SLHAS
Sri Lanka Health and Ageing Study

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Inequities In The Provision Of COVID-19 Testing And Vaccination in Sri Lanka's Mixed Health System

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BACKGROUND

Sri Lanka context

COVID-19 timeline in Sri Lanka

Sri Lanka Health and Ageing Study

Sri Lanka health system context

Economy

- Lower-middle income economy (GDP per capita ~USD 3,800)

UHC attainment

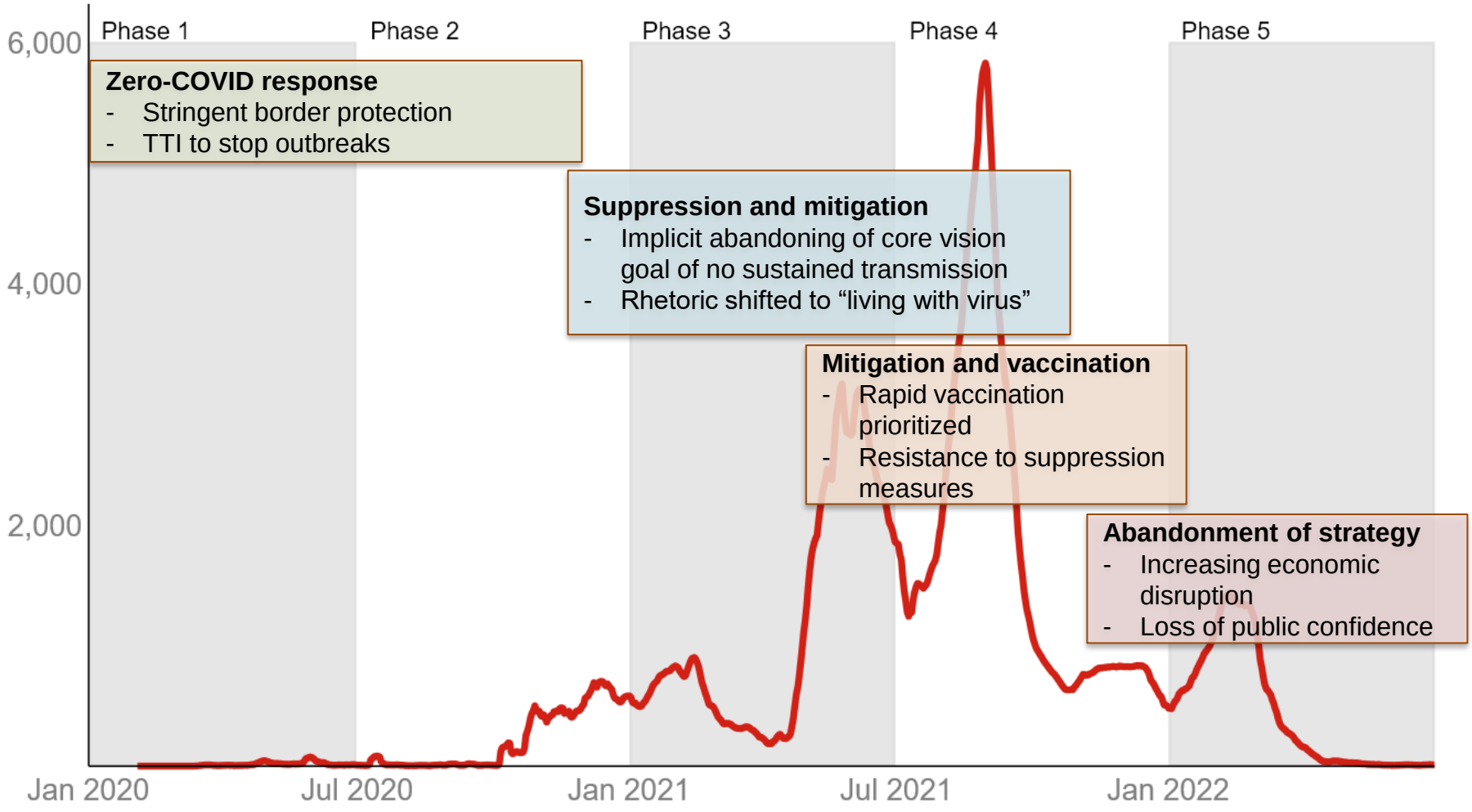
- Extreme positive outlier in health outcomes
- High levels of healthcare utilization similar to OECD nations
- Routine EPI vaccination levels higher than most OECD nations
- Elimination of major infectious diseases (malaria, polio, measles)

Financing and delivery

- Low levels of overall health spending ~3% of GDP
- Mixed system with (1) pro-poor public sector + (2) pro-rich private sector
- Financing: ~50%, 50% private
- Provision:
  - Inpatient and preventive services ~95% public
  - Outpatient/primary healthcare ~50% public

COVID-19 timeline in Sri Lanka

Reported cases/day



Data source

Sri Lanka Health and Ageing Study (SLHAS)

- National longitudinal health cohort study started in 2018/19
- Wave 2 survey 2021/22 (CATI)
    1. SLHAS cohort sample (77%) reachable by phone
    2. Random dial digit (RDD) sample
- Samples combined using iterative proportionate fitting (IPF) for weighting
- Domains covered: socioeconomic wellbeing; health status; healthcare use; COVID-19

INEQUALITIES IN TESTING

Background

Data

Methods

Finding

Critical role of testing in Zero-COVID strategies in 2020/21

Successful Zero-COVID strategies before Delta required **high levels** of **PCR** testing of **symptomatic** individuals at primary care level with broad definition of symptoms to detect outbreaks within 2–3 weeks

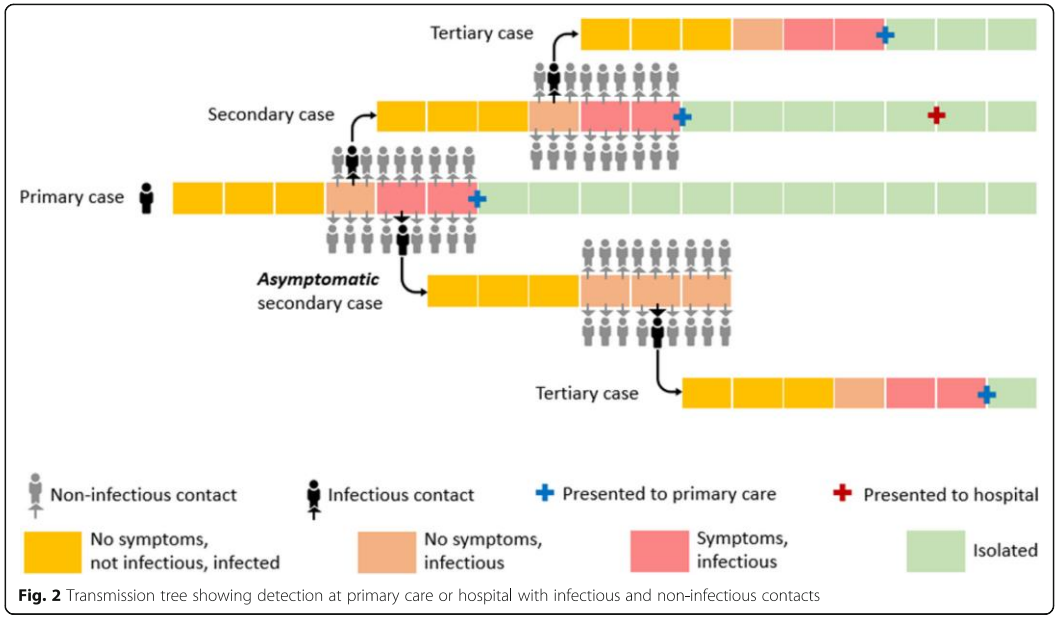
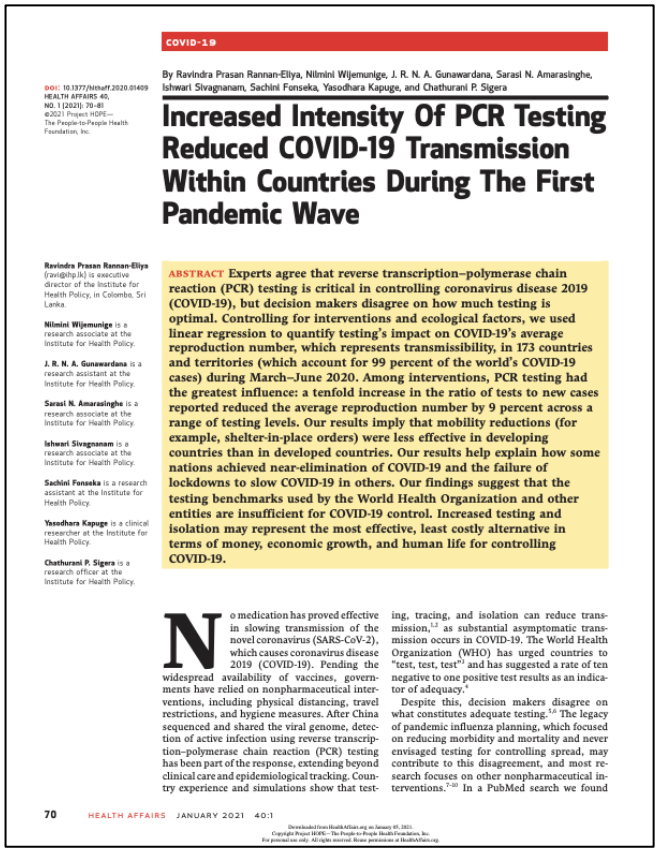


Fig. 2 Transmission tree showing detection at primary care or hospital with infectious and non-infectious contacts

Source: Lokuge K, Banks E, Davis S, et al. Exit strategies: optimising feasible surveillance for detection, elimination, and ongoing prevention of COVID-19 community transmission. BMC Med. 2021;19(1):50. doi:10.1186/s12916-021-01934-5



COVID-19

By Ravindra Prasan Rannan-Eliya, Nilmini Wijemunige, J. R. N. A. Gunawardana, Sarasi N. Amarasinghe, Ishwari Sivagnanam, Sachini Fonseka, Yasodhara Kapuge, and Chathurani P. Sigera

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Increased Intensity Of PCR Testing Reduced COVID-19 Transmission Within Countries During The First Pandemic Wave

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ABSTRACT **Experts agree that reverse transcription–polymerase chain reaction (PCR) testing is critical in controlling coronavirus disease 2019 (COVID-19), but decision makers disagree on how much testing is optimal. Controlling for interventions and ecological factors, we used linear regression to quantify testing's impact on COVID-19's average reproduction number, which represents transmissibility, in 173 countries and territories (which account for 99 percent of the world's COVID-19 cases) during March–June 2020. Among interventions, PCR testing had the greatest influence: a tenfold increase in the ratio of tests to new cases reported reduced the average reproduction number by 9 percent across a range of testing levels. Our results imply that mobility reductions (for example, shelter-in-place orders) were less effective in developing countries than in developed countries. Our results help explain how some nations achieved near-elimination of COVID-19 and the failure of lockdowns to slow COVID-19 in others. Our findings suggest that the testing benchmarks used by the World Health Organization and other entities are insufficient for COVID-19 control. Increased testing and isolation may represent the most effective, least costly alternative in terms of money, economic growth, and human life for controlling COVID-19.**

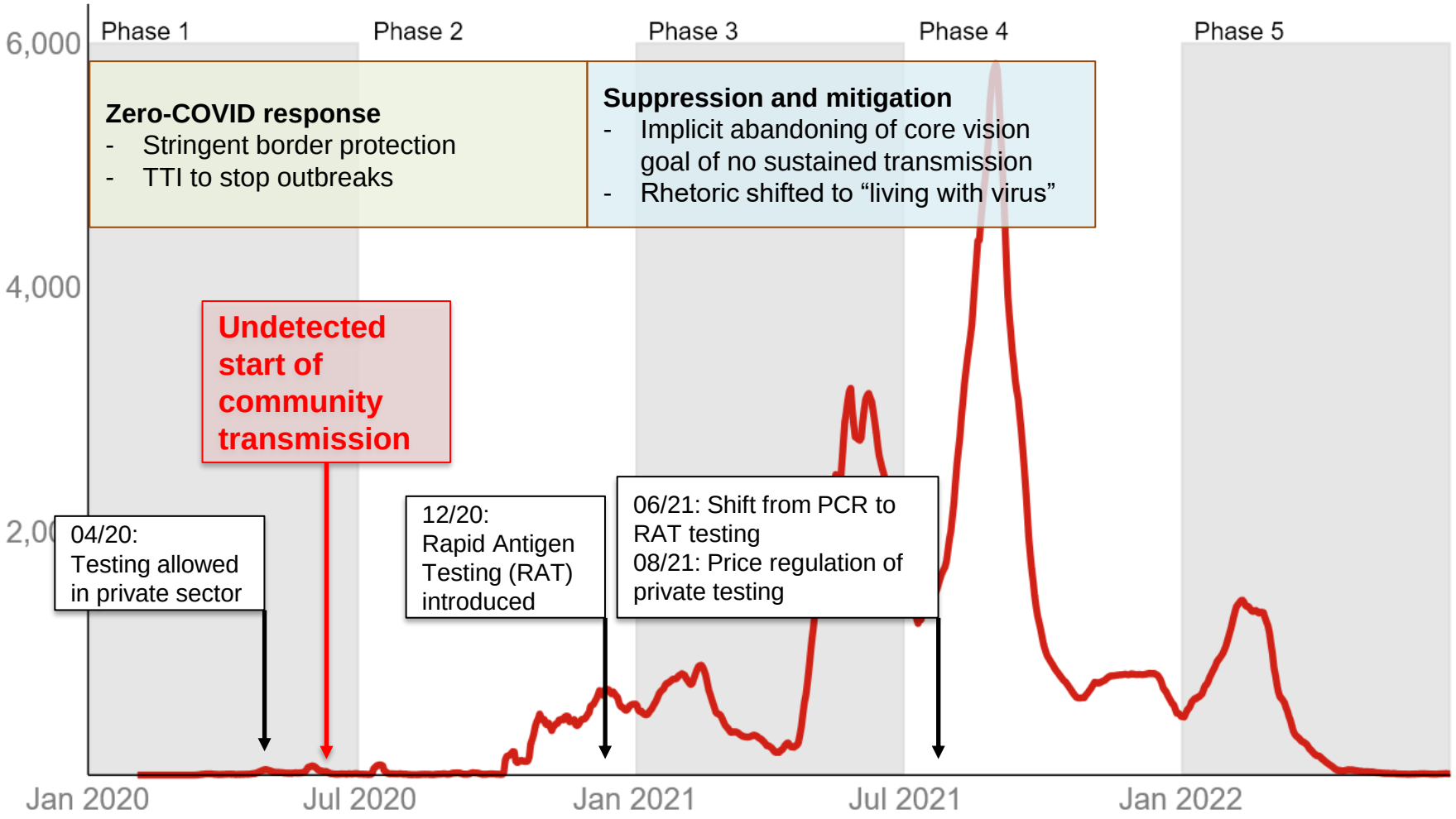
No medication has proved effective in slowing transmission of the novel coronavirus (SARS-CoV-2), which causes coronavirus disease 2019 (COVID-19). Pending the widespread availability of vaccines, governments have relied on nonpharmaceutical interventions, including physical distancing, travel restrictions, and hygiene measures. After China sequenced and shared the viral genome, detection of active infection using reverse transcription–polymerase chain reaction (PCR) testing has been part of the response, extending beyond clinical care and epidemiological tracking. Country experience and simulations show that testing, tracing, and isolation can reduce transmission,[1,2] as substantial asymptomatic transmission occurs in COVID-19. The World Health Organization (WHO) has urged countries to "test, test, test"[3] and has suggested a rate of ten negative to one positive test results as an indicator of adequacy.[4]

Despite this, decision makers disagree on what constitutes adequate testing.[5,6] The legacy of pandemic influenza planning, which focused on reducing morbidity and mortality and never envisaged testing for controlling spread, may contribute to this disagreement, and most research focuses on other nonpharmaceutical interventions.[7–10] In a PubMed search we found

Source: Rannan-Eliya RP, Wijemunige N, Gunawardana J, et al. Increased Intensity Of PCR Testing Reduced COVID-19 Transmission Within Countries During The First Pandemic Wave. Health Aff (Millwood). 2021;40(1):70-81. doi:10.1377/hlthaff.2020.01409

COVID-19 timeline in Sri Lanka

Reported cases/day



Inequalities in testing
Data and methods

- Phone (CATI) interviews with national sample
- Interviews conducted 06/09/2021–30/09/2022
- Respondents asked:
  - Whether ever tested
  - If tested, details of last 3 tests
  - Date, Type (PCR/RAT), Reason for testing, Source (provider)
- Study samples weighted using IPF
- SES ranking based on PCA of household assets
- Inequalities assessed using concentration indices (age-sex standardized)

Participant characteristics

- N=6,334
- 72% cohort, 28% RDD sample
- Male 51%
- Ages 18–98 years
- Well-balanced by SES, province, sector
- Ever tested: 28.8% (n=1,826)
- Test provider: public 71%, private 23%, NK 6%

Inequalities in testing

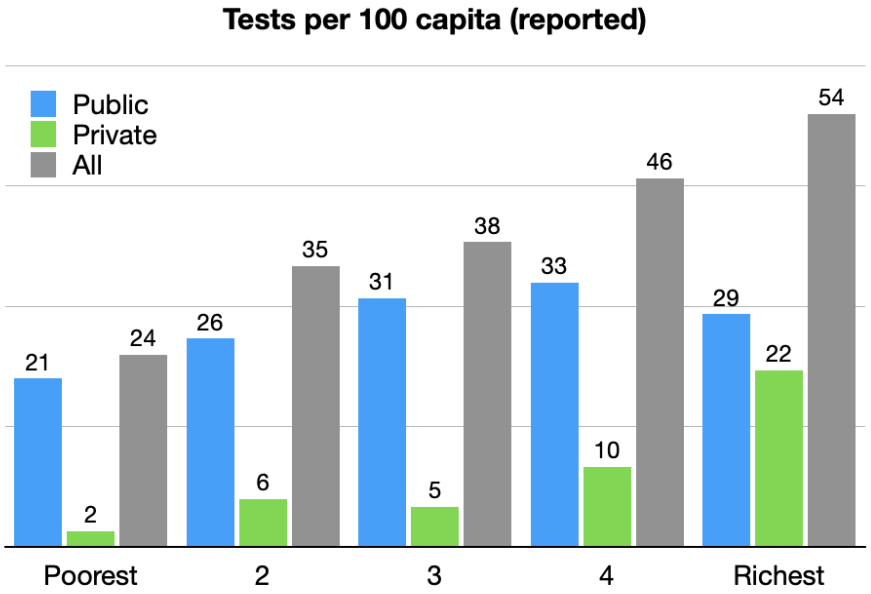
Concentration curve analysis

Public testing not unequal, but private and all testing pro-rich

PCR testing more pro-rich than RAT

Testing by reason:

- Symptomatic: pro-rich (p=0.09)
- Close contacts: pro-rich (p=0.02)
- Random testing: pro-poor (p=0.001)
- Other testing: pro-poor (p=0.05)



Inequity in COVID-19 testing

	N	Concentration index	P-level
Public tests	6,334	0.012	0.243
Private tests	6,334	0.031	<0.0001
Any tests	6,334	0.044	<0.0001
PCR tests	6,334	0.027	<0.001
RAT tests	6,334	0.016	<0.0001

Inequalities in testing

Logistic odds ratio analyses of determinants of being tested

- Logistic odds ratio estimates controlling for sex, age, sector, education, SES, province, chronic illnesses
- Increased odds with male, younger age , diabetes
- Increased odds with higher SES quintile
  - Similar finding for private testing

Ever tested

	Adj. Odds Ratios	p-value
SES quintile		
Poorest	Ref.	
2	1.04	0.65
3	1.12	0.32
4	1.36	0.01
Richest	1.31	0.04
Male	Ref.	
Female	0.78	<0.001
Self-reported diabetes	1.42	<0.001
Muslim	0.71	0.02

INEQUALITIES IN VACCINATION

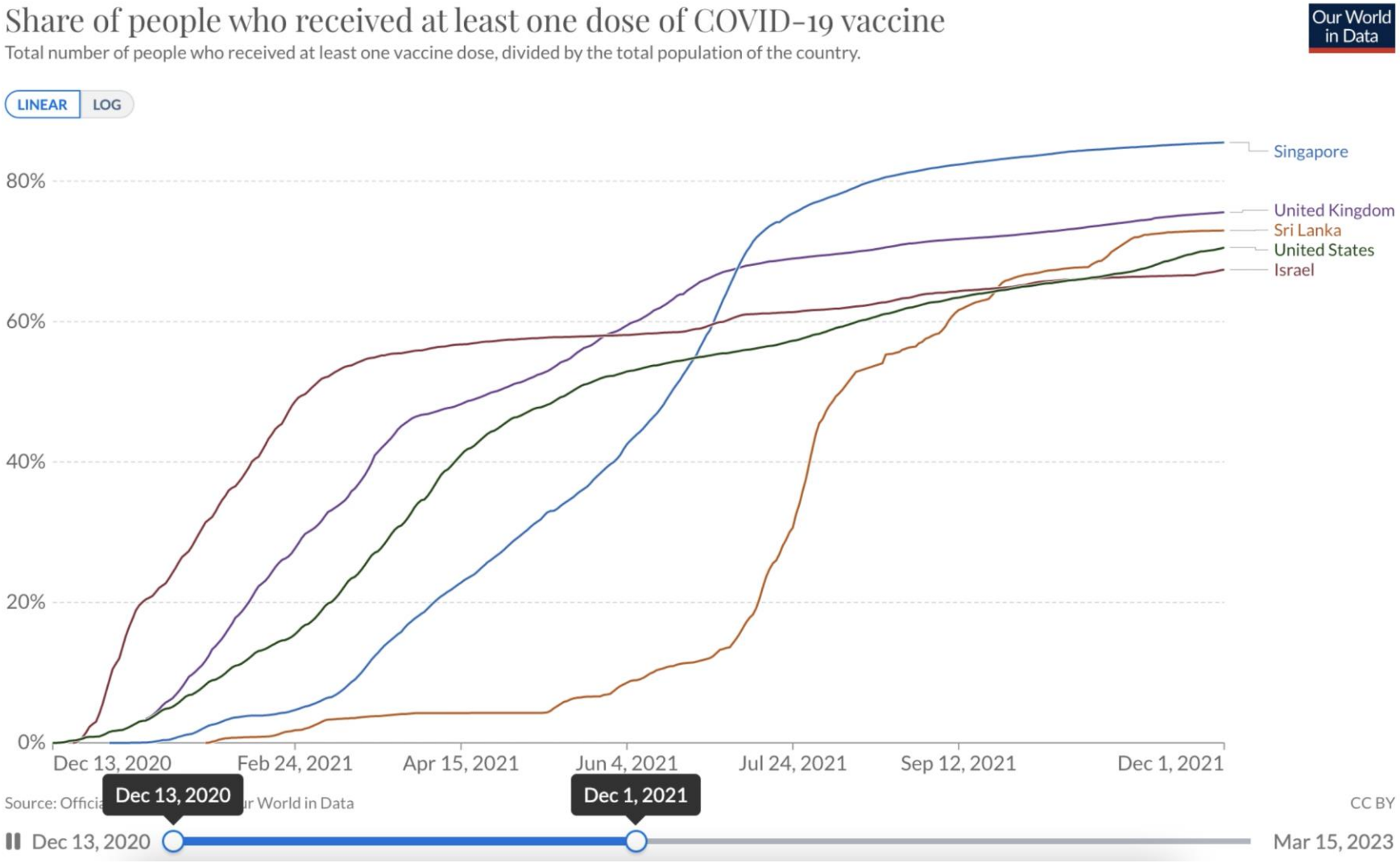
Background

Data

Methods

Finding

Vaccination rollout



Source: Our World in Data (2023)

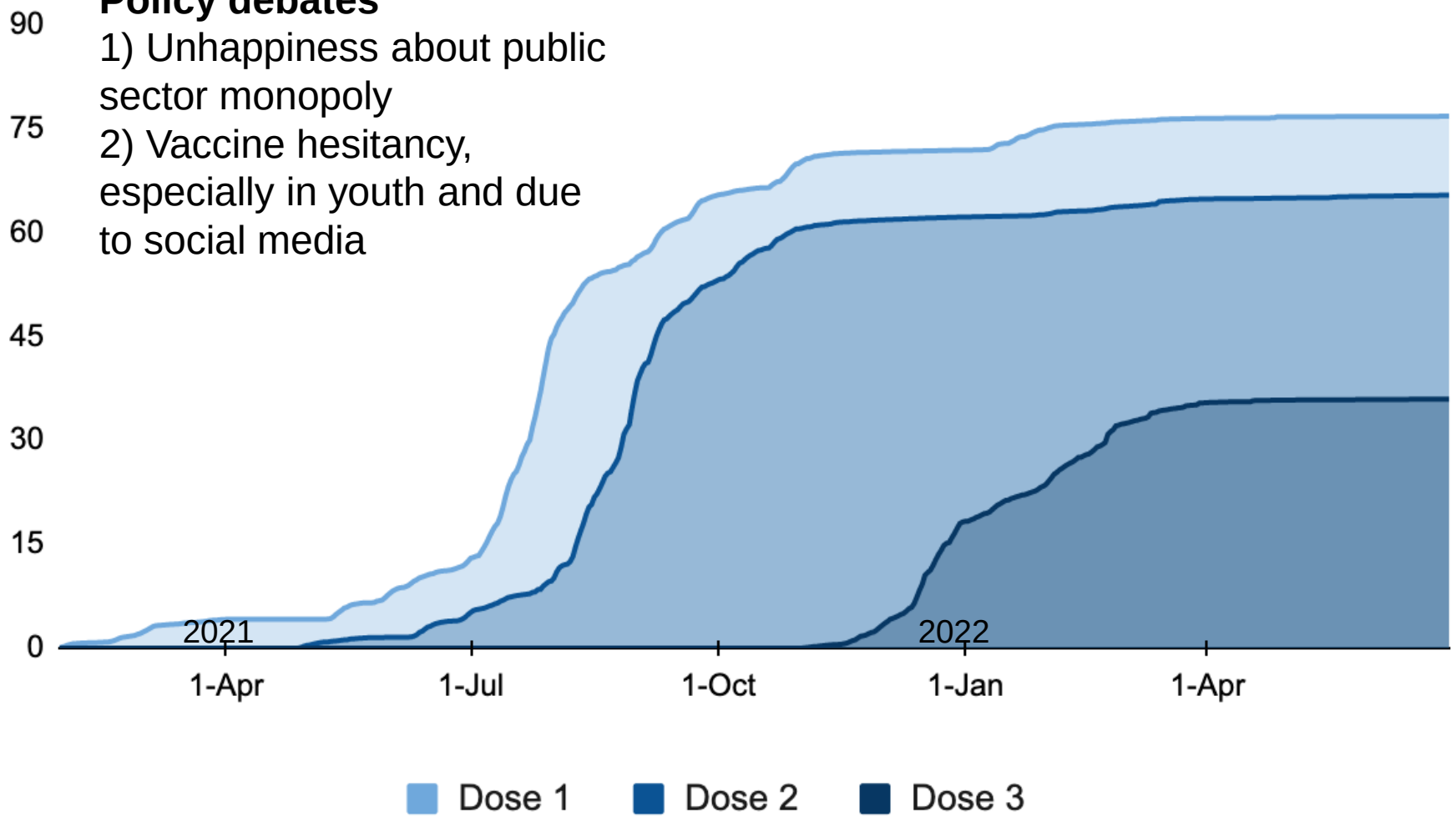
COVID-19 vaccination coverage

Feb 2021 - June 2022 (% of population)

Policy debates

1) Unhappiness about public sector monopoly

2) Vaccine hesitancy, especially in youth and due to social media



Note: IHP analysis of MOH vaccination data

Inequalities in vaccination
Data and methods

- Phone (CATI) interviews with national sample
- Interviews conducted 31/08/2021–1/07/2022
- Respondents asked:
  - Vaccination history (date, dose #, brand, provider, eligibility category)
  - Vaccine hesitancy (if intending to take, reasons why not)
  - Brand preference
- Study samples weighted using IPF
- SES ranking based on PCA of household assets
- Outcome: Full vaccine coverage (2 doses)

Participant characteristics

- N=5,606
- 72% cohort, 28% RDD sample
- Male 51%
- Ages 18–98 years
- Well-balanced by SES, province, sector, ethnicity
- 95% ever vaccinated; 92% fully vaccinated (2 doses); 71% with booster (3 doses) by July 2022

Inequalities in vaccination
Methods

Construction of time series data set

- Time series data set (N=5,606) generated from interview responses showing vaccine status by dose by week from 2020w52 to 2022w26 (1 July 2022)
- Missing data on weekly vaccine status imputed by modeling likelihood of having transitioned to next dose
  - Most missing data due to inability to accurately recall date of vaccination
  - Model considered age, sex, SES, vaccine brand history, province, ethnicity, etc.

Analyses

- Cox proportional hazards model fitted for fully vaccinated status (2 doses) for those who received 1+ doses
- Regression analysis of time to receive dose 2 since eligibility for receiving COVID-19 vaccine
  - Separately for: (1) those receiving Astra-Zeneca as dose 1; and (2) all others

COVID-19 vaccination

Cox proportional hazards model

Analysis

- Time since 2020w52

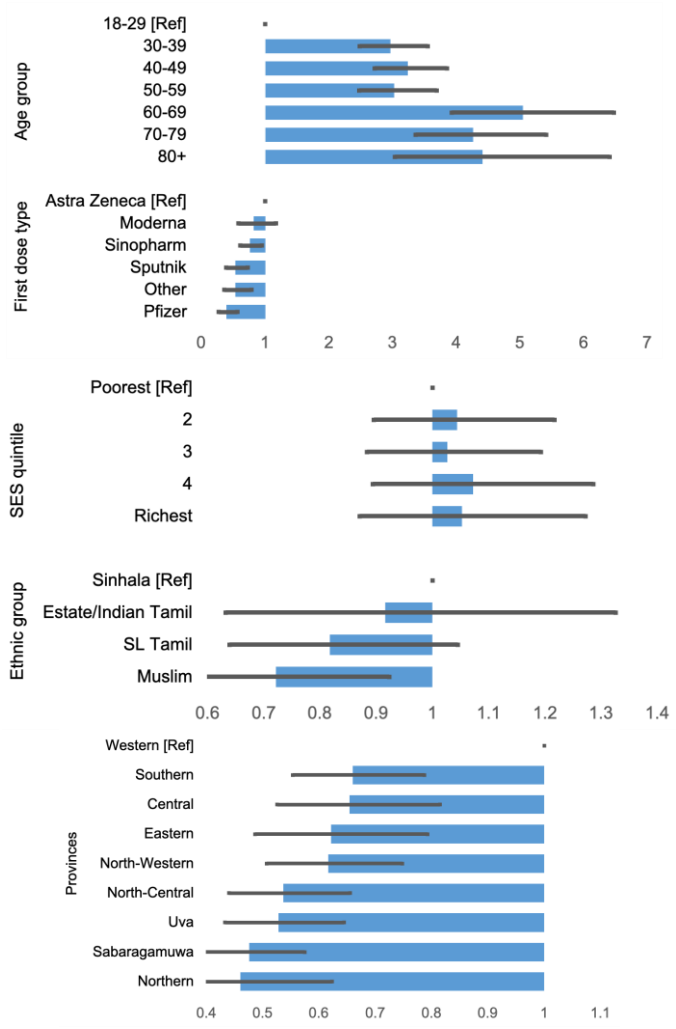
Main findings

- No significant disparities by sex, education, SES quintile, urban/rural sector, healthcare worker, ethnicity (except Muslims), Facebook or Whatsapp use
- Older people (p<0.001) and Western Province residents (p<0.001) vaccinated earlier
- Provinces outside Western Province, Muslims vaccinated slower
- Those receiving AZ as first dose full vaccinated earlier and Pfizer slowest

Comment

- Differences by age and province correspond to known differences when people became eligible. Eligibility status based on age, sex, healthcare worker status, and certain preexisting condition categories

Hazard ratios for receiving two doses from 2020w52



COVID-19 vaccination

Linear regression of time to fully vaccinate status

Analysis

- Time since eligibility

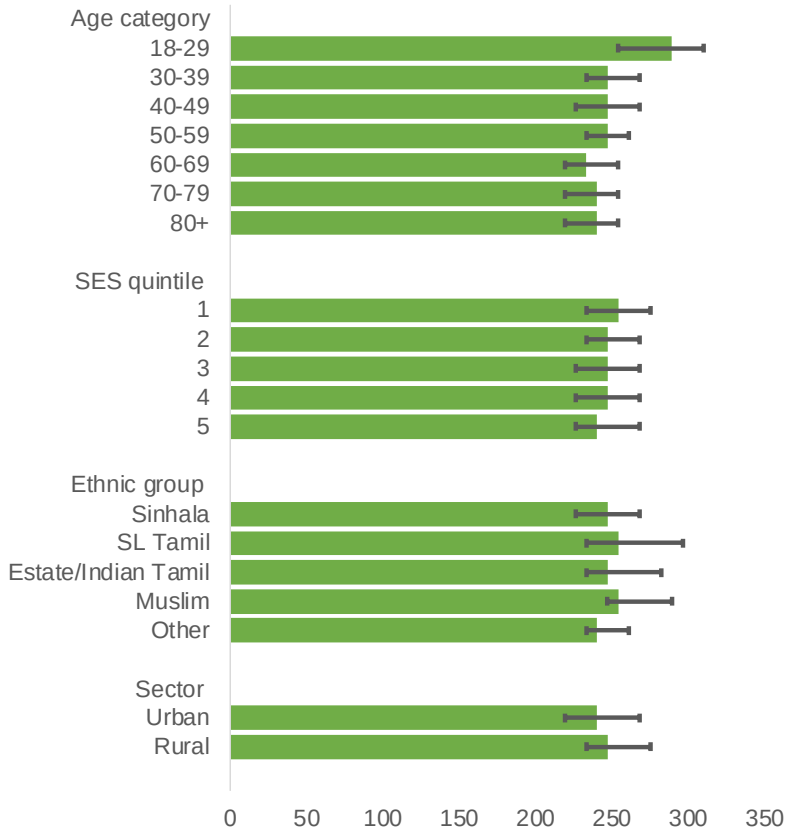
Key findings

- No statistically significant differences by sex, education, healthcare worker status, Facebook/Whatsapp use, SES quintile
- No differences by age for those above age 30 years
- No significant disparities by ethnicity, province

Comment

- Controlling for factors that affected eligibility status removed most disparities

Median time to receive two doses of COVID vaccine from end December 2020 (days from eligibility)



COVID-19 vaccination

Vaccine hesitancy

Data

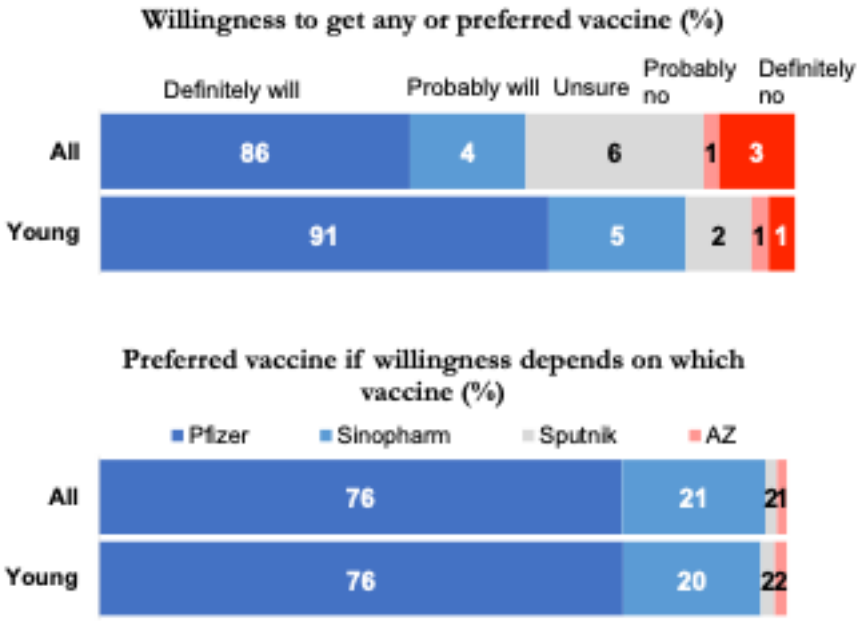
- Respondents who were not vaccinated were asked about intent to vaccinate and reasons if not.

Key findings

- Very low rates of vaccine hesitancy through 2021/2022. More comparable to East Asia/Australia/New Zealand than Western/other developing countries
- Vaccine hesitancy never higher in younger adults.
- Reluctance to take vaccine immediately was primarily about brand preference. Significant preference for Pfizer led to people to wait for availability.

Implications

- Unclear why health authorities complained about vaccine hesitancy, and especially in youth. Potential sampling bias and inadequate analysis in MOH surveys?
- Delays in youth were probably driven more by policy restricting access to youth.
- Were policymaker views excessively introduced by Western discourse?



Source: IHP analysis of SLHAS Wave 2 data for 31/08/2021–31/07/2022 (N=6,129). Estimates weighted to match national population.

DISCUSSION

Implications

Implications

- COVID-19 testing was inequitable with better-off having more access to testing
  - Better-off had more access to PCR testing, and more access to testing when symptomatic
  - Public testing was not pro-rich, but testing of poorer Sri Lankans more likely to be ineffective, random testing
  - Expansion of testing through reliance on private provision increased inequity and probably reduced effectiveness in blocking transmission
- Vaccination coverage was equitable with observed disparities explained by when individuals became eligible
  - Lack of vaccine hesitancy contributed to high levels and rapid uptake of vaccination coverage, with most delays due to ”rational” vaccine preference
- Mixed public-private supply failed to ensure equity owing to inadequate supply
  - Mixed supply strategy only works to achieve equity if public supply is adequate and high enough to prevent barriers to access
  - Reliance on private provision of testing failed as a preventive health strategy
  - Reliance on public financing and provision of vaccination proved effective in achieving rapid and equitable coverage