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FINANCIAL INNOVATIONS LAB®

Financing Global Early Warning Systems

Country Case Study: Brazil

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 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.

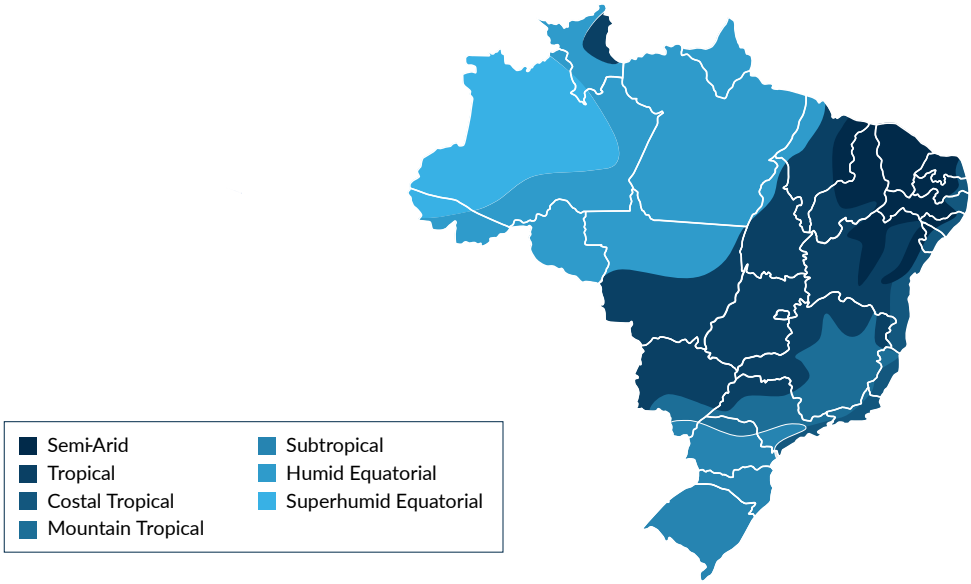
This report summarizes the findings and recommendations from interviews and roundtables in Brazil:

- **Data Sharing: Initiate an Exchange Focused on Data and Insight Collaboration for EWS.** Participants discussed the idea of a Health Information and Insight Exchange that would provide a mechanism for private-sector stakeholders to connect and share data to identify signals of emerging pathogens.
- **Financing: Use Public Capital to Catalyze Private Investment in EWS Infrastructure.** Participants highlighted the significant role of public capital in Brazil. The Lab participants delved into its application across two financing models—public-private partnerships (PPPs) and blended finance—aimed at building both the physical and digital health-care infrastructure and stimulating private-sector investments.
- **Capacity Building: Enhance the Skilled Health-Care Workforce to Operate the EWS.** Participants agreed with the use of private-sector capital to build out labor force capacity via private investment in tech-education and social impact bonds.

COUNTRY BACKGROUND

Brazil, the second most populous country in the Americas with over 200 million people, faces significant challenges posed by frequent epidemics. Dense urban centers (where nearly 90 percent of the population lives), a landmass that spans the Amazon rainforest and shares borders with 10 countries, and a tropical climate all create conditions for vector-borne diseases and the rapid spread of outbreaks.[2]

Figure 1: Climates of Brazil



Source: Milken Institute (2024), based on Brasil em Mapas (2020)[3]

During COVID-19, Brazil recorded the second-highest global mortality rate, with ripple effects extending to the economy.[4] Unemployment surged to over 13 percent, and economic growth contracted by more than 3 percent in the first year of the pandemic. The services sector, which accounts for 63 percent of GDP and 68 percent of the workforce, contracted by 8 percent. Prior to that, Brazil contended with the yellow fever outbreak (2016–2019) and the Zika virus (2015-2016).

Most recently, 2024 saw a severe dengue outbreak, forcing major cities, including Rio de Janeiro and São Paulo, to declare health emergencies. The health minister warned that El Niño, record heat, and above-average rainfall were contributing to the proliferation of mosquito-breeding areas.[5] These outbreaks, in addition to persistent challenges, such as HIV/AIDS, tuberculosis, chikungunya, and malaria, put immense pressure on the health-care system, reducing preventive measures and treatments for other diseases and resulting in significant social and economic turmoil.[6]

Climate change, coupled with the country's unique economic structure, increases the risks of future outbreaks of known and unknown diseases. Brazil is the world's largest producer of soy, coffee, and sugar, and second in cotton and

beef.[7] Approximately 20 percent of the Amazon has been deforested (since the 1970s). Such rapid deforestation of the world's largest intact and biodiverse forest, driven by cattle farming and agriculture, poses high risks of vector-borne and zoonotic diseases. Rising temperatures (as seen in 2023's record heat) and extreme weather events exacerbate these risks by increasing the spread of vector-borne diseases.[8]

An early warning system would provide timely and accurate information on emerging health threats, which would allow authorities, private businesses, and the public to take proactive measures to minimize detrimental health, social, and economic consequences. For example, the current national dengue vaccine program would benefit from an EWS by rapidly deploying the limited supply (covering only 10 percent of the child population) toward high-risk areas. It would also incorporate early detection of variants and accelerate research such as São Paulo state's new dengue vaccine clinical trials.

CURRENT LANDSCAPE OF EARLY WARNING SYSTEMS IN BRAZIL

Given the persistent challenges confronted by public- and private-sector stakeholders due to outbreaks, notable initiatives exist in Brazil to develop early warning systems.

During the COVID-19 pandemic, the Adolfo Lutz Institute, a national laboratory based in São Paulo, played a pivotal role as a public-sector EWS. Using government in-kind donations (lab equipment) and private funding, it scaled up data collection and analysis facilities at its flagship São Paulo location, integrating data from various parts of the country, including border areas. A specialized Rapid Response and Strategy Center was set up to orchestrate data aggregation from 645 municipalities in the state, and all 27 state and federal laboratories.[9] Analytical equipment was relocated to the laboratory to facilitate the swift processing of incoming samples and communicate timely response strategies to the authorities. However, following the pandemic, this comprehensive early warning initiative has been reduced greatly.

In 2021, Dasa, a major South American medical diagnostics firm, initiated the Genov project to track COVID-19 variants, supported by Germany's development bank (KfW) and Illumina.[10] Collaborating with local research institutions, Genov sequenced viral genomes to enhance vaccine development and inform public health policies, sharing the information with the public and the Global Initiative on Sharing All Influenza Data (GISAID).

After the pandemic, a public-sector EWS initiative centered on human data, the Early Alert System of Outbreaks with Pandemic Potential (AESOP), was initiated.[11] Launched under the Ministry of Health umbrella, AESOP was led by Brazil's leading institute for health-related science and technology, the Oswaldo Cruz Foundation (Fiocruz), and funded by the Rockefeller Foundation. AESOP, currently still under development, aims to leverage data from primary health-care visits, drug sales, and social media trends to predict disease outbreaks.

There is an emerging focus on vector-borne diseases. Fiocruz, via its laboratory (LATHEMA, a laboratory for dengue, Zika, yellow fever, and other vector-borne pathogens), is testing the use of advanced technologies, such as near-infrared spectroscopy to detect infections in mosquitos before they transmit to humans.[12]

Nontraditional data from wastewater, climate, and geospatial sources are also getting more traction in their potential to provide early warnings. During the pandemic, the Ministry of Health initiated an EWS via a wastewater monitoring network across large cities.[13] It demonstrated a cost-effective alternative to clinical testing-based surveillance. However, it was limited to the few cities that had sewage infrastructure. At an international level, US academic institutions, such as Princeton University and Columbia University, partnered with Brazilian researchers to use meteorological data (temperature and rainfall) and develop a "probabilistic forecast system."[14] This EWS would predict conditions most conducive to the accelerated transmission of mosquito-borne viruses.

The importance of communicating timely insights for public health decision-making as a fundamental element of an EWS is also being explored. Vital

Strategies, a global public health organization, supported the Consortia of City and State Health Departments and the National Front of Mayors (a consortium of mayors from the 400 largest cities) to develop a national risk communication campaign and communication hub during the pandemic.[15]

While these initiatives show promise, there are some notable challenges. Primarily, there is a lack of coordination among ongoing endeavors, which are operating in siloed spaces. Within the private sector and academic institutions, there seems to be a preference to prioritize internal research rather than publishing timely EWS data and insights. Moreover, there is an absence of public-private data sharing, even in crises like the pandemic, although 25 percent of the population uses private health care, accounting for approximately 50 million individuals.

The second challenge has been the lack of infrastructure to support a national EWS. This was notable in the sewage surveillance effort, which only covered cities with the necessary facilities and equipment in place. Finally, Brazil lacks a robust health-care workforce, which impedes the building out of a national EWS.

RECOMMENDATIONS

Given this backdrop, the Milken Institute convened a roundtable in January 2024 in São Paulo to discuss the future of a comprehensive EWS in Brazil. The aim was to craft recommendations for private-sector engagement through partnership and innovative financing models. The event assembled a diverse panel of stakeholders, including health specialists, investors, sustainability experts, foundations, and family offices. The discussion identified pathways for companies and financial investors to build a comprehensive, responsive, and effective EWS that can adapt to Brazil's particular challenges and enhance its overall health security.

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

Recommendation	Models for Mobilizing Private-Sector Engagement
Data Sharing: Initiate an Exchange Focused on Data and Insight Collaboration for EWS	• FioCruz's Early Alert System of Outbreaks with Pandemic Potential • Adolfo Lutz Institute's Rapid Response and Strategy Center
Financing: Use Public Capital to Catalyze Private Investment in EWS Infrastructure	• Bahia state PPP project to build imaging infrastructure in hospitals • Brazil's national development bank BNDES' guarantee fund to facilitate credit access for entrepreneurs and small and midsized companies
Capacity Building: Invest in Building a Skilled Workforce to Operate the EWS	• Health-care start-up Virohan's model to provide online training to health-care workers • Colombia's social impact bonds for vocational training

Source: Milken Institute (2024)

Data Sharing: Initiate an Exchange Focused on Data and Insight Collaboration

Lab participants highlighted the primary challenge faced in the pandemic preparedness and response functions in Brazil—the siloed nature of EWS initiatives conducted by public health agencies, private companies, research institutions, and laboratories. Lab participants likened it to a traditional water infrastructure system with disconnected pipes: Despite data being collected and analyzed by stakeholders across the board, the information and insights generated failed to flow through the networks and reach recipients (authorities, colleagues, private businesses, and the public).

Recently, there have been efforts to connect these "pipes." Noteworthy here is the Adolfo Lutz Institute's Rapid Response Center, which became a vital public-sector network during the pandemic, collecting and facilitating information and insight exchange with other public-sector stakeholders. Genov, a private-sector initiative, united international donors like KfW, health tech firms, and local private labs to pull funding, technology, and data together to track COVID-19 variants. Both initiatives display a collective willingness and readiness to collaborate during emergencies.

Based on these efforts, Lab participants discussed the potential of a more permanent, structured data-sharing and aggregation platform. This collaboration for an EWS is grounded in the concept of a Health Information and Insight Exchange (Exchange) discussed at a Financial Innovations Lab for financing global EWS, which convened in New York City in 2023. The Exchange would serve as a mechanism for private-sector stakeholders to connect and share data to identify signals of emerging pathogens and as a resource that would generate insights for the benefit of the stakeholders and the public.

Participants discussed key elements for future consideration:

1. **Develop Data Standards:** Several participants emphasized standardizing data collection and analysis across diverse sources to ensure comprehensive, seamless, and uninterrupted information flow. A potential solution is to develop interoperability and security standards to facilitate smooth exchanges while safeguarding sensitive personal and business information.
2. **Offer Tailored Incentives:** Participants stressed the need to incentivize the private sector to share data and proposed that the Exchange could offer customized incentives. For instance, it was mentioned that corporate entities and laboratories perceived benefits, such as enhanced brand reputation and an elevated social responsibility profile through media references for supporting pandemic efforts.
3. **Form a Steering Committee:** Discussions included creating an expert committee tasked with setting data-sharing protocols and defining EWS alert criteria. Participants suggested this committee could include representatives from public-sector agencies to ensure that the insight from the Exchange is effectively used to inform its stakeholders and bolster public health response.

The establishment of an Exchange could position Brazil as a regional leader in health security by partnering with international initiatives, such as the WHO Berlin Hub, and by advancing cross-border research via genomic sequencing data contributions to GISAID.

Financing: Use Public Capital to Catalyze Private Investment in EWS Infrastructure

Participants recognized that creating an Exchange alone should not be seen as a panacea for future pandemics. The efficiency and effectiveness of an EWS relies on the quality of the physical and digital infrastructure supporting it, including labs,

equipment, supplies, transportation networks, and information systems. Participants discussed the high costs incurred in traditional data collection for a country as vast as Brazil (the fifth largest landmass in the world). Developing an EWS with traditional data and further integrating nontraditional data would necessitate investing in infrastructure, devices, and technologies. An example of infrastructure limitations was seen during the pandemic when the wastewater surveillance effort could not be rolled out nationwide: Municipality sewage infrastructure coverage in the rest of the country (excluding the southeast region's 96 percent) was below 14 percent.[16]

Fortunately, Brazil has a unique advantage in using public-sector funding effectively to foster social development outcomes. State governments, their respective development banks, and the federal-level development bank BNDES have served as key engines for project developers to access below-market rate capital, vital for projects associated with commercial return risks.

Participants discussed the potential of public-private partnerships to catalyze the development of health-care infrastructure, much needed for an effective EWS. In Brazil, this has been noted in the state of Bahia, which has demonstrated how the public sector can leverage its access to low-cost capital, real estate, and international technical and advisory services to attain tangible private-sector investment in a social outcome. In 2010, the state collaborated with BNDES and the International Finance Corporation (IFC) PPP Advisory services to award a project to a consortium comprised of a Brazilian and French company to build and operate a hospital in one of the most underserved districts for 10 years. It was the first state hospital built in that area for over 20 years.[17]

More recently, with advisory help from the IFC, the State of Bahia awarded an 11.5-year contract to a private-sector consortium to provide imaging services in 12 hospitals. All units would be connected to a single diagnostic center facilitating the flow of information. Both PPPs saw approximately $70 million of private financing put into projects. Public-sector payments to the private-sector partners were contingent on them meeting preset goals for the project.[18]

Blended finance models are another compelling pathway to leverage public sector financing to attract private investment. The key financing in the model is the presence of grants (which have no repayment) and concessional financing (including below-market-rate funds and favorable terms like extended repayment periods). This funding, typically from the public sector and philanthropic organizations, plays a critical role in reducing the cost of capital for project developers and providing a layer of financial cushion for private-sector commercial investors (such as banks, venture capital, and equity investors), which generally seek market-rate returns for perceived and actual project risks.

In an area like EWS infrastructure, which could entail high commercial risks, this model would use public and philanthropic capital as a catalyst to spur greater investment. Brazil is among the top 10 countries in mobilizing private capital through concessional capital, which makes this pathway a viable opportunity. Existing initiatives can be extended to include EWS infrastructure.[19]

For instance, BNDES' Investment Guarantee Fund (FGI), established in response to the tight credit conditions following the 2008 global financial crisis, aimed to improve credit access and reduce borrowing costs for entrepreneurs and small and midsize enterprises (SMEs) by offering loan guarantees. This served as a powerful tool to lower the risk profile of the project, and in the 10 years since the program started, FGI guaranteed loans over BRL7 billion for working capital requirements and to support innovation. The FGI could be extended to start-ups and SMEs involved in EWS activities, such as a laboratory requiring new sequencing equipment or a wastewater treatment plant needing upgrades for sample collection.

Capacity Building: Invest in Building a Skilled Workforce to Operate the EWS

An EWS is only as effective as the workforce that implements and supports it. Participants highlighted the shortage of a skilled labor force, which was evident during the pandemic. A later survey of over 1,600 workers revealed that none of the health-care professionals felt adequately prepared.[20] Participants also emphasized the vast regional disparities, noting that rural and remote areas with the highest health-care needs often experience shortages in human resources, perpetuated by the lack of educational opportunities or medical schools in those areas. Addressing these challenges requires investments to build capacity in a skilled health-care labor force, addressing current shortages, uneven distribution, and burnout issues.

One potential solution to build a health-care workforce is via private-sector investment in online education and training tools. This approach offers a cost-effective means to address the current labor force gap by ensuring health-care workers across the vast landscape receive the latest medical guidelines and maintain desired data quality and standards. An example of successful implementation was seen in India, where Virohan, a health-care education technology start-up, backed by $7 million in venture capital funding, provided vocational training through hybrid classrooms and online training.[21] This model of training and skill upgrades through accessible mediums could serve as a blueprint for developing specialized EWS training programs nationwide. Lab participants felt that private investment firms, currently focused on education and financial services, could extend their expertise and financing to invest in health ed-tech start-ups.

Another way to invest in a health-care labor force could be via social impact bonds (SIBs). These instruments fund social outcomes through private sources of capital with investor returns based on the success of the program. In an SIB, a payer (typically a public-sector agency) that desires the outcome (here, health-care workforce additions) agrees to pay the investors (here, health and vocational training companies) based on predetermined targeted outcomes. This approach was successfully implemented in Colombia, where a workforce SIB targeted three urban centers with two key performance metrics—job placement and retention rates.[22] A similarly structured SIB, focusing on education and training for epidemiologists and technicians, would build the health-care workforce required, while providing income security across the nation, especially for rural and remote areas.

CONCLUSION

There is a clear path to creating an effective EWS and ensuring its long-term sustainability in Brazil. The groundwork for this has been laid over many years with many strong initiatives in place that can support early warning capabilities. What is missing, however, are the “pipes” to connect these disparate initiatives. A private sector-led Exchange has a role to play to help unify the fragmented data landscape and leverage unique financing models in Brazil. Initiatives like these would also have a vital role in informing the EWS efforts for the broader international community. As Brazil assumes the G20 presidency in 2024 and gears up for COP30 in 2025, it is positioned to spearhead international collaborations in sustainable development and health security.

ENDNOTES

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