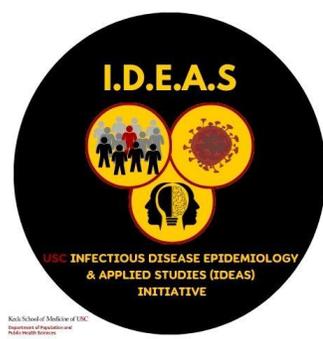




Infectious Diseases Epidemiology and Applied Studies Initiative



IDEAS Seminar Series Spring 2024

Jeffrey D. Klausner, MD, MPH

Professor of Population and Public Health Sciences
Professor of Medicine and Infectious Diseases

Jennifer Unger, PhD

Professor of Population and Public Health Sciences

With Support from **Frank Gilliland, MD, PhD**

Professor of Population and Public Health Sciences



Through discovery, training and action, we are solving public health and health equity challenges, from local to global, for today and tomorrow.

Keck School of Medicine of **USC**
Department of Population and
Public Health Sciences

The Infectious Disease Epidemiology and Applied Studies (I.D.E.A.S.)
Initiative and USC IIGH present:

Refugee Health and Infectious Disease
With an emphasis on STI Research in Refugees and
Internally Displaced Populations



Ghina Mumtaz
PhD

Assistant Professor
Department of Epidemiology &
Population Health
American University of Beirut



Parveen Farmar
MD, MPH

Director, Social and Global
Emergency Medicine
Professor of Clinical Emergency
Medicine at USC Keck School of Medicine

December 6, 2023
12:30PM - 1:30PM PST
SSB 115 & ZOOM
[Register for Zoom link](#)



Our Previous Seminars

2022-2023

Keck School of Medicine of USC
Department of Population and
Public Health Sciences

NOVEMBER 30TH, 2022
12 : 30 PM - 1:30 PM PST
SSB 115/116 & ZOOM

The Global Infectious
Diseases Initiative
Presents:

**"IMPROVING ACCESS TO HIV PREVENTION AND TB
TREATMENT SERVICES IN SOUTH AFRICA" WITH:**
Andrew Medina-Marino, PhD

Adjunct Associate Professor at University of Pennsylvania
Honorary Associate Professor at University of Cape Town
Senior Investigator at Desmond Tutu Health Foundation

REGISTER FOR ZOOM MEETING

Lunch will be
provided

Keck School of Medicine of USC
Department of Population and
Public Health Sciences

The Infectious Disease Epidemiology and Applied
Studies (I.D.E.A.S.) Initiative and USC IIGH present:

**A pill to prevent HIV
around the world**

"HIV prevention implementation in Peru: A large scale PrEP demonstration
project in conjunction with the Peruvian Ministry of Health"

with
**Professor
Kelika Konda,
PhD, MHS**

Clinical Associate Professor at University of Southern California

JANUARY 17TH, 2023
1:30PM - 2:30PM
SSB 114 & ZOOM
[Register for Zoom link](#)

Keck School of Medicine of USC
Department of Population and
Public Health Sciences

The Infectious Disease Epidemiology and Applied
Studies (I.D.E.A.S.) Initiative and USC IIGH present:

The end of antibiotics

"Evaluating antimicrobial resistance in Neisseria gonorrhoeae
among HIV PrEP users in Vietnam"

with Paul
**Adamson,
MD MPH**

Assistant Clinical Professor of Medicine at the University
of California, Los Angeles

FEBRUARY 28TH, 2023
1:00PM - 2:00PM
SSB 114 & ZOOM
[Register for Zoom link](#)

The Infectious Disease Epidemiology and Applied Studies (I.D.E.A.S.)
Initiative and USC IIGH present:

**Pediatric Vaccine Hesitancy in the US &
Around the World**
Moderated by **Dr. Andrea Kim** from the
Los Angeles County Department of Public Health



James Conway
MD, FAAP

Professor of Pediatrics &
Director, Office of Global Health
UW School of Medicine and Public
Health (SMPH)



Andrea Kim
PhD, MPH

Director, Vaccine Preventable
Disease Control Program LADPH
& Adjunct Professor, DPPHS,
USC

November 9, 2023
12:00PM - 1:00PM PST
SSB 115 & ZOOM
[Register for Zoom link](#)



Keck School of Medicine of USC
Department of Population and
Public Health Sciences

The Infectious Disease Epidemiology and Applied Studies
(I.D.E.A.S.) Initiative and USC IIGH present:

**Public Health Approach to
Elimination of Hepatitis C**

Experts weigh in from the LA County Department of Public
Health and the White House

Prabhu Gounder,
MD

Medical Epidemiologist
Los Angeles County
Department of Public Health

Rachael L.
Florence, PhD, MSc

Senior Advisor to Dr. Francis Collins
(Science Advisor to the President of
the United States)

April 10TH, 2023
12:00PM - 1:00PM PST
SSB 301 & ZOOM
[Register for Zoom link](#)

Keck School of Medicine of USC
Department of Population and
Public Health Sciences

The Infectious Disease Epidemiology and Applied
Studies (I.D.E.A.S.) Initiative and USC IIGH present:

**Malaria: old and new approaches
toward control and elimination**

with Philip J.
Rosenthal, MD

Professor of Medicine at the University of California, San Francisco
Associate Chief for Academic Affairs and Research in the Division of
HIV, Infectious Diseases, and Global Medicine at San Francisco General
Hospital

MARCH 16TH, 2023
3:00PM - 4:00PM PST
via ZOOM
[Register for Zoom link](#)

Keck School of Medicine of USC
Department of Population and
Public Health Sciences

The Infectious Disease Epidemiology and Applied Studies
(I.D.E.A.S.) Initiative and USC IIGH present:

**Groundbreaking Findings from STI and
HPV Cancer Screening During Pregnancy
in Bangladesh**

Rokana Karim,
PhD, MBBS

Associate Professor
Department of Population and
Public Health Sciences

AKM Fazlur Rahman,
PhD, MBBS, MPHil

Executive Director
Center for Injury Prevention and
Research, Bangladesh

May 18TH, 2023
10:00AM - 11:00AM PST
SSB 301 & ZOOM
[Register for Zoom link](#)

Keck School of Medicine of USC
Department of Population and
Public Health Sciences

The Infectious Disease Epidemiology and Applied
Studies (I.D.E.A.S.) Initiative and USC IIGH present:

**Cervical Cancer Control and
Prevention in India**

with Purnima
**Madhivanan,
MBBS, MPH,
PhD**

Associate Professor in Health Promotion Sciences
Mel & Enid College of Public Health at University of Arizona

September 11TH, 2023
12:00PM - 1:00PM PST
Hybrid Seminar
[Register for Zoom link](#)

Keck School of Medicine of USC
Department of Population and
Public Health Sciences

USC Institute on Inequalities in Global Health

An event produced by The Infectious Disease Epidemiology and Applied
Studies (I.D.E.A.S.) Initiative and USC IIGH

**What can Public Health learn from Games
and TV shows like "The Last of Us"?
Narrative Tropes, Climate Change & Fungal Disease**

Tom Chiller, MD, MPH

Chief of Mycotic Diseases Branch
Centers for Disease
Control and Prevention (CDC)

Marietta Gotsis MFA

Professor of Cinema Practice
Interactive Media & Games
USC School of Cinematic Arts

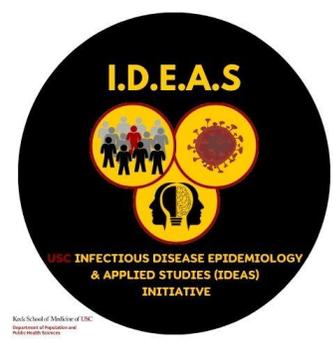
An interdisciplinary expert panel produced by junior scholars
of the USC Creative Media & Behavioral Health Center.

OCTOBER 3, 2023
1:30PM - 3:00PM PST
SSB 116 & ZOOM
[Register for Zoom link](#)



Through discovery, training and action, we are solving public health and health equity
challenges, from local to global, for today and tomorrow.

Keck School of Medicine of USC
Department of Population and
Public Health Sciences



Our Upcoming Seminars

Keck School of Medicine of USC
Department of Population and
Public Health Sciences

USC Institute on Inequalities in Global Health

The Infectious Disease Epidemiology and Applied Studies (I.D.E.A.S.)
Initiative and USC IIGH present:

Highly Effective Infectious Disease Prevention Strategy: Changing the Community Narrative



**Lourdes Baezconde-
Garbanati PhD, MPH**

Professor of Population and
Public Health Sciences
Keck School of Medicine
University of Southern California



**Sheila Teresa Murphy
PhD**

Professor of Communication
Annenberg School of
Communication and Journalism
University of Southern California

February 20, 2024

11:30 - 12:30PM PST

SSB 103E & ZOOM

[Register for Zoom link](#)



USC University of
Southern California

Keck School of Medicine of USC
Department of Population and
Public Health Sciences

USC Institute on Inequalities in Global Health

The Infectious Disease Epidemiology and Applied Studies (I.D.E.A.S.)
Initiative and USC IIGH present:

Vector Borne Infections in the US and Around the World with an Emphasis on Chikungunya & Dengue Viruses



**Scott Weaver
PhD**

Chair, Department of Microbiology & Immunology
Director, Institute for Human Infections & Immunity
Professor, Microbiology & Immunology and Pathology
The University of Texas (UTMB)

March 19, 2024

12:00 - 1:00PM PST

SSB 114 & ZOOM

[Register for Zoom link](#)

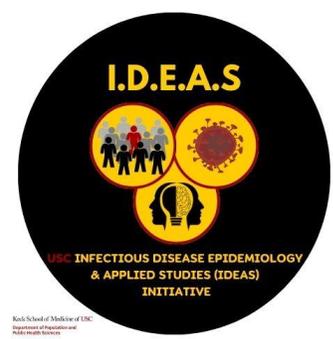


USC University of
Southern California



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Keck School of Medicine of USC
Department of Population and
Public Health Sciences



Keck School of Medicine of USC
Department of Population and
Public Health Sciences

USC Institute on Inequalities in Global Health

The Infectious Disease Epidemiology and Applied Studies (I.D.E.A.S.)
Initiative and USC IIGH present:

SARS-CoV-2 Infection and Excess Mortality in Canada, China, India and Sierra Leone 2020-2023



**Prabhat Jha
MD, DPhil**

Professor of Global Health and Epidemiology
Dalla Lana School of Public Health
Professor, Faculty of Medicine
University of Toronto

Happy New Year!

Welcome to SPRING 2024

Happening Today!!!

January 29, 2024

10:00 - 11:00PM PST

SSB 114 & ZOOM

[Register for Zoom link](#)



Through discovery, training and action, we are solving public health and health equity challenges, from local to global, for today and tomorrow.

Keck School of Medicine of USC
Department of Population and
Public Health Sciences

SARS-CoV-2 infection and mortality: lessons learned from various countries

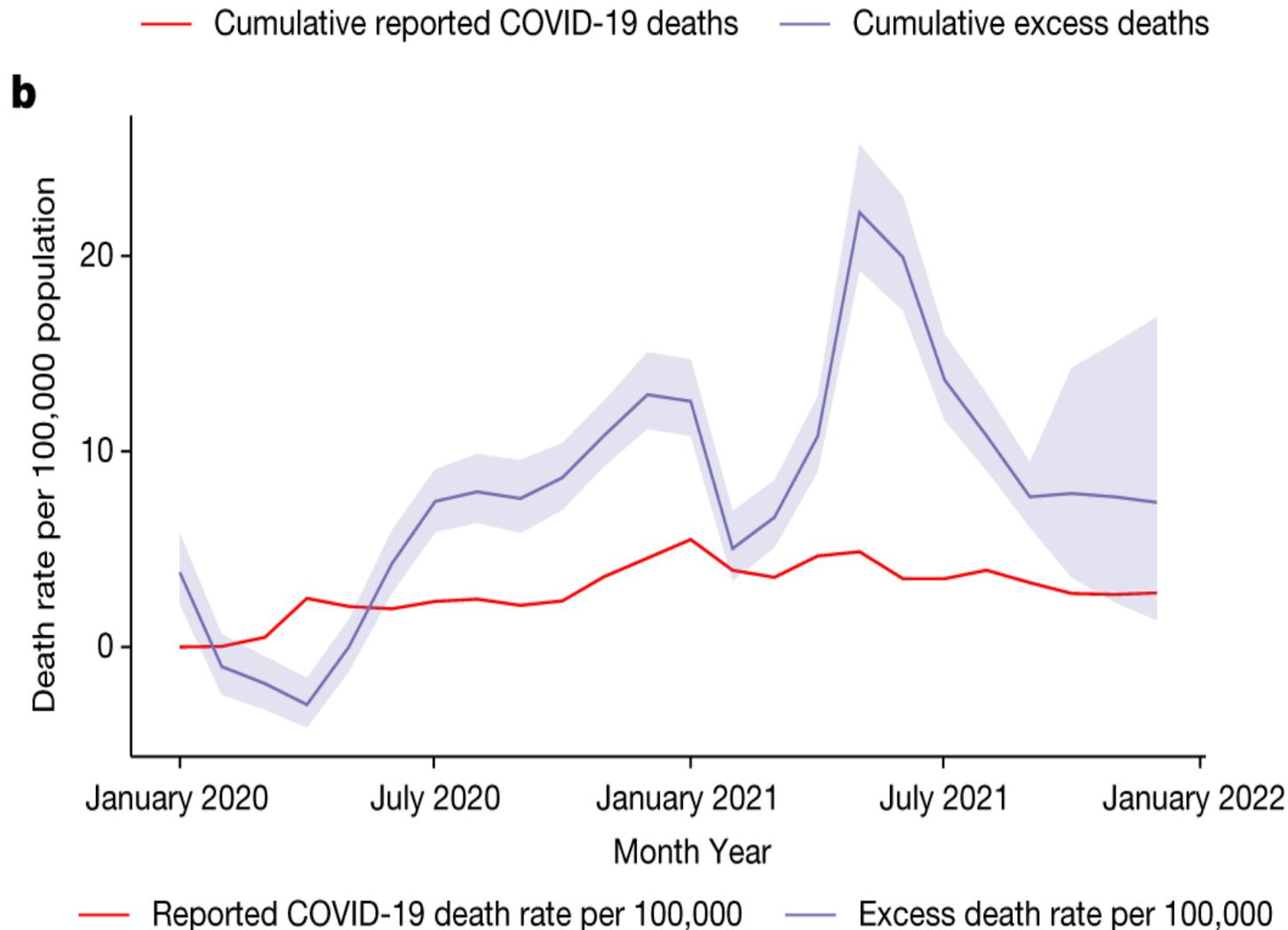
Prabhat Jha for many others

Prabhat.Jha@utoronto.ca Twitter: @counthedeatd

University of Toronto

Supported by the Bill and Melinda Gates Foundation, Queen Elizabeth Scholarships and Mastercard Foundation, CIHR, CITF and University of Toronto, Canada

Worldwide excess and reported COVID deaths, 2020-2022



**Cumulative ~15M
excess deaths vs
6M reported
Likely ~20M by 2023,
including ~1M in China**

**Of ~9 million “Missing”
deaths by 2022, ~ 3-
4M were in India**

Ab-C Investigators

Unity Health Toronto

Prabhat Jha, Director CGHR, Scientist (PI)

Arthur Slutsky, Scientist (Chair, Advisory Committee)

Patrick Brown, Scientist

Nico Nagelkerke, CGHR Senior Fellow

Aiyush Bansal, Post Doctoral Fellow (PDF)

Peter Rodriguez, CGHR Database Coordinator

Maria Pasic, Lead Scientist

Chaim Birnboim, Senior Technical Advisor

Jeff Companion, Lab Scientist

Abha Sharma, PDF

Xuyang Tang, PDF

Eo Rin Cho, PDF

Richard Wen, PDF

Bapujee Biswabandan, PDF

Hellen Gelband, Senior Fellow

Justin Slater, Research Fellow

Sze Hang (Hana) Fu, GIS Technician

Daphne C Wu, Research Fellow

Catherine Meh, Research Fellow

Wilson Suraweera, Research Fellow

Leslie Newcombe, Research Fellow

Divya Santhanam, Research Intern

Shreya Jha, Research Intern

Zoe Greenwald, PhD Student

Vedika Jha, Research Intern

Varsha Malhotra, Economist

Sinai Health Toronto

Anne-Claude Gingras, Senior Investigator

Karen Colwill, Staff Scientist

Geneviève Mailhot, Technician

Melanie Delgado-Brand, Technician

Adrian Pasculescu, Senior Bioinformatician

Miriam Barrios-Rodiles, Scientific Associate

Jenny Wang, Lab Automation Specialist

Kento T Abe, Graduate Student

Bhavisha Rathod, Research Assistant

Mahya Fazel-Zarandi, Student Research Assistant

Samir Sinha, Director of Geriatrics

University Health Network

Isaac Bogoch, Scientist

Rupert Kaul, Clinician Scientist

Children's Hospital of Eastern Ottawa and University of Ottawa

Pranesh Chakraborty, Associate Professor

Marc-André Langlois, Professor

Angus Reid Institute and Angus Reid Forum

Angus Reid

Ed Morawski

Demetre Eliopoulos

Teresa Lam

Andy Hollander

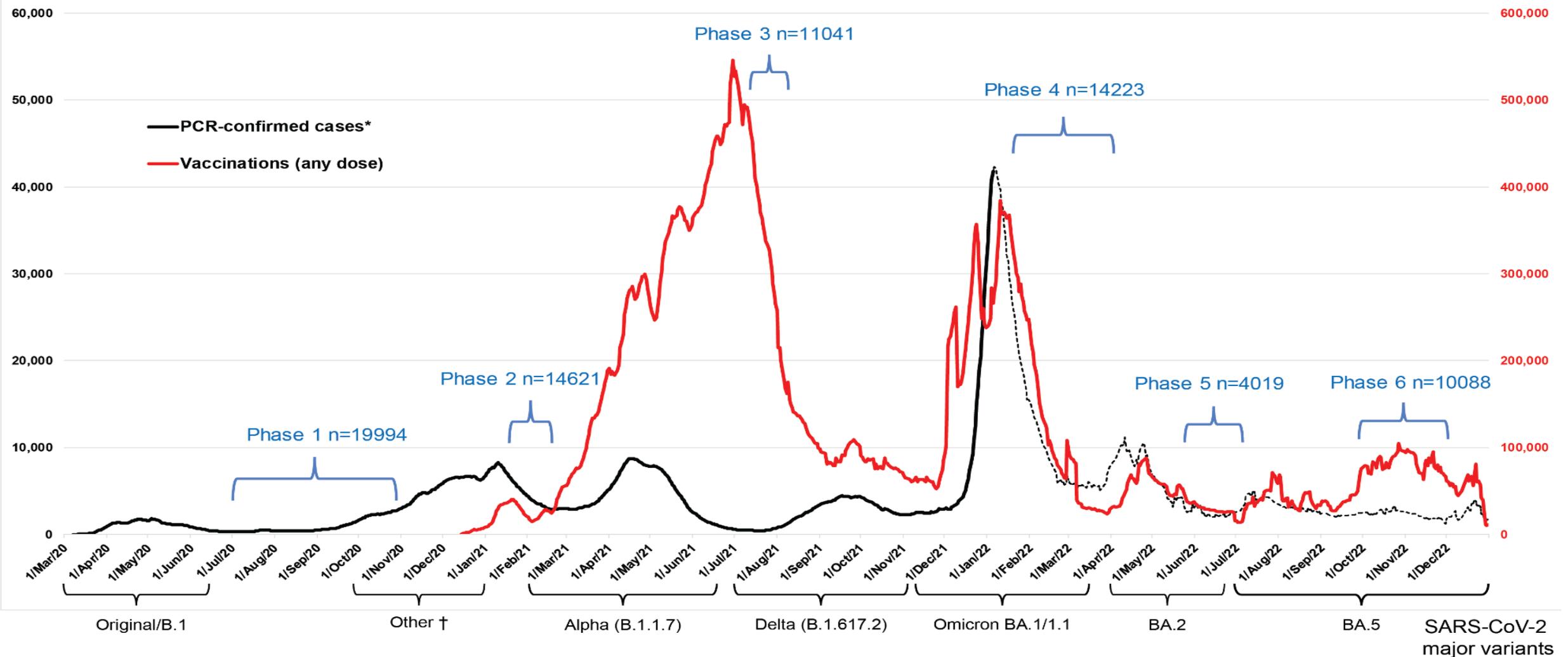
Ben Aloï

Conclusions: Canada (population 37 million)

1. Low cumulative adult COVID infection (~13%) prior to Omicron waves
2. Omicron BA.1/1.1 period incidence of ~23%
3. Omicron BA.2/5 period incidence of ~42%
4. Cumulatively, at least 25M Canadian adults infected, along with 30M+ double vaccinated, so “hybrid immunity” is high
5. Low COVID death rates, except for Alpha wave infections among nursing homes (incidence ~12-16%) accounting for 80% of all COVID deaths till that time period
6. Simple home-based dried blood spots are a practicable strategy in high-income settings.

Ongoing epidemiological studies (serosurveys, mortality studies) essential for response and to guide vaccine programs

Seven-day rolling averages of PCR-confirmed COVID cases in CANADA (black solid and dotted line), and SARS-CoV-2 vaccinations (any dose; red line) in relation to Ab-C data collection phases



* Dotted line indicates period after restrictions to PCR testing eligibility
 † Major variants include AE.8, B.1.36.36, B.1.2, B.1.160, B.1.438.1

Action to Beat Coronavirus in Canada (Ab-C) Study

- 12 min poll of symptoms, risk factors, testing and vaccination history
- Safe, simple home dried blood sample (DBS) which takes 10 min
- Mail (safely) to central lab
- Quality control: humidity & storage
- Test for antibodies to determine how many Canadians infected in ongoing waves



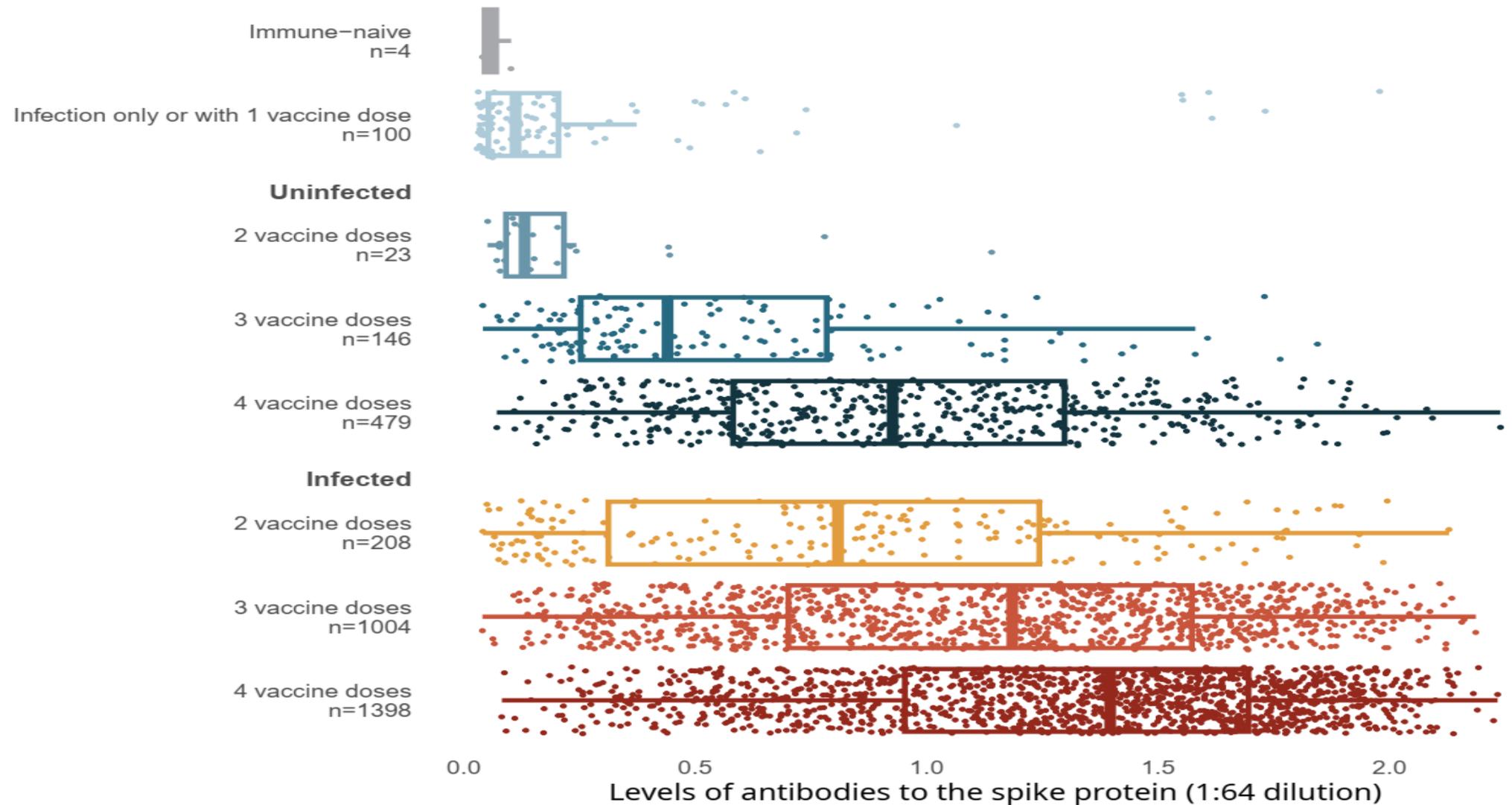
Representativeness of online poll

| Comparison group | Census 2016 distribution | Survey sample | |
|--|-----------------------------|---------------|---------|
| | | Phase 1 | Phase 6 |
| Education | | | |
| Some college or less | 45% | 33% | 34% |
| College graduate/some university | 32% | 33% | 32% |
| University graduate | 23% | 34% | 34% |
| Visible minority | 22% | 15% | 24% |
| Ever smoking | 54% | 51% | 51% |
| Indigenous | 5% | 8% | 9% |
| Obese (≥ 30 kg/m²) | 27% | 27% | 28% |
| Diabetes | 9% | 10% | 11% |
| Hypertension | 23% | 26% | 30% |

Cumulative incidence, numbers of infected adults, cumulative deaths, and period COVID mortality rate in Canada during various SARS-CoV-2 viral waves

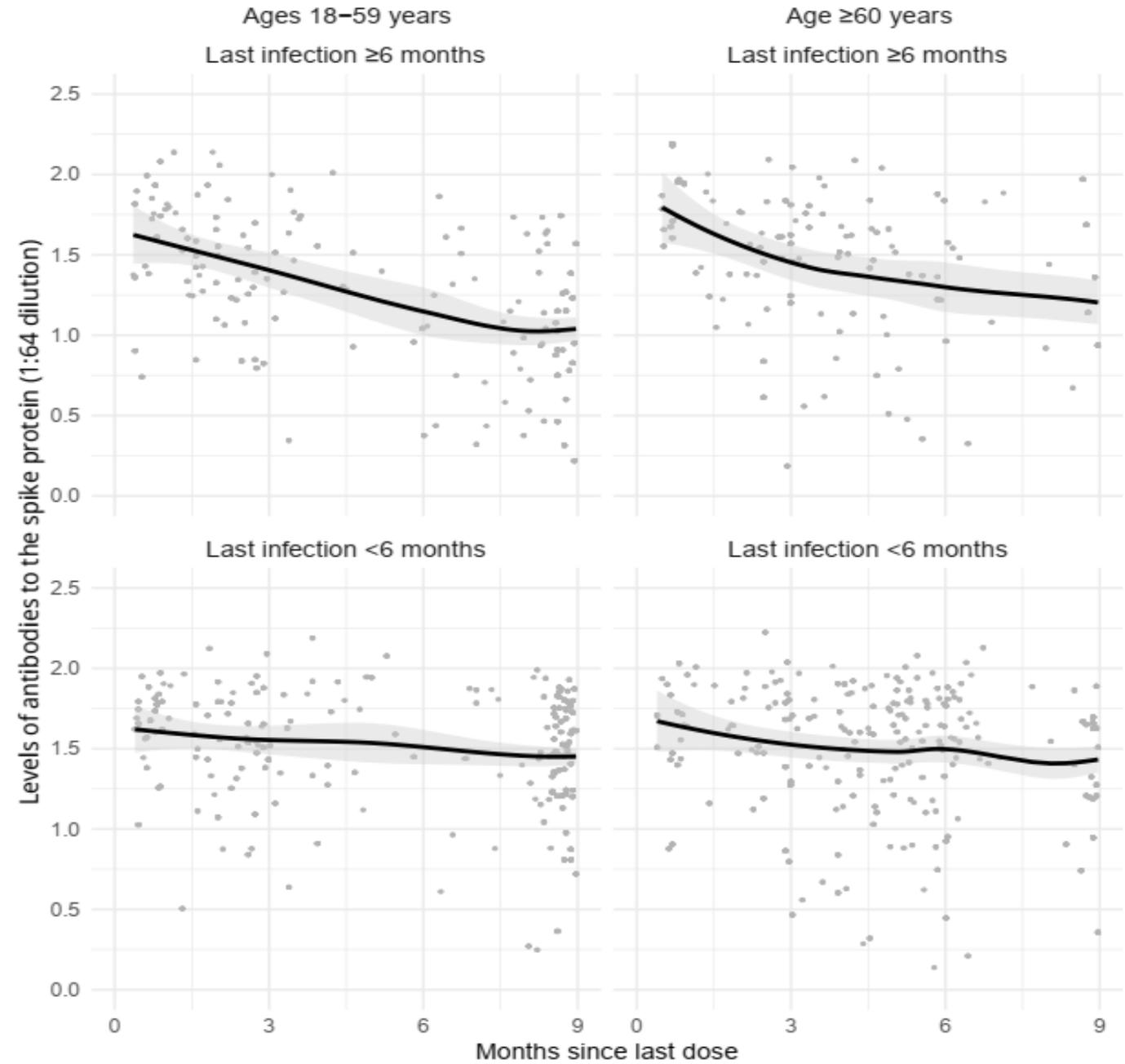
| Time period | Cumulative incidence* % (95% CI) | No of adult (age 18+) infections in millions | Cumulative no of deathst† | Covid mortality rate per million per week during the relevant period |
|---------------------------------------|-------------------------------------|--|---------------------------|--|
| Pre-Omicron 2020-2021 | 12.7 (11.2-14.1) | 3.9 (3.5-4.4) | 30 149 | 8.6 |
| Omicron BA.1/1.1 Jan.-Mar. 2022 | 35.7 (34.0-37.4) | 11.3 (10.7-11.8) | 37 750 | 16.6 |
| Omicron BA.2/5 Apr.-Dec. 2022 | 77.7 (75.7-79.6) | 24.6 (23.9-25.2) | 49 674 | 7.7 |

CANADA: Levels of antibodies to the spike protein stratified by infection and number of vax doses

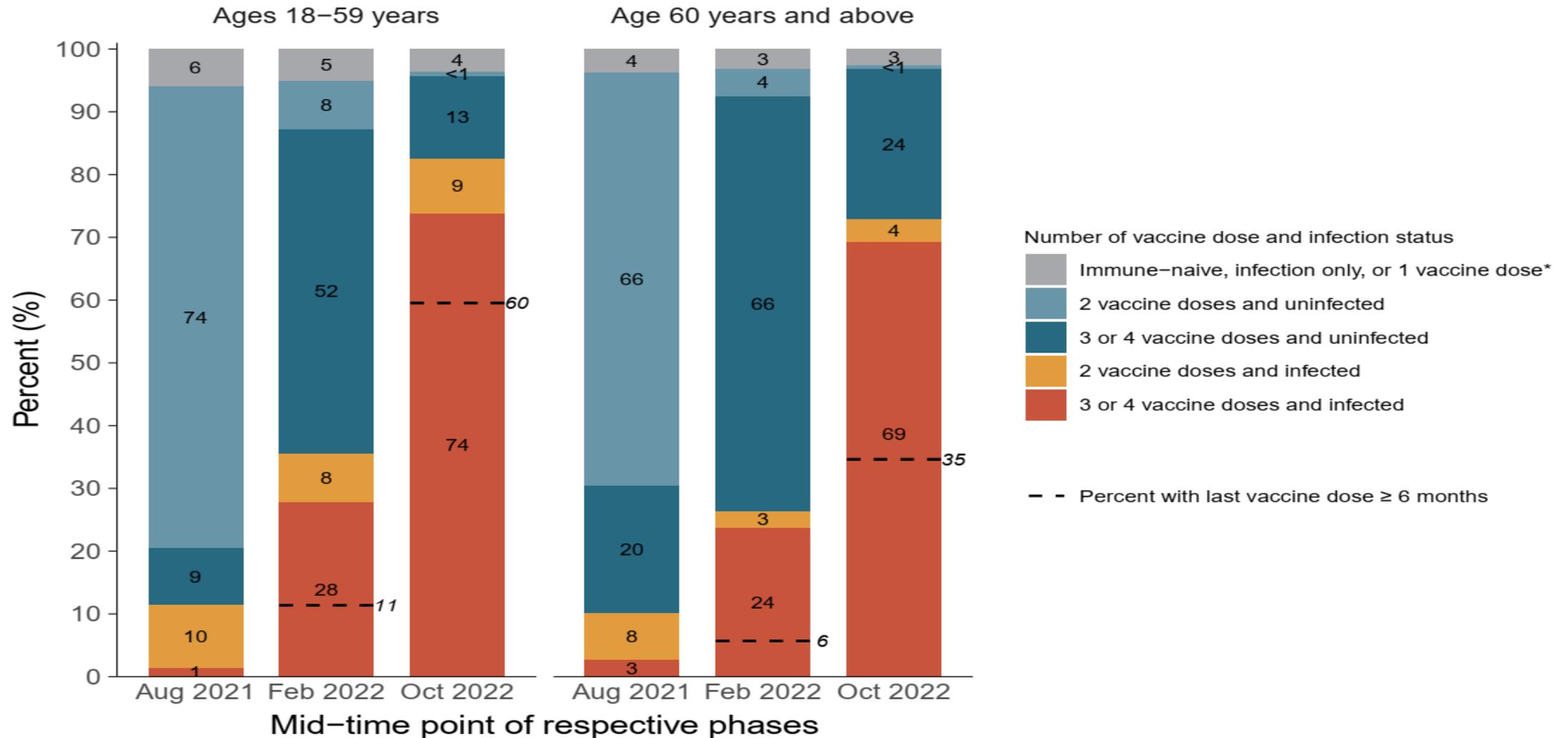


CANADA: Age-specific trends to nine months in levels of antibodies to the spike protein among adults vaccinated with 3-4 doses, stratified by infection > or < 6 months ago

(A) By age group



CANADA: Cumulative incidence in each stratum of infection and vaccination in the pre-Omicron wave and during the Omicron BA.1/1.1 wave, and BA.2/BA.5 waves by age

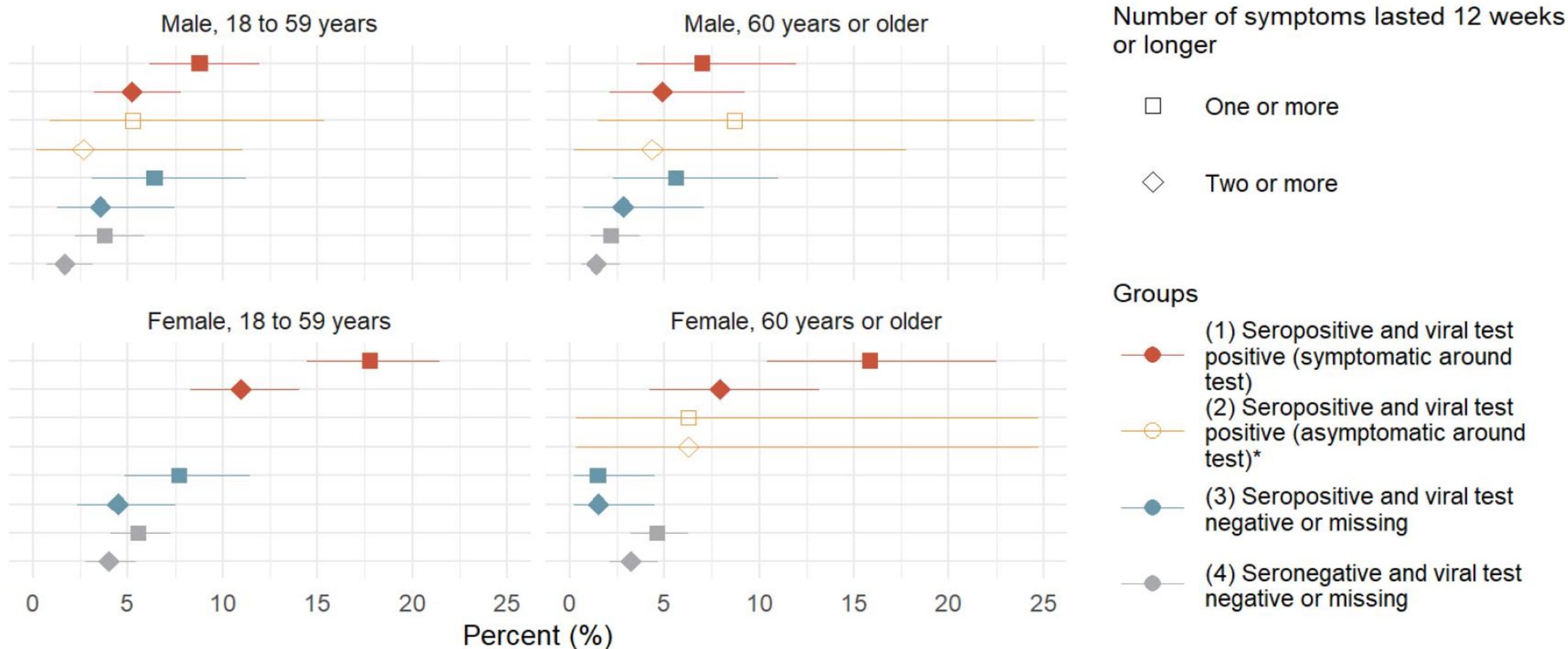


Sub study on cellular immunity

- Population: convenience sample (n=54), from Ab-C survey participants in Greater Toronto Area
- Whole blood samples drawn April-May 2022
- SARS-CoV-2 Interferon Gamma Release Assay for T-cell activity

| Subgroup | No. of participants | No. of positive | No. of negative |
|---------------------------|----------------------------|------------------------|------------------------|
| Vaccinated + infected | 30 | 30 (100%) | 0 |
| Vaccinated + uninfected | 3 | 3 (75%) | 0 |
| Unvaccinated + infected | 2 | 1 (50%) | 1 (50%) |
| Unvaccinated + uninfected | 5 | 2 (40%) | 3 (60%) |
| Total | 40 | 36 (88%) | 4 (10%) |

Proportions of respondents with 1+ or 2+ symptoms lasting 12+ weeks during Omicron BA.1/1.1 wave



Proportion with any long COVID symptoms

| Serology | Viral test result (symptoms around test) | Percent with ≥ 1 symptom |
|-----------------|---|---|
| Positive | Positive (with symptoms) | 13.1 |
| Positive | Positive (asymptomatic) | 5.1 |
| Positive | Negative or missing | 5.7 |
| Negative | Negative or missing | 4.3 |

Average number of symptom weeks

| Age group (years) | Serology | Viral test result (symptom around test) | Average no. of symptom weeks | |
|-------------------|----------|---|------------------------------|--------|
| | | | Male | Female |
| 18-59 | Positive | Positive (with symptoms) | 6.5 | 11.4 |
| | Positive | Positive (asymptomatic) | 3.5 | 0.2 |
| | Positive | Negative or missing | 3.1 | 3.7 |
| | Negative | Negative or missing | 1.5 | 2.8 |
| 60 and above | Positive | Positive (with symptoms) | 5.0 | 8.7 |
| | Positive | Positive (asymptomatic) | 1.9 | 2.8 |
| | Positive | Negative or missing | 2.3 | 1.2 |
| | Negative | Negative or missing | 1.0 | 2.7 |

INDIA: Excess mortality from June 2020 to June 2021 during the COVID pandemic (from uncontrolled transmission)

Jha *et al.*, *Science* **375**, 667–671 (2022) 11 February 2022

CORONAVIRUS

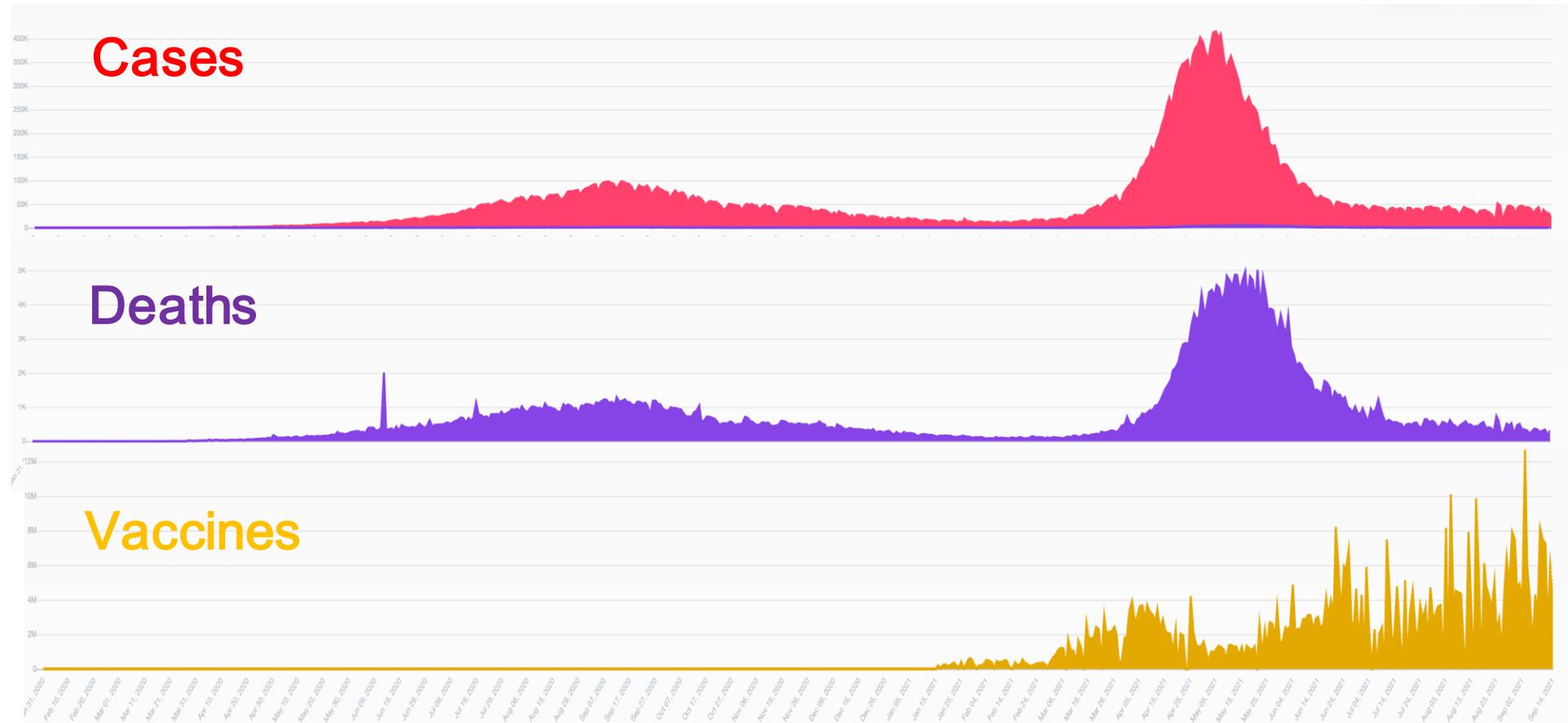
COVID mortality in India: National survey data and health facility deaths

Prabhat Jha^{1*}, Yashwant Deshmukh², Chinmay Tumbe³, Wilson Suraweera¹, Aditi Bhowmick⁴, Sankalp Sharma⁴, Paul Novosad⁵, Sze Hang Fu¹, Leslie Newcombe¹, Hellen Gelband¹, Patrick Brown¹

Excess mortality studies in India during uncontrolled transmission

1. COVID was the main contributor to India's substantial excess of deaths in the peak pandemic months of 2020 and 2021
2. India's actual cumulative COVID deaths about 3 million, 7-8 times higher than the officially reported
3. India accounted for ~ 3-4M of the "missing" total of ~9M COVID deaths globally

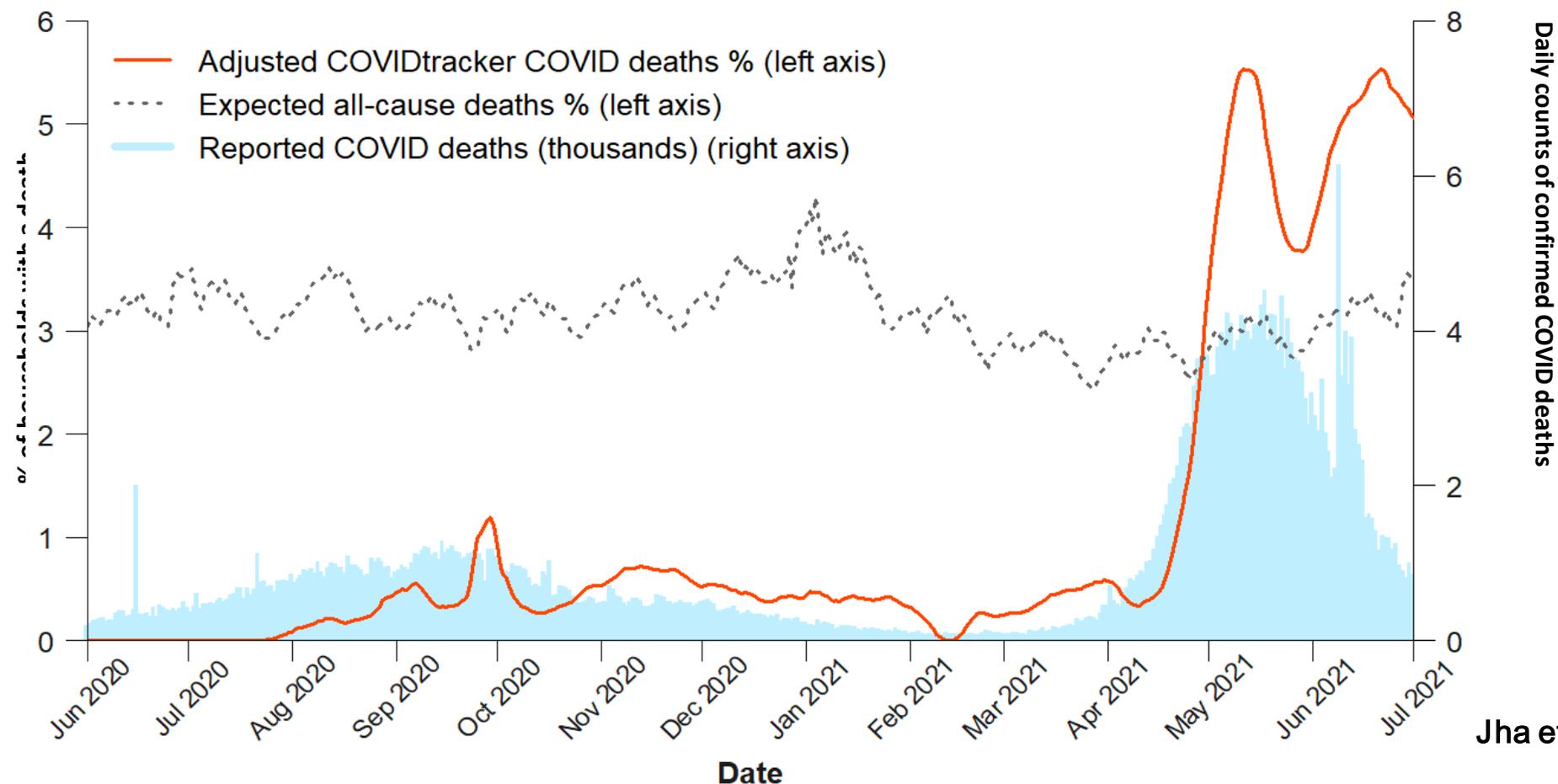
India's COVID cases, deaths, and vaccination March 2020-Sept 2021



CVoter survey design

- Random digit dialing (computer assisted telephone interview)
- 90% + mobile phone coverage
- Adults 18+ in 2100 randomly selected areas (300/day rolling sample) drawn from 4000 local electoral areas
- Overall margin of error + - 3% nationally, weighted distribution like Census or NSSO data
- Main study 140,000 adults but with less exact question about household deaths
- Substudy of 57,000 adults from July 1-Sept 15, 2021 with exact household deaths

Adjusted percentages of adults reporting daily death in household, expected percentage in 2020 and daily confirmed COVID deaths in India, June 2020-June 2021



Jha et al, Science 2022

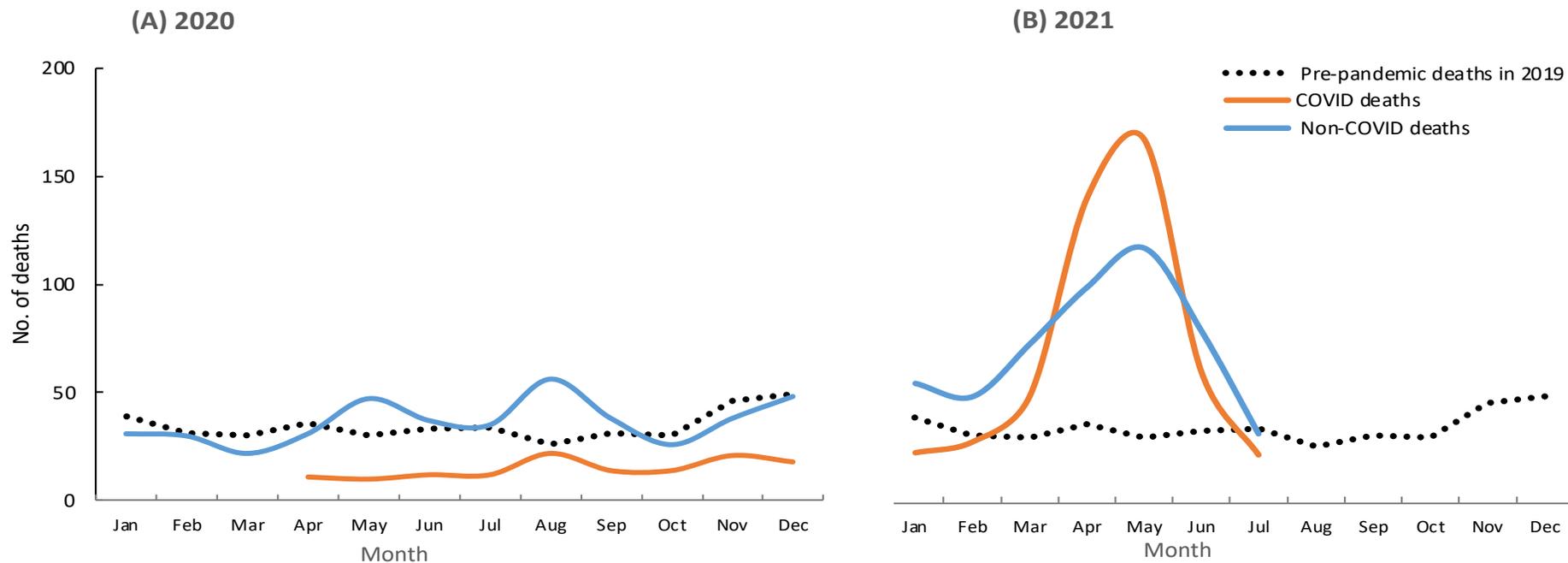
COVIDtracker deaths (red line, left vertical scale) represent COVID deaths reported daily (smoothed for rolling 7-day averages) at age 35 or older, adjusted for possible over-reporting (see text). Expected all-cause deaths (grey line, left vertical scale) per year of 3.16% applies the UN estimated total deaths in 2021 (10.0 million) to the number of households in India (316.3 million, based on the average household size of 4.6 in the 2011 census). The daily variation in this percentage applies the variation observed among 480,000 deaths in the Million Death Study. Confirmed COVID deaths (blue bars, right vertical scale) are daily reports from Covid19india.org.

Sub-survey of 13,500 households (~57,000 people)

Who was alive in Jan 2019? Who died since and when?

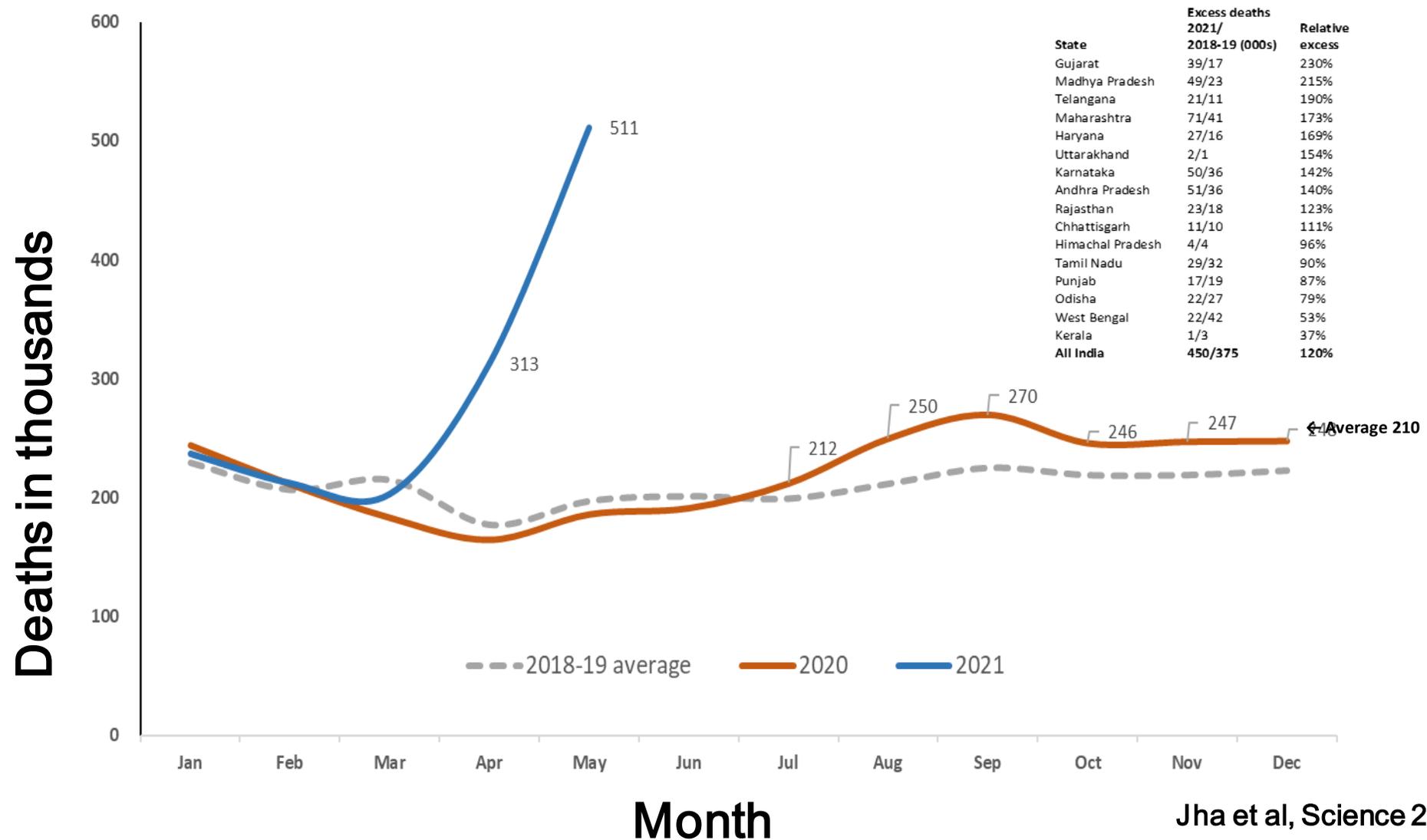
| <u>Year</u> | All cause mortality <u>rate/1000</u> |
|-------------|---|
| 2019 | 7.0 (vs UN/SRS rates of 8.1/6.2) |
| 2020 | 10.5 |
| 2021 | 18.4 |

Sub-survey of 13,500 households (~57,000 people)



Overall, ~4.5% of households reported a COVID death vs 3.5% expected from all causes. Sub-study consistent with main poll result showing ~doubling of overall death rates for ~3 months

Reported deaths from all causes in India's Ministry of Health and Family Welfare covering 0.2 M health facilities nationally, 2020 and 2021 versus average of 2018-19, by month

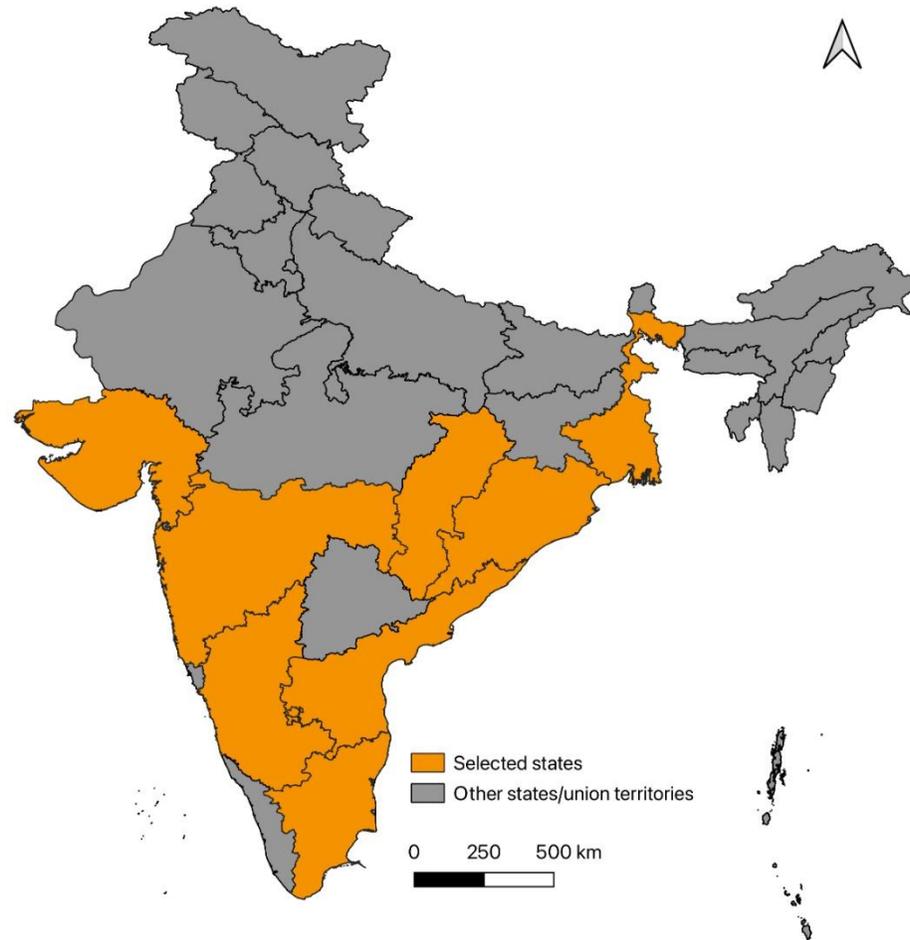


| State | Excess deaths 2021/2018-19 (000s) | Relative excess |
|------------------|-----------------------------------|-----------------|
| Gujarat | 39/17 | 230% |
| Madhya Pradesh | 49/23 | 215% |
| Telangana | 21/11 | 190% |
| Maharashtra | 71/41 | 173% |
| Haryana | 27/16 | 169% |
| Uttarakhand | 2/1 | 154% |
| Karnataka | 50/36 | 142% |
| Andhra Pradesh | 51/36 | 140% |
| Rajasthan | 23/18 | 123% |
| Chhattisgarh | 11/10 | 111% |
| Himachal Pradesh | 4/4 | 96% |
| Tamil Nadu | 29/32 | 90% |
| Punjab | 17/19 | 87% |
| Odisha | 22/27 | 79% |
| West Bengal | 22/42 | 53% |
| Kerala | 1/3 | 37% |
| All India | 450/375 | 120% |

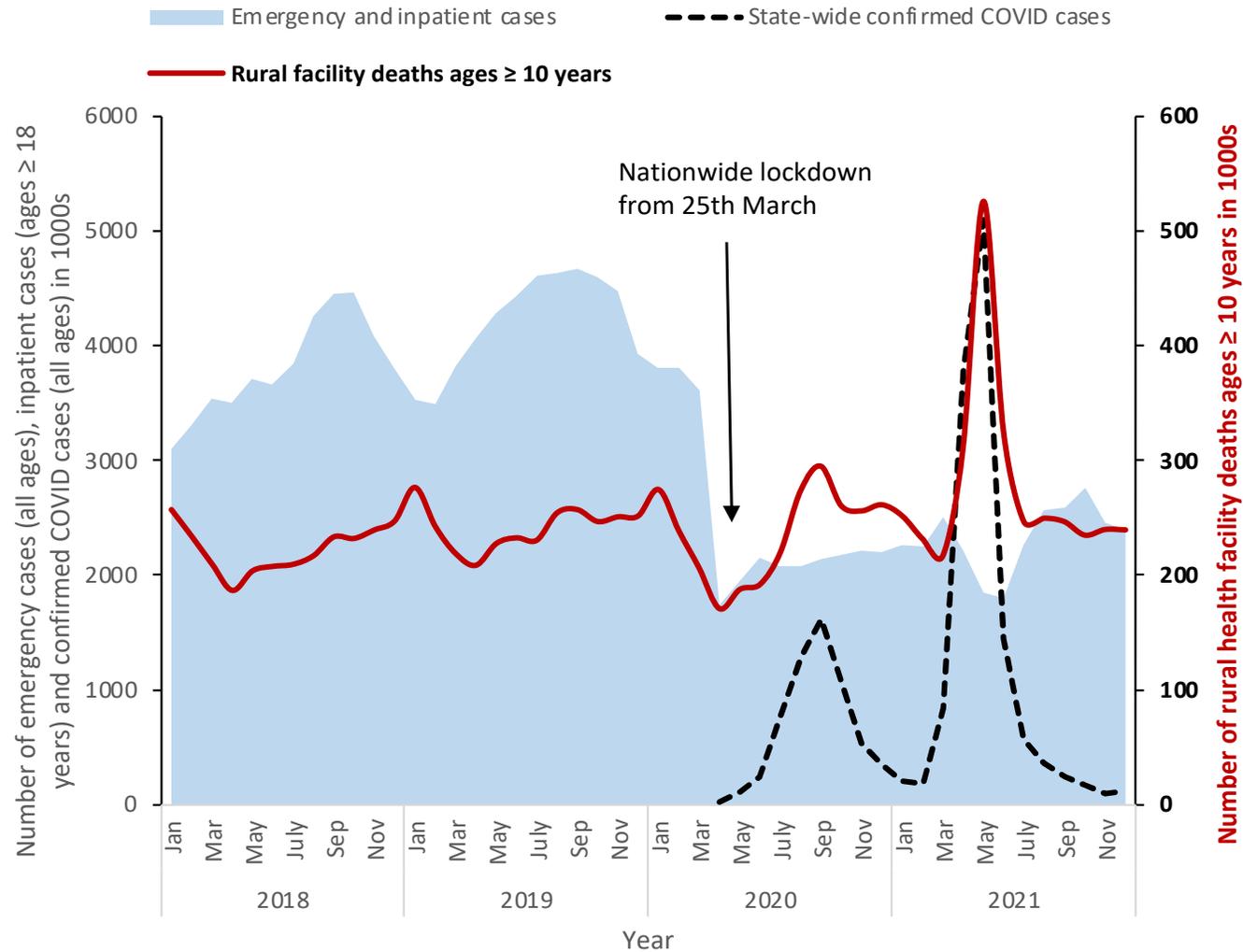
Summary estimates of excess deaths in India

| Data source | Reference period | Months | Excess deaths mid (LL,UL) in 000s | Excess as percentage of UN estimated deaths; mid (LL,UL) |
|---|-------------------------|--------|-----------------------------------|--|
| National Survey | | | | |
| | June 2020- July 2021 | 13 | 3325 (3159, 3491) | 30.3 (28.8, 31.9) |
| Facility-based deaths, national | | | | |
| | July 2020- May 2021 | 11 | 630 (531, 730) | 27.4 (23.1, 31.7) |
| Civil registration deaths in 10 states | | | | |
| | July 2020- May 2021 | 12 | 1247 (1002, 1491) | 25.8 (21.3, 30.8) |

Examination of 6 million rural facility deaths in 8 states in India, 2020-22

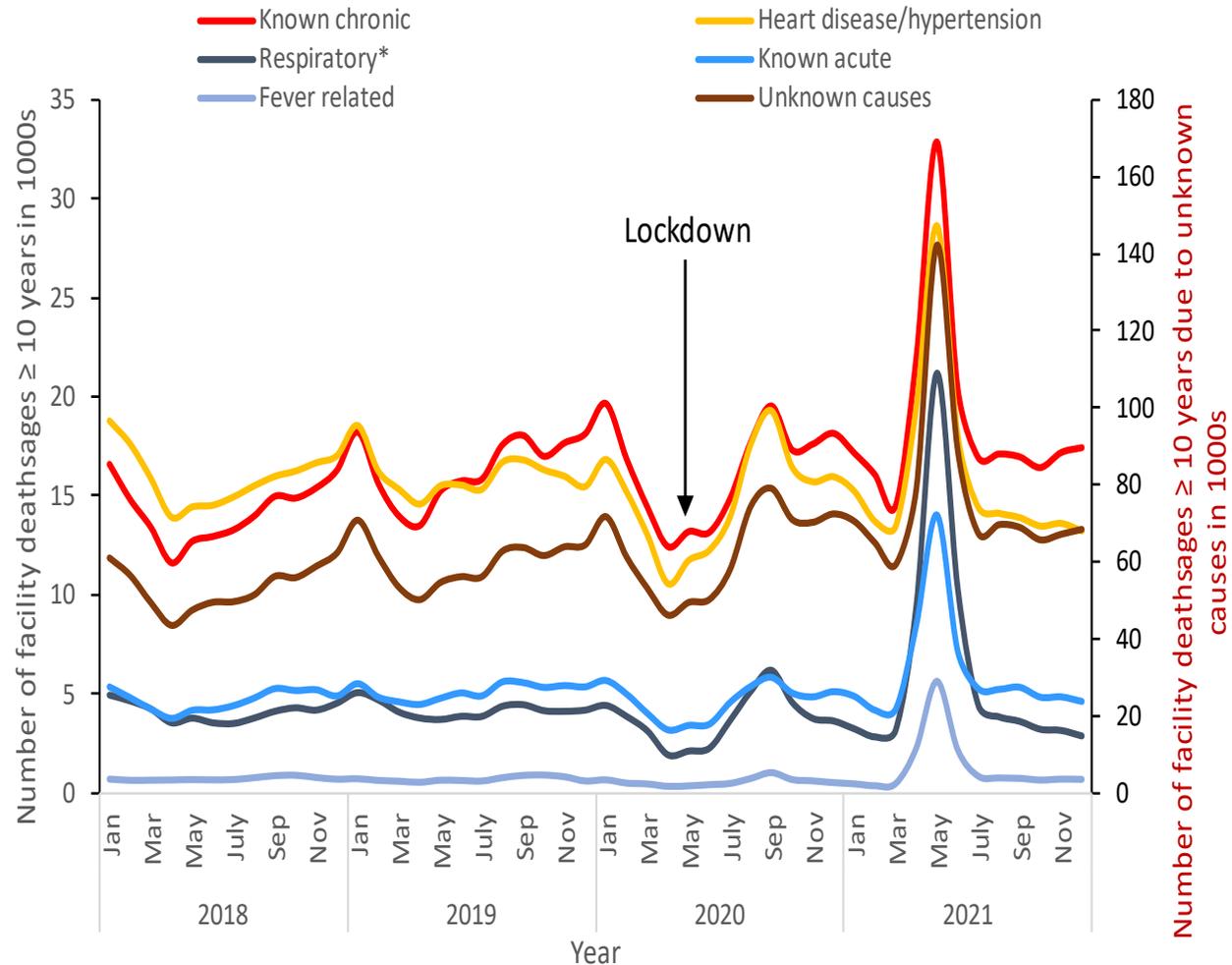


Number of emergency cases (all ages), inpatient cases (ages ≥ 18 years), health facility deaths ages ≥ 10 years in rural health facilities and confirmed COVID cases (all ages) India, 2018-2021

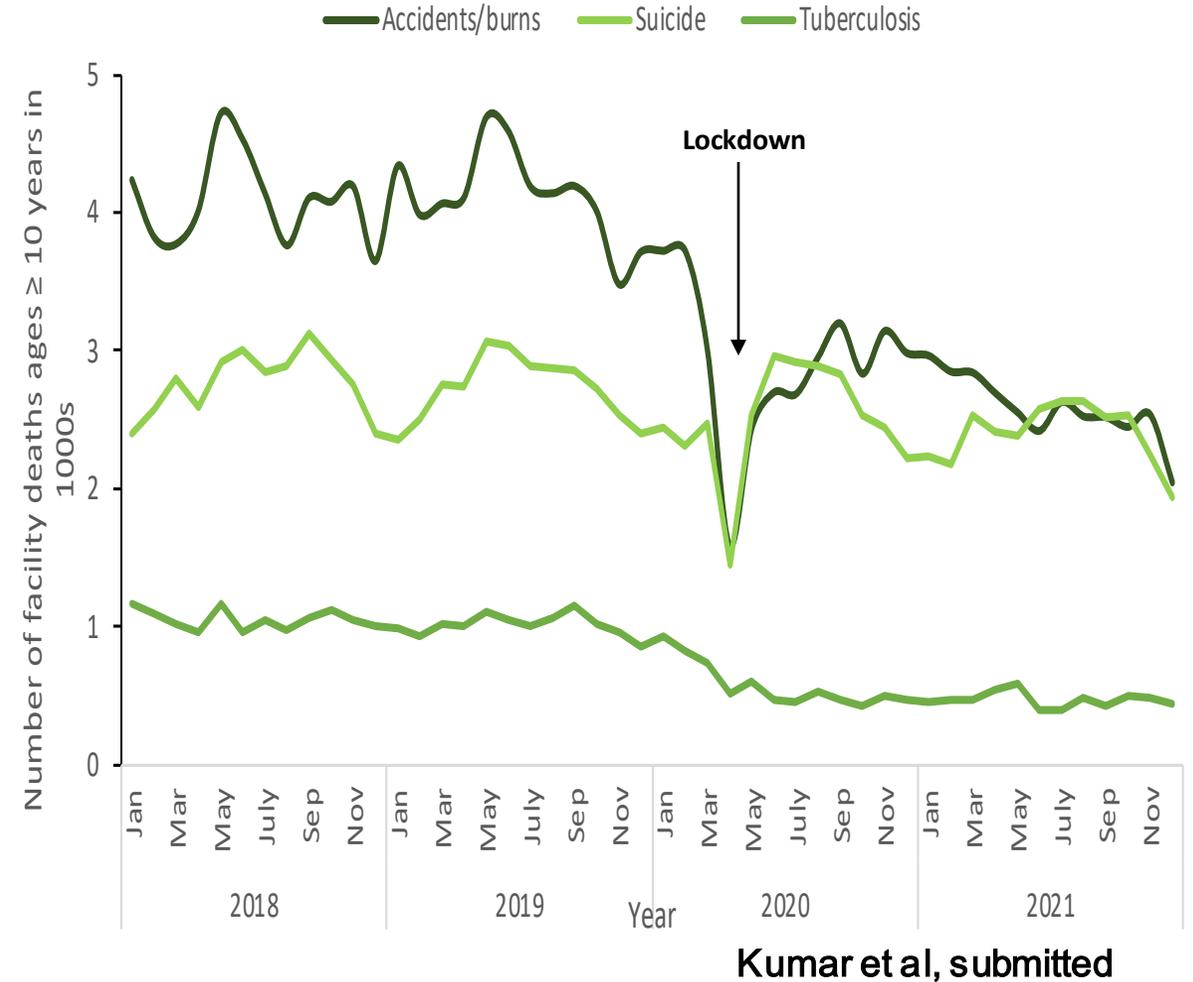


Deaths at ages ≥ 10 years in rural health facilities 2018-2021 from causes likely related and unrelated to SARS-Cov-2

a: Deaths due to causes likely related to SARSCoV-2



b: Deaths due to causes likely unrelated to SARS-Cov-2



Deaths at ages ≥ 10 years in rural health facilities 2018-2021 from causes likely related and unrelated to SARS-CoV-2

| Cause of deaths | % Excess deaths due to Delta wave | |
|--|-----------------------------------|-----------------------------------|
| | vs. non peak periods | vs. Pre-COVID deaths in 2018-2019 |
| Causes likely related to SARS-CoV-2 | | |
| Respiratory | 322 | 612 |
| Fever related | 461 | 1016 |
| Known acute | 103 | 354 |
| Known chronic | 49 | 275 |
| Heart disease/ Hypertension | 59 | 195 |
| Stroke | 33 | 143 |
| Causes weakly related to SARS-CoV-2 | | |
| Diarrhoea | 29 | 59 |
| Tuberculosis | 10 | -2 |
| HIV/AIDS | 33 | 32 |
| Cancer | 19 | 95 |
| Causes likely unrelated to SARS-CoV-2 | | |
| Accidents/Burns | 0 | 21 |
| Animal bites/stings | 24 | 136 |
| Suicide | 6 | 75 |
| Unknown causes | 52 | 315 |
| Total deaths | 60 | 270 |

Government of India data corroborate estimates of excess deaths for 2020 (1)

- India has **10M** annual deaths not **8.3M** as **GOI** claims
- Civil Registration Data (covers about 71% of all deaths, NOT 95% as GOI claims)
- CRS average deaths in 2018-9: 7.30M vs 8.12M in 2020 or **11%** relative excess or 0.83M absolute excess.
- CVoter polling: **9%** relative excess or 0.6M absolute excess in June 20-Jan 21 (8 months) vs earlier months
- WHO estimate for 2020: **9%** relative excess or 0.8M absolute excess versus earlier years

Government of India data corroborate estimates of excess deaths for 2020 (2)

- **Medically Certified Cause of Death** in urban hospitals (covering about 1.8M deaths out of 10M national total)
- 2020: COVID=9% of MCCD deaths, same proportion as CVoter national poll for COVID deaths and WHO's estimate for excess deaths
- COVID proportion higher in Maharashtra (**18%**), consistent with much bigger 2020 COVID wave in that state
- Absolute MCCD COVID deaths in 2020=160,000 which is greater than confirmed COVID deaths of 150,000
- **Life Insurance Claims:** ~3M claims, and estimate of ~4 million additional deaths in 2021 versus 2019

China's mortality during the COVID era

Mortality rates per 1000 at ages 60 years or older and 15-59 years in a nationally representative survey in China from 2020-23 compared to United Nations estimates for earlier years

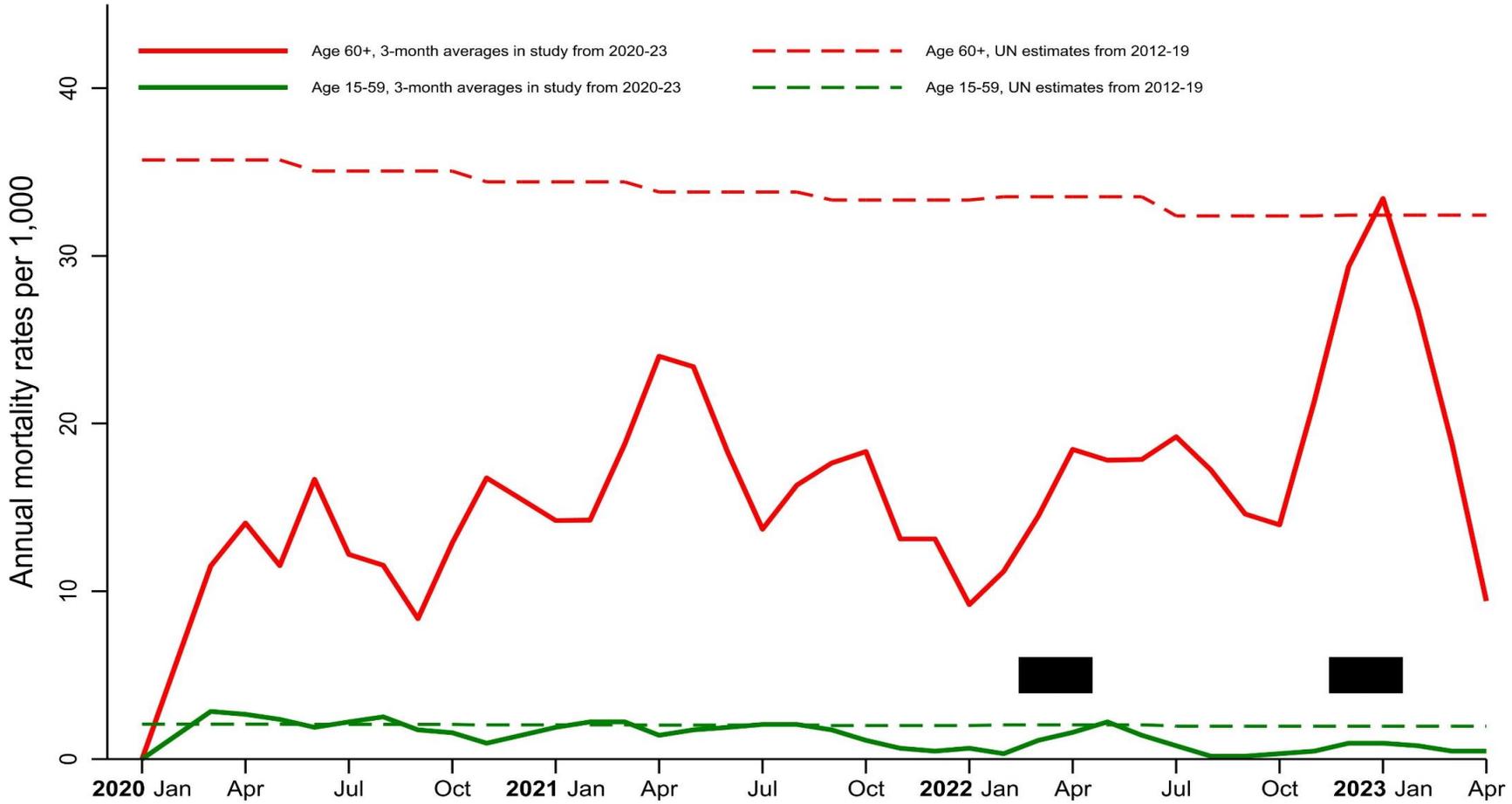


Figure legend:
 Peak viral periods in March-April 2022 and Dec 2022-Jan 2023 are shown in the black rectangles. The numbers of study deaths are shown in the text below the figure. Study deaths use rolling three-month averages. The annual mortality rates are per 1,000 person-years.

Study deaths by period and age

| | | | | | | | | | | | | | | |
|-----------|---|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Age 60+ | 4 | 22 | 19 | 20 | 22 | 37 | 21 | 28 | 14 | 28 | 29 | 21 | 50 | 14 |
| Age 15-59 | 5 | 17 | 14 | 10 | 12 | 9 | 13 | 7 | 4 | 10 | 5 | 2 | 6 | 3 |

SARS-CoV-2 infection and mortality in Sierra Leone

Ahmed Osman, Ashley Aimone, Rashid Ansumana and many others



<https://healsl.org/>

Ministry of Health

Njala University, University of Toronto

HEAL-SL Supported by the Bill and Melinda Gates Foundation, Queen Elizabeth Scholarships and Mastercard Foundation and University of Toronto, Canada



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Sierra Leone



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Conclusions (1)

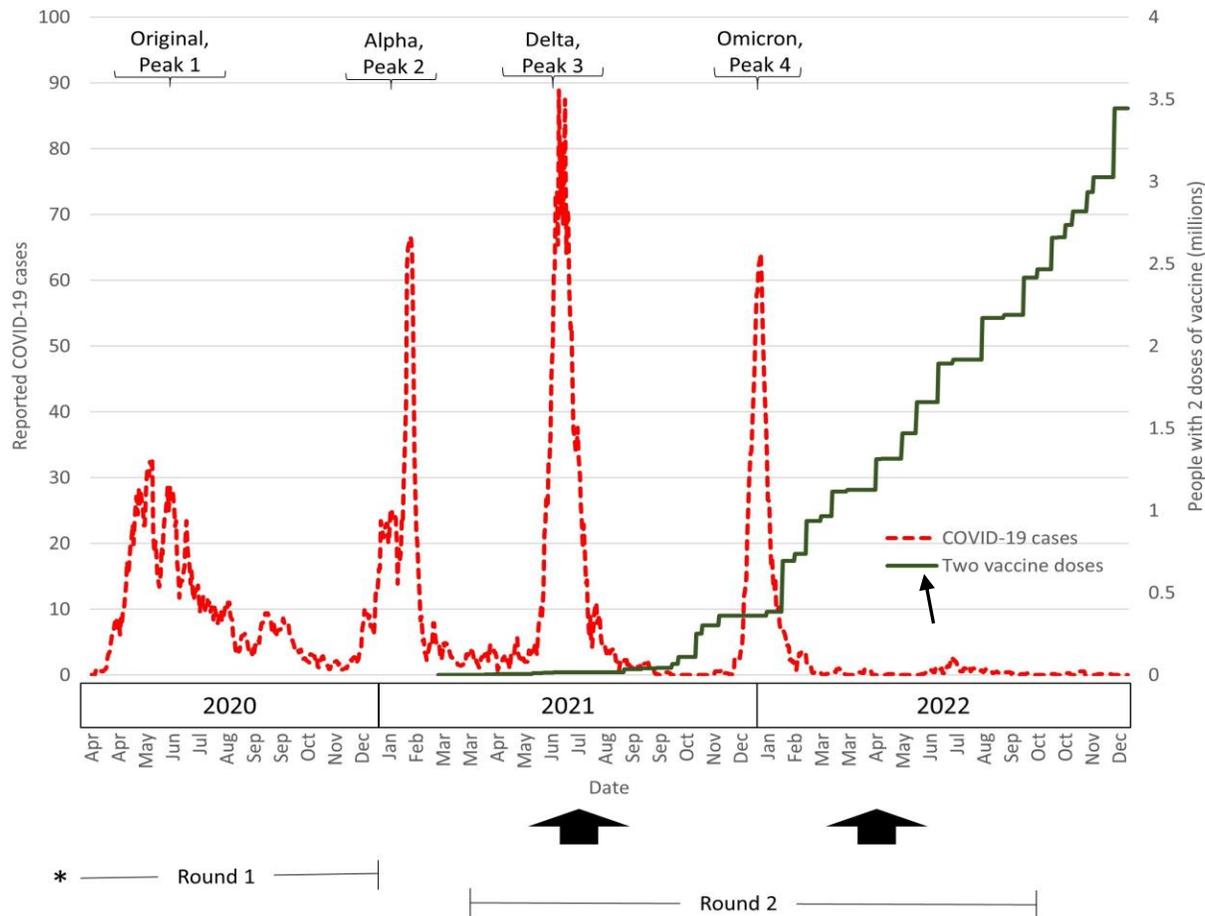
- Sierra Leone appears to have widespread SARS-CoV-2 transmission, but relatively low levels of excess mortality from COVID.
- Cumulative seroincidence, approached 70% by July 2021, and nearly 85% by April 2022, mostly prior to vaccines.
- About half of the infections generated neutralizing antibody response.
- Despite high levels of prior infection, the Omicron viral wave managed to infect about 20% of adults, and age patterns were consistent with widespread household transmission.

Conclusions (2)

- Despite very high and rapid transmission, excess deaths from COVID appear to have been remarkably low in Sierra Leone, mostly concentrated at older ages.
- During the peak viral weeks, excess mortality was 22% at ages 30-69 years and 70% at ages 70 or more.
- Observed excess deaths were notable for respiratory infections, but did not differ greatly across specific causes that would, a priori, be strongly associated with COVID, nor among those with or without chronic disease risk factors.

Is there a “West African” Paradox? Correlates that protect against disease but not SARS-CoV-2 infection?

Reported COVID infections and cumulative number of people who received two SARS-CoV-vaccine doses in Sierra Leone



80% of ~7500 reported cases are in Western Area Urban (Freetown) and Rural, and incoming passengers; Vaccinated- by April 2022- **1.3 M/total pop 8M**

SIERRA LEONE: SARS-2-CoV Serosurvey in urban Bo

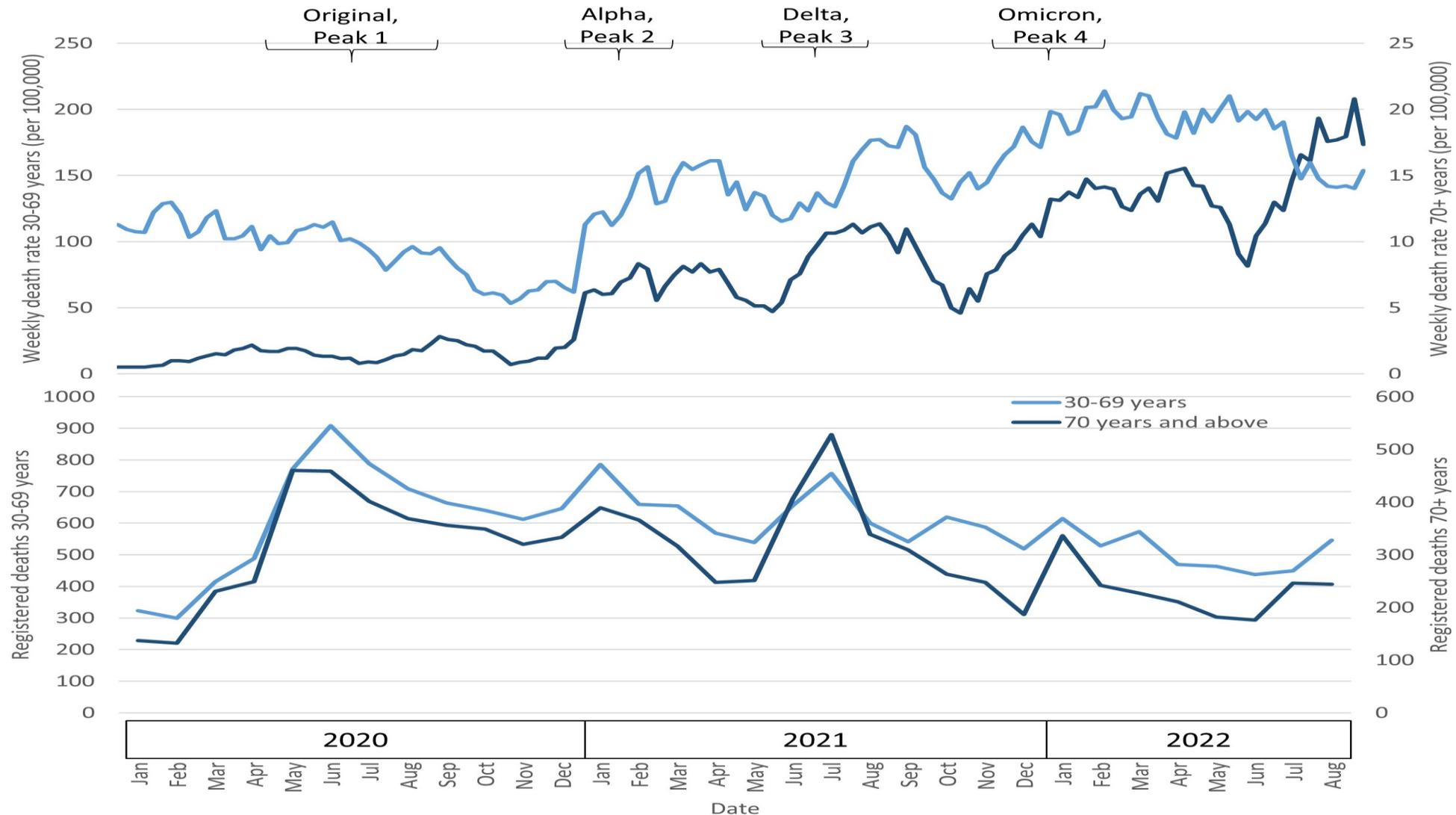
- COMSA DBS study covered about 4200 adults age 18+ randomly selected from about half of Bo urban areas
- Field work was first done July-Aug 2021 (during malaria/rainy season): not a COVID survey but a “healthy lifestyle” survey.
- 224 of 4200 randomly selected for COVID antibody testing
 - High quality chemiluminescence ELISA at Sinai Labs, Toronto
 - 3 antigens- RBD, Spike and Nucleocapsid (to reduce false positives)
 - Sub-set underwent neutralizing antibody assays at University of Ottawa labs
- Follow up survey in April 2022 of same cohort

SARS-CoV-2 Serosurveys in urban Bo, Sierra Leone

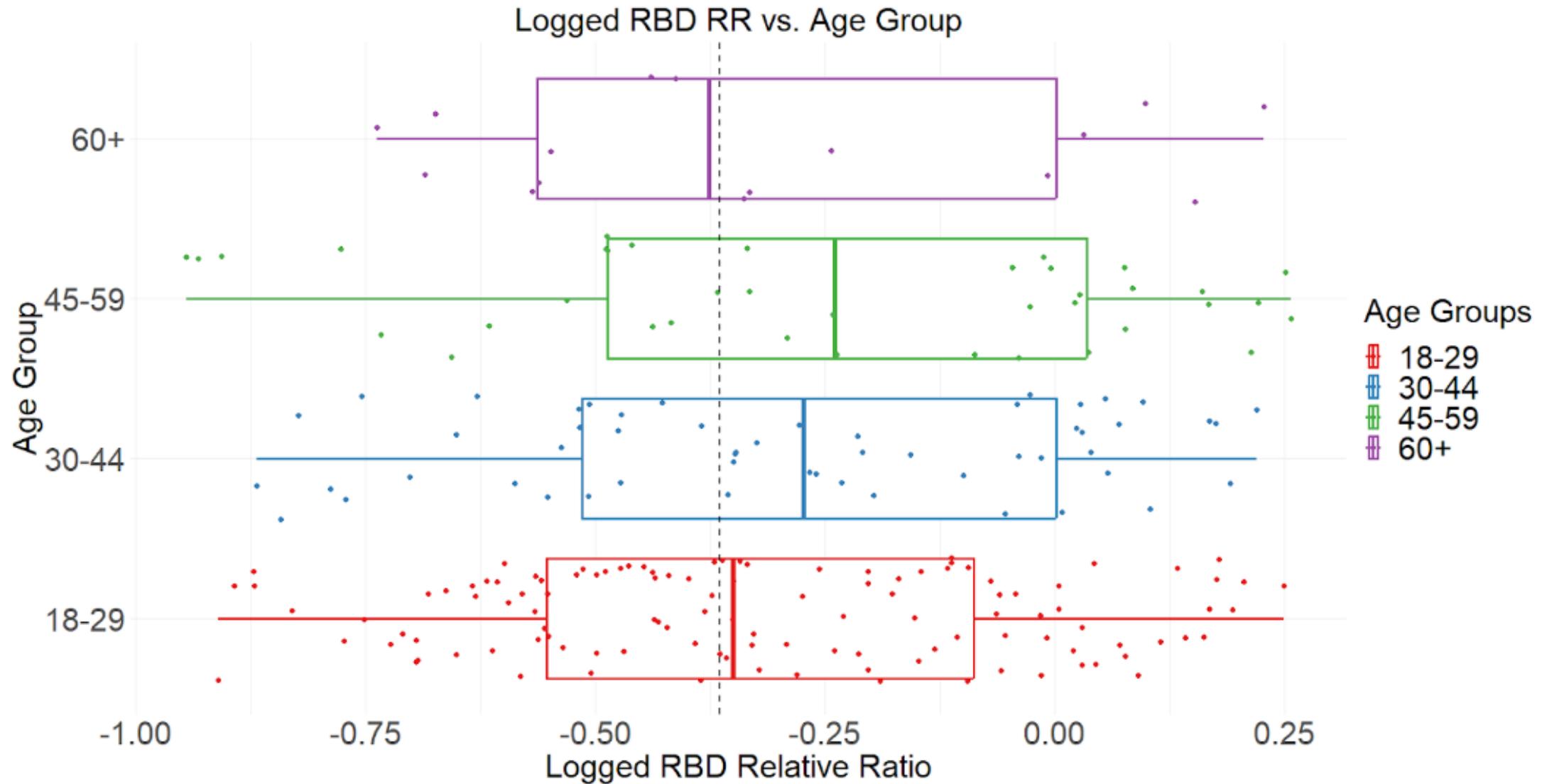
| Assay | Delta wave: July 2021 N = 227* | Omicron wave: April 2022 N=114 |
|--|---|---|
| Antigens on sensitive/specific ELISA | | |
| RBD AND Spike positive | 69% (157) | 84% (96) |
| RBD OR Spike positive | 91% (207) | 98% (112) |
| Nucleocapsid positive | 67% (153) | 74% (84) |
| Neutralizing antibodies (subset) | 43% (97) | |
| Seroconversion from July 2021 to April 2022 | | |
| No change | | 64% (73) |
| Became positive | | 21% (24) |
| Became negative | | 15% (17) |

*excludes 3 missing sex or age

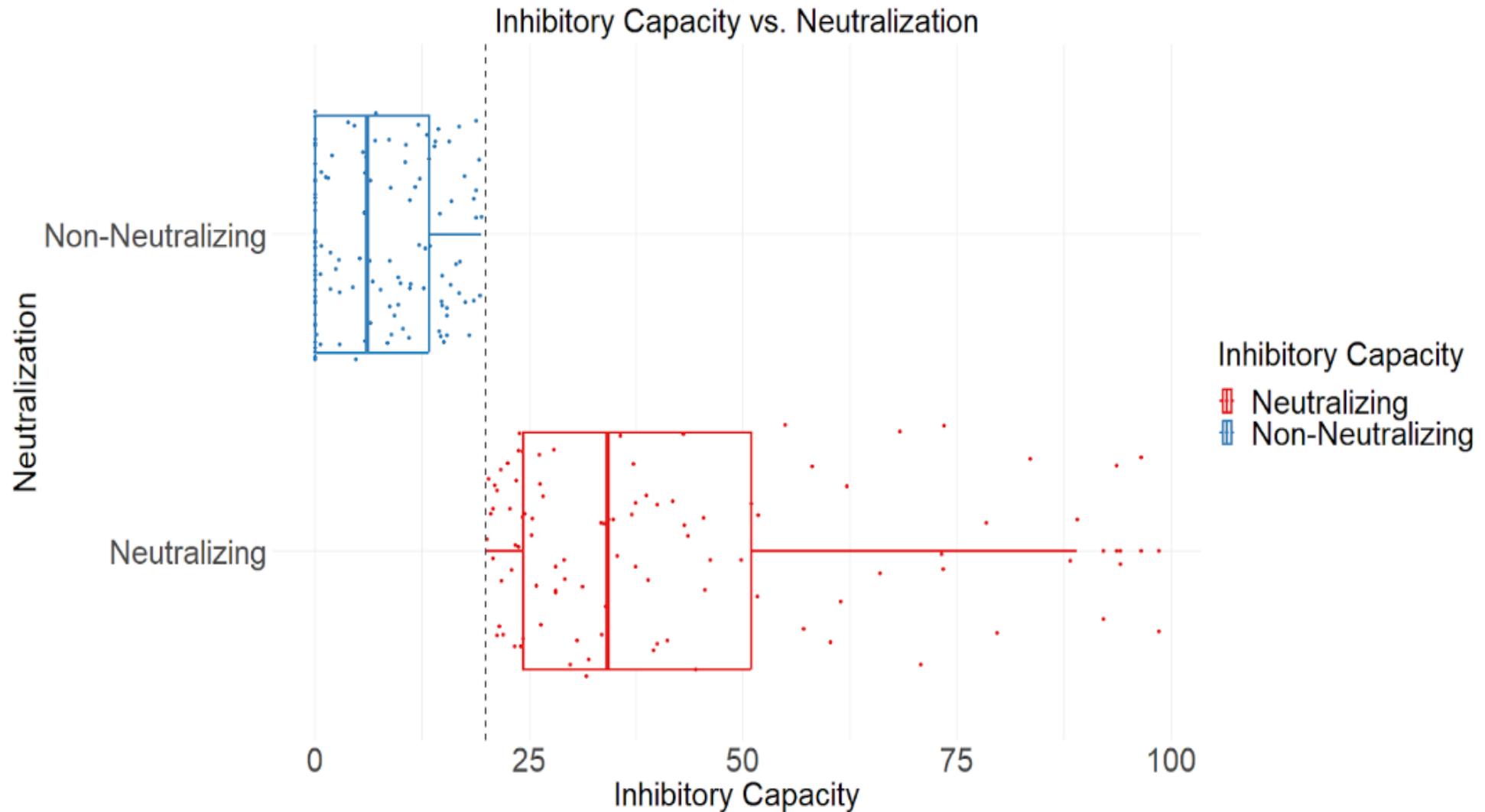
Age-specific mortality rate per 100,000 in HEAL-SL (top panel) and registered deaths from NCRA (bottom panel)



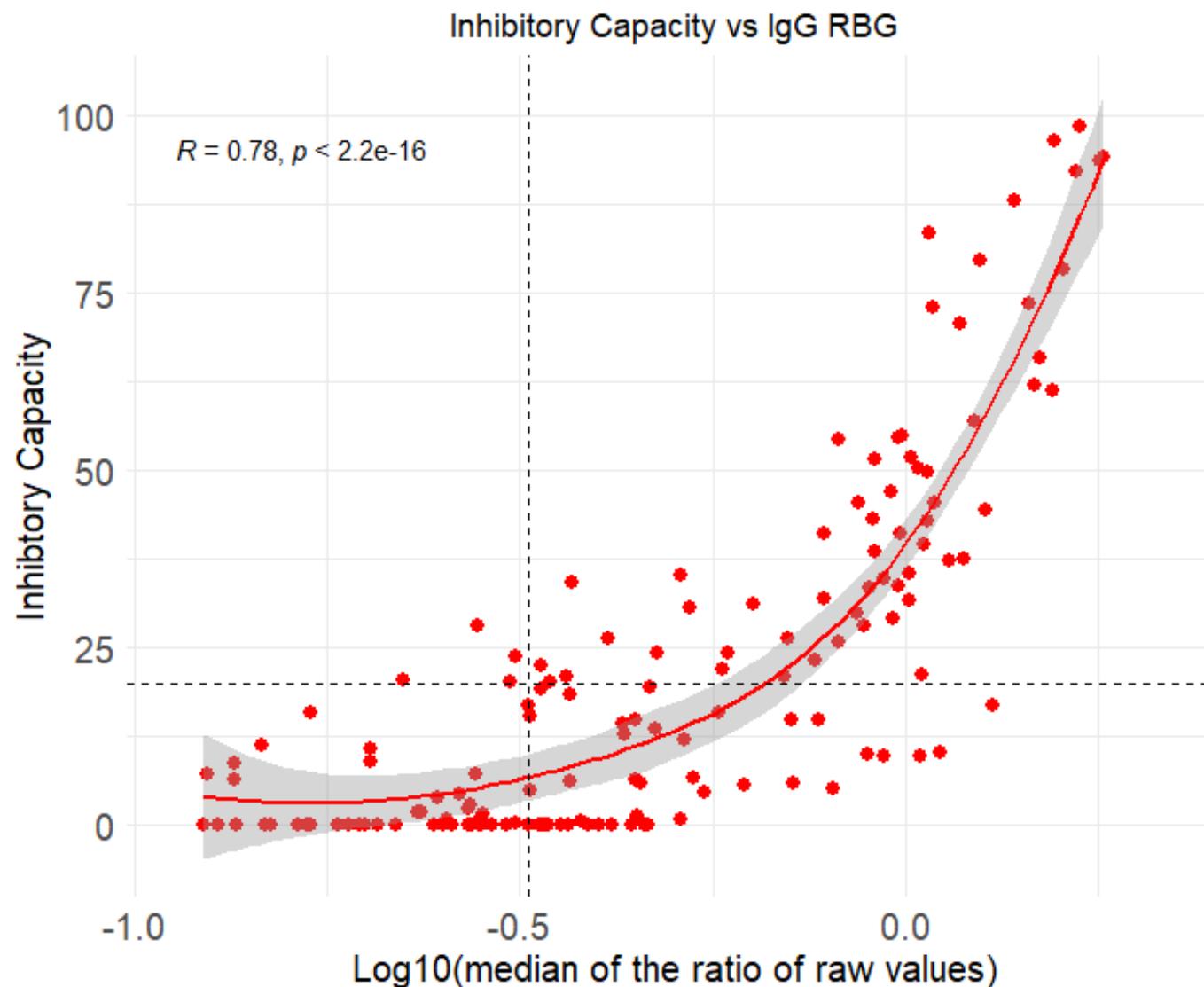
RBD seropositivity by age in Sierra Leone



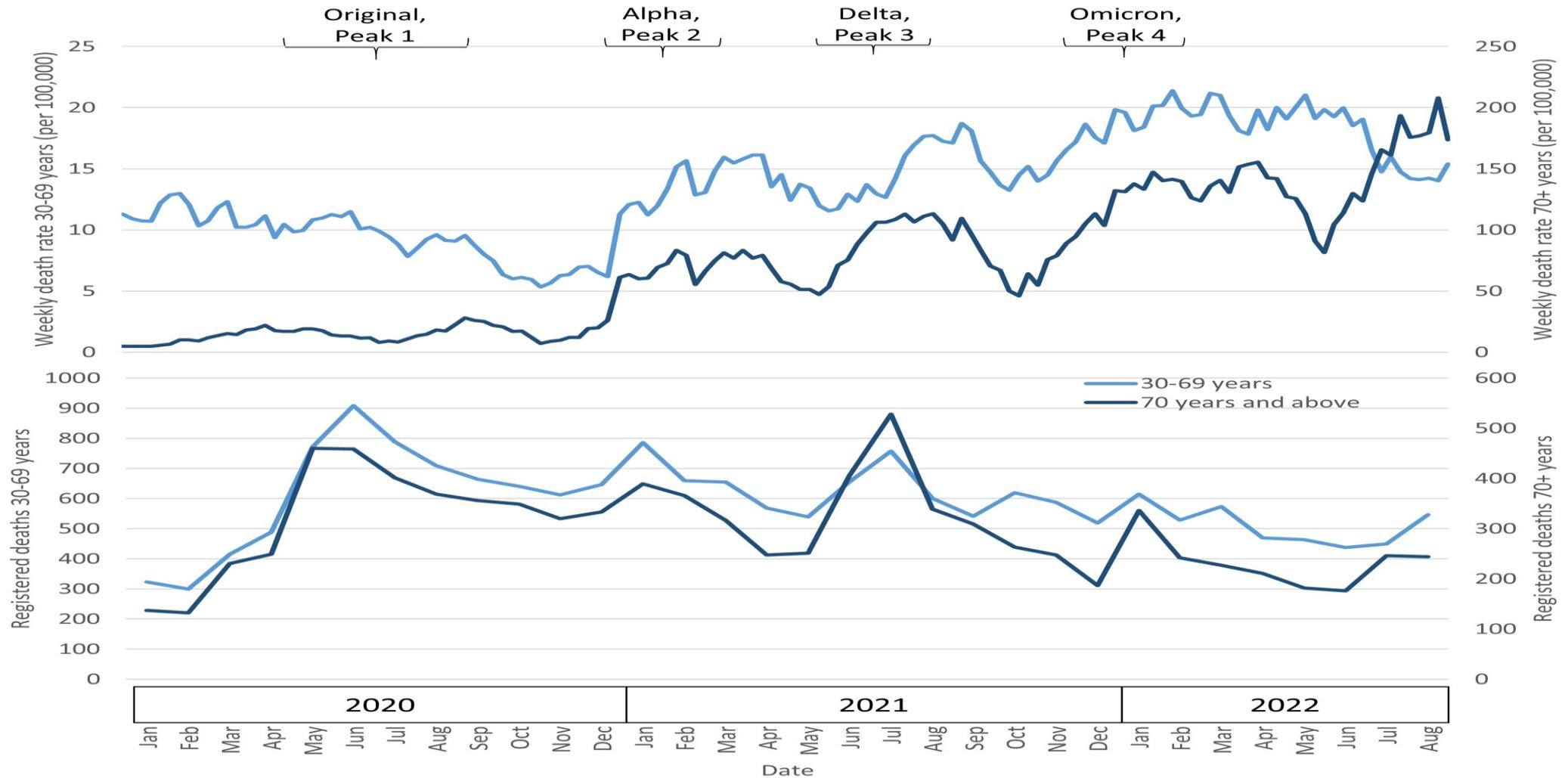
Neutralizing antibody in Sierra Leone



RBD "titers" versus Neutralization "titers"



Age-specific mortality rate per 100K population in Sierra Leone 2020-2022 from HEAL-SL (top) and registered deaths from NCRA (bottom)



Excess mortality in Sierra Leone: death rates (per 100,000) from HEAL-SL and death registration

| | Peaks | Non-peaks | Excess risks, based on regression (95% CI) |
|-------------------------------------|-------|-----------|--|
| HEAL-SL (median deaths/week) | | | |
| ≥70 years | 96 | 63 | 1.70 (1.23,2.35) |
| 30-69 years | 15 | 14 | 1.22 (0.93,1.61) |
| NCRA (median deaths/month) | | | |
| ≥70 years | 400 | 272 | 1.22 (1.16,1.28) |
| 30-69 years | 715 | 587 | 1.10 (1.05,1.14) |

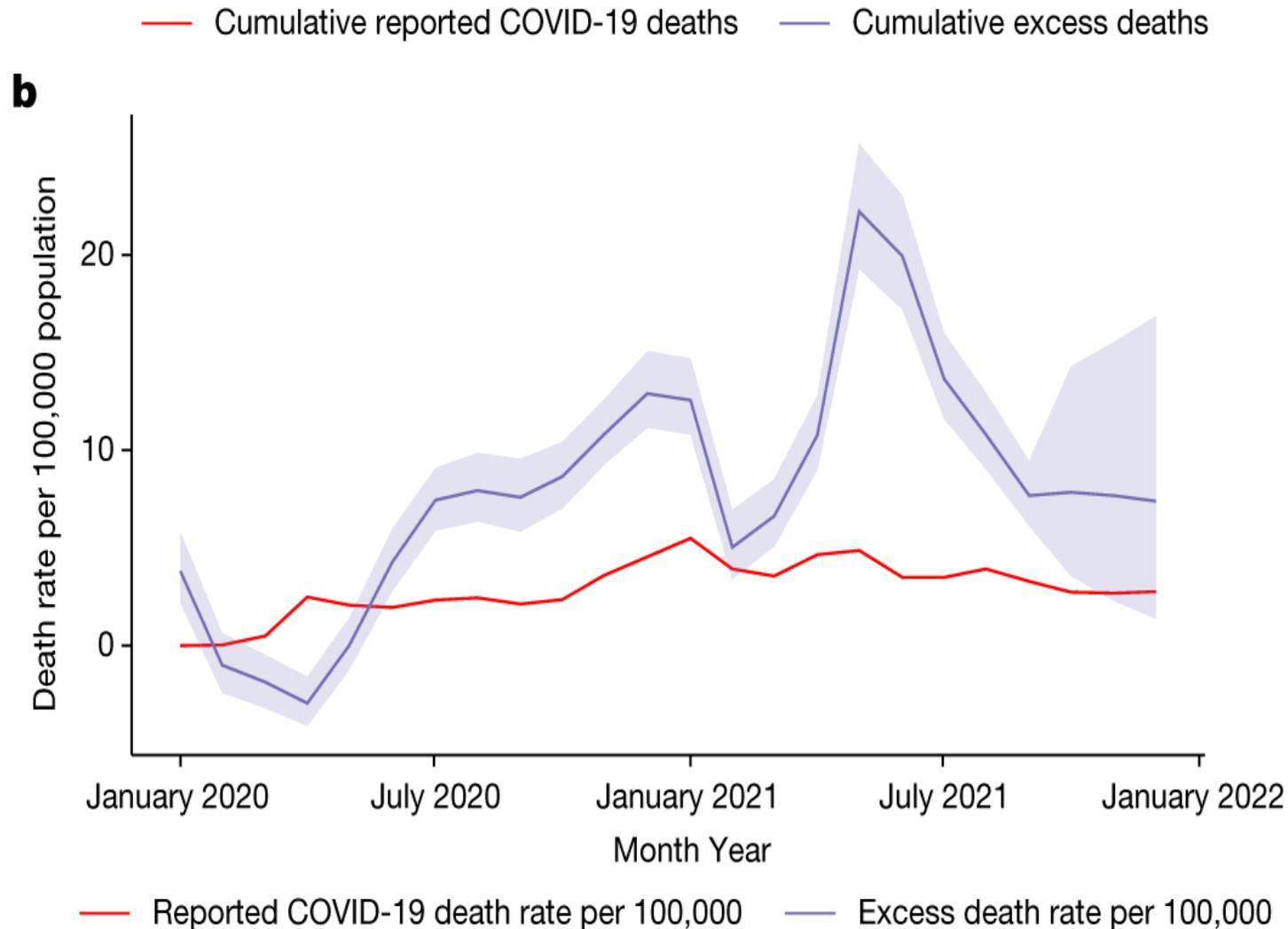
Excess mortality by cause of death

| | Weekly average deaths per 100,000 (number of deaths) | | | | Excess mortality RR (95%CI) [†] |
|----------------------------------|--|------------|-------------|------------|--|
| | Peaks | | Non-peaks | | |
| COVID-associated | 8.2 | 139 | 6.0 | 336 | 1.38 (1.14,1.69) |
| Vascular | 5.3 | 90 | 4.2 | 234 | 1.29 (1.01,1.64) |
| Respiratory | 2.3 | 39 | 1.2 | 66 | 1.97 (1.33,2.93) |
| Fever and infection | 0.6 | 10 | 0.6 | 36 | 0.93 (0.46,1.87) |
| Possibly COVID associated | 10.9 | 184 | 8.8 | 496 | 1.24 (1.05,1.47) |
| Not COVID associated | 2.3 | 39 | 1.9 | 106 | 1.23 (0.85,1.78) |
| Unknown | 0.6 | 10 | 0.4 | 24 | 1.39 (0.67,2.91) |
| All-cause mortality | 22.1 | 372 | 17.1 | 962 | 1.29 (1.15,1.46) |

Comparisons of SARS-CoV-2 excess mortality, Africa

| Setting and age group | Average per 100,000 population | (Lower, upper bounds) |
|--|--------------------------------|-----------------------|
| Excess death rate per 100,000 by age | | |
| WHO estimate for Sierra Leone for 2020-2021, all ages | 95 | (6, 192) |
| Sierra Leone for 2020-2022, ages ≥30 years, present study | 262 | (59, 576) |
| The Gambia for 2020, ages ≥18 years* | 197 | - |
| Coastal Kenya for 2020-21, ages ≥45 years [†] | 407 | - |
| South Africa for 2020-2021, all ages [‡] | 497 | - |
| Lusaka, Zambia, burial grounds for 2020-June 2021, all ages [§] | 153 | |
| Namibia, national mortality report for 2021 | 197 | |
| Total excess deaths | | |
| Total ≥30 years in Sierra Leone for 2020-2022 | 6,900 | (1,500, 15,000) |
| WHO estimate for Sierra Leone, all ages for 2020-2021 | 7,900 | (480, 15,700) |
| Excess as percent of deaths ≥30 years in Sierra Leone for 2020-2022 | 5.8% | (1.3%, 12.8%) |

Worldwide excess and reported COVID deaths, 2020-2022



**Cumulative ~15M
excess deaths vs
6M reported
Likely ~20M by 2023,
including ~1M in China**

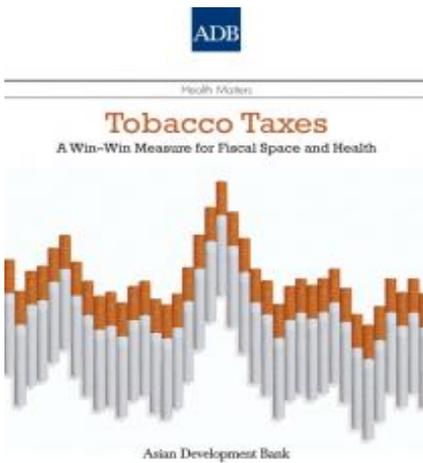
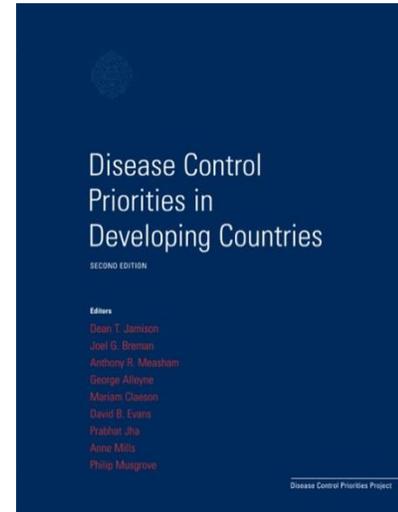
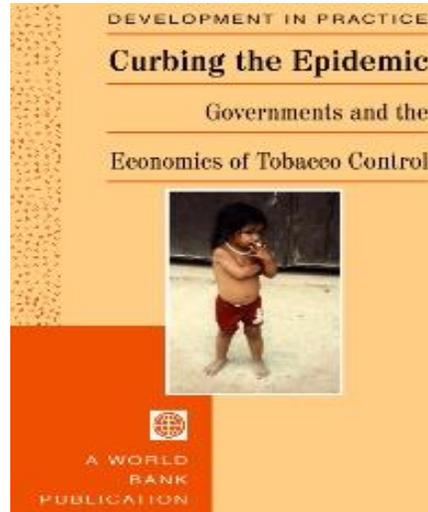
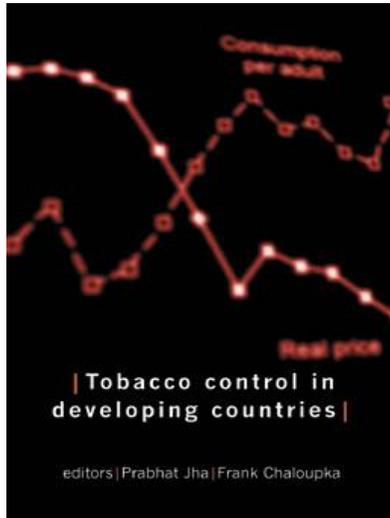
**Of ~9 million “Missing”
deaths by 2022, ~ 3-
4M were in India**

Overall conclusions

- Hugely variable SARS-CoV-2 pandemic globally, with different patterns of hybrid immunity (vaccine plus infection) across settings
- Canada mostly spared large excess deaths, except for nursing home populations
- Substantial excess deaths from COVID in India and China but surprisingly little excess deaths in Sierra Leone
- Reliable mortality data and rapid serosurveys are central for future pandemic response

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(Don't buy my books)



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