Responding to COVID-19 with Data, Analytics and Digital Solutions

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(Evolving) COVID Epidemiology

COVID-19 reproductive rate is 2.5 – 3.0: higher than influenza at 1.1-1.5.

During first 5 days, COVID-19 patients shed up to 1,000 times more virus than SARS. SARS patients are usually only infectious during deep-lung, late stage illness. But, with COVID-19, **asymptomatic and pre-symptomatic cases infect disproportionately** – most infectious before we know we are ill

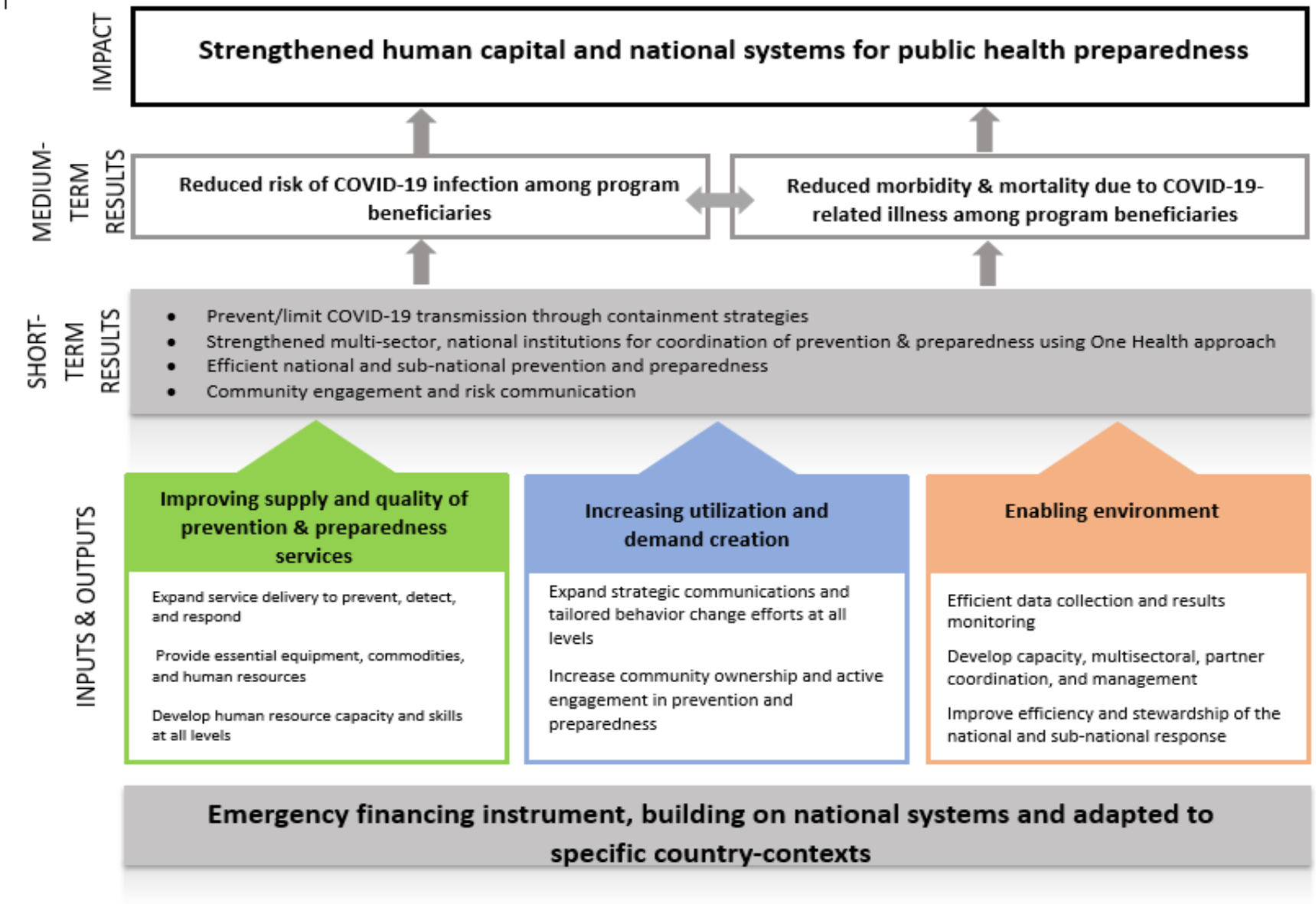
Case fatality rate is highly dependent on the age structure of those infected and underlying health conditions

Three unknowns that will influence intensity and future waves: proportion infected and recovered (with acquired immunity for the 2nd wave), seasonality and duration of immunity

World Bank Group's COVID-19 Response

- **WBG COVID Financing Facility** with up to $150bn in funds
- **Purpose:** Assist IBRD and IDA-eligible countries in their efforts to prevent, detect and respond to the threat posed by COVID-19 and strengthen national systems for public health preparedness.

World Bank's COVID Emergency Response: Theory of Change



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Typical Activities for WB COVID-19 Response Projects

SHORT TERM

Component 1: Emergency COVID-19 Response (prevention and containment strategies)

- Case Detection, Confirmation, Contact Tracing, Recording, Reporting
- Social Distancing Measures
- Health System Strengthening
- Communication Preparedness
- Social and Financial Support to Households

LONG TERM

Component 2: Strengthening Multi-sector, National Institutions and Platforms for One Health

Component 3: Supporting National and Sub-national, Prevention & Preparedness

Component 4: Community Engagement & Participation

Component 5: Implementation Management and Monitoring and Evaluation

How data, analytics and digital interventions have already been used in COVID

- Unprecedented use to date
- Famously, BlueDot's AI system picked up an anomaly before public was notified:
  - WHO notified on 9 Jan 2020, CDC on 6 Jan 2020, and BlueDot on 31 Dec 2019
- Several predictive models to predict epidemic spread and health system capacity
- Governments around the world quote modellers widely in predictions and potential impacts; translated to general health promotion messages -- #FlattenTheCurve

- Plethora of digital interventions either being developed or customized
- US Government created a COVID-19 Open Research Dataset (CORD-19) – urging AI developers to develop tools to mine and analyze the data. Available here: https://pages.semanticscholar.org/coronavirus-research
  - Since then, **29 other open datasets** relating to COVID made available open
  - World Bank Group's Data Collaboratives effort – additional requests from data collaborators

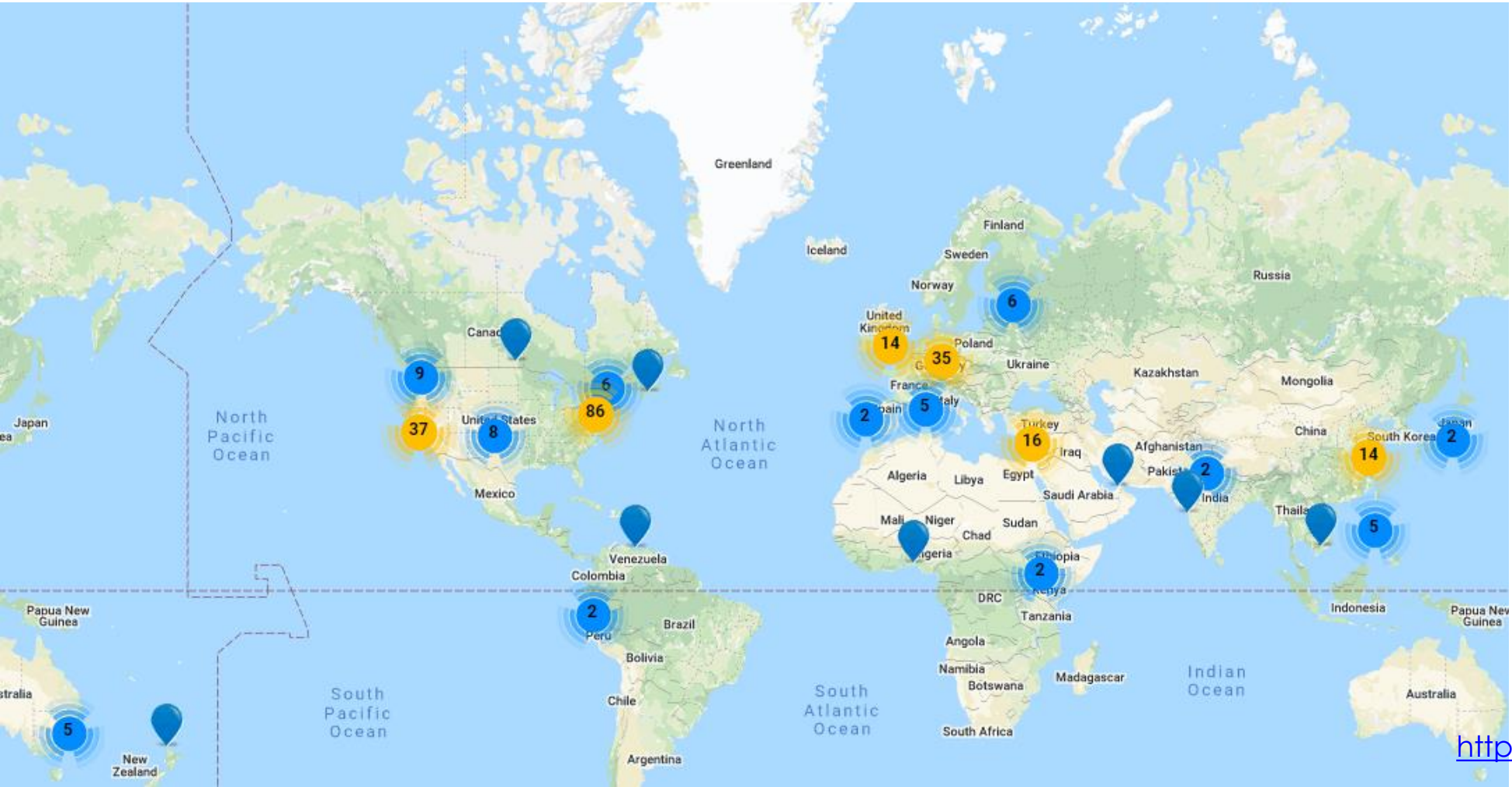
STARTUP Blink

HEALTH INNOVATION EXCHANGE
ACCESS • IMPACT • INVESTMENT

MOSCOW AGENCY OF INNOVATIONS

Coronavirus Innovation Map

Global map of innovative solutions created in response to Covid-19. Read more here.



https://coronavirus.startupblink.com/

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https://datacollaboratives.worldbank.org

https://docs.google.com/document/d/1JWeD1AaIGKMPry_EN8GjIqwX4J4KLQIAqP09exZ-ENI/edit

COVID-Net: A Tailored Deep Convolutional Neural Network Design for Detection of COVID-19 Cases from Chest Radiography Images

https://arxiv.org/pdf/2003.09871.pdf

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Big Data Analytics to Support Countries with COVID-19 Response

1. Analytics to **predict future spread** and **impact** of response options

2. Analytics for **geographic and subpopulation hotspots** and prioritization

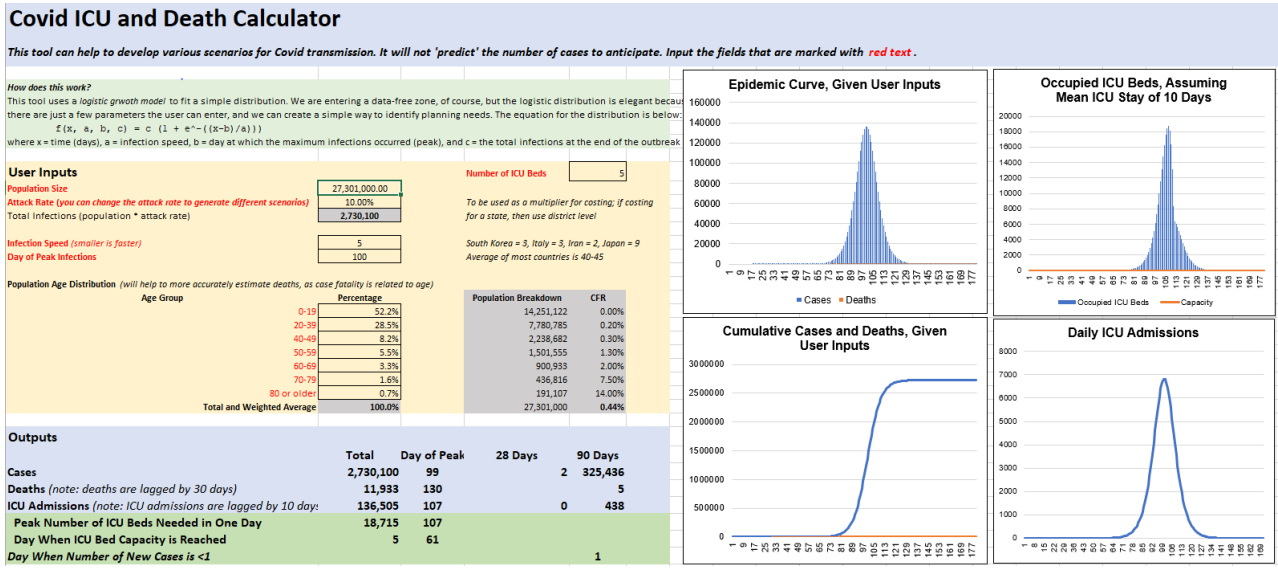
3. Analytics to **monitor, track, change and evaluate implementation**

4. Analytics that estimate the **wider economic impacts** and interventions to mitigate them

Models to **predict future spread** and **impact** of response options

ONLINE MODELLING TOOLS AVAILABLE

- **Univ of Basel tool**: Neher Lab (University of Basel) (https://neherlab.org/covid19),
- **Penn Medicine tool**: **CHIME** (**C**OVID-19 **H**ospital **I**mpact **M**odel for **E**pidemics) https://penn-chime.phl.io/
- **Johns Hopkins SURGE Tool** - https://www.pacerapps.org/
- Tool used by some **WHO offices:** COVID ICU and Death Calculator
- Modeling COVID-19 Spread vs Healthcare Capacity https://alhill.shinyapps.io/COVID19seir/
- Epidemic Calculator http://gabgoh.github.io/COVID/index.html.
- COVID-19 FORECASTING http://epidemicforecasting.org/ from the Future of Humanity Institute, University of Oxford, which is based on server inputs : experts' forecasting, an advanced epidemic modelling software, an airline booking dataset, a commuting database, multiple levels of global mitigation measures, and multiple models of SARS-CoV-2.



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Models to **predict future spread** and **impact** of response options

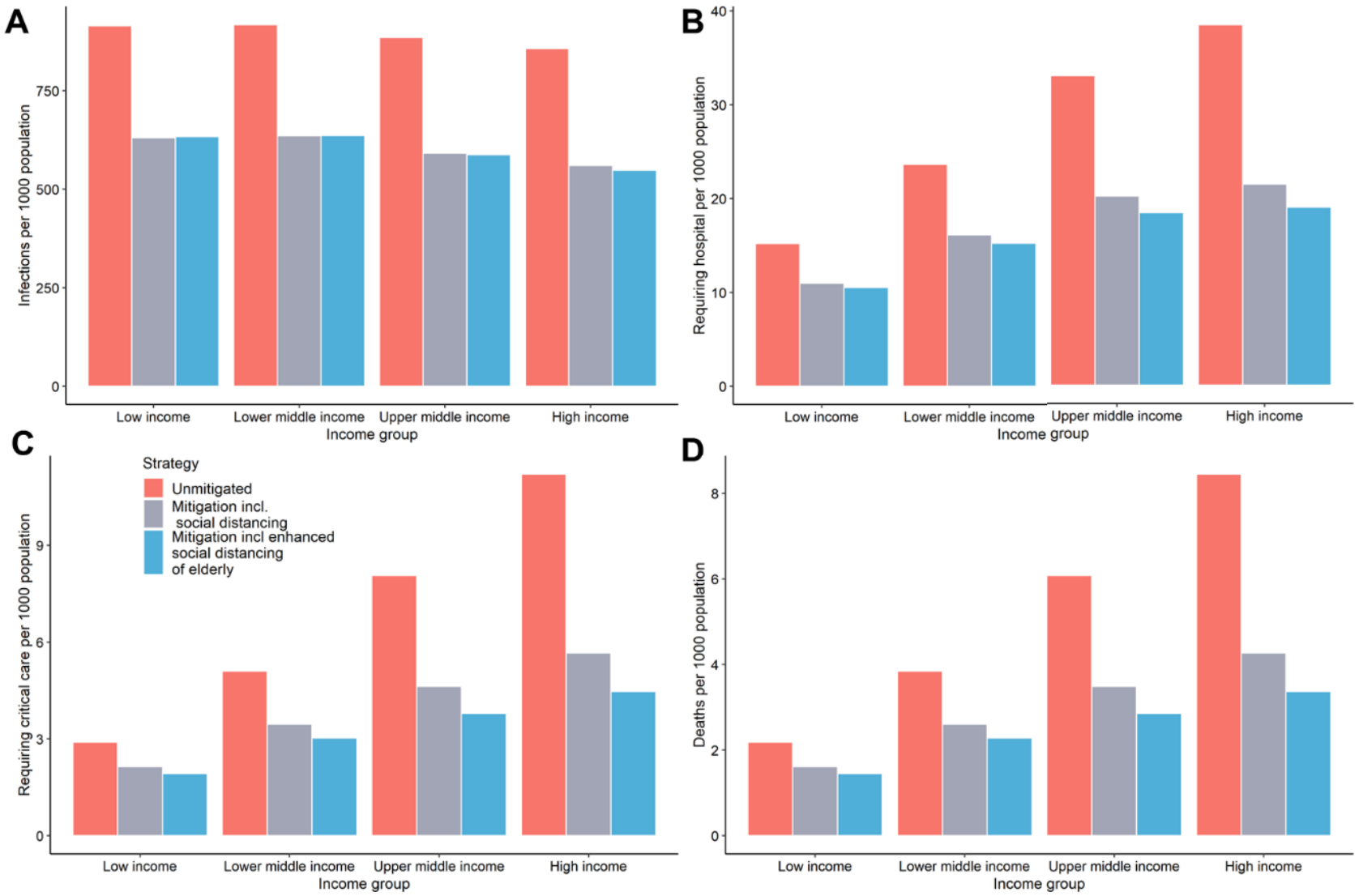
MODELS DEVELOPED BY MODELLING GROUPS WITH TECHNICAL ASSISTANCE AVAILABLE

- Harvard modelling: https://dash.harvard.edu/handle/1/42638988
- MIT consortium: https://covid-19-sds.github.io/assets/pdfs/Preliminary_Report_Effectiveness_of_social_distance_strategies_COVID-19.pdf
- Imperial college modelling work: https://www.imperial.ac.uk/mrc-global-infectious-disease-analysis/news--wuhan-coronavirus/ (Graphic User Interface for administering the tool online oneself will be available in the near future
- Johns Hopkins University is providing modelling support: If task teams or their managers need such modeling analysis for specific countries, they may consider contacting Justin Lessler at "jlessle1@jhu.edu" (bio at https://www.jhsph.edu/faculty/directory/profile/2566/justin-lessler).

GLOBAL MODEL DEVELOPMENT AND ALIGNMENT IN THE WORKS WITH NUMEROUS PARTNERS AROUND THE WORLD

- World Bank is co-covening – with the International Decision Support Initiative -- this effort
- Intended to link to economic impact modelling

Predicted Global Spread and Impact of Response Options in 202 countries



Source: Imperial College, 26 March 2020
https://www.imperial.ac.uk/mrc-global-infectious-disease-analysis/news--wuhan-coronavirus/

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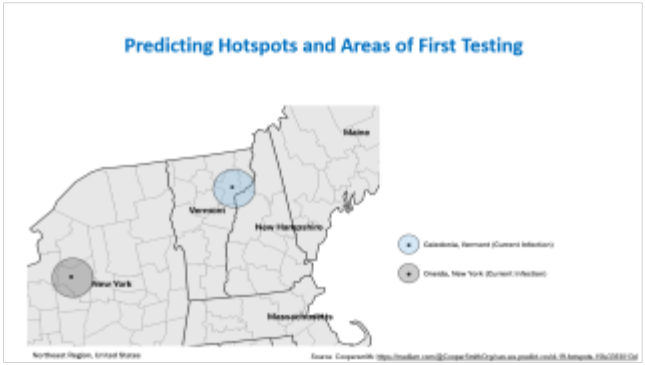

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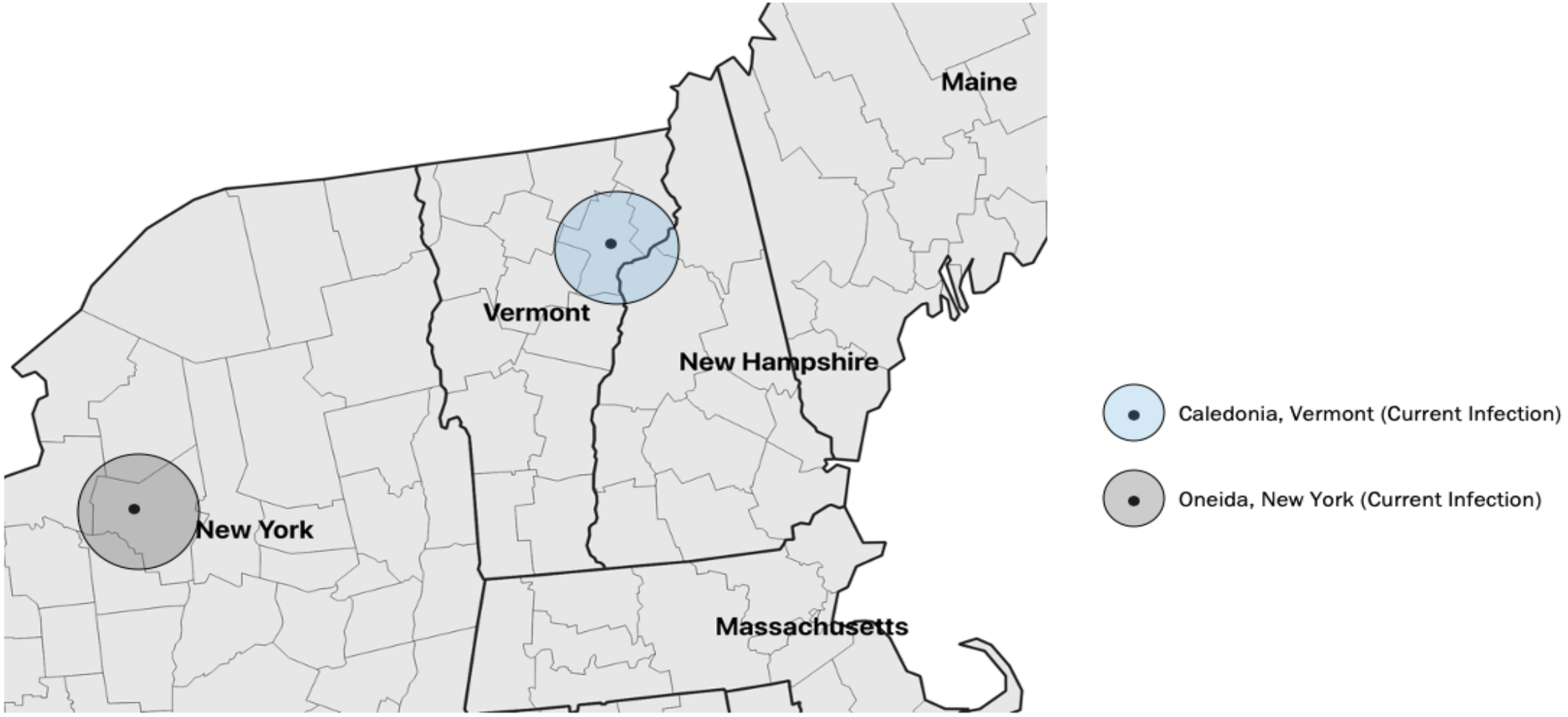
Predicting Hotspots and Areas of First Testing



Northeast Region, United States

Source: Coopersmith: https://medium.com/@CooperSmithOrg/can-we-predict-covid-19-hotspots-15fe3393013d

Data Elements to Better Identify High-Risk Zones

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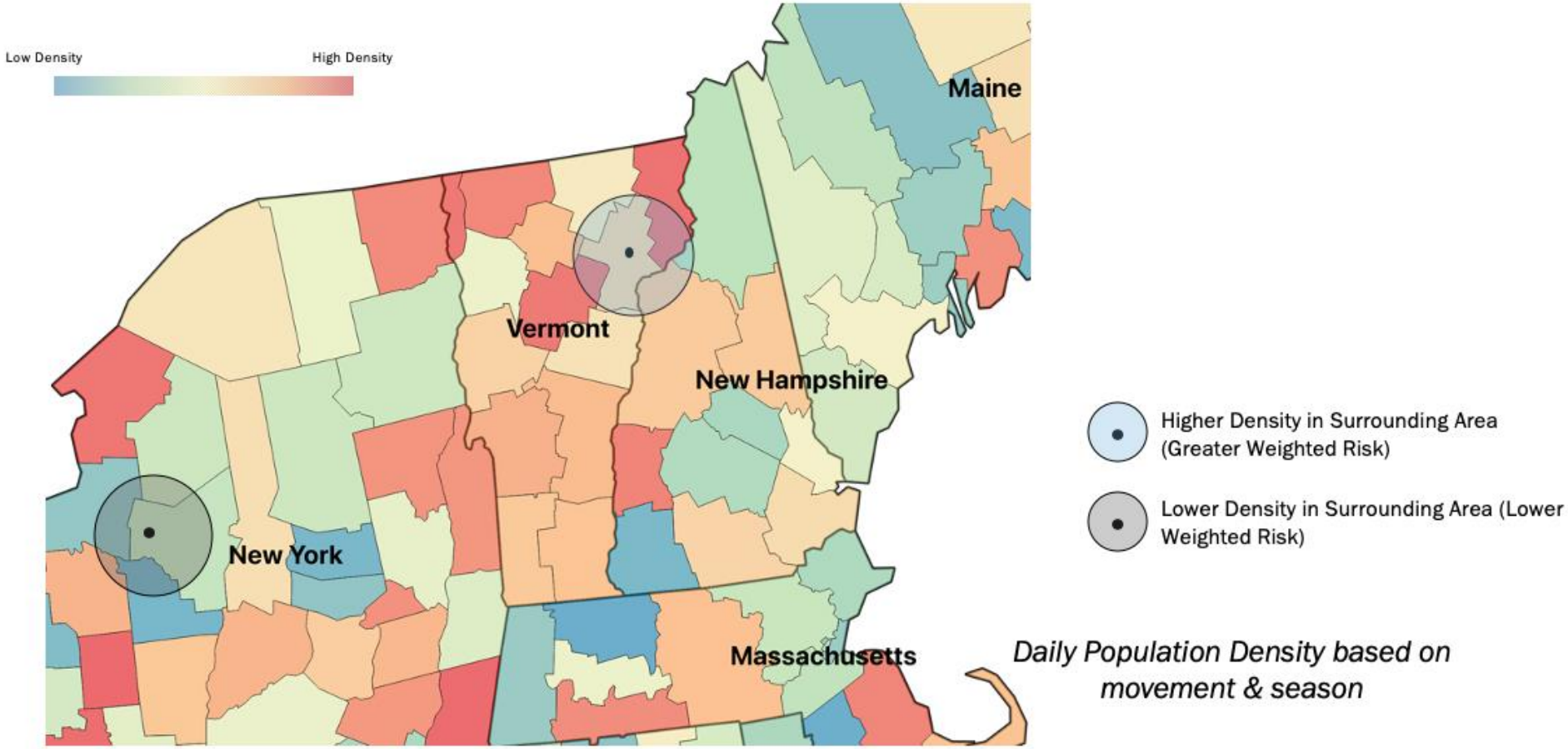
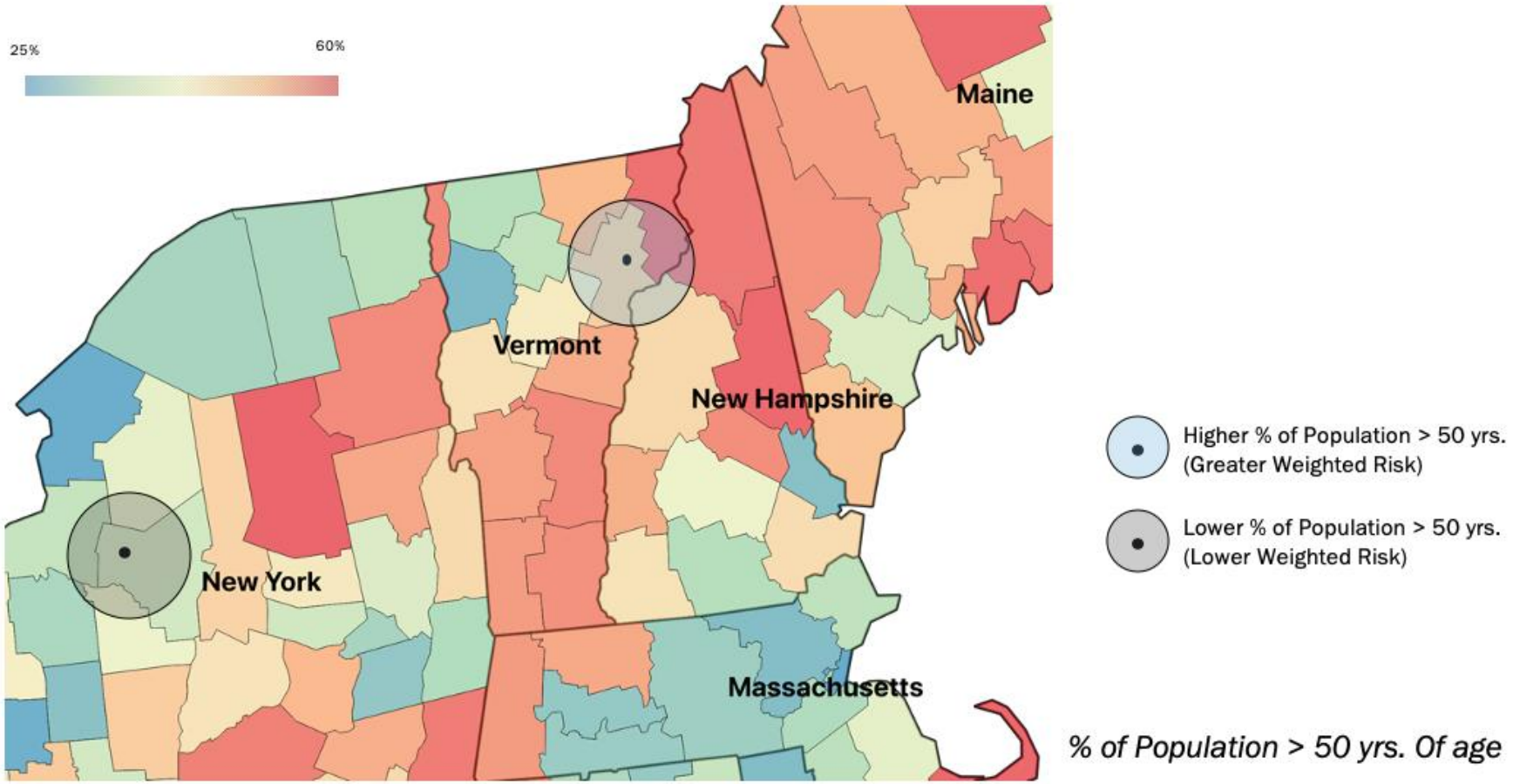
Data to Enhance High-Risk Zones – Population Density



Northeast Region, United States

Source: Coopersmith: https://medium.com/@CooperSmithOrg/can-we-predict-covid-19-hotspots-15fe3393013d

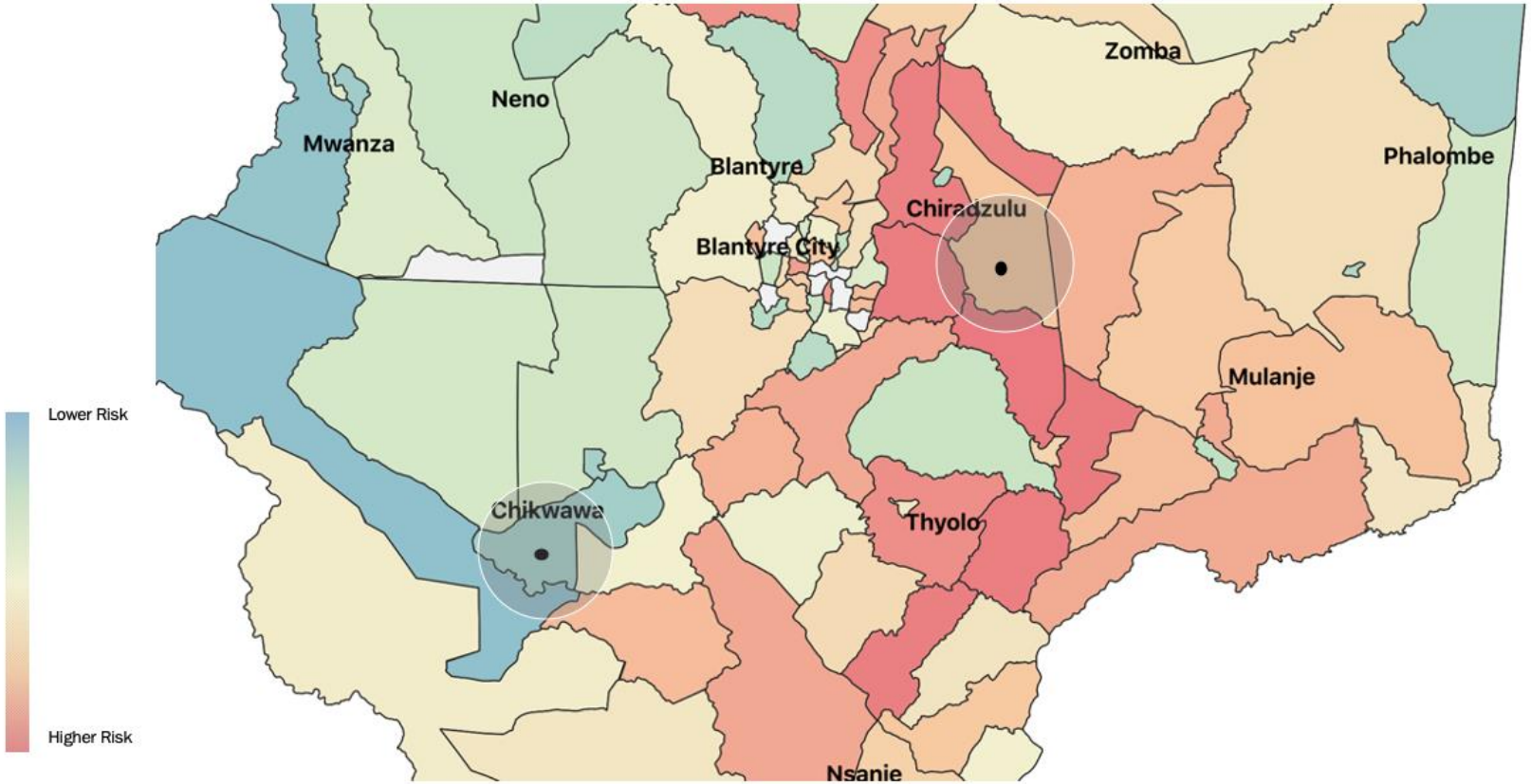
Data to Enhance High-Risk Zones – Age



Source: Coopersmith: https://medium.com/@CooperSmithOrg/can-we-predict-covid-19-hotspots-15fe3393013d

Final Output - Ranked Risk Model

Ranked Risk Model – Population Density & Movement, Age, Disease Burden



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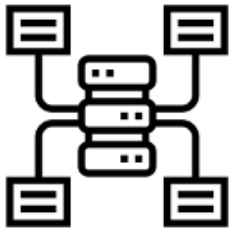
Source: Coopersmith: https://medium.com/@CooperSmithOrg/can-we-predict-covid-19-hotspots-15fe3393013d

Resources for Replication

Success depends on four essential technical building-blocks:

Participation and support of mobile network operators

Technical partner to anonymize and aggregate individual user data



Access to relevant public data (e.g. census data) and private data (e.g., clinic data), if available

External Dashboards that pull in real-time data for public use

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Source: Coopersmith: https://medium.com/@CooperSmithOrg/can-we-predict-covid-19-hotspots-15fe3393013d

Other Approaches to Use Big Data to Sense COVID Infection 'Signals' at the WBG

- Classification of social media posts mentioning COVID-related symptoms (source: Twitter API, Global)
- Survey of social media users posting COVID-related symptoms to infer their health status to overcome the lag in testing
- Retrospective validation at the local level using actual reported cases
- Monitoring of COVID-related hashtags and news sharing on social media to infer awareness of COVID at the local level
- Natural language processing of news to track governments actions to increase social distancing (source: Factiva API, Global)

For more info, contact WBG Data Collaboratives team (Holly Krombeck), COVID Mobile Data Task Force (Ariana Legovini), Aivin Solatorio (DEC), Dunstan Matekhanya (DEC), or Sam Fraiberger (DEC)

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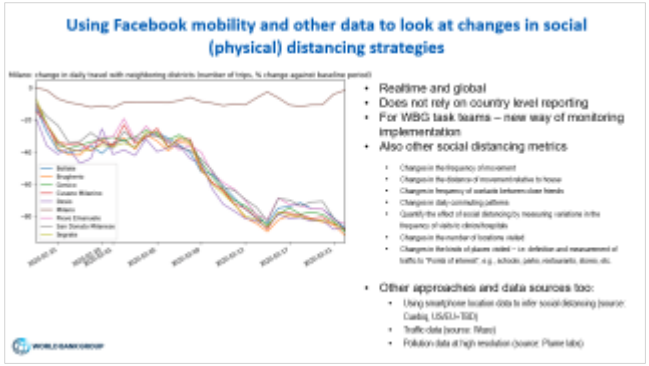
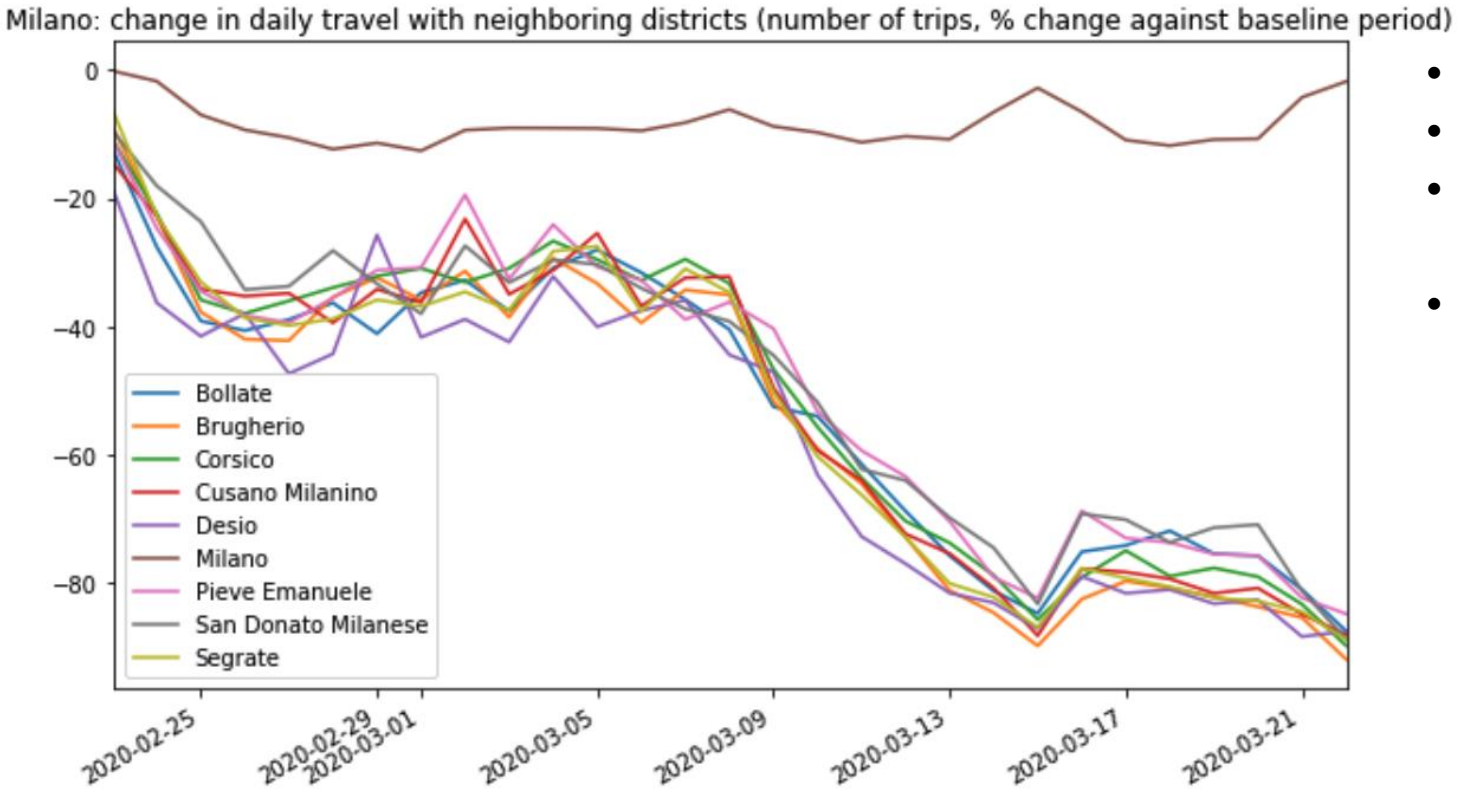


Using Facebook mobility and other data to look at changes in social (physical) distancing strategies



- Realtime and global
- Does not rely on country level reporting
- For WBG task teams – new way of monitoring implementation
- Also other social distancing metrics
  - Changes in the frequency of movement
  - Changes in the distance of movement relative to house
  - Changes in frequency of contacts between close friends
  - Changes in daily commuting patterns
  - Quantify the effect of social distancing by measuring variations in the frequency of visits to clinics/hospitals
  - Changes in the number of locations visited
  - Changes in the kinds of places visited – i.e. definition and measurement of traffic to “Points of interest”, e.g., schools, parks, restaurants, stores, etc.
- Other approaches and data sources too:
  - Using smartphone location data to infer social distancing (source: Cuebiq, US/EU+TBD)
  - Traffic data (source: Waze)
  - Pollution data at high resolution (source: Plume labs)

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Digital Solutions for COVID-19 Responses

Inventory of COVID-19 Digital Health Solutions

https://docs.google.com/spreadsheets/d/15hkhdtGNzx7oHkO8Y2MOiY83JsHjqxL4MhMGvlA_J6I/edit#gid=579623365

ICTworks POWERED BY inveneo TECHLAB IntraHealth TechChange

10 Digital Health Technology Solutions for Global COVID-19 Response

By Wayan Vota on March 11, 2020

Newsletters and Online Conference

Global Digital Health Network
Formerly the mHealth Working Group

Version 1.0 Published 18/3/2020 12:00
This catalogue is continuously updated. Check for updates on www.healthtechhub.org/covid-catalogue

NEEDS DRIVEN HEALTH TECH SOLUTIONS

For Managing the COVID-19 Crisis

Prepared by HEALTH TECH HUB COPENHAGEN

www.healthtechhub.org/covid19

17th March 2020

Add-ons to Existing Mobile Services

viamo
improving lives via mobile

- **Module 1 - Community Engagement** through 3-2-1 & large scale push voice and SMS campaigns
- **Module 2 - Frontline Worker Training** (via mobile phone) for via mobile phone (more info here)
- **Module 3 - Mobile Surveys** - for hygiene and social distance knowledge measurement, outbreak monitoring AND healthcare access monitoring (more info here)

For more information, contact Stephen Meyer <stephen.meyer@viamo.io>

access.mobile
INTERNATIONAL

- Based on national guidelines and multi-language
  - South Africa: USSD COVID-19 Symptom Checker
  - South Africa: USSD Frontline Health Worker Clinical Decision Support Tool

For more information, contact

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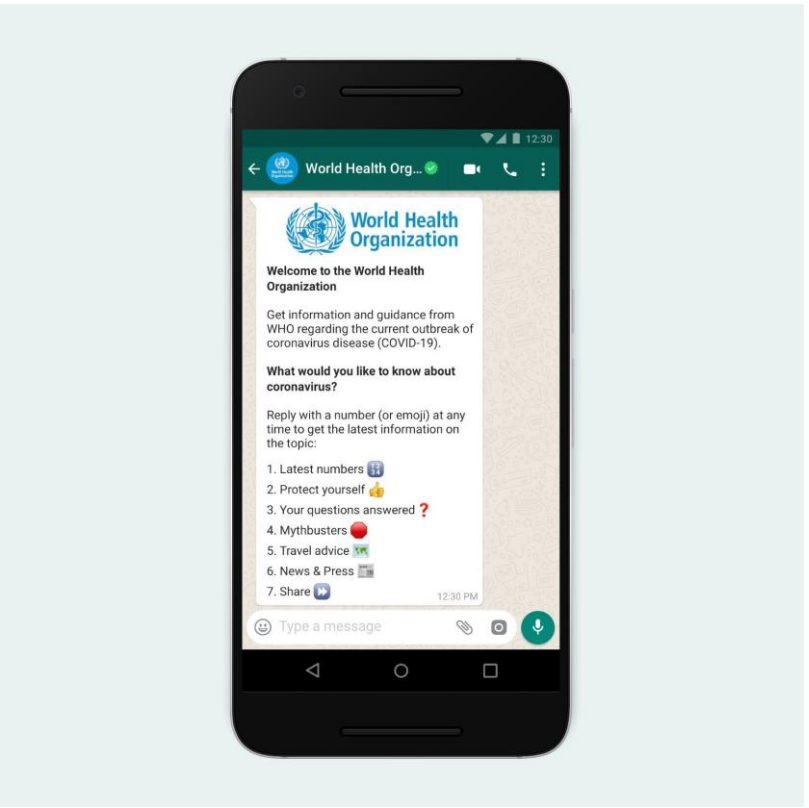
Add-ons to Existing Mobile Services



Send a WhatsApp to +41 79 781 87 91, and say ‘Hi’ for this conversation to start

The service can be accessed through a link that opens a conversation on WhatsApp. Users can simply type “hi” to activate the conversation, prompting a menu of options that can help answer their questions about COVID-19.

SafePaths: Private Kit

Global scale COVID-19 private tracker without government tracking

For individuals and health authorities

Mathematically enforced privacy of personal data

Open Source App by MIT faculty

No Servers,

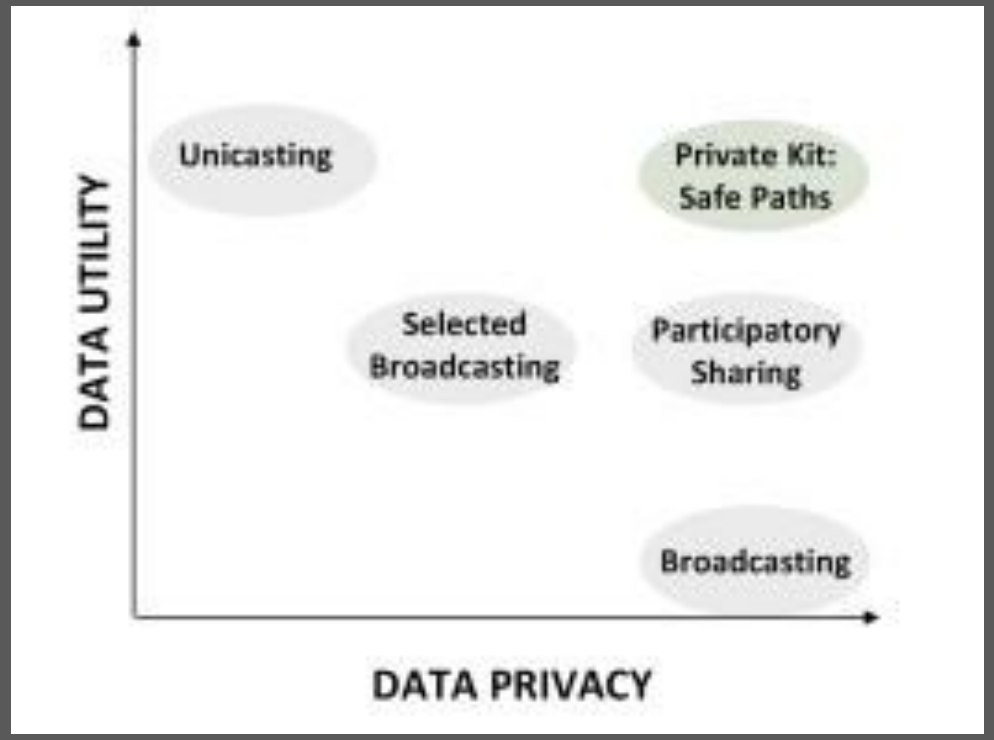
Plug-ins by Partners

Download the app: https://play.google.com/store/apps/details?id=edu.mit.privatekit

IOS version coming soon

Safe Path- Prioritizing Privacy and Utility

- The Private Kit: Safe Paths platform has been built to optimize both data use and data privacy, creating maximum utility while protecting users



- World Health Organization (WHO) has identified this is a priority partner and solution for decentralized, participatory COVID-19 surveillance and tracking, with the WHO committing to release this real time epidemiology tool for citizens.

For more information, please contact

EY (coordination and set up):
Jeff Saviano-- jeffrey.saviano@ey.com
Fernando Morera--Fernando.MoreraMartinez@ey.com
Susan Garfield–- susan.garfield@ey.com

SafePaths (technology and background)
Khahlil Louisy-- khahlil.louisy@gmail.com
Ramesh Raskar-- rameshboston@gmail.com

How it Works

1) Patient is diagnosed with COVID-19

2) Clinician photographs QR code from PrivateKit and adds to patient's record

3) Response center receives code and converts to location details

4) Data can be analyzed and visualized for immediate public health use

5) Public will be able to see overlap with diagnosed patients

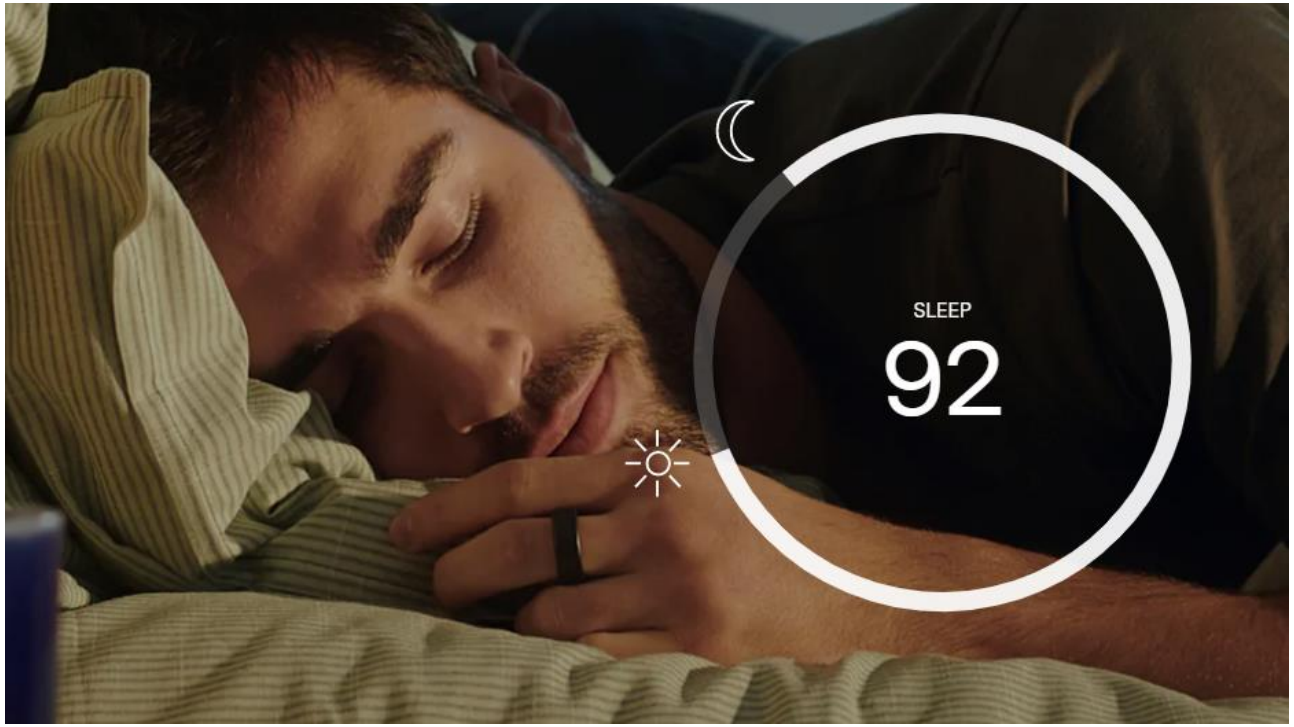
Beta

Version 1.0

Version 2.0

Oura ring: Realtime vital signs tracking of health workers

- Lets healthcare workers easily track changes in their body temperature, respiratory rate, and heart rate
- Improves early warning signs of infection within the group and to take necessary actions to better coordinate this unprecedented push to fight COVID-19.
- Then, everyone who currently owns an Oura



TemPredict

UCSF Health | ŌURA

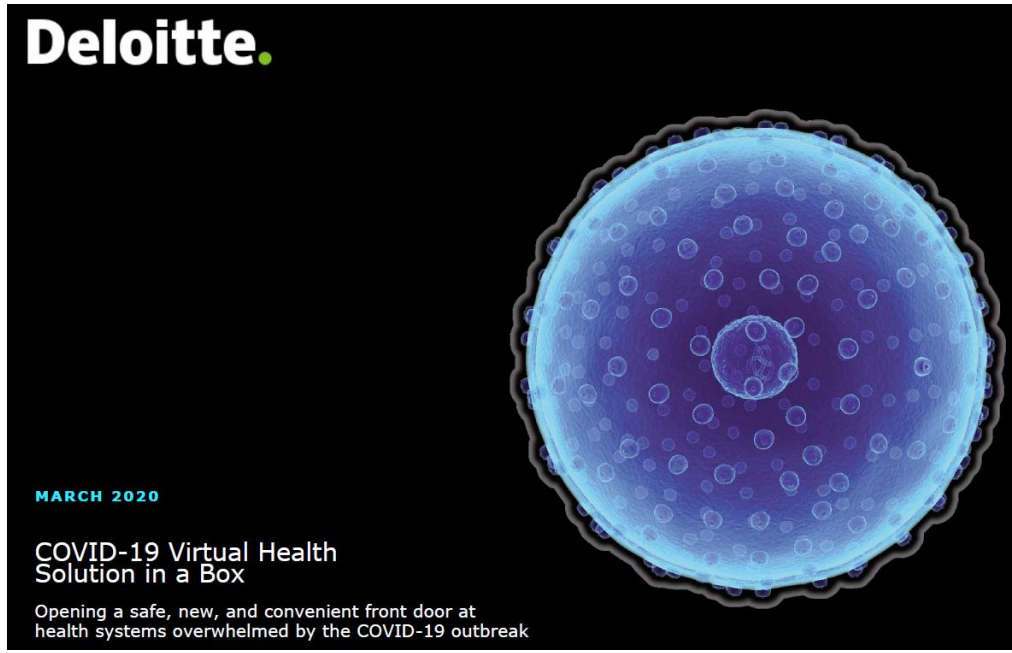
Rapid Acceleration of Telemedicine Services

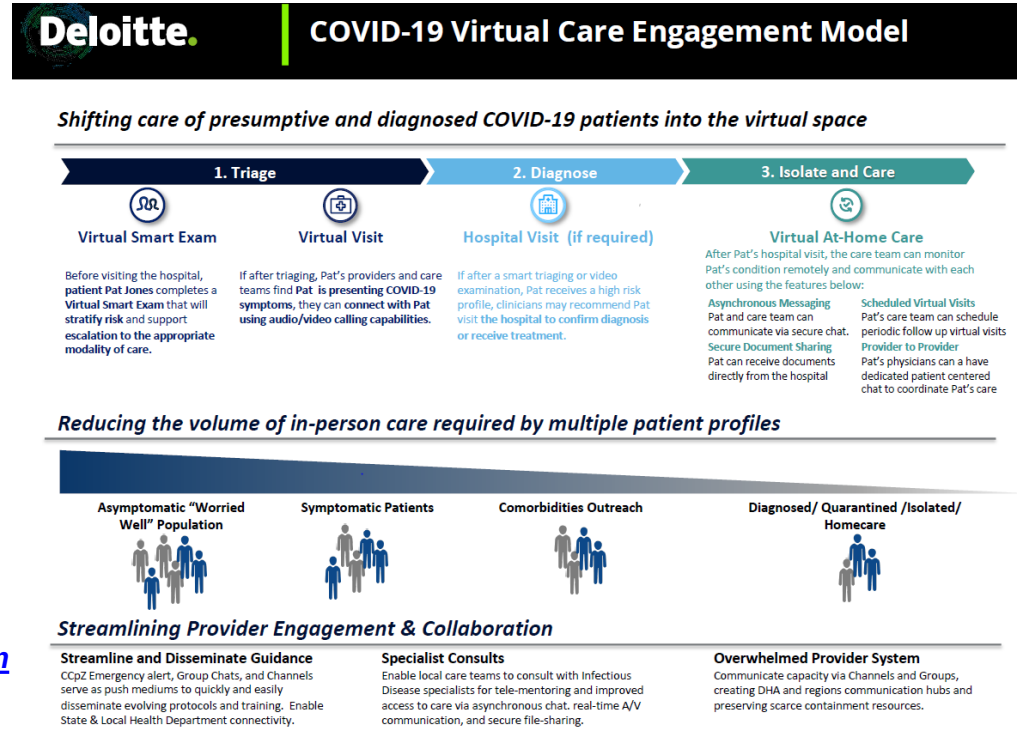
Two purposes

- Prevent COVID-19 positive cases from infecting others
- Keep COVID-19 negative persons with underlying conditions away from facilities for routine and regular care

Virtual Field Hospital approach

- Telemedicine ‘in a box’
- Triage all NCD patients away from facilities or to non-COVID primary care
- Technical deployment within 4 days
- Business model is subscription basis (per health worker)





For more information, please contact
Shaun Rangappa, *srangappa@deloitte.com*
Laura Baker, *labaker@deloitte.com*

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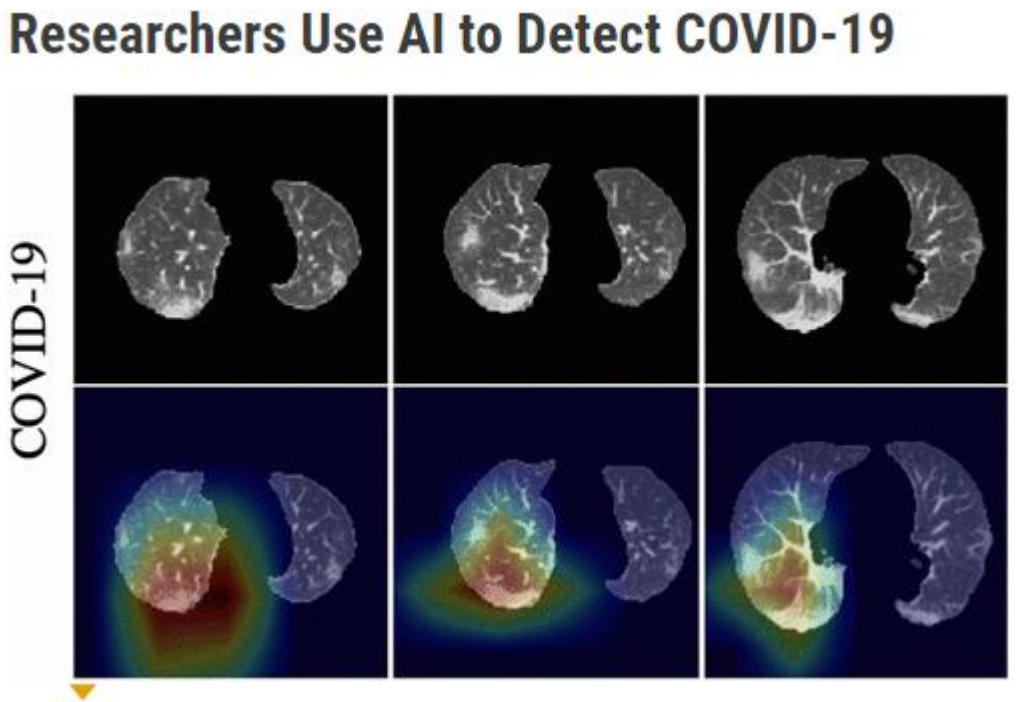
Chinese Hospitals Deploy AI to Help Diagnose Covid-19

Software that reads CT lung scans had been used primarily to detect cancer. Now it's retooled to look for signs of pneumonia caused by coronavirus.



https://www.itnonline.com/content/researchers-use-ai-detect-covid-19

Resources as discussed and requested from the BBL

Strategic Impact Evaluation Fund (SIEF) – Call for Proposals for Education-related Impact Evaluations, including for COVID-19 responses

https://www.worldbank.org/en/data/interactive/2020/03/24/world-bank-education-and-covid-19

https://www.worldbank.org/en/programs/sief-trust-fund

https://www.worldbank.org/en/programs/sief-trust-fund/brief/call-for-proposals-can-technology-accelerate-learning-and-skills

Video from South Korea on how they flattened the curve with digital technology:
https://www.youtube.com/watch?v=aJKGPzAsABw&feature=youtu.be

CORE Group BBL on 8 different digital technologies: See https://www.eventbrite.com/e/covid-19-global-pandemic-response-coordination-call-digital-technologies-tickets-100834412442

Resources as discussed and requested from the BBL

Government of India launched its own WhatsApp chatbot: https://techcrunch.com/2020/03/21/india-whatsapp-mygov-corona-helpdesk-bot/

TraceTogether is an initiative from Government of Singapore: https://www.tracetogether.gov.sg/

Government of India has published Telemedicine Practice Guidelines

Australian Society of Telehealth has made guides available for remote consultations. Their information for GPs on video consultations is very helpful

Success stories for Digital Health: https://www.ictworks.org/digital-health-covid-response-success-stories/

UK's WhatsApp bot: https://www.bbc.co.uk/news/technology-52049520

Resources as discussed and requested from the BBL

Database with cumulative cases per day and per country: https://coronavirus.jhu.edu/map.html

Telemedicine Society of India is taking leadership in training 500 000 doctors in telehealth: https://www.mohfw.gov.in/pdf/Telemedicine.pdf

Australian College of Rural and Remote Medicine and the Australasian Telehealth Society:

http://www.aths.org.au/wp-content/uploads/2020/03/Quick-Guide-to-Telehealth.pdf

Comprehensive guide on managing appointments and conducting remote consultations

http://www.aths.org.au/wp-content/uploads/2020/03/Comprehensive-Guide-to-Telehealth.pdf

https://www.paho.org/ish/images/docs/covid-19-teleconsultations-en.pdf?ua=1

Resources as discussed and requested from the BBL

New York University's Digital Health Innovation Lab (HITLAB) – townhall recording on Digital Solutions for COVID-19 in New York

https://www.youtube.com/watch?v=lNDW-slJPu0

COVID-19 GOVERNMENT RESPONSE TRACKER BY UNIVERSITY OF OXFORD

https://www.bsg.ox.ac.uk/news/worlds-first-covid-19-government-response-tracker-launched-today