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INSTITUTE

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FINANCIAL INNOVATIONS LAB®

*Financing Global
Early Warning Systems*

Country Case Study: Indonesia

INTRODUCTION

Since 2020, the Milken Institute has promoted collaboration to develop and improve early warning systems (EWS) for pandemic preparedness and health security, convening experts and stakeholders to outline a vision for a global early warning network, as well as key considerations for governance, data, and financing. The early warning network would predict, detect, and monitor potential infectious disease outbreaks through cross-sector coordination, data collection, and data analysis, identifying unusual patterns or upticks in key indicators to prevent or mitigate disease spread.

Expanding local, national, and regional EWS and enabling them to interact beyond their silos with a global network will require ongoing commitment and funding from the public, philanthropic, and private sectors. A 2022 World Bank/World Health Organization (WHO) analysis of funding needs for surveillance, collaborative intelligence, and early warning concluded an annual cost of US\$13.3 billion, with an annual \$4.1 billion funding gap.¹

While multiple efforts are underway to bridge the gap in the public and philanthropic sectors, the path for private-sector engagement and investment has yet to be clearly delineated. In response, in 2023, the Milken Institute's Innovative Finance team interviewed global stakeholders, hosted a Financial Innovations Lab®, and organized two working groups to identify innovative financing models that could “crowd in” the private sector into global early warning systems.

Throughout this work, it became apparent that each country's early warning systems hold particular challenges and opportunities that could hinder or facilitate their integration with global early warning capabilities. To gain a more nuanced understanding of these challenges, the Institute conducted in-depth interviews with national and local stakeholders and organized roundtables focusing on Indonesia, Brazil, and Kenya.

This report summarizes the findings and recommendations from interviews and roundtables focused on Indonesia:

- **Create partnerships between the Indonesian government and private-sector data and technology companies to enable health data digitalization, standardization, and interoperability.** Participants called for a multisectoral collaboration to unify various health information systems, enhancing early warnings through a more integrated data landscape.
- **Incentivize private investment in EWS infrastructure and genomic technologies.** Innovative financing mechanisms like social bonds, public-private partnerships, and blended finance could be implemented to attract private-sector investments, crucial for improving physical and digital infrastructure and genomic research capabilities.
- **Identify private-sector companies with nontraditional data sources to generate EWS insights.** Participants emphasized the necessity of incorporating nontraditional data sources from the private sector, including health-care supply chain data, consumer behavior, and environmental trends to enrich early warning datasets.

COUNTRY BACKGROUND

Indonesia, the world's fourth most populous country with a 2023 population estimate of 277.5 million people, is navigating complex challenges in health management. Over half the population resides on Java, while the rest live across more than 6,000 islands in its vast archipelago.² Income levels differ among regions: Jakarta has the highest GDP per person at approximately \$19,000, while some remote islands have much lower incomes. This immense population, geographical distribution, and income disparity intensify the intricacies of health management across the nation.

Figure 1: GDP per Capita, Indonesia (2021)



Source: Milken Institute (2024), based on *The Economist* (2023)³

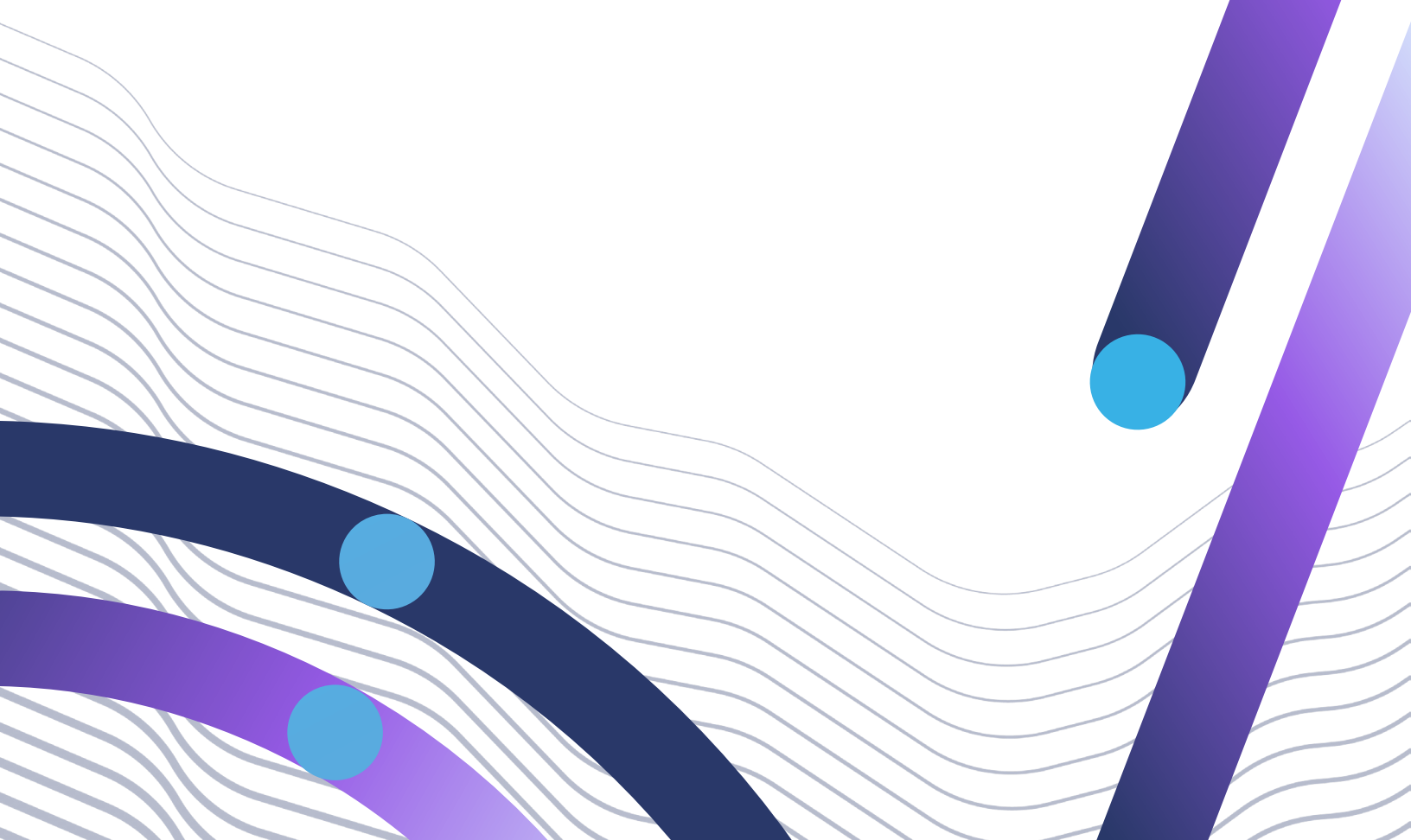
The fiscal decentralization Indonesia underwent in 2001 shifted control of public health spending to local governments, compounding the existing geographic and economic disparities across the numerous islands.⁴ After decentralization, provinces, municipalities, districts, and hospitals began to develop their own versions of district-level systems (SIKDA), which have various formats, software, and datasets. This further fragmented Indonesia's health information systems, weakening the communication between the local systems and

the national information system (SIKNAS).

Indonesia grappled with one of Southeast Asia's highest COVID-19 caseloads, reporting nearly 7 million cases and 161,918 deaths as of December 2023.⁵ The pandemic's ripple effects extended beyond the immediate health crisis. It disrupted the management of other prevalent illnesses, such as tuberculosis.⁶ The pandemic triggered a socioeconomic crisis in Indonesia—an additional 2.7 million individuals fell below the poverty line,

unemployment surged to 7.1 percent, students lost on average one year of schooling, and it took two years for real GDP to rebound to 2019 levels.⁷

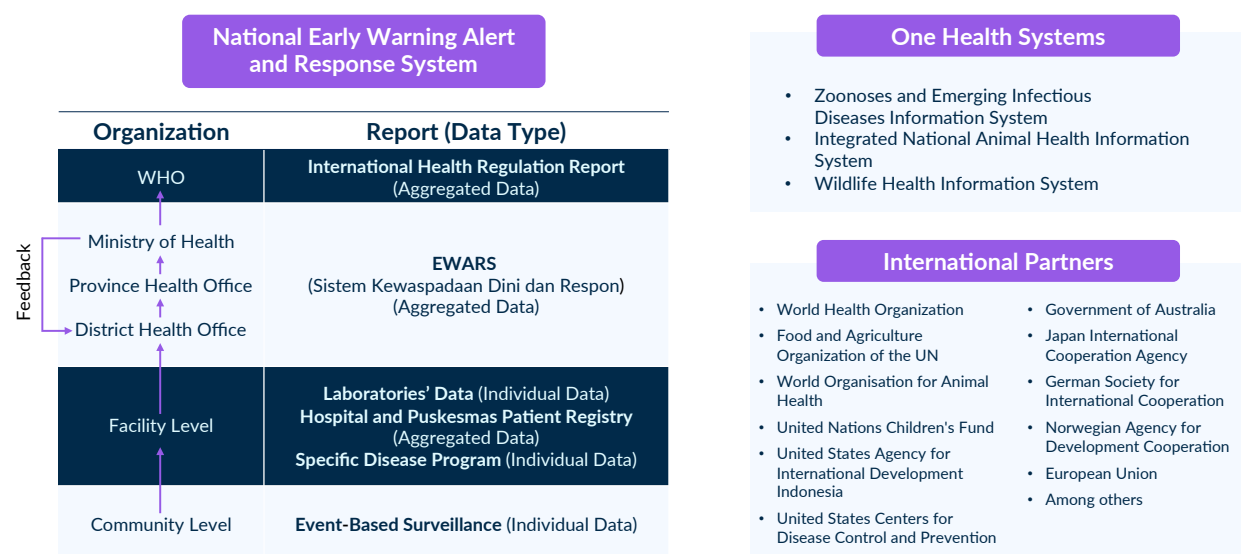
Climate change and large-scale deforestation significantly increase Indonesia's risk of another major disease outbreak. The historical transformation of forested areas into palm oil plantations—Indonesia is now the world's No. 1 producer—has been linked to the rise of vector-borne diseases.⁸ Rising temperatures aggravate these risks by broadening the geographical range of mosquito-borne illnesses like malaria, dengue, and filariasis.⁹ Amid these challenges, the benefits of a robust early warning system are clear. As we describe below, EWS implementation is early in Indonesia but has seen meaningful progress.



CURRENT STATE OF EWS IMPLEMENTATION

Indonesia's Early Warning and Response System (EWARS) is a national infectious disease EWS and a critical component of the country's public health infrastructure. Since its implementation in 2009, EWARS has made important infrastructure advancements by facilitating data sharing and response coordination among communities, various health jurisdictional levels, and the WHO (Figure 2).

Figure 2: Current Early Warning and Surveillance Landscape in Indonesia



Source: Milken Institute (2024) (left side adopted from Quality of National Disease Surveillance Reporting before and during COVID-19: A Mixed-Method Study in Indonesia)

The ministries and agencies connected through EWARS have adopted the country's One Health approach, a strategy that recognizes the interconnectedness among people, animals, plant life, and the environment, and applies this approach to multisectoral collaboration from local to global levels.¹⁰

For example, the Zoonoses and Emerging Infectious Diseases Information System (SIZE) is a collaboration of the Ministry of Agriculture and the

UN Food and Agriculture Organization, supported by the US Agency for International Development. It streamlines data sharing and communication across surveillance systems such as EWARS, the National Animal Health Information System (iSIKHNAS), and the Wildlife Health Information System (SehatSatli). Indonesia's coordination, implemented through EWARS and SIZE, marks a transition from previous sector-managed surveillance systems to a more integrated approach and a major step forward in enhancing the government's preparedness in preventing and responding to zoonotic diseases.

However, EWARS faces challenges due to Indonesia's limited mobile and internet infrastructure, alongside constraints in human and financial resources. These issues are particularly pronounced in remote areas, compounded by a widespread lack of epidemiological training. While the public sector should retain the central role in operating and funding the EWARS, the system is well-poised for private-sector innovation and investment to expand its reach and capabilities. Yet the path for private-sector engagement has yet to be clearly delineated.



RECOMMENDATIONS

Given this backdrop, the Financial Innovations Lab convened a roundtable in September 2023 to discuss the future of EWS in Indonesia and formulate recommendations for partnership models and financing solutions to incentivize private-sector engagement and investment. The event assembled a diverse panel of experts, including policymakers, government health leaders, health specialists, investors, and philanthropic leaders. These discussions are critical in framing a path for private companies and investors to contribute to more responsive and effective early warning systems that could adapt to the country’s particular challenges and enhance its overall health security.

Table 1: Summary of Recommendations and Examples of Private-Sector Engagement in Indonesia

Recommendation	Models for Mobilizing Private-Sector Engagement
<p>Create partnerships between the Indonesian government and private-sector data and technology companies to enable health data digitalization, standardization, and interoperability</p>	<ul style="list-style-type: none"> • 2024 Digital Health Transformation Strategy • Health data digitalization and integration platform, SatuSehat
<p>Incentivize private investment in EWS infrastructure and genomic technologies</p>	<ul style="list-style-type: none"> • Blended finance platform, SDG Indonesia One • Biomedical and Genomic Science Initiative • Genomics technology company, Nusantics
<p>Identify private-sector companies with nontraditional data sources to generate EWS insights</p>	<ul style="list-style-type: none"> • Purchase data on over-the-counter cough and fever medications • Weather data, such as rainfall and warmer temperatures, related to vector-borne diseases

Source: Milken Institute (2024)

Create Partnerships between the Indonesian Government and Private-Sector Data and Technology Companies to Enable Health Data Digitalization, Standardization, and Interoperability

A primary challenge in Indonesia's EWARS is effectively integrating fragmented health data sources. This challenge partly stems from differences among information systems used by over 10,000 *puskesmas* (public community health centers) and private clinics spread across the archipelago. Currently, over 80 percent of health-care facilities lack digital technologies, and around 90 percent of doctors in *puskesmas* rely on manual record-keeping.¹¹

The lack of data and system standardization hinders the system's ability to generate timely, actionable early warnings for public- and private-sector decision-makers. To address this, the Indonesian Ministry of Health (MoH), in partnership with the UN Development Programme (UNDP) and with support from the Government of Japan, initiated the 2024 Digital Health Transformation Strategy to modernize Indonesia's health-care infrastructure. However, participants acknowledged that considerable technological and financial challenges are still involved in digitizing all the country's frontline health-care facilities.

Recognizing that the journey toward digitalization will be long, participants suggested that the private sector could contribute to the "digitalization of doctors" with virtual platforms. HaloDoc, a private health-tech platform that links patients, physicians, hospitals, and pharmacies, is already in operation across Indonesia's 180 cities.¹² During the COVID-19 pandemic, HaloDoc's real-time data-sharing platform provided 10–14 days' lead time for outbreak detection, improving the government's response strategies.

Building on the example of HaloDoc, participants underscored the need for more such innovative

digital platforms that could bridge gaps between health-care providers and patients across the country's diverse geographical landscape. Any new digital platforms must align seamlessly with the existing health-care infrastructure, including government databases and health management systems, for effective data management. Thus, the Lab identified a key priority to be initiating government-led collaborative partnerships with private data and technology providers, especially in addressing privacy and security concerns, to accelerate health data digitalization.

Of equal importance is data standardization among the country's patchwork health data systems. With over 400 health applications, each with its own set of guidelines and developed by various government entities and the private sector,¹³ it is essential to harmonize data formats and protocols across diverse platforms for seamless data connection, communication, and interoperability. As part of the government's overarching Digital Transformation Strategy, the MoH is leading the integration of Indonesia's health-care ecosystem on a unified platform called SatuSehat, which includes both health data system integration and big data analytics system development.¹⁴

Health technology companies could support the government's efforts to improve data standardization and interoperability. In collaboration with the Ministry of Health, for example, they could lend their expertise on data collection, cleaning, storage, and exchange to create industry-accepted data standards that align with government needs. The government could leverage existing technologies to develop operating systems that allow for data communication and integration across disparate health-care applications. In terms of connectivity, Indonesia may consider Malaysia's approach, which rolled out a centralized electronic medical record system in 2019, driven by 5G technology provided by the private sector.¹⁵

Moreover, data and technology companies

could design and implement user-friendly interfaces in health applications for frontline health-care workers to optimize efficiency, for example, automatically converting raw data into a standardized, high-quality format, eliminating manual data entry, and facilitating faster data analysis. Lastly, participants highlighted the potential of using AI-driven predictive analytics in rural areas, where digitalization of health data might lag or would be otherwise incomplete, to ensure comprehensive coverage of EWS data and accuracy of EWS insights.

Incentivize Private Investment in EWS Infrastructure and Genomic Technologies

A robust early warning system relies on the quality of the larger physical and digital infrastructure, such as labs, equipment, health information systems, data centers, and networks; participants noted a growing awareness among private investors to invest in these projects. Discussions centered on specific areas in need of continuous investment to ensure that early warning systems are fully operational during health crises and maintained and upgraded for resilience during periods of normalcy—training on endemic disease and health conditions. For example, investments may focus on building biobanks and data centers, establishing secured channels for data exchange, or acquiring equipment that enhances data collection in clinics, hospitals, and laboratories. One promising investment approach is the issuance of social bonds or other debt instruments dedicated to funding infrastructure. These instruments could appeal to institutional investors interested in socially responsible investments with long-term returns.

Additionally, the potential of public-private partnerships (PPPs) in digital infrastructure was discussed and examined. With the private sector accounting for only 2 percent of health-care investments, there is a significant opportunity to use alternative financing tools such as PPPs

to improve health-care infrastructure across the country.¹⁶ Indonesia could look to Uttar Pradesh, one of the most populated states in India, as a model for how public- and private-sector collaborations could enhance digital infrastructures. The government of Uttar Pradesh partnered with Apollo Hospitals Enterprise to provide tele-radiology services, including digital infrastructure and IT-based solutions at 134 Community Healthcare Centers, which will be able to serve close to 14 million residents.¹⁷ For Indonesia, adopting a similar approach could catalyze the development of its digital infrastructure related to EWS, leveraging private investment to introduce advanced technologies.

Blended finance is another approach that could leverage public and philanthropic funds as concessionary capital to absorb some investment risks for private investment. An example of blended finance in action is the SDG Indonesia One platform, managed by the state-owned enterprise PT Sarana Multi Infrastruktur (PT SMI) for infrastructure projects that align with the Sustainable Development Goals (SDGs). As a government-backed platform combining various public- and private-sector funding sources (philanthropy, donors, banks, and bilateral and multilateral financial institutions), SDG Indonesia One is designed to attract private capital by mitigating risk and providing the opportunity to expose partners to new markets for future business. From 2018 to 2022, the platform successfully implemented 62 blended finance models, securing a substantial commitment of \$3.19 billion.¹⁸ In the context of EWS infrastructure and technology, where initial investments are relatively high and risky, blended finance could be particularly effective in unlocking greater private investment.

Beyond infrastructure gaps, Lab participants identified several technology areas that could bolster EWS insights and are well-positioned to benefit from increased private investment. Genomics research and development, for example,

has shown notable momentum in recent years. In response, the Indonesian government launched the Biomedical and Genomic Science Initiative in 2022, which aims to sequence genomes of at least 10,000 Indonesians over the next two years to detect and monitor select priority diseases.¹⁹ Since there were only 12 genomic sequencing machines in the country, the government planned to rely on the Shenzhen-based biotech company MGI Tech Co. Ltd., which will donate its genomic sequencing infrastructure to the project, underscoring the demand and opportunity for private investment to transform disease surveillance in this area.

However, Lab participants noted that the nationwide shortage of expertise and absence of regulatory frameworks contribute to an unfavorable environment for further investment. Private investment and partnerships with the private sector are pivotal to overcoming Indonesia's genomic challenges and facilitating breakthroughs in personalized medicine, disease prevention, and health-care R&D. For example, the Jakarta-based VC firm East Ventures, which projected a significant economic impact of US\$110 billion in Indonesia through genomics, has invested in the genome sequencing companies NalaGenetics (Singapore) and Nusantics (Jakarta).²⁰ Notably, Nusantics, founded in 2019 as Indonesia's first genomics tech start-up specializing in microbiome testing, initially served the beauty industry. However, it pivoted during the onset of the pandemic and developed Indonesia's first local COVID-19 test kit. Nusantics was able to raise US\$703,262 for the production of 100,020 COVID-19 kits and supported a genome sequencing project.

Leveraging the investment community's recognition of Indonesia's potential in genomics could lead to continuous growth in this sector. Government guarantees and PPPs as a safety net could further lower venture capital funds' reluctance to participate in higher-cost, higher-risk sectors like genomics and biotechnology.

More favorable policies and incentives, for instance,

tax deductions or credits, for private capital in biotech start-ups could also help stimulate investment. India and other countries have issued new tax exemptions to promote venture capital and angel investment in their biotechnology industries, including genomics. These investments were initially taxed as income, but exemptions from the so-called "angel tax" have expanded the pool of investors for these companies.²¹ In the policy arena, streamlining the regulatory pathway for genomics technologies could encourage investment by shortening the time and reducing the costs of bringing new products or innovations to market.

Identify Private-Sector Companies with Nontraditional Data Sources to Generate EWS Insights

In Indonesia, a multitude of private-sector companies hold vast and diverse datasets that are invaluable for the early detection of health threats. This rich repository of information, if harnessed effectively, could play an important role in identifying potential health risks at an early stage, thereby enabling timely interventions and strengthening the nation's overall health security.

Nontraditional data residing within the private sector have yet to be fully used to generate early warning insights. A notable example occurred in early 2020 before COVID-19 was known to exist. One of China's largest pharmaceutical and medical equipment distributors, headquartered in Wuhan, detected an unexpected increase in demand for over-the-counter cough and fever medications in the city. In anticipation of a disease outbreak, the company reached out to the Asian Development Bank for a CNY130 million loan for working capital. With timely financial support, the company expanded capacity, secured additional sources, and gained crucial time for faster responses. Beyond health-care supply chain data, other data sources, such as consumer data of pest control chemicals, analysis of human mobility patterns, and social media trends could bolster EWS by providing a broader data spectrum for analysis.

Observing rainfall, temperature, and other weather trends could also provide early indicators of potential outbreaks, particularly vector-borne diseases like malaria or dengue fever prevalent in certain regions. Integrating these relatively lower-cost nontraditional data sources with human and animal health data offers a comprehensive, more nuanced assessment of health risks, enhancing the ability to detect and respond to emerging health threats.



CONCLUSION

In today's interconnected world, we are only as strong as our weakest link. Establishing robust national-level EWS across all countries is foundational to global collaboration on combating new and re-emerging pandemics. Indonesia could offer a compelling blueprint for countries that have already embarked on an early warning system yet are struggling with fragmented systems and obsolete infrastructure. The recommendations from the roundtable would leverage private-sector innovation and investments to address critical gaps in Indonesia, providing a viable pathway for similar countries to enhance their pandemic preparedness and health security.

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PARTICIPANTS

First	Last	Title	Organization
Belinda	Chng	Senior Director, Asia	Milken Institute
Sung Hee	Choe	Managing Director, FasterCures	Milken Institute
Willson	Cuaca	Founding Partner	East Ventures
Yun	Fu	Associate Director, Innovative Finance	Milken Institute
Daichi	Hirose	Partner	SDG Impact Japan Inc.
Martin	Hutagalung	Senior Director, Government Affairs—Asia Pacific & Japan	Illumina, Inc.
Amit	Kakar	Senior Partner and Head of Asia	Novo Holdings
Sun Min Sylvia	Kim	Emerging Markets, Global Philanthropy	UNICEF
Jia Liang	Koh	Intern, Asia	Milken Institute
Esther	Krofah	Executive Vice President, MI Health	Milken Institute
Inge Sanitasia	Kusuma	Indonesia Country Head	Tanoto Foundation
Monica	Latuihamallo	Global Health Security Team Lead	USAID Indonesia
Doddy	Lukito	Co-Founder and Chief Information Officer	Halodoc
Caitlin	MacLean	Senior Director, Innovative Finance	Milken Institute
Natalie Marko	Nietsch	Head of Social Sustainability	Standard Chartered Bank
Monica	Nirmala	Technical Advisor to the Minister of Health	Ministry of Health, Republic of Indonesia

First	Last	Title	Organization
Aniruddha	Patil	Unit Head, Health and Education Investments, Private Sector Operations	Asian Development Bank
Arif	Rachmat	Executive Director	Triputra Group
Michael	Rampangilei	Legacy Lead of One Shot Campaign, Deputy Chairman KADIN for Healthcare Committee of Infectious Disease	ASEAN Business Advisory Council
Helena L.	Rosalin	Executive Assistant to the Minister of Health	Ministry of Health, Republic of Indonesia
Budi Gunadi	Sadikin	Minister of Health	Ministry of Health, Republic of Indonesia
Aryanti	Savitri	Head of Strategic Planning and Partnership	Tanoto Foundation
Raline	Shah	Director	PT. Fajar Agung
Andrew	Shaw	Head of Grants and Programs	FMO
Antony	Subagia	Chief Operations Officer	Asa Ren
Bonanza Perwira	Taihitu	Director for Centre for Global Health and Technology Policy	Ministry of Health, Republic of Indonesia
Ella	Tan	Senior Associate, Asia	Milken Institute
Charles	Zheng	APAC Market Access	Roche Diagnostics Asia, Pacific

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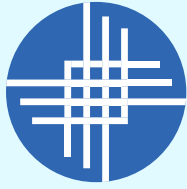
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