PUBLIC HEALTH INNOVATIONS FOR COVID-19

FINDING, TRUSTING, AND SCALING INNOVATION

Martina Merten, Susann Roth, and Fazilah Shaik Allaudin

NO. 70

October 2020

ADB SUSTAINABLE DEVELOPMENT
WORKING PAPER SERIES

ADB Sustainable Development Working Paper Series

Public Health Innovations for COVID-19: Finding, Trusting, and Scaling Innovation

Martina Merten, Susann Roth, and
Fazilah Shaik Allaudin

No. 70 | October 2020

Martina Merten is a public health expert and a consultant for the Asian Development Bank (ADB) consultant. Susann Roth is a principal knowledge sharing and services specialist for the Sustainable Development and Climate Change Department, ADB. Fazilah Shaik Allaudin is the senior deputy director of the Planning Division, Ministry of Health, Malaysia.

Creative Commons Attribution 3.0 IGO license (CC BY 3.0 IGO)

© 2020 Asian Development Bank
6 ADB Avenue, Mandaluyong City, 1550 Metro Manila, Philippines
Tel +63 2 8632 4444; Fax +63 2 8636 2444
www.adb.org

Some rights reserved. Published in 2020.

Publication Stock No. WPS200283-2
DOI: <http://dx.doi.org/10.22617/WPS200283-2>

The views expressed in this publication are those of the authors and do not necessarily reflect the views and policies of the Asian Development Bank (ADB) or its Board of Governors or the governments they represent.

ADB does not guarantee the accuracy of the data included in this publication and accepts no responsibility for any consequence of their use. The mention of specific companies or products of manufacturers does not imply that they are endorsed or recommended by ADB in preference to others of a similar nature that are not mentioned.

By making any designation of or reference to a particular territory or geographic area, or by using the term “country” in this document, ADB does not intend to make any judgments as to the legal or other status of any territory or area.

This work is available under the Creative Commons Attribution 3.0 IGO license (CC BY 3.0 IGO) <https://creativecommons.org/licenses/by/3.0/igo/>. By using the content of this publication, you agree to be bound by the terms of this license. For attribution, translations, adaptations, and permissions, please read the provisions and terms of use at <https://www.adb.org/terms-use#openaccess>.

This CC license does not apply to non-ADB copyright materials in this publication. If the material is attributed to another source, please contact the copyright owner or publisher of that source for permission to reproduce it. ADB cannot be held liable for any claims that arise as a result of your use of the material.

Please contact pubsmarketing@adb.org if you have questions or comments with respect to content, or if you wish to obtain copyright permission for your intended use that does not fall within these terms, or for permission to use the ADB logo.

The ADB Sustainable Development Working Paper Series presents data, information, and/or findings from ongoing research and studies to encourage exchange of ideas and elicit comment and feedback about development issues in Asia and the Pacific. Since papers in this series are intended for quick and easy dissemination, the content may or may not be fully edited and may later be modified for final publication.

Corrigenda to ADB publications may be found at <http://www.adb.org/publications/corrigenda>.

Note:
In this publication, “\$” refers to United States dollars.

Printed on recycled paper

CONTENTS

TABLES	iv
ACKNOWLEDGMENTS	v
ABBREVIATIONS	vi
I. INTRODUCTION	1
II. TRENDS IN INNOVATIONS RELATED TO COVID-19 IN THE HEALTH SECTOR	1
A. Innovative Solution Providers and Overall Trends	1
B. Fields of Innovation	2
III. ENABLING FACTORS FOR HEALTH INNOVATIONS RELATED TO COVID-19	11
A. Health Data Quality, Governance, and Ethics	11
B. Regulatory Aspects for Public Health Innovation	12
IV. CONCLUSION	13

TABLES

1	Repositories and Trackers Cataloguing COVID-19-Related Innovations	3
2	Selected Surveillance Innovations	5
3	Selected Testing Innovations	6
4	Selected Risk Stratification Innovations and Information	6
5	Selected Communication Innovations	7
6	Selected Innovations and Information in Clinical Trialing for Treatment and/or Vaccination	8
7	Selected Supply Chain Management Innovations and Information	8
8	Selected Innovations in Hospital Upgrading	9
9	Selected Innovations and Information in Isolation (Use of Drones and Robots)	10
10	Selected Innovations on Research Collaboration	10

ACKNOWLEDGMENTS

The authors would like to thank the following for their review, input, and contributions—Hirman Ismail and Mohamad Anas Putra Mohamed Ismail of the Medical Development Division, MOH, Malaysia; Maheshwara Rao Appanan of the Disease Control Division, MOH, Malaysia; Louise Agersnap, head of innovation, World Health Organization (WHO); Ken Carswell, technical officer, Department of Mental Health and Substance Use, WHO; J.K. Sharma, regulation expert and WHO consultant; Sonalini Khetrpal, health expert, ADB; and Patrick Osewe, chief of Health Sector Group, ADB.

ABBREVIATIONS

ADB	Asian Development Bank
ASEAN	Association of Southeast Asian Nations
COVID-19	coronavirus disease
CURA	Connected Units for Respiratory Ailments
DHIS22	District Health Information Software 2
ICU	intensive care unit
SORMAS	Surveillance, Outbreak, Response Management and Analysis System
WHO	World Health Organization

I. INTRODUCTION

When the coronavirus disease (COVID-19) started to spread, the world was not at all prepared. While some individuals and organizations had great ideas about how to prevent and manage pandemics using innovative approaches, they did not receive much attention. But that has quickly changed.

With more than 23 million COVID-19 cases in 188 countries and regions by late August 2020, and the impact of prolonged lockdowns, creative minds are in high demand in a world seeking solutions to COVID-19 and the complex problems it creates. Innovators are speeding up the development of new technologies, which will have a huge impact on countries, societies, and individuals. Global efforts to face the public health challenge are enormous. In only a few months, innovators have shared countless solutions to the innumerable aspects of the crisis. For example, many digital health approaches aim to improve the COVID-19 response of low-resource health systems. Others aim to fill the gaps in already well-functioning health-care systems in high-income settings. Because the infrastructure of many innovations is relatively simple, they are easy to implement. But users often find it hard to decide which solutions make sense in which context and how to find them.

Myriad innovative solutions must be structured to guide the user through the new world of advances and data management tools. Testing, iterating, improving, implementing, and scaling—but also failing—must be carefully managed and informed by evidence. In the long run, “fit-for-purpose” innovative solutions should be identified for each country’s health care setting. Reliability and trust are preconditions for the sustainable implementation and further growth of public health innovations. Misinformation must be avoided. Regulatory barriers need to be overcome.

We need innovative tools and skills to mobilize society and government during this crucial time and beyond. We need to improve the curation of relevant innovations and knowledge, and overcome fragmentation of platform and sources. Based on the preliminary work done for this issue, a brief “living” platform needs to be created to share knowledge, exchange experiences, search for solutions, mobilize financing, and connect demand and supply.

Because one thing is for sure: another public health crisis will come.

II. TRENDS IN INNOVATIONS RELATED TO COVID-19 IN THE HEALTH SECTOR

A. Innovative Solution Providers and Overall Trends

Over the past months, numerous companies big and small, organizations, and academic institutions have come up with innovative solutions to manage the COVID-19 crisis.

In the first weeks of the pandemic, innovators’ focus was on tools for surveillance, supply chain management, and clinical trialing, and then gradually on solutions for diagnosing patients and efforts to develop a vaccine. Over time, innovators have started looking for ways to ensure that they communicate properly with the public.

Research collaboration platforms on COVID-19 were steadily established and more complex fields such as isolation of patients, hospital upgrading innovations, and risk stratification tools were developed and made public.

To guide health experts and laypersons through the growing number of solutions for COVID-19, the World Health Organization (WHO), the European Union, the World Economic Forum, development partner organizations, as well as smaller start-ups and academic institutions have established various overview platforms to ease finding and vetting solutions, often even supported by industry. Here are a few of the platforms:

- The inventory of digital health solutions for COVID-19 consists of about 150 solutions. The Global Coronavirus Innovation Map, launched by StartupBlink and the Joint United Nations Programme on HIV/AIDS [Health Innovation Exchange](#), geographically visualizes the global database of diagnostics, treatment, and lifestyle changes, among others.
- WHO established the COVID-19 Initiative in the [Digital Health Atlas](#) to help coordinate and scale effective digital health efforts and to serve as a hub of information about software planned and deployed in response to the pandemic.
- Duke University created [Innovations in Healthcare](#), which highlights promising innovations from diverse global organizations, including corporations and foundations committed to strengthening and increasing the scale of health-care innovations.
- The Milken Institute built the [Treatment and Vaccine Tracker](#), which lists treatments and vaccines in development.
- The MAera platform ([Malaysian Alliance for Embedding Rapid Reviews in Health Systems Decision Making](#)) promotes the utilization of rapid review outcomes in health system decision making. Its COVID-19 Health Systems Response to the COVID-19 pandemic Dashboard chronicles the action Malaysia's government has taken in response to the spread of the virus. The platform was initiated by the Alliance for Health Policy and Systems Research—an international partnership hosted by WHO—which had put up a call for the establishment of such a platform. The Institute for Health Systems Research at the Ministry of Health Malaysia won the bid.
- [The COVID-19 Health Funding Tracker](#), sponsored by Wellcome Trust, synthesizes global funding efforts in near real-time, from pledge to disbursement. The tracker brings together data from governments, multilateral agencies, and funders such as the Bill & Melinda Gates Foundation and the Chan Zuckerberg Initiative, and provides an overview of who is funding which aspect of the health response, from treatments to tests.

Many of the small-scale innovations originate in countries in Asia (e.g., Bangladesh, India) or in Africa (e.g., Nigeria). The three cities leading COVID-19 innovation, however, are in the United States (US): [Boston Area, New York, and San Francisco](#).

B. Fields of Innovation

Since the pandemic started to unfold, some categories of health-related innovations—including digital and other solutions—have emerged. Digital solutions are prominent: surveillance tools, testing (diagnosis) solutions, treatment innovations, and communication aids. Other innovative solutions target hospital upgrading, isolation mechanisms, supply chain management, and research collaboration.

Table 1: Repositories and Trackers Cataloguing COVID-19-Related Innovations

Repository and/or Tracker Name	Description
Data Collaboratives in Response to COVID-19	Living online repository, which is part of a call for action to build a responsible infrastructure for data-driven pandemic response.
Coalition for Epidemic Preparedness Innovations	A global alliance financing and coordinating the development of vaccines against emerging infectious diseases.
Coronavirus Tech Handbook for Doctors	
coronavirus-openkit.net	Open-source equipment for health.
COVID-19 Health System Response Monitor	Joint undertaking of the World Health Organization's Regional Office for Europe, the European Commission, and the European Observatory on Health Systems and Policies.
COVID-19 Open Innovation Index	Open data projects and open-source hardware that seek to address COVID-19.
COVID-19 Health Funding Tracker	The <i>COVID-19 Health Funding Tracker</i> , sponsored by Wellcome, synthesizes global, health-related funding efforts, from pledge to disbursement.
Duke University, Innovations in Healthcare:	The project highlights the efforts of network innovators to prepare and respond to the pandemic.
European Centre for Disease Prevention and Control	Distribution of worldwide COVID-19 cases.
European mHealth Hub	Solutions for managing the COVID-19 outbreak.
EuroMOMO	A mortality monitoring activity that aims to detect and measure excess deaths related to seasonal influenza, pandemics, and other public health threats in Europe.
Flourish	A map of countries with the most COVID-19 cases over time.
Global Digital Health Network	A coronavirus innovation spreadsheet.
Global Innovation Exchange	Funded by the United States Agency for International Development (USAID) and others. COVID-19 Innovation Hub – innovations identified for their COVID-19 efforts.
Health Intervention Tracking for COVID-19	A living global database (Johns Hopkins University, Boston University, United States).
Health Innovation Exchange	Founded by United Nations Programme on HIV/AIDS. Identifies challenges faced by public health actors and connects them with innovations that have high potential for impact.
MAera platform	Malaysian Alliance for Embedding Rapid Reviews in Health Systems Decision Making.
mHealth solutions for managing the outbreak	Focused on Europe, European Union-funded.
Milken Institute	COVID-19 Treatment and Vaccine Tracker
Massachusetts Institute of Technology	COVID-19 Rapid Innovation Dashboard
Organisation for Economic Co-operation and Development (OECD).	Key country policy tracker.
OECD Observatory for Public Sector Innovation	COVID-19 Innovative Response Tracker.
Integrated Health Information Systems (Singapore)	Creative health-care solutions around COVID-19.
StartUp Health	COVID-19 Navigator.
StartupBlink	Coronavirus Innovation Map.
Trello	Collective intelligence projects (COVID-19 sub-board).

continued on next page

Table 1: *continued*

Repository and/or Tracker Name	Description
United Nations Innovation Network Update	COVID-19 Special Edition.
World Health Organization	Clearinghouse for COVID-19 response. Digital & Innovations for Health Community: Fight COVID-19. Digital Health Atlas—COVID-19 Initiative.
World Economic Forum	COVID Action Platform.

COVID-19 = coronavirus disease.

Source: Authors.

More global health efforts are doubtless needed, e.g., in measures to create work and life spaces and transport systems that are safe, and in hospital upgrading and refurbishment. And many issues in supply chain management have not been solved and need more innovation efforts.¹¹

Surveillance

It comes as no surprise that many innovative solutions have emerged in surveillance, testing and diagnosis, and communication since all three are crucial for handling an early outbreak. The District Health Information Software 2 (DHIS2) COVID-19 [surveillance tracker](#) is well known. New, innovative, and practical digital data packages developed by the [Health Information Systems Program](#) at Norway's University of Oslo accelerate case detection and automate situation reporting, active surveillance, and response. The packages are optimized for Android data collection with the DHIS2 capture app and can be downloaded from the Google Play Store. The four packages involve clinical examination, laboratory testing, and outcome; port-of-entry screening and community follow-up; contact tracing; and outbreak line listing.

Another promising tool was created by Germany's Helmholtz Center for Infection Research, and the country's largest public health institute, the Robert Koch Institute. They designed an information technology (IT) system to help control the Ebola outbreak in 2014—[SORMAS](#) (Surveillance, Outbreak, Response Management and Analysis System). The system runs a mobile phone app that forwards information about infected people and their contacts to health authorities. SORMAS helps detect individual cases of COVID-19 at an early stage and contact-traces outbreak clusters even in remote regions and countries with weak infrastructure. The system documents clinical details and laboratory confirmations and offers guidance on early therapy if patients fall ill. It generates data in real-time for ongoing national and international risk assessment and targeted interventions.

India's National Informatic Centre, Ministry of Electronics and Information Technology developed [Aarogya Setu](#), a COVID-19 surveillance app. It tells users the risk of getting COVID-19 by scanning a database of known cases across India, helps the user self-identify COVID-19 symptoms and risk profile, gives local and national COVID-19 updates, and allows e-pass integration. Aarogya Setu has become the world's fastest-growing mobile app, with more than 50 million installs despite privacy concerns.

¹¹ The order of categories presented in the paper does not follow a specific scheme. However, more innovative solutions could be found around "surveillance, testing and diagnosing, risk assessment and communication" than around "clinical trialing and vaccination, supply chain management, hospital upgrading and research collaboration." The paper tries to represent a mix of innovative COVID-19-related solutions from all over the world, not limited to developing member countries, realizing that some countries have been more active in developing ideas than others.

Table 2: Selected Surveillance Innovations

Surveillance Innovation	Description
DrDoctor COVID-19 response toolkit	Broadcasts information to up to 10,000 patients about their care. Patients can either be added to the list or automatically enrolled if they meet certain COVID-19 symptoms criteria.
BroadReach	Ensures that facilities can manage COVID-19 patients by sending out facility readiness surveys to facility managers via an app.
District Health Information Software 2 (DHIS2)	A digital data package that accelerates COVID-19 case detection and automates situation reporting, active surveillance, and response.
SORMAS (Surveillance, Outbreak, Response Management and Analysis System)	For disease prevention, disease detection, and outbreak response.
Aarogya Setu	An app that uses contact tracing to record details of people the user may have encountered.
Pacitan	Dashboard that monitors the spread of COVID-19 in Pacitan District, East Java Province, Indonesia. It also displays data on people at risk of infection, infected people in medical care, and visitors from outside the district.

COVID-19 = coronavirus disease.

Source: Authors.

WHO created a highly useful [Annex](#), which discusses COVID-19 contact tracing, provides information on digital tools and their use for COVID-19 contact tracing, and lists opportunities and challenges for integrating digital tools for that purpose. Another WHO [guide](#) discusses ethical considerations related to the use of digital proximity tracking technologies for COVID-19 contact tracing, including data privacy concerns.

Testing and Diagnosing

Testing and diagnosis innovations are important at every stage of any pandemic. Many diagnostic service providers, including Unilabs, established drive-through testing centers at the beginning of the COVID-19 outbreak. Some countries are discussing a digital COVID-19 health certificate (coronavirus immunity pass). Digital Health Germany, for example, has come up with IT infrastructure that anchors the COVID-19 status and other relevant data of a tested person in a blockchain, which makes the data accessible to the health-care system, the patient, and businesses at any time and across supported applications.

Because of insufficient evidence on the effectiveness of antibody-mediated immunity to guarantee the accuracy of immunity passes or risk-free certificates, WHO published a [scientific brief](#) underlining that testing innovations should continue.

Risk Assessment

Closely related to testing innovations are the means to provide information on COVID-19 risks and risk assessment. Worth highlighting is a tool created by ThinkMD, founded by physicians from the University of Vermont Larner College of Medicine in the US. The tool guides users through a COVID-19 self-risk assessment, which is based on the latest published peer-reviewed WHO and US Centers for Disease Control and Prevention clinical data on presenting signs, symptoms, and risk factors. [MySejahtera](#) proves that in some countries—in this case, Malaysia—the government leads in providing highly innovative solutions to efficiently resolve the COVID-19 crisis. The app, developed by the National Security Council, the Malaysian Administrative Modernisation and Management Planning Unit, and the Ministry of Health, enables users to assess their and their dependents' health.

Table 3: Selected Testing Innovations

Testing Innovation	Description
Unilabs	Drive-through testing centers.
COVID-ID	Immunity pass.
Digital corona health certificate	A system in which the corona status of a tested person is anchored in a block chain and can thus be used digitally at any time by all parties - healthcare, patients, business.
Systemone	Aspect software platform: A platform to communicate health care data in low-resource settings. Every diagnostic device testing for coronavirus disease (COVID-19) in a country can be connected via cellular data network using smart 2G and 3G routers for rapid and secure data transmission.

Source: Authors.

Table 4: Selected Risk Stratification Innovations and Information

Innovation and Information	Description
Wellthy Therapeutics	A COVID-19 screening, education, and disease monitoring tool for chronic disease management.
ThinkMD	A COVID-19 screening and educational tool that guides users through a self-risk assessment, based on the latest published peer-reviewed WHO and US Centers for Disease Control and Prevention clinical data on presenting signs, symptoms, and risk factors.
European Centre for Disease Prevention and Control	Provides information on COVID-19 risk assessment.
MySejahtera	A COVID-19 risk assessment app developed by the Government of Malaysia under the Prevention and Control of Infectious Diseases Act 1988 (Act 342). The app helps users assess their risk of COVID-19 infection, monitors their health, and enables the Ministry of Health to immediately provide treatment to those in need.

COVID-19 = coronavirus disease, US = United States, WHO = World Health Organization.

Source: Authors.

The app obtains information for early detection and intervention through its hotspot tracker, which lets users check for confirmed COVID-19 cases near their current location and search particular areas on demand. As of early August 2020, the mandatory app had more than 11 million users and nearly 467,000 businesses registered.

Communication

Communication is key to quickly teach people how to protect themselves. It is key to manage fear, mental stress, discomfort, and the spread of false information. Small and medium-sized enterprises have started to use innovative approaches to help patients and experts by providing means of communicating about the disease. WHO has developed [tools](#) to fight misinformation and provides multimedia support, including [audio guides](#), to help people cope with mental health issues related to COVID-19.

These are some of the innovations:

- To fight myths and misinformation that emerge on social media and other sources, and to provide accurate, tailored information, WHO established the [Information Network for Epidemics \(EPI-WIN\)](#)

Table 5: Selected Communication Innovations

Communication Innovation	Description
Wellthy Therapeutics	Provision of social distancing guides for high-risk populations.
The Conversation	Public awareness campaign using cartoons.
WHO EPI-WIN	A risk communication platform that provides resources and updates on the outbreak, targeting five groups.
WHO Chatbot	A tool for providing information and fighting misinformation.
WHO audio guide	Helps manage stress.
WHO multimedia	Helps children and young people cope with COVID-19.
Granicus	Tools to keep the community informed about COVID-19.
MayaMD	A digital health assistant app that helps people find solutions to their COVID-19-related problems. See also https://www.maya.com.bd/about
FactCheck. Guide to COVID-19 coverage.	
The Commonwealth Fund	Tools to lessen the isolation of the elderly.
The COVID-19 Chronicles	Prepared by the Yong Loo School of Medicine, National University of Singapore. Series of educational illustrations, supporting the behavior change communication campaign in Singapore.

COVID-19 = coronavirus disease, WHO = World Health Organization.

Source: Authors.

as part of its Health Emergency Programme's risk communication efforts. It provides resources and updates on the epidemic for five major target groups: employers and workers; the health sector; the travel and tourism sector; individuals, communities, and cities; and local governments.

- The [WHO Chatbot](#) provides information and fights misinformation, powered by Facebook Messenger.
- Various enterprises established digital health assistant apps that help people find solutions to their COVID-19 health issues, e.g., the Bangladesh health technology [company Mayalogy](#).
- Wellthy Therapeutics in India informs high-risk populations about disease management and provides a [social distancing guide for high-risk populations](#).

Clinical Trialing and Vaccination

COVID-19 research and development are progressing quickly. The world has never seen such rapid vaccine research and development by scientists, physicians, funders, and manufacturers working together. Besides these global efforts, numerous worldwide clinical trials of potential COVID-19 treatments and interventions are ongoing.

An innovative approach to get a geographical overview of planned, ongoing, and completed clinical trials is the [Map of Hope](#), created by Germany's Heidelberg Institute of Geoinformation Technology. Another overview—limited to registered clinical trials of potential COVID-19 treatments and interventions worldwide—is provided by the European Clinical Research Infrastructure Network.

WHO and its partners recently launched the [Solidarity clinical trial](#), to compare four treatment options against standard of care to assess their relative effectiveness against COVID-19.

Supply Chain Management

Ensuring a proper supply chain for COVID-19 has proven to be demanding. Small contingents, supply shocks, logistics constraints because of lockdowns, and unsafe work environments are among the most pressing challenges for companies worldwide, even more in the field of health care. Innovative solutions have been established to analyze the supply chains to improve management decisions, e.g., by Germany's CamelotITLab. The company's [COVID-19 impact analyzer for supply chain management](#) offers free-of-charge solutions to better analyze the impact of the COVID-19 crisis on the supply chain. The analyzer quickly gives fact-based insights on supply and demand based on the product and/or country, before and after the first COVID-19 outbreak. The results can help build further supply chain scenarios and help companies respond to daily changing situations.

It is worth mentioning that international organizations such as WHO started early on to provide advice on the pandemic. It issued a guide on how to [rationally use personal protective equipment](#), offering information on how to minimize the need for it and optimizing its availability. WHO also developed a [suite of surge calculators](#) to gauge the need for supplies and equipment and health workforce requirements.

Table 6: Selected Innovations and Information in Clinical Trialing for Treatment and/or Vaccination

Innovation and Information	Description
Solidarity	An international effort to find a treatment for COVID-19, launched by WHO and its partners. Compares four treatment options against standard of care to assess their relative effectiveness against COVID-19.
European Clinical Research Infrastructure Network	An overview of registered clinical trials of potential COVID-19 treatments and interventions worldwide.
Map of Hope	Geographical overview of planned, ongoing, and completed clinical trials, provided by the Heidelberg Institute of Geoinformation Technology, Germany.
Coalition for Epidemic Preparedness Innovations	A product development partnership funded by Australia, Canada, Germany, Japan, Norway, the Bill & Melinda Gates Foundation, and the Wellcome Trust, among others.
WHO	Launched a coordinated effort to develop a vaccine against COVID-19.
International Clinical Trials Registry Platform	Aims to provide a single point of access to information about ongoing and completed clinical trials.

COVID-19 = coronavirus disease, WHO = World Health Organization.

Source: Authors.

Table 7: Selected Supply Chain Management Innovations and Information

Innovation	Description
Celonis	App for managing cash preservation and supply chain exposure.
WHO guide	Rational use of personal protective equipment.
WHO COVID-19 essential supplies forecasting	Tool to help governments, partners, and other stakeholders estimate requirements for essential supplies to respond to the pandemic.
COVID-19 impact analyzer	For supply chain management. Provides a free-of-charge solution to better analyze the impact of the pandemic on supply chains.
Scoutbee	Rapidly searches for emergency suppliers of critical and scarce items such as surgical masks, protective suits, cotton swabs, and more. Supports nongovernment organizations, public bodies, local and national governments, and health-care providers with urgent pharmaceutical or medical sourcing needs.

COVID-19 = coronavirus disease, WHO = World Health Organization.

Source: Authors.

Table 8: Selected Innovations in Hospital Upgrading

Innovation	Description
Connected Units for Respiratory Ailments (CURA)	Open-source design for emergency coronavirus disease (COVID-19) hospitals, using repurposed shipping containers to create plug-in intensive care units with biocontainment through negative pressure. See also http://www.constructionplusasia.com/id/cura-hospital-could-help-tackle-covid-19/
Helmet-Based Ventilation.	Manufactures helmets for noninvasive ventilation for patients with respiratory distress as a complication of COVID-19.

Source: Authors.

Hospital Upgrading

Innovatively upgrading and refurbishing a hospital or designing a new one under time pressure is one of the most challenging tasks, especially in low-resource settings where funds are limited and supply chains severely affected by lockdowns. Increasing the capacity of intensive care units (ICUs) to manage the growing number of COVID-19 patients suffering from severe symptoms remains a global challenge.

A project that has attracted a lot of international attention is the design of Connected Units for Respiratory Ailments ([CURA](#)). Following the efforts of an international task force (including the designer Carlo Ratti Associati with Italo Rota, engineers at Jacobs, and health technology company Philips for medical equipment supply), the first prototype was financially supported by the Pan European bank UniCredit and used in Turin, Italy.

What is special about CURA?

Each CURA unit is hosted in a 20-foot intermodal container, repurposed with biocontainment equipment. An extractor creates indoor negative pressure, complying with the standards of airborne infection isolation rooms. Two glass windows on opposite sides of the containers give doctors a sense of the status of patients inside and outside the pods. Each pod is autonomous and can be promptly shipped to any location in the world and adapted to the needs of the local health-care infrastructure.

CURA is open-source, with its technical specifications, drawings, and design materials accessible at <https://curapods.org/open-source-files>.

A program that could be easily implemented in other countries to upgrade hospitals' operational efficiency is Malaysia's Crisis Preparedness and Response Centre Medical Programme. An online reporting tool to monitor hospital preparedness for the pandemic, it leverages the already existing blood bank information system cloud framework and platform of the Ministry of Health to support data collection. Before the system was used in the early days of the pandemic, daily bed use in Malaysia's hospitals was monitored manually, which posed risks of unreliable data and inefficient data transmission. Now the online reporting tool serves as a centralized data collection platform and can output an easy-to-use interactive dashboard. The system can produce daily data and analyses on the use of COVID-19 and ICU beds and of ventilators. With the tool, the Ministry of Health can decide much more quickly what is necessary in times of crisis.

Isolation

To isolate COVID-19 patients, various countries have been using drones and robots. Both can have integrated cameras to monitor medical care. They can also have sensors to check a patient's temperature and heart or breathing rate from a distance. Drones and robots can be used to support social distance mechanisms in delivering food or distributing medicine to patients. Both can help disinfect items or areas

that are difficult to reach. Robots can be used for collecting medical waste for disposal in the COVID-19 isolation wards. Innovators come up with a long list of useful interventions, for sure there's more to come.

[Projects](#) were initiated by, among others, the European Commission to analyze funding opportunities to support the use of artificial intelligence (AI) robotics in COVID-19 solutions and initiatives.

Research Collaboration

An innovative approach to boost research coalitions on COVID-19 in low-resource settings is the joint effort of the Drugs for Neglected Diseases Initiative, the Mahidol Oxford Tropical Medicine Research Unit, and the Infectious Diseases Data Observatory. The [COVID-19 Clinical Research Coalition](#) brings together individuals and institutions working to fast-track research on COVID-19 prevention, diagnosis, and case management in low-resource settings.

Another important tool is the [COVID-19 International Research Collaboration](#), a dedicated zone on the Researcher platform, providing the latest science on COVID-19, divided into COVID-19-related fields such as vaccination, drugs, treatment, and others.

WHO's [COVID-19 technology access pool](#) invites those with knowledge, intellectual property, and data to share them to promote international solidarity and global health security.

Table 9: Selected Innovations and Information in Isolation (Use of Drones and Robots)

Innovation and Information	Description
Indian Robo Store	A drone start-up providing thermal detection headgear to scan body temperature and sanitize areas. See also https://yourstory.com/2020/05/drone-startup-indian-robotics-solution-coronavirus-thermal-headgear
Indian Institute of Technology Guwahati	Develops products for isolation, and works on research initiatives, among others, regarding the use of robots.
Digital Innovation Hubs in Health Care Robotics	The Horizon 2020-funded project has issued an emergency call for late-stage robotics technologies and solutions that can be deployed quickly to help health-care professionals meet clinical needs.
American Psychological Association	Offers behavioral health support for patients and conducts virtual town halls to tackle anxiety, depression, and other mental health challenges of those in quarantine centers.

Source: Authors.

Table 10: Selected Innovations on Research Collaboration

Innovation	Description
COVID-19 Clinical Research Coalition	Aims to accelerate COVID-19 research in those areas where the virus could wreak havoc on already-fragile health systems and cause the greatest health impact on vulnerable populations.
COVID-19 International Research Collaboration	Gathers studies on its Researcher platform.
Emblem Technology Transfer, European Bioinformatics Institute.	With collaborators, started developing the European COVID-19 data platform, improving and accelerating the exchange of data among researchers globally. See also https://www.ebi.ac.uk/covid-19

COVID-19 = coronavirus disease.

Source: Authors.

III. ENABLING FACTORS FOR HEALTH INNOVATIONS RELATED TO COVID-19

There is no shortage of innovative solutions. The immediate need is the greater use of digital health tools, robotics, AI, and approaches to nudge behavior change, and the willingness to cooperate on research and evaluation. It is crucial to further leverage public and private sector agility and collaboration in public health innovation. This requires testing, iterating, and scaling innovations, underpinned by evidence-based experimentation, agile funding and regulation, health data governance, and public health research ethics. COVID-19 has shown that rapid public health innovation is possible if leaders clearly recognize the challenge, are open for collaboration with relevant industry leaders and other private sector players, if budgets are flexible, and if governments and societies can come together in one marketplace to innovate for a common goal. In Malaysia, the combination of society participation and flexible funding contributed to successful public health innovations to address the COVID-19 challenges.

A. Health Data Quality, Governance, and Ethics

Health data quality and governance, including data ownership, stewardship, and security concerns, highlight the need to define what parts of digital health are public goods.

At the center of digital health stands the health data used for digital health systems and generated by and extracted from the systems. The health data must be considered assets shared by all stakeholders, be they patients or care providers, to fully benefit from digital health. Otherwise, the sustainability, quality, reliability, efficiency, and effectiveness of digital health solutions and patient safety could be jeopardized.

The way data have been used to manage the pandemic has shown that a gray area exists between what is good for the individual and what is good for the population. These questions need to be asked:

- Who has the right to use or control the data?
- How can good data stewardship be fostered?
- How can data solidarity be encouraged and developed?
- Who is responsible for health data privacy and security?

Data ethics principles are needed to enable health data governance nationally, regionally, and globally, which requires recognizing and regulating digital health public goods.

The use of digital proximity tracking technologies to deal with COVID-19 should be ethical. Of utmost importance is that an individual's decision to download and use an application for public health surveillance or digital proximity tracking is voluntary and informed, and not government-imposed. Everybody should be properly informed about why data are being collected. And it is important that digital tracking be time-bound, i.e., it should continue only for as long as necessary to resolve a specific outbreak situation.

This pandemic is an opportunity to build these shared digital health assets and provide guidance on how to build sustainable digital public health solutions. The best-case scenario is where decision makers

in low- and middle-income countries can agree on standardized health data governance and ethics to clearly identify and provide critical information to everybody. Perhaps this should be discussed in the review of WHO's International Health Regulations.

B. Regulatory Aspects for Public Health Innovation

Many of the medical devices, often innovative and new, that have been used to diagnose, prevent, and treat COVID-19 patients—diagnostic tests, ventilators, or personal protective equipment—have not always been available in all countries. The reasons include a combination of slow regulatory authorization, lack of funding, and fragile supply chains. For example, even though most Association of Southeast Asian Nations (ASEAN) members have come a long way in harmonizing their regulatory frameworks for importing medical devices and medicines by complying with the ASEAN Medical Device Directive, the laws of the 10 ASEAN members are not yet fully in line to ensure standards and coordination on licensing requirements, approvals, complaint channels, and fines for noncompliance. Differences in technical capabilities and institutional capacity in some countries, combined with slow alignment efforts of international institutions, have hampered full harmonization. Most countries do not have harmonized protocols for regulating diagnostic test devices or common principles for safety and effectiveness. Registering the same diagnostic kit across countries is arduous and lengthy. The result was that, when prompt availability of tests was crucial to save lives and shorten lockdowns, regulation became a stumbling block.

Harmonized protocols for rapid regulation of innovative products for public health emergencies in all product categories are needed to avoid product rejection and shortages. International regulators must join forces to work toward harmonization of regulatory affairs, as well as on capacity development of weaker regulatory agencies.

IV. CONCLUSION

The COVID-19 pandemic has shown that collaboration and coordination for innovation in public health is more important than ever. Before COVID-19, innovation in health focused mainly on diagnostics, treatment, and care and not so much on prevention, risk-based public health interventions, communication, and disease surveillance. Ministries of health did not have large and flexible budget lines to experiment with innovative approaches, and private sector players, such as health technology industry leaders, were not overly interested in public health. This has changed due to one of the world's most severe pandemics.

Now is the right moment to create a *living platform for public health innovations*. The numerous innovations from all over the world presented in *this paper* can serve as the starting point for this future platform—a platform which should be regularly expanded.

This newly created public health innovation platform and network will be divided into subcategories of problems and challenges and their related innovations, digital and non-digital, by region and country. With its help, stakeholders and policy makers will finally be able to quickly identify challenges, consult with industry leaders to appreciate trends in new solutions, and identify fit-for-purpose innovative solutions in their respective countries' health-care setting. They will no longer be asking which tools might be suitable for solving a specific challenge. They will have quick access to innovative solutions for similar challenges in similar country contexts, learn faster from lessons learned by other countries, understand which solutions failed and which worked, and know what foundations need to be in place in a health system to quickly scale innovative solutions.

The living platform will serve as a space for health ministry policy makers, local governments, public health practitioners, academia, civil society, the private sector, and regulators to collaborate on identifying key problems that require public health innovation. It will help to reach a connected problem-solving process across disciplines and serve as the core of a new, innovation-driven global health partnership between public, private, academic, philanthropic, and civil society actors.

It should be the source of trustworthy information, evidence, and examples for policy makers, technical advisors, and practitioners in our increasingly complex world.

This future public health innovation platform will underline once more what finally got obvious to international health actors through the COVID-19 pandemic: public health innovation is an important public good. It is an investment that will pay off to protect economies and, first and foremost, lives.

Public Health Innovations for COVID-19

Finding, Trusting and Scaling Innovation

The public and private sector, civil society, and academic institutions have developed many innovative solutions to manage public health aspects of the coronavirus disease (COVID-19) pandemic. Innovators have focused on tools for surveillance, supply chain management, clinical trials, diagnosis, communication, and developing vaccines. These have been supplemented by research collaboration platforms, isolation and hospital upgrading novelties, as well as risk stratification resources. This paper provides an overview of these solutions to enhance the evidence-based application of innovative public health approaches. The author's also propose that a “living platform” for sharing public health innovations is developed.

About the Asian Development Bank

ADB is committed to achieving a prosperous, inclusive, resilient, and sustainable Asia and the Pacific, while sustaining its efforts to eradicate extreme poverty. Established in 1966, it is owned by 68 members —49 from the region. Its main instruments for helping its developing member countries are policy dialogue, loans, equity investments, guarantees, grants, and technical assistance.

ASIAN DEVELOPMENT BANK

6 ADB Avenue, Mandaluyong City

1550 Metro Manila, Philippines

www.adb.org