

Innovations in big-data and real-time monitoring for the COVID-19 response

Lessons from Indonesia

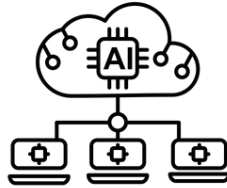
Paul Pronyk, Deputy Director, SDGHI

University of Indonesia: Iwan Ariawan, Pandu Riono, Muhamad N Farid, Hafizah Jusril

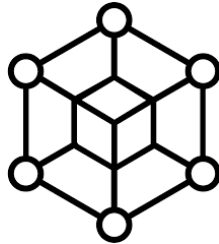
UNICEF: Charlotte Lie-Piang, Suci Wulandari, Anthony Mockler, Bheta Arsyad, Fernando Carrera, Benjamin Grubb, Manual Herranz, Vedran Sekara

Renaissance in Digital Innovations

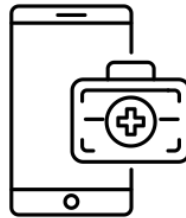
Artificial Intelligence & Big Data



Blockchain
Technology



Remote Sensing &
Satellite Imagery



Mobile Health & Person-centred monitoring

Overview

COVID-19 response in Indonesia

Application of digital innovations to inform policy decisions

- Big-data
- Real-time monitoring

Implications and opportunities to improve health in lower and middle-income contexts



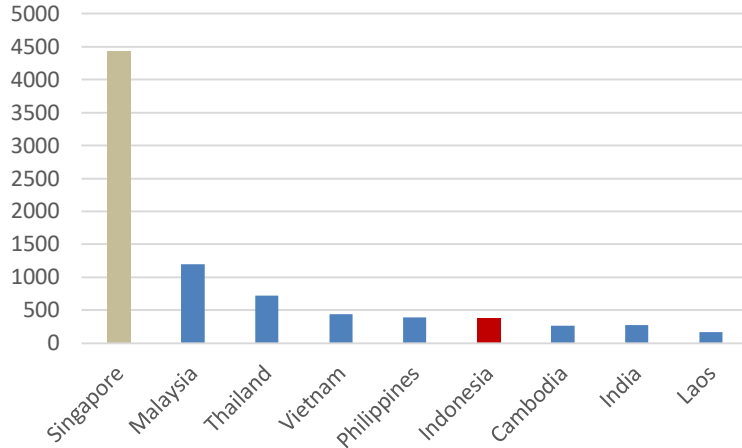
COVID-19 in Indonesia



- **Early arrival**
 - Strong social, cultural, economic ties with China
 - 1.2 million travellers to Bali alone in 2019
 - Travel during initial COVID risk period Dec 1-Jan 31
 - 300,000 travellers from Wuhan alone
- **Late detection**
 - 1 PCR machine in national laboratory – no COVID reagent
 - First case identified March 2
- **Rapid transmission**
 - All 34 provinces within one month

Baseline Vulnerabilities

Low health expenditure across much of Asia *Singapore on par with high income countries*



Source: [WHO, Per capita spending \(PPP\) 2018](#)

Demographic risks

- Large population (~273 M)
- High internal migration
- Rapid urbanization (42% 2000 → 56% 2019); high density
- 1/3 urban households reside in slums

Economic and social risks

- 1/3 households < \$3/day
- Poor hygiene and sanitation
 - 50% population –open defecation communities

Health risks

- Lack of personal protective equipment
- Limited lab and surveillance capacity
- High rates of concurrent disease

Asian success in COVID control?

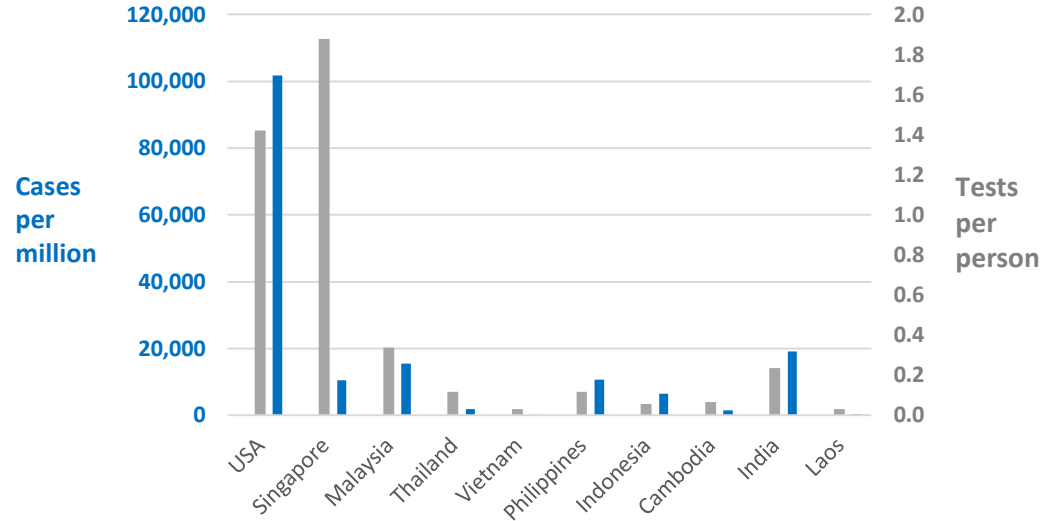


GETTING TO GRIPS WITH . . .

How Southeast Asia's poorest nations successfully suppressed Covid-19

Region has reported low infection and death rates following speedy responses to pandemic

JOE EVANS
8 FEB 2021



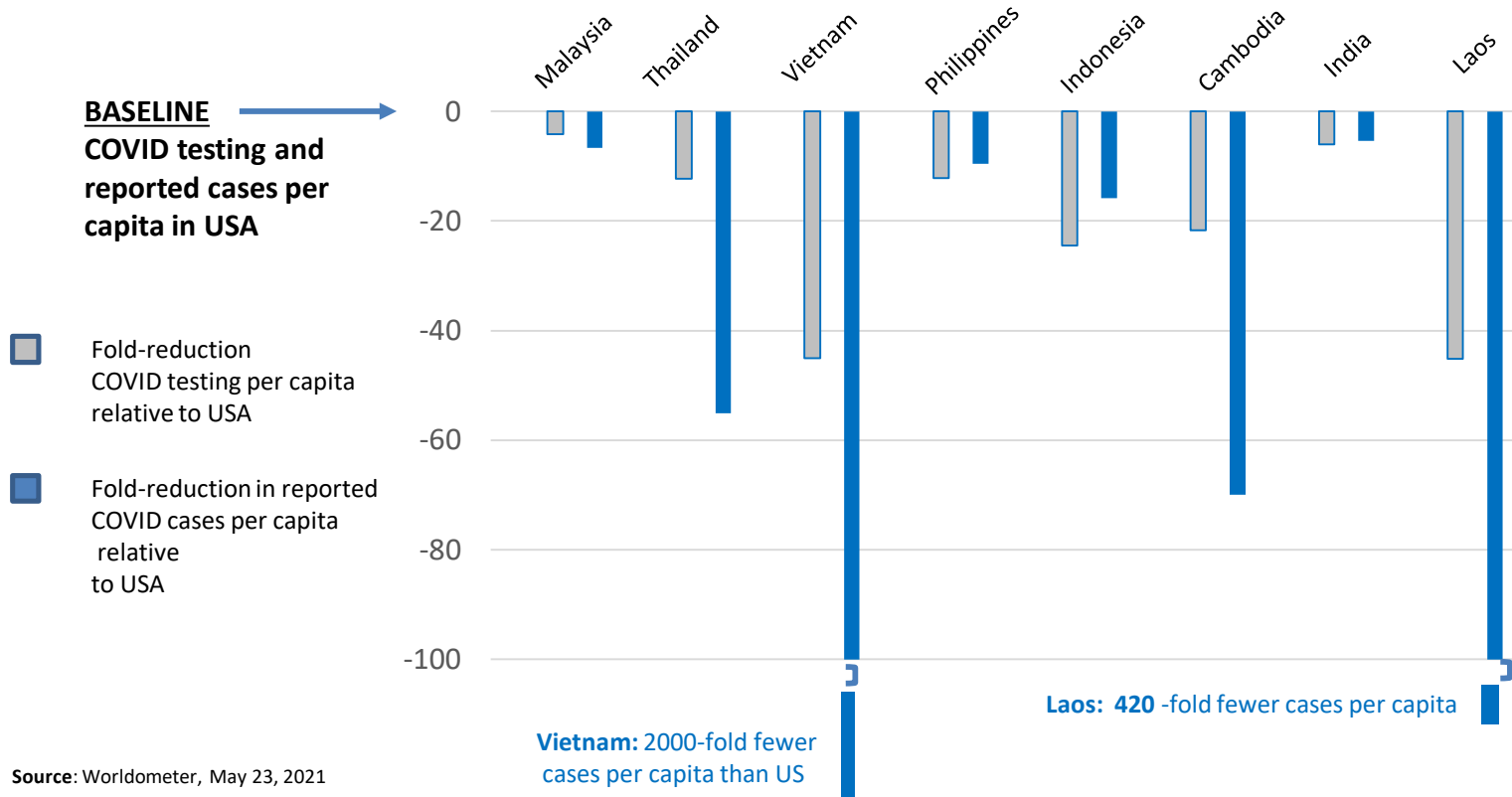
High health spending



Low health spending

Source: Worldometer, May 23, 2021

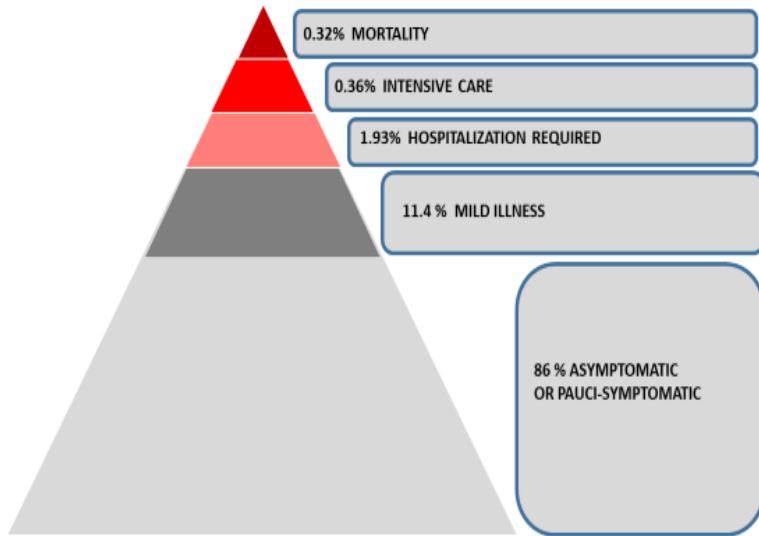
Estimated levels of under-detection



Source: Worldometer, May 23, 2021

Elimination vs Suppression

COVID-19: 86% of infections → few or no symptoms



ELIMINATION

Well-resourced health system

Precision public health approaches

- Screening
- Early detection and isolation
- Contact tracing

SUPPRESSION

Poorly-resourced health system

Test the sickest

Widespread community transmission
Population based strategies essential

Sources: China CDC Weekly, The Epidemiological Characteristics of an Outbreak of 2019 Novel Coronavirus Diseases (COVID-19), Feb 2020
Li R, et al. Substantial undocumented infection facilitates the rapid dissemination of novel coronavirus (SARS-CoV2), Science, March 16, 2020
Pollan et al. Prevalence of SARS-CoV-2 in Spain (ENE-COVID): a nationwide, population-based seroepidemiological study Lancet July 6, 2020

Circuit breakers and adaptive triggering

DAY 0-14

Transmission

Behavioural monitoring absent

LMIC Gaps



? Digital innovations

DAY 7-21

Cases

Low testing
Delayed result reporting

DAY 21-30

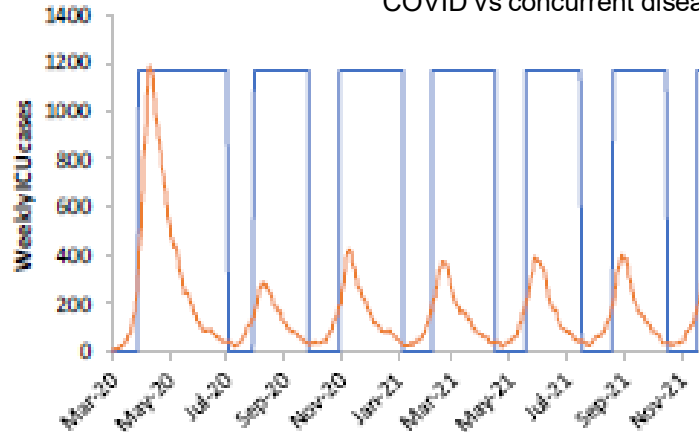
Hospitalization

Poor hospital records
No national database
Delayed reporting
COVID vs concurrent disease

DAY 30+

Deaths

Death reporting systems poorly developed



Source: Ferguson, N., D. Laydon, et al. (2020). Impact of non-pharmaceutical interventions (NPIs) to reduce COVID-19 mortality and healthcare demand. London, Imperial College.

Can digital innovations inform policy decisions?

Greater Jakarta
30 million population

PHYSICAL DISTANCING



STAY-AT-HOME

BEHAVIOURAL INTERVENTIONS



MASK
USE

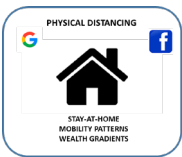


1 m

SAFE
DISTANCE



HAND
WASHING



Big-data and physical distancing

Big Data

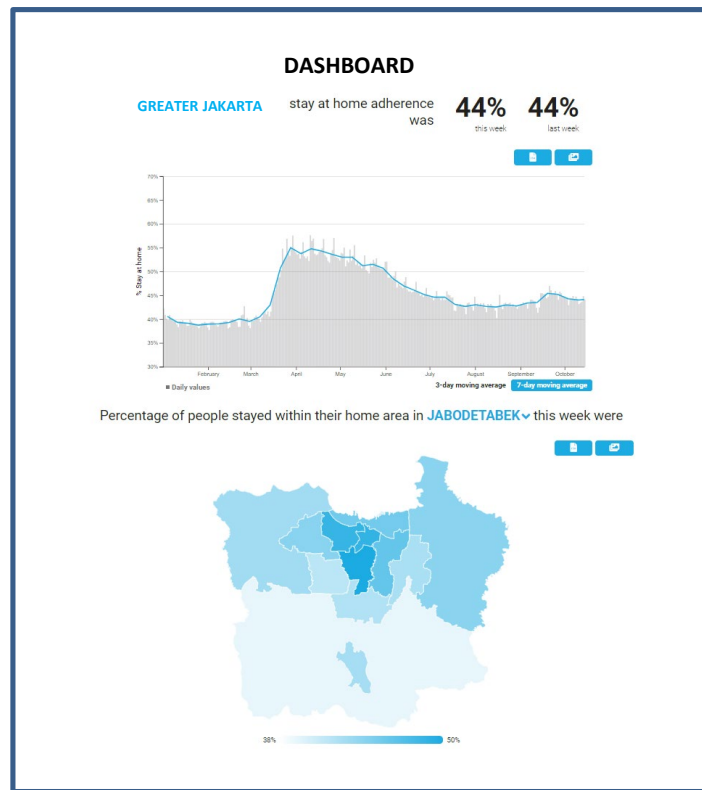
- Cuebiq – Android phone
- Facebook – 140 million users in Indonesia
- Anonymized/aggregated, updated daily
- Visualize down to village level
- Accurate to 50m
- **Stay-at-home** = day location vs night location

Policy introduction

- Link to timing of policy changes

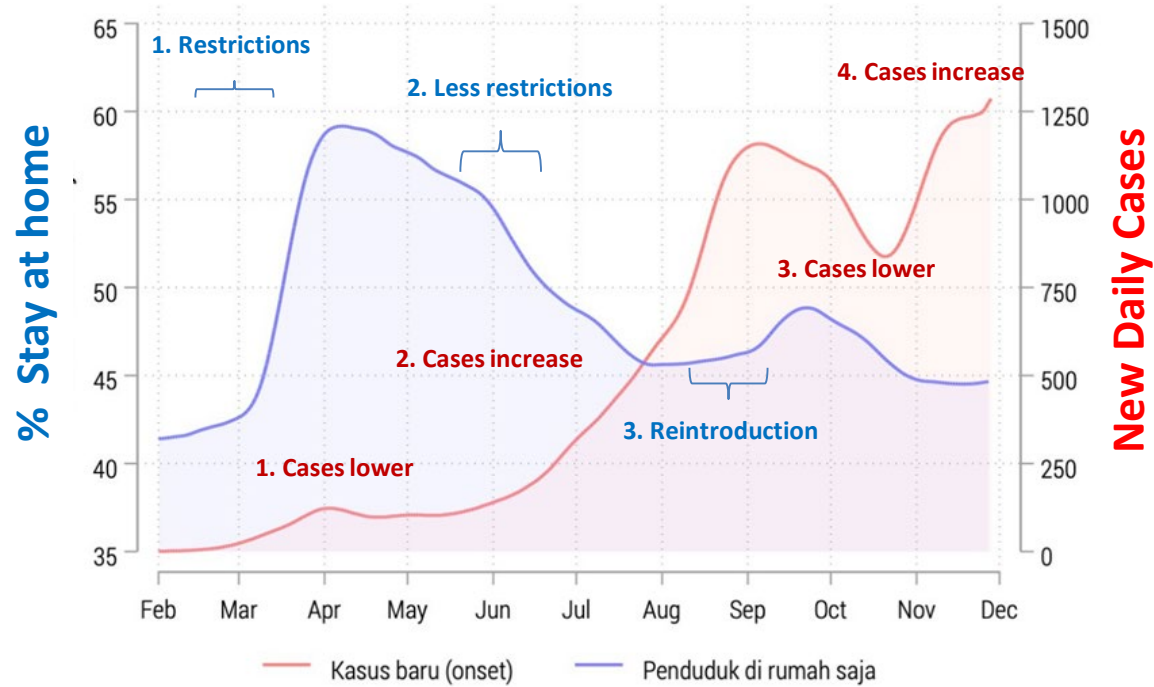
COVID-19 cases

- Individual case data from Jakarta government
- Adjusted for date of symptom-onset





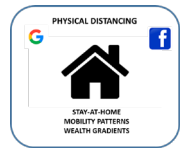
Policy, mobility and COVID-19 - JAKARTA



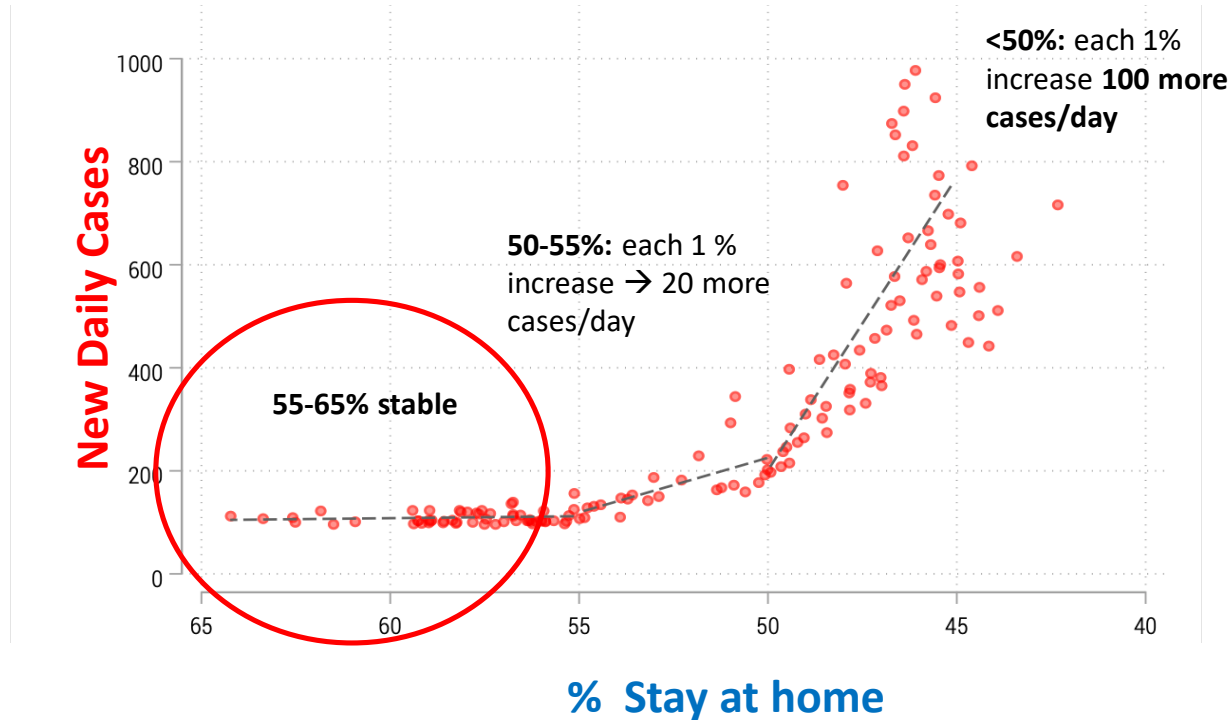
- Immediate effects of policy change
- Predictive of COVID-19:
 - 7 days advance warning
- Immunity?
 - Oct vs April
 - Lower 'stay-at-home' needed to reduce transmission

Sources: Cuebiq mobility, Governor of Jakarta daily cases



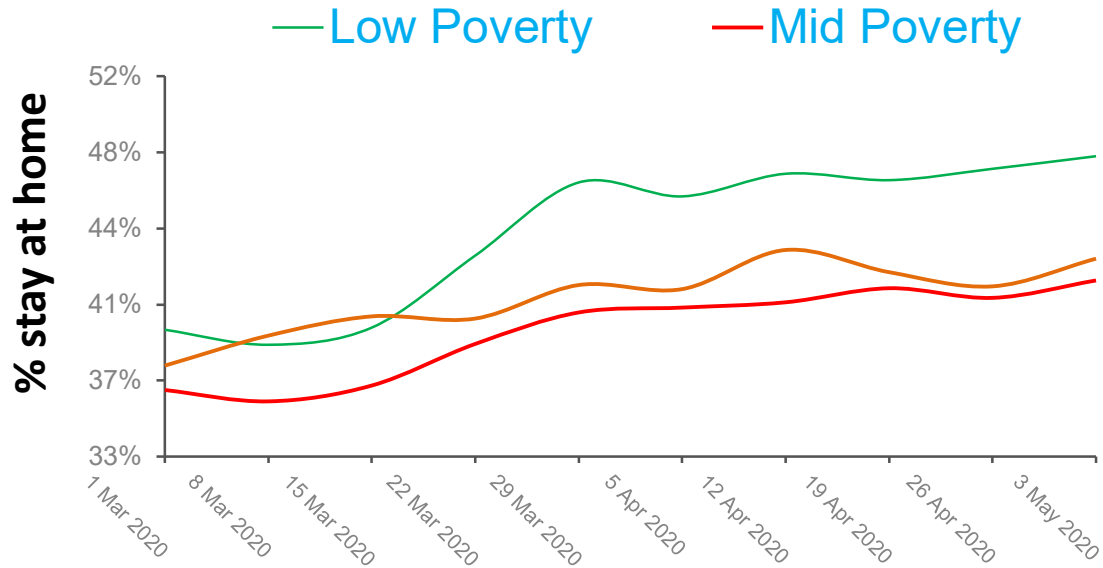


What level of mobility reduction is enough?





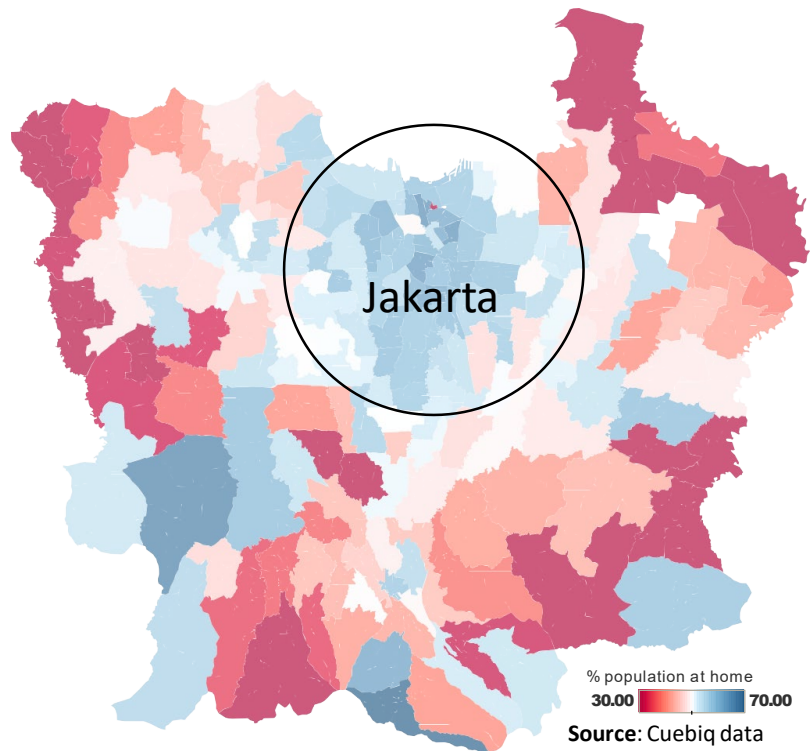
AI and remote sensing: Wealth gradients



Less physical distancing in poor households

Source: % population stay at home based on Cuebiq mobility data.

Physical distancing by local area



Better targeting of social protection programs

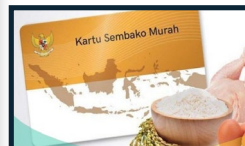
SUPPORT TO VILLAGES FOR COVID-19



Guidance on the use of Village Fund
For local COVID-19 Response

Increased local funding to enhance
enrolment into social protection schemes
(11 million new beneficiaries)

EXPANDED SOCIAL PROTECTION FOR HOUSEHOLDS



Kartu Sembako Murah
Staple food purchase

Expanded from 15
to 20 million
recipients



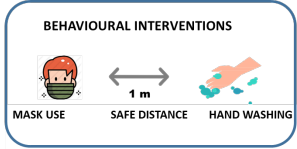
Program Keluarga Harapan
Cash Grants

Increased benefit
package by 25%
per month to
poor households
(10 million
beneficiaries)



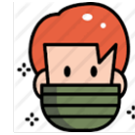
Kartu Pra-Kerja
Small Business
Informal Workers

Increased enrollment
by 11 million
households



Real-time behaviour monitoring

- ✓ Observed behavior
 - Independent volunteers
 - Paid with air-time tokens
- ✓ Focus on public places
 - School, religious place, station, public transport, market
 - Data daily/weekly
- ✓ Mobile phone data collection
 - Sms, Whatsapp
- ✓ Data visualization
- ✓ Immediate user-feedback



Menggunakan masker dengan benar
Proper mask usage

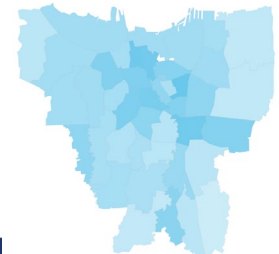


1 m

Menjaga jarak
Keep safe distance



Mencuci tangan pake sabun
Handwashing with soap





Data visualization platform

INDONESIA

Persentase kepatuhan 3M di Indonesia pada minggu ini sebesar

38% ¹
43% ↓
(minggu lalu)
Mencuci Tangan

73% ¹
73% ↓
(minggu lalu)
Memakai Masker

65% ¹
64% ↑
(minggu lalu)
Menjaga Jarak

persebaran dari kepatuhan memakai masker

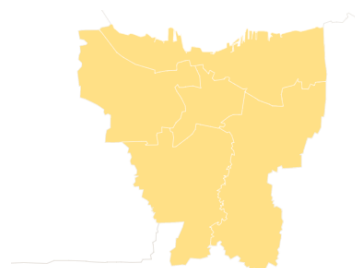


JAKARTA

37% ¹
39% ↓
(minggu lalu)
Mencuci Tangan

76% ¹
73% ↑
(minggu lalu)
Memakai Masker

68% ¹
62% ↑
(minggu lalu)
Menjaga Jarak



■ <50% ■ 50% - 80% ■ >80% ■ data tidak tersedia

JAKARTA SELATAN
156 pengamatan
10/10 kecamatan **84.4%**

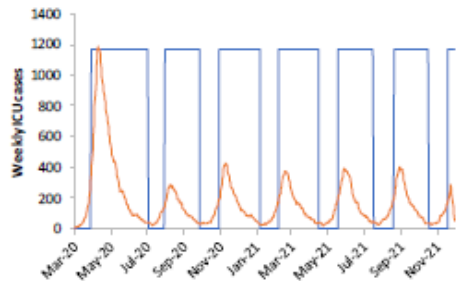
■ <50% ■ 50% - 80% ■ >80%

Population-based approaches to COVID suppression

Big-data

Real-time monitoring

- Monitor behaviours that influence transmission



AI & remote sensing

- Identify vulnerable communities

When precision public health measures are not an option

- Overcome gaps in testing, surveillance and reporting capacity
- Allows more tailored population-based risk reduction
- Enables local action
- Targeted social protection programs

One Health Framework

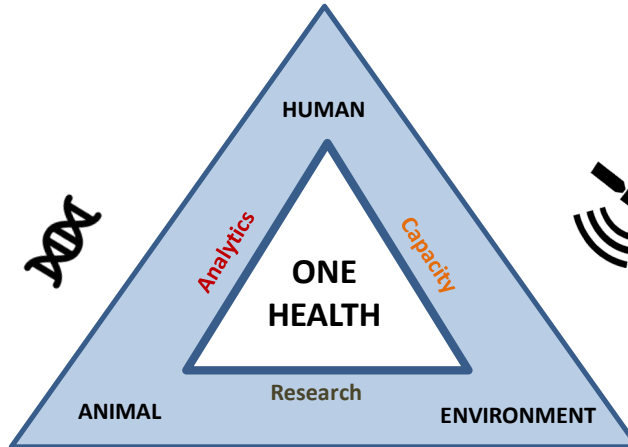


AI and big data

- Population mobility, early risk-detection

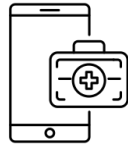
Genomics

- Human-animal-viral



Remote sensing

- Climate change
- Biodiversity shifts
- Vector biology
- Human settlements



Mobile applications

- Real-time surveillance
- Human-animal interface

Regional/Global Models

Predict-Prepare-Respond

World One Health Congress 2022



7th world one health CONGRESS
7 – 11 November 2022
Organized by Health

SAVE THE DATE
7 - 11 November 2022
Venue:
Sands Expo & Convention Centre

*Integrating Science, Policy and Clinical Practice
A One Health Imperative Post-COVID-19*

WHY ONE HEALTH

One Health is a global movement underpinned by the interdependence between humans, animals and the environment. COVID-19 has exemplified how instability at the human-animal-ecosystem interface brought about by the rapid pace of globalisation, population mobility, animal trade and the loss of biodiversity can result in profound health, social and economic consequences. Similar disruptions have resulted in the introduction and dissemination of a wide range of new and re-emerging diseases, accelerated antimicrobial resistance, compromised human and animal health systems and unprecedented threats to global health security. Integrated and well-coordinated regional and global efforts are essential to predict, prepare and respond to crises and to ensure a healthy and sustainable future for our planet.

ABOUT WORLD ONE HEALTH CONGRESS

The World One Health Congress (WOHC) is the world's premier conference to advance the One Health agenda. The Congress leverages the experience of the One Health Platform (OHP) to profile and advance trans-disciplinary efforts that further our collective understanding of animal-human disease transmission alongside their social and environmental determinants. The WOHC takes place biennially, attracting professionals from academic institutions, civil society, national governments, the private sector and multi-lateral organisations. Leading scientists and policy makers come together to share learning across diverse disciplines including epidemiology and disease surveillance, animal production and trade, food safety, animal science, human health, environmental science/ecology and global health security.

*Integrating Science, Policy and Clinical Practice:
A One Health Imperative Post-COVID-19*

Singapore: Nov 7-11, 2022

- First time in Asia

Hosted by SingHealth Duke-NUS Global Health Institute

Post-mortem on COVID response + future proofing

Scientists – Practitioners – Policy makers