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GLOBAL HEALTH INSTITUTE

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

Lessons from Indonesia

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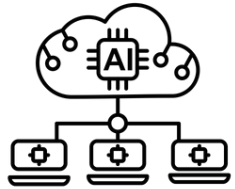
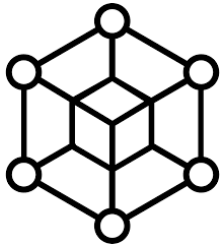
Renaissance in Digital Innovations

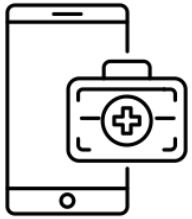
Artificial Intelligence & Big Data



Blockchain Technology



Remote Sensing & Satellite Imagery



Mobile Health & Person-centred monitoring

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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

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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

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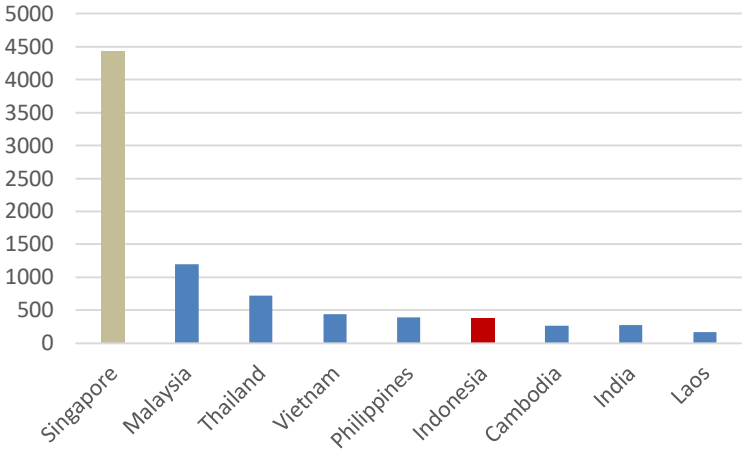
Baseline Vulnerabilities

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

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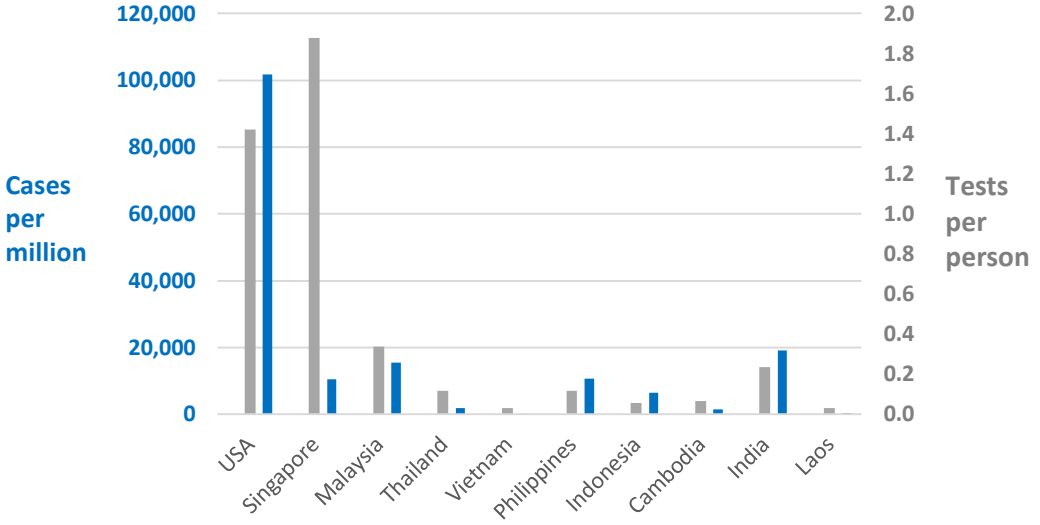
Asian success in COVID control?

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

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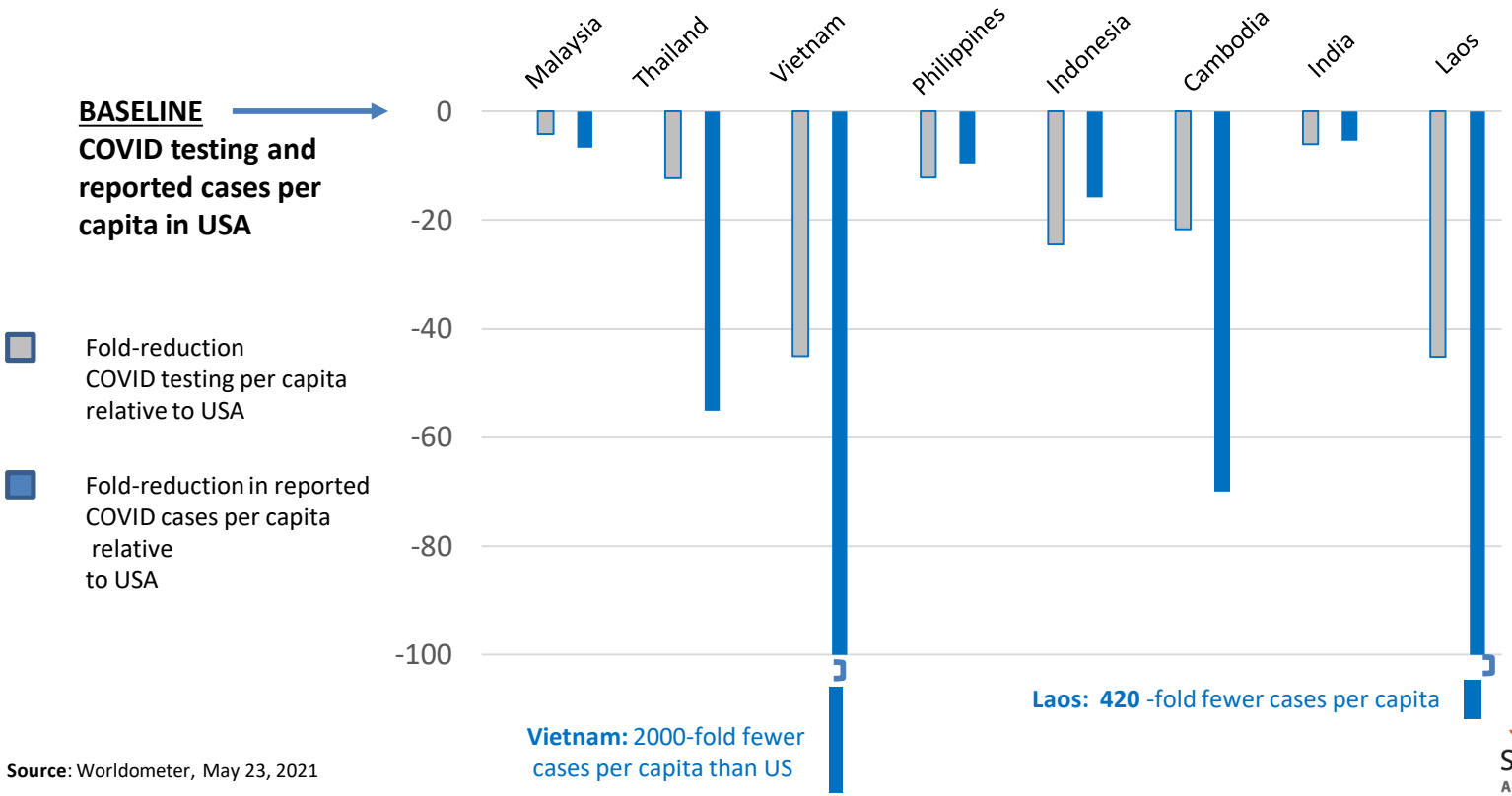
Estimated levels of under-detection



Source: Worldometer, May 23, 2021

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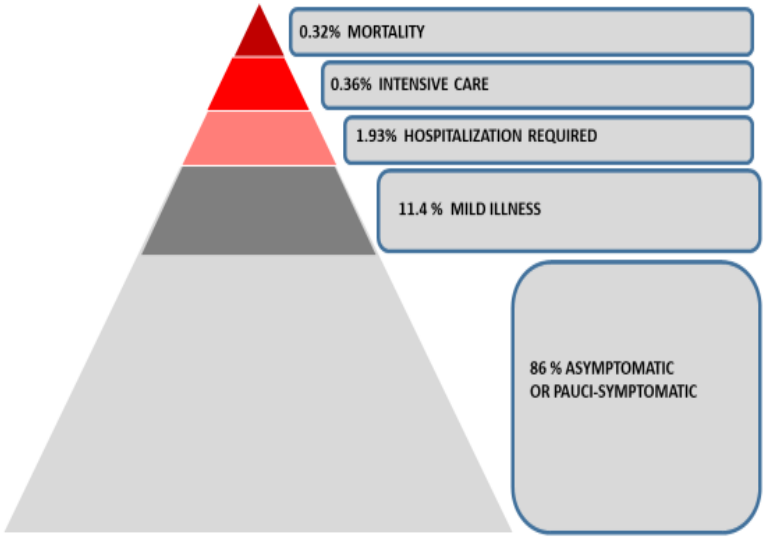
Elimination vs Suppression

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

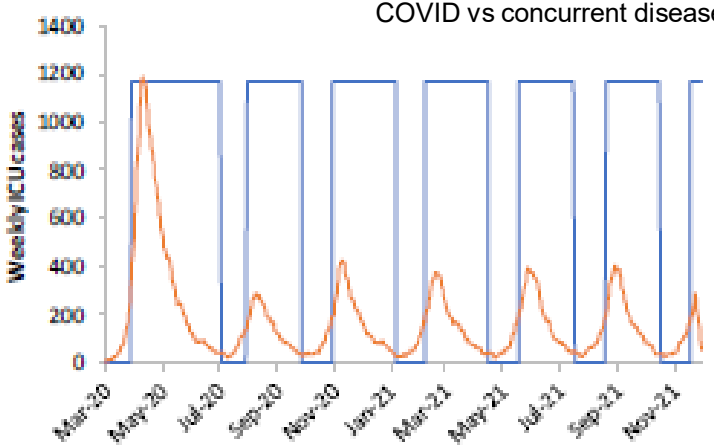
Test the sickest
Widespread community transmission
Population based strategies essential

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	DAY 7-21	DAY 21-30	DAY 30+
	Transmission	Cases	Hospitalization	Deaths
LMIC Gaps	Behavioural monitoring absent	Low testing Delayed result reporting	Poor hospital records No national database Delayed reporting COVID vs concurrent disease	Death reporting systems poorly developed

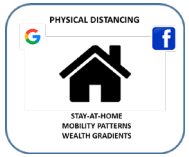
? Digital innovations



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



Big-data and physical distancing

Big Data

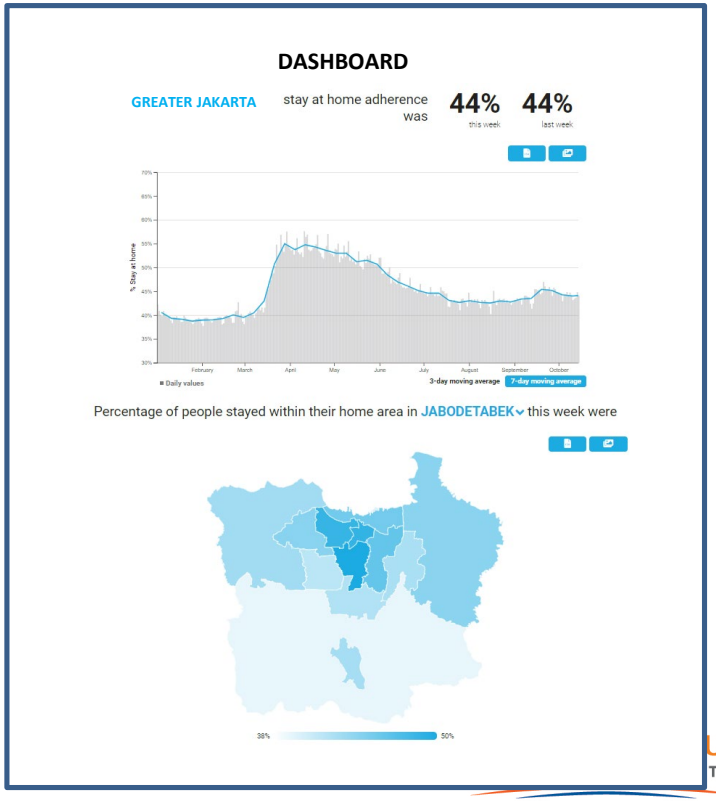
- Cuebiq – Android phone
- Facebook – 140 million users in Indonesia
- Anonymized/aggregated, updated daily
- Visualize down to village level
- Accurate to 50m
- **Stay-at-home** = day location vs night location

Policy introduction

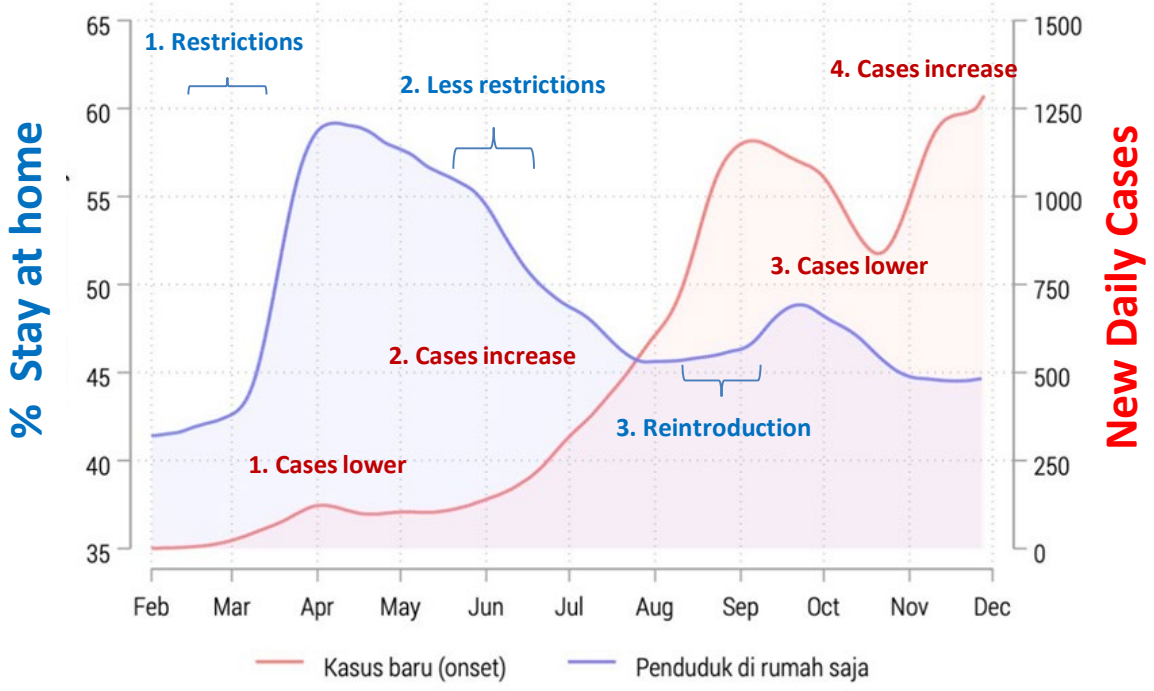
- Link to timing of policy changes

COVID-19 cases

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



Policy, mobility and COVID-19 - JAKARTA



Sources: Cuebiq mobility, Governor of Jakarta daily cases

- **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

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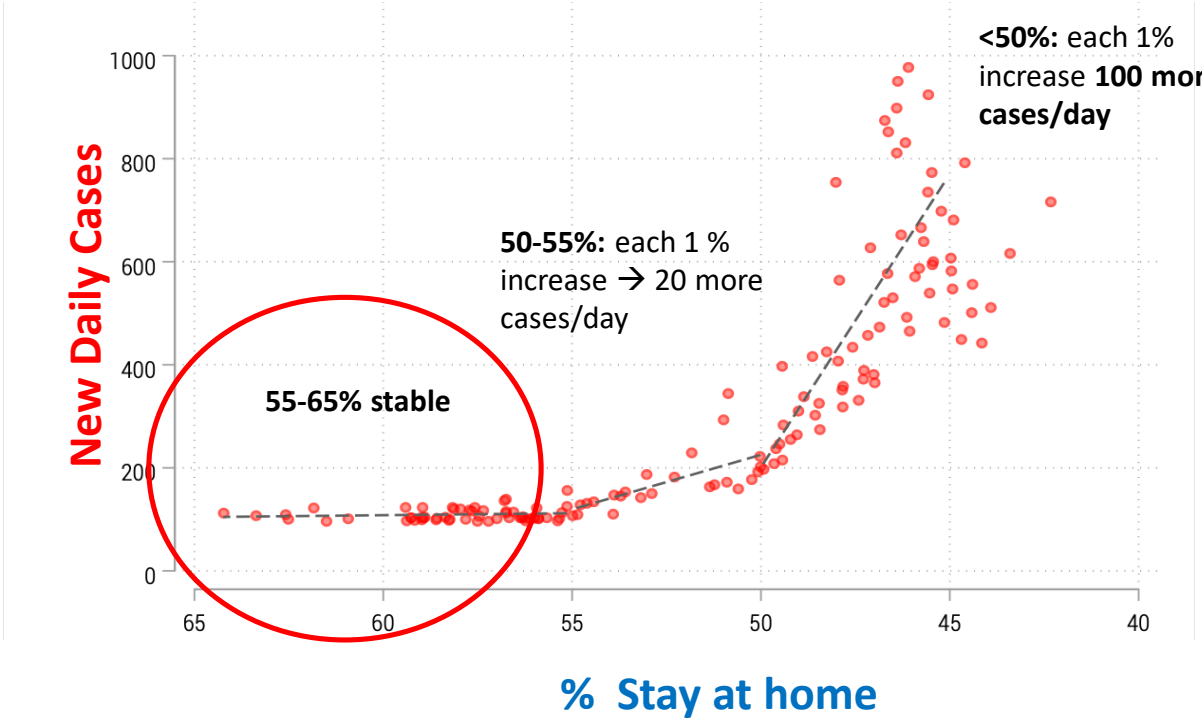
What level of mobility reduction is enough?



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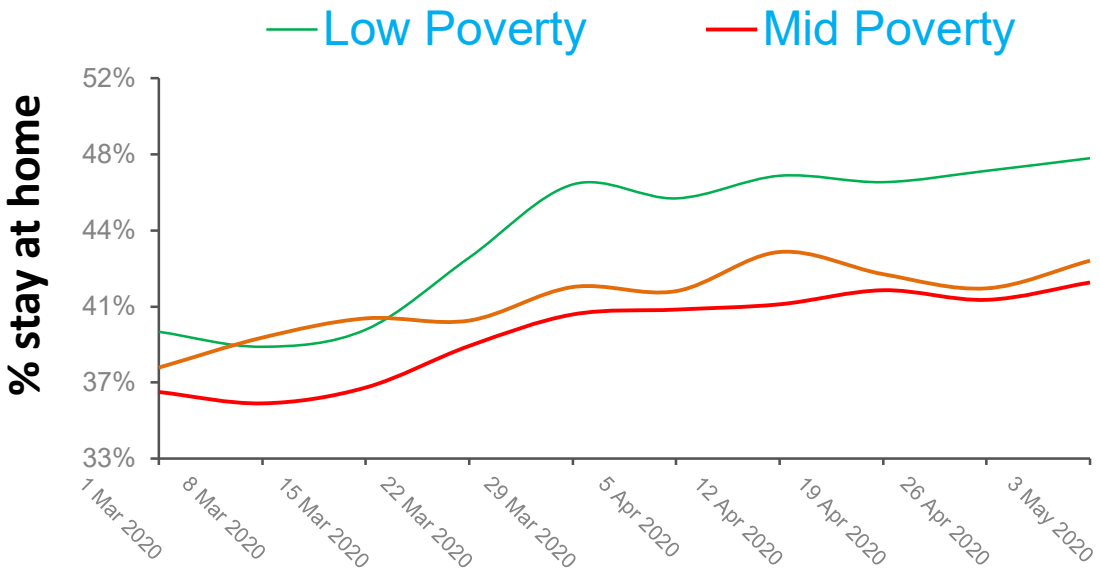
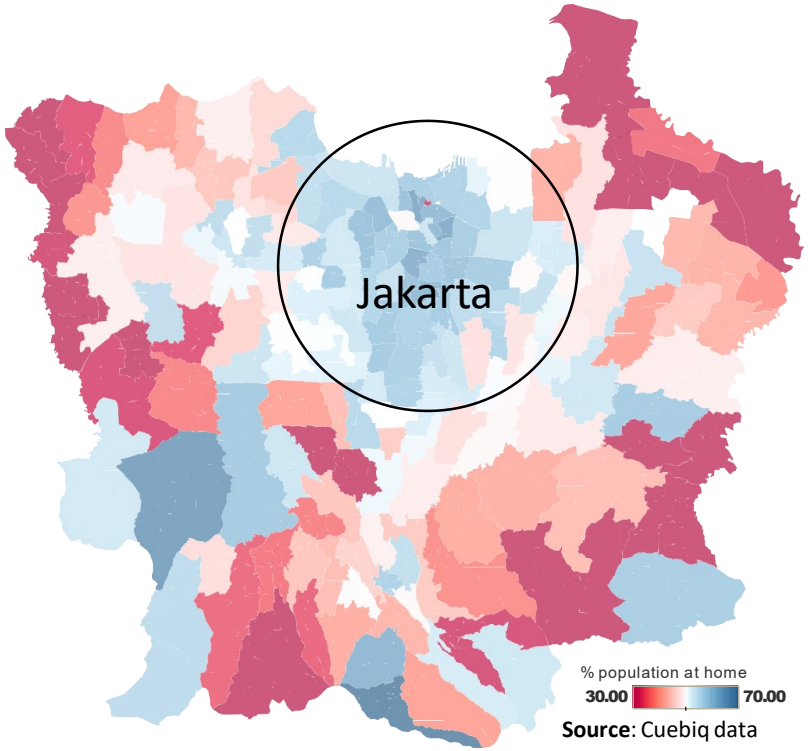
AI and remote sensing: Wealth gradients

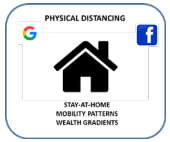


Less physical distancing in poor households

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

Physical distancing by local area





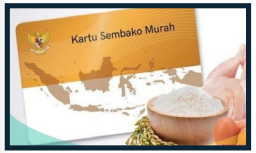
Better targeting of social protection programs

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

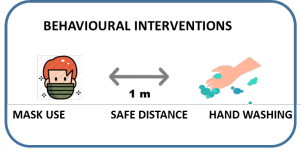
Expanded from 15 to 20 million recipients

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

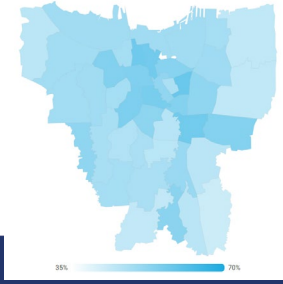
Proper mask usage

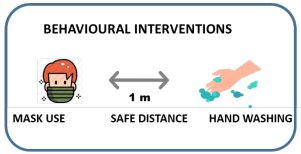
Menjaga jarak

Keep safe distance

Mencuci tangan pake sabun

Handwashing with soap





Data visualization platform

INDONESIA

Persentase kepatuhan 3M di Indonesia pada minggu ini sebesar

38% 43% ↓ (minggu lalu) Mencuci Tangan

73% 73% ↓ (minggu lalu) Memakai Masker

65% 64% ↑ (minggu lalu) Menjaga Jarak

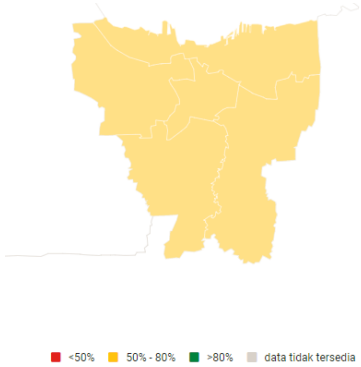
persebaran dari kepatuhan memakai masker

JAKARTA

37% 39% ↓ (minggu lalu) Mencuci Tangan

76% 73% ↑ (minggu lalu) Memakai Masker

68% 62% ↑ (minggu lalu) Menjaga Jarak



JAKARTA SELATAN
156 pengamatan
10/10 kecamatan
84.4%

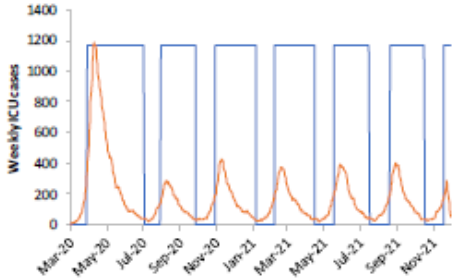
Population-based approaches to COVID suppression

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

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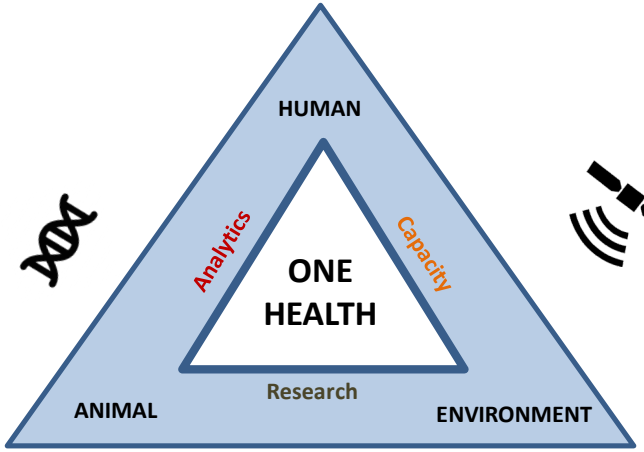
One Health Framework

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

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

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