS FOR CLINICAL CARE

01	Prepare a plan to mobilize non-clinical personnel to conduct specialized training to help with addressing the problem of healthcare worker shortages in a public health emergency.
02	Establish a national infection prevention and control (IPC) taskforce to revise, adapt, and disseminate and implement guidelines and protocols.
03	Create a single authority/agency for dissemination channel for active communication to prevent miscommunication among healthcare professionals and the public.
04	Integrate AI-powered solutions for healthcare delivery, contact tracing, and recommendations for isolation and quarantine.

Roles of Stakeholders for Clinical Care

GOVERNMENT

Policymakers, public health authorities, regulatory bodies, and funding agencies

The government coordinates and oversees the development and dissemination of infection control guidelines in collaboration with infection control / occupational and safety healthcare units and professional clinical bodies in Malaysia. As the leading national health authority, the Ministry of Health must issue clear and consistent guidelines and policies to strengthen communication of scientific evidence, clinical protocols, and public health directives to public and private healthcare institutions. Clear and updated clinical guidelines reduce the risk of misinformation, and increase healthcare professionals' adoption of best practices to deliver high-quality care.

During future outbreaks, it is imperative for the government to retain and support the needs of its healthcare workforce for effective clinical care delivery. High workloads and long working hours predispose frontline healthcare personnel to burnout in addition to their increased risk of infections as they conduct IPC or medical treatment. The government is responsible for safeguarding the wellbeing of healthcare and allied professionals, and should work with healthcare institutions to ensure support measures including adequate personal protective equipment, access to vaccines, diagnostics, and treatment as appropriate, management of workload and shiftwork, and provision of mental health services for staff.

Digitization is playing a significant and increasing part of improving clinical care access and delivery, which the government can play a leading role in implementing. By driving the adoption and integration of digital tools in healthcare, government agencies can adapt clinical frameworks as technologies continue to evolve.

"There is an overreliance on manual processes for data consolidation that led to delays. There was a loss of control during the COVID-19 surge due to inadequate digital infrastructure. Government agencies have an urgent need to automate systems and streamline data processing. Significant financing is required to strengthen digitization efforts."

Participant

ACADEMIA

Universities, research institutions, and other knowledge producers

Academia is invaluable in gathering insights on evolving outbreaks, especially those involving novel pathogens, and update national clinical guidelines encompassing IPC measures, therapeutics, and vaccines. Local research institutions and universities can also tap on their regional and international networks with sister institutions to collaboratively share knowledge and study various clinical practices implemented by other countries, including the use of new clinical care delivery models such as virtual wards and home care.

Academics can discuss with government agencies which practices are feasible for deployment in Malaysia's local context, based on their knowledge on the strengths and limitations of health system organization, available medical supplies, and levels of infrastructure.

INDUSTRY

Pharmaceutical companies, biotechnology companies, technology companies

Industry players can work collaboratively with government to support clinical care services through digital innovations and ensuring equitable distribution of medical supplies. With increasing digital penetration, industry players can provide support for facilitating virtual wards. Technology companies can develop telemedicine platforms to facilitate remote consultations with physicians and nurses. Pharmaceutical and device manufacturers can provide medicines and medical equipment (e.g., oximetry, supplemental oxygen) for patients to self-monitor and medicate. Remote care services, facilitated by industry partnerships, are integral to ensuring equitable access to care to vulnerable populations such as those living in rural areas without close access to healthcare facilities.

Healthcare companies are also essential to ensuring resilient supply and manufacturing chains for medicines, diagnostic tests, PPEs, and medical supplies for clinical care. Private sector manufacturers can complement public sector efforts to stockpile medical inventory before an outbreak, and provide logistical assistance by rolling out medical countermeasures to healthcare providers in their networks.

"Initially, during the early waves of the pandemic, the public sector, private sector, and the community efforts faced challenges to work collaboratively to efficiently deliver clinical care. At the peak of the Delta wave when the health system was under severe strain, the Greater Klang Valley Task Force was formed under the leadership of the Ministry of Health and the Royal Malaysian army which brought all sectors together to stabilize a health system near collapse. Drawing on these lessons, industry players have an opportunity to ensure resources most efficiently reach those who need them urgently."

Professor Dato' Dr Adeeba Kamarulzaman CEO, Pro-Vice Chancellor and President Monash University, Malaysia

CIVIL SOCIETY

Non-profit organizations, community groups, the public

Civil society organizations can work directly with populations to to raise awareness about the importance, benefits, and risks of healthcare during a pandemic Similar to academia, civil society can utilize community knowledge to inform improvements in care delivery, as well as patient follow up to evaluate the success of new methods. In addition, civil society organizations can raise awareness of the benefits of new and updated clinical practices introduced to safeguard public health.

HEALTHCARE PROFESSIONALS

Physicians and community health workers

As direct providers of healthcare services, healthcare professionals and medical associations play a pivotal role in clinical care. With their nuanced understanding of day-to-day operations, healthcare professionals, supported by medical associations, should play a lead role in the development of emergency guidelines for timely and effective healthcare delivery to meet population health needs in. Additionally, healthcare professionals should take a leading role in the national IPC taskforce to ensure that guidelines are practical and can be effectively implemented across all healthcare settings. Medical associations can then ensure the efficient dissemination of these guidelines to relevant personnel. Furthermore, medical associations can support the establishment of a single authority dedicated to information dissemination and help coordinate centralized communication channels.

Table 5: At-a-glance: Clinical care recommendations

Recommendation	Primary Stakeholders	Key Enablers
Prepare a plan to mobilize non-clinical personnel to conduct specialized training to help with addressing the problem of healthcare worker shortages in a public health emergency.	• Government • Civil society • Healthcare Professionals	Coordination & Collaboration Healthcare Workforce & Infrastructure
Establish a national infection prevention and control (IPC) taskforce to revise, adapt, and disseminate and implement guidelines and protocols.	• Government • Healthcare Professionals	Policy & Legislation Coordination & Collaboration Partnerships
Create a single authority/agency for dissemination channel for active communication to prevent miscommunication among healthcare professionals and the public.	• Government • Industry	Coordination & Collaboration Digitalization
Integrate AI-powered solutions for healthcare delivery, contact tracing, and recommendations for isolation and quarantine.	• Government • Healthcare Professionals	Coordination & Collaboration Digitalization

"Did we communicate enough with various sectors? There was a gap in terms of planning. For example, when it came to our stockpile of PPEs, the private sector's decrease was totally ignored. In the month of April 2020, there were no face masks and many clinics had to shut down because of this. After we faced this shortage, we coordinated with other sectors but there should have been better coordination from the start, especially at the top-level."

Participant

Medical countermeasures refer to products used to prevent, mitigate, or treat adverse health effects, such as biologic products (vaccines, blood products, antibodies), drugs (antimicrobials, antivirals) and devices (diagnostic tests and personal protective equipment)[23] .Equitable, stable, and timely access to medical countermeasures is critical to mitigate the impact of a public health crisis and ensure that people get the services they need.

During COVID-19, participants recognized that there was a lack of centralized resource management of medical supplies and medicines in Malaysia - as in most other countries - which led to shortages and delays in delivery of countermeasures. Among the most notable challenges in this area were the shortage of adequate personal protective equipment (PPE), diagnostic test kits, and vaccines once they became available.

Moving forward, to avoid shortages of medical supplies, resources must be monitored continuously, with ongoing predictions of population need and provider supply. To accurately determine the required production volume for medical countermeasures, participants emphasized that coordination between the public sector and industry producers must be strengthened. Although factors, such as supply chain interruptions, are beyond the control of any one sector, adequate preparation and stockpiling can reduce the impact of shortages.

23 Office of the Commissioner. (2024, June 11). *What are medical countermeasures?* FDA. https://www.fda.gov/emergency-preparedness-and-response/about-mcmi/what-are-medical-countermeasures

RECOMMENDATIONS FOR ACCESS TO COUNTERMEASURES

01 Establish legislation to control prices and improve access to PPE and other medical products, as well as to prevent illegal price hiking during crisis.

02 Encourage localization of PPE production, procurement of medical products, and other medical equipment sourcing, ultimately increasing exports and reducing imports of these products.

03 Provide countermeasures to prioritize for stockpiling (e.g. vaccines, antivirals, antibiotics, non-specific supportive treatments), the volumes to stockpile, and inventory management to prevent wastage. As part of this, dedicated inventory of necessary medical resources, in addition to funding, must be committed to PPR.

04 Ensure the timely adoption of the Malaysian Action Plan on Antimicrobial Resistance (MyAP-AMR 2022-2026)[24] for continued effectiveness of medical countermeasures.

05 Set up oversight mechanisms that can address system challenges (like the availability of cold storage facilities and vaccine distribution to rural communities) to follow through on the National Vaccine Development Roadmap (NVDP).

24 *Malaysian Action Plan on Antimicrobial Resistance (MyAP-AMR) (2022-2026). (2022).* Ministry of Health Malaysia, & Ministry of Agriculture and Food Security.

Roles of Stakeholders for Access to Countermeasures

GOVERNMENT

Policymakers, public health authorities, regulatory bodies, funding agencies, and physicians (public-sector)

Government agencies should secure access to medical countermeasures and establish a clear plan for how these will be deployed. This plan must involve the creation of oversight mechanisms such as for cold storage facilities and vaccine distribution programs across communities, particularly those in rural areas who may be harder to reach. Governments must also orchestrate emergency preparedness and response contingencies to distribute countermeasures across the country, considering any barriers to access as well as prioritization for at-risk groups. In the future, mobilization of resources requires the government to distribute medical resources evenly across and throughout various government agencies.

> ***"Decentralizing the mobilization of medical resources and optimizing their use across various agencies and government organizations will be useful in increasing efficiency. Further, decentralizing the operational decision-making process, such as procurement and therapeutics, will allow for more responsive and localized management of medical needs."***
>
> *Participant*

While coordination should be maintained in this process to ensure consistent standards of safety are adhered to, collaboration should be established between agencies such as the Ministry of Health and Ministry of Finance, to support stockpiling of preventive countermeasures.

When taking action to combat these issues, participants have suggested possible areas for government intervention, such as the introduction of price controls, price monitoring mechanisms, and penalties for illegal price hiking to ensure affordability and accessibility. While working to improve equitable access, the government should create a policy environment that incentivizes industry players to continue the research and development of countermeasures. Participants suggested that localization of such processes can help to prevent supply chain issues and reduce import costs, as well as boosting local economies through job creation and other benefits that follow from strengthening the capacity of local industries.

ACADEMIA

Universities, research institutions, and other knowledge producers

Basic scientific, clinical, translational, and operational research will continue to be essential for pandemic preparedness and response. Academia can work with policymakers and industry players to determine local adaptation of new or enhanced medical countermeasures for an effective national response.

During an outbreak, academia can conduct timely research based on surveillance data on local variants and transmission patterns of respiratory pathogen strains. Locally generated evidence will provide critical insights to industry for developing medical countermeasures that are effective in the local context (e.g. specific to strains, modes of transmission or community resources).

INDUSTRY

Pharmaceutical companies, biotechnology companies, technology companies

During the COVID-19 pandemic, there was a global shortage of essential raw materials for producing countermeasures. Additionally, response plans emphasized the necessity of future stockpiling to mitigate such shortages. Industry players should explore ways to utilize Malaysia's existing resources and capabilities, e.g. rubber plantations, to support the production of PPE products. By assessing domestic resources and capabilities, industry players can assist the government in preventing shortages and decreasing international dependence by developing countermeasures domestically.

Moreover, industry can work with the government to strengthen supply chains for medical products and equipment. Industry players, with their in-depth knowledge of specific sectors, can play an important role in sourcing raw materials and streamlining supply chains for countermeasures production. Industry players with established manufacturing and distribution infrastructure can be leveraged to facilitate the rapid scaling of production for essential countermeasures once a pandemic threat is identified. This proactive approach ensures a readily available supply of critical drugs, vaccines, and treatments when they are needed most. Additionally, industry expertise can be harnessed to develop agreements with the government that optimize supply chains and minimize waste through streamlined and efficient stockpiling and inventory control strategies.

> ***"To complement stockpiles, pre-emptive arrangements could be made with suppliers of pharmaceutical agents which have short shelf lives, should large quantities be needed urgently."***
>
> *Position Paper on COVID 19, page 81*
> *ASM Special Interest Group on COVID-19*[25]

25 ASM Special Interest Group on COVID-19. (2021). *Position Paper on COVID-19.* Academy of Sciences Malaysia. https://www.akademisains.gov.my/position-paper-on-covid-19/

CIVIL SOCIETY

Non-profit organizations, community groups, the public

Civil society organizations can utilize their on-ground experience and established rapport in local communities to improve access to medical countermeasures. During COVID-19, civil society organizations disseminated information on the benefits and availability of vaccines, therapeutics, and other essential countermeasures and promote their uptake.

By partnering with government agencies and healthcare providers, civil society can help coordinate the distribution of medical countermeasures, ensuring they are provided efficiently and equitably. Civil society organizations can also mobilize volunteers to assist in various aspects of the distribution process, from logistics and transportation to on-the-ground support in administering vaccines and other treatments.

HEALTHCARE PROFESSIONALS

Physicians and community health workers, healthcare providers

Healthcare providers are often the primary administrators of medical countermeasures. Their frontline position enables healthcare institutions to identify gaps in the availability and distribution of medical countermeasures, which can be promptly communicated to suppliers and government authorities, ensuring that shortages are swiftly addressed.

Healthcare professionals also play a critical role in educating patients about the importance and benefits of medical countermeasures, such as vaccines and therapeutics. Given the high level of trust the public places in healthcare professionals, it is crucial that they provide clear, evidence-based information. By dispelling myths and misinformation, they can increase public trust and acceptance, encouraging more individuals to seek out and adhere to recommended medical counter measures.

Table 6: At-a-glance: Access to countermeasures recommendations

Recommendation	Primary Stakeholders	Key Enablers
Establish legislation to control prices and improve access to PPE and other medical products, as well as to prevent illegal price hiking during crisis.	• Government • Industry	Coordination & Collaboration Digitalization
Encourage localization of PPE production, procurement of medical products, and other medical equipment sourcing, ultimately increasing exports and reducing imports of these products.	• Government • Academia • Industry	Policy & Legislation Coordination & Collaboration Healthcare Workforce & Infrastructure
Provide countermeasures to prioritize for stockpiling (e.g. vaccines, antivirals, antibiotics, non-specific supportive treatments), the volumes to stockpile, and inventory management to prevent wastage. As part of this, dedicated inventory of necessary medical resources, in addition to funding, must be committed to PPR.	• Government • Academia • Industry • Healthcare Professionals	Coordination & Collaboration Healthcare Workforce & Infrastructure
Ensure the timely adoption of the Malaysian Action Plan on Antimicrobial Resistance (MyAP-AMR 2022-2026) for continued effectiveness of medical countermeasures.	• Government	Policy & Legislation Coordination & Collaboration Healthcare Workforce & Infrastructure
Set up oversight mechanisms that can address system challenges (like the availability of cold storage facilities and vaccine distribution to rural communities) to follow through on the National Vaccine Development Roadmap (NVDP).	• Government • Industry • Healthcare Professionals	Policy & Legislation Coordination & Collaboration Partnerships

Conclusion

Evaluating the approaches taken in response to COVID-19, both within Malaysia and globally, reveals that the translation of technical public health guidance into policy and action remains inadequate for preparing nations for future global outbreaks. The current interpandemic window presents a critical opportunity for Malaysia to enhance its preparedness for the next threat, especially while lessons from the COVID-19 pandemic are still fresh in the minds of stakeholders and policymakers.

Through our research and stakeholder consultations, we identified the WHO Preparedness and Resilience for Emerging Threats (PRET) framework and its accompanying pillars—namely Emergency Coordination, Collaborative Surveillance, Community Empowerment, Clinical Care, and Access to Countermeasures—as an effective tool for reviewing and proposing actions to strengthen Malaysia's pandemic preparedness. This paper outlines recommendations according to these five pillars for Malaysia to implement during this interpandemic period. However, the successful implementation of these recommendations relies on the active involvement of stakeholders and the adoption of key enablers.

Active collaboration among multisectoral stakeholders is fundamental to building trust and developing effective partnerships for pandemic preparedness. The Government of Malaysia should serve as the central authority to coordinate and convene academia, civil society, healthcare providers, and industry players. By leveraging their expertise and resources, the government can ensure that the recommended actions are feasible and supported by a broad coalition of stakeholders. Only by mobilizing a whole-of-society approach can Malaysia build a robust foundation to address future pandemic threats.

The enabling environment for pandemic preparedness that we identified comprises existing factors such as policy and legislation, coordination and collaboration, partnerships, healthcare workforce and infrastructure strengthening, and digitalization. The government should ensure that these factors are taken into account and consider investing in their enhancement when implementing the proposed recommendations.

While every public health crisis generates valuable insights, we need to remember that future pathogens with pandemic potential may present challenges different from those of COVID-19. Response mechanisms and emergency coordination plans must be adaptable to the unique epidemiological characteristics of each outbreak. Pandemic preparedness planning must also be realistic and aligned with the current or projected infrastructure, resources, and capabilities of Malaysia's health systems at the district, regional, and national levels. Ideally, pandemic preparedness should be bolstered and financed based on an evolving assessment of national needs rather than predetermined historical budgets.

By adopting a proactive and adaptive approach, Malaysia can ensure that its health systems are resilient and prepared to effectively manage and mitigate the impact of future pandemics.

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