



# Wastewater Surveillance for Tracking Viruses and Antimicrobial Resistance: Insights from Bangalore City, India

**Varsha Shridhar, PhD**

**Co-Founder,  
Molecular Solutions Care Health LLP  
&**

**Precision Pandemic Health Initiative**



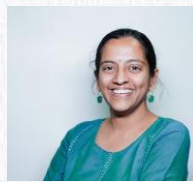
# Über mich

Ich bin Dr. Varsha Shridhar, eine Molekularbiologin und Unternehmerin

Deutsche Sprache interessiert mich  
(Ich habe drei Jahre lang Deutsch  
Sprache in der Hauptschule in Indien  
gelernt!) viele Jahre vor

Mein Unternehmen ist Molecular Solutions  
Care Health LLP (MSCH).  
Das ist sieben Jahre alt.

Es führt diagnostische Tests und  
Abwasserüberwachung durch



# About me

- Scientist-entrepreneur
- Passionate about health equity and public health
- Molecular Solutions Care Health LLP (MSCH): Transdisciplinary Public Health diagnostics lab  
Motto of "Access to All"
- Among India's largest Covid testing labs; pioneer in setting up city-wide wastewater surveillance platforms through the **Precision Pandemic Health Initiative Consortium**



NEW V  
RESILIENCY

# By the end of my talk, you will:

- a) Appreciate the extent and range of Wastewater Surveillance (WWS) work by our Consortium
- b) Recognize the critical need for diversity in consortia, particularly the need for businesses, alongside academia, govt and philanthropy
- c) Reach out to me to partner/ collaborate with or fund our expansion and scaleup





# Context to my work

MSCH started off as an R&D company innovating in the field of drug resistance diagnostics.

During Covid, pivoted to diagnostic services:

- ISO 15189 (for molecular diagnostics) accredited
- >1.5 million RT PCR tests done
- ~100 molecular biology technicians trained
- Capacity built from 50 tests/day to >4000 tests/day

Also deeply involved in the establishment of Asia's largest hybrid city-wide wastewater surveillance platform in Bangalore, India, covering ~13 million ppl.

# Precision Pandemic Health Initiative

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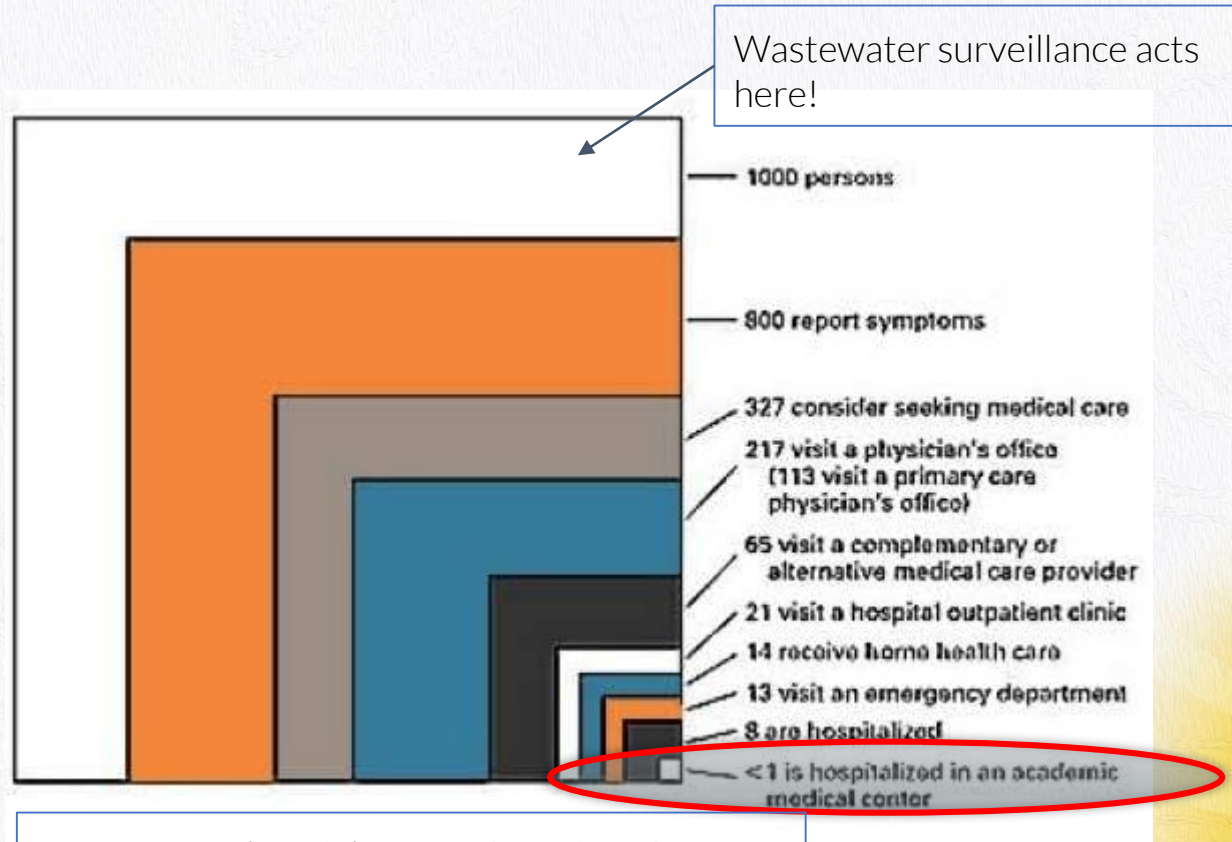


Basu et al Access Microbiol 2022  
Chaudhuri et al PLOS Global Health 2023  
Harshe et al Population Health 2023



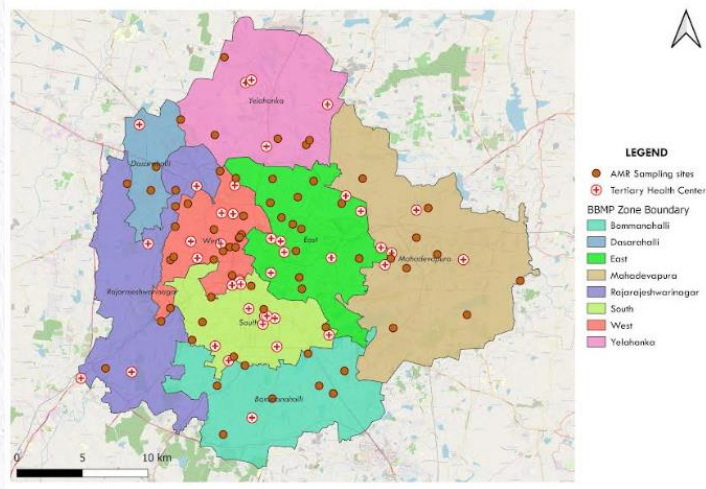


# The Need for Hyper-Local Insights in Public Health Action



Most national guidelines are based on this.  
Highly skewed data!

# Hypothesis 1: WWS can provide community-level, hyperlocal insights of practice and policy value in Bangalore city



## INTEGRATED DASHBOARD

### Select by Type

Covid

H1N1

Influenza-A

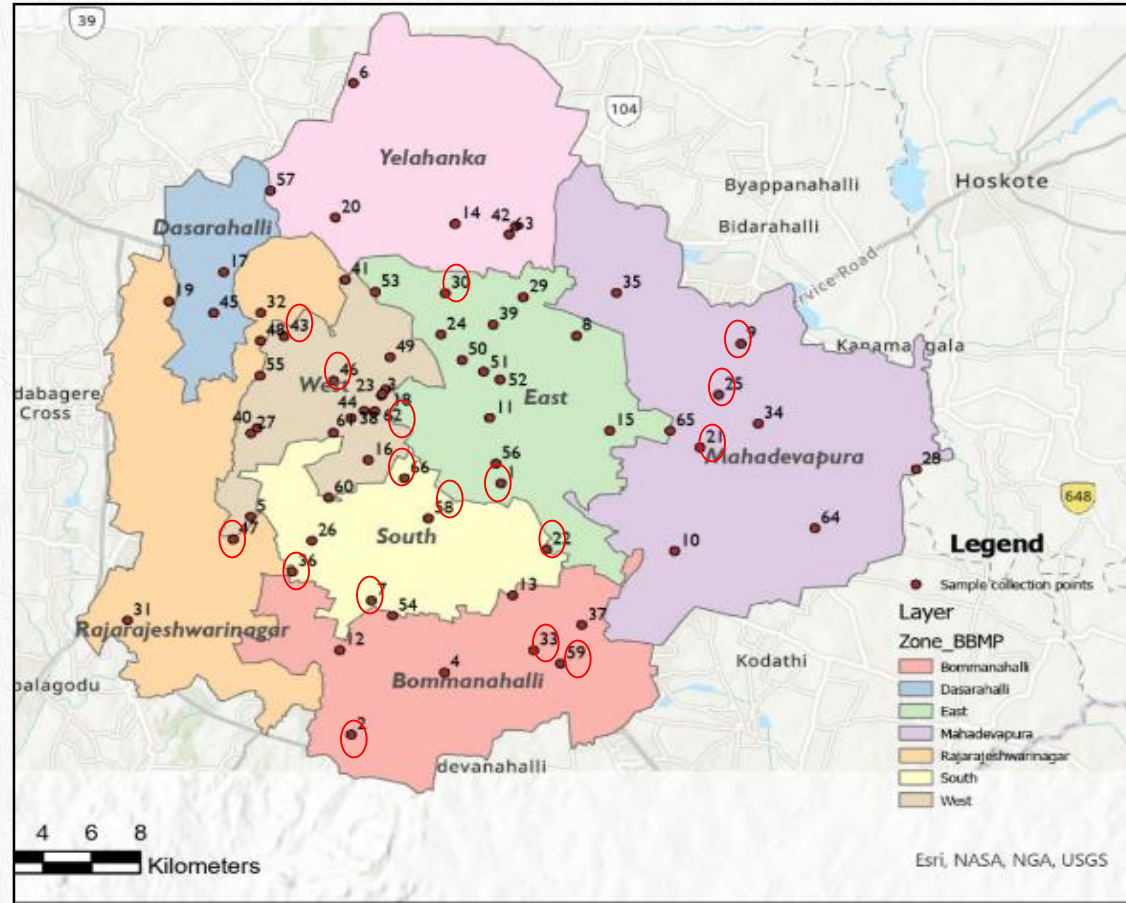
Influenza-B

Negative





# Discrete Hotspots of Meropenem Resistance Identified in WW in Bangalore





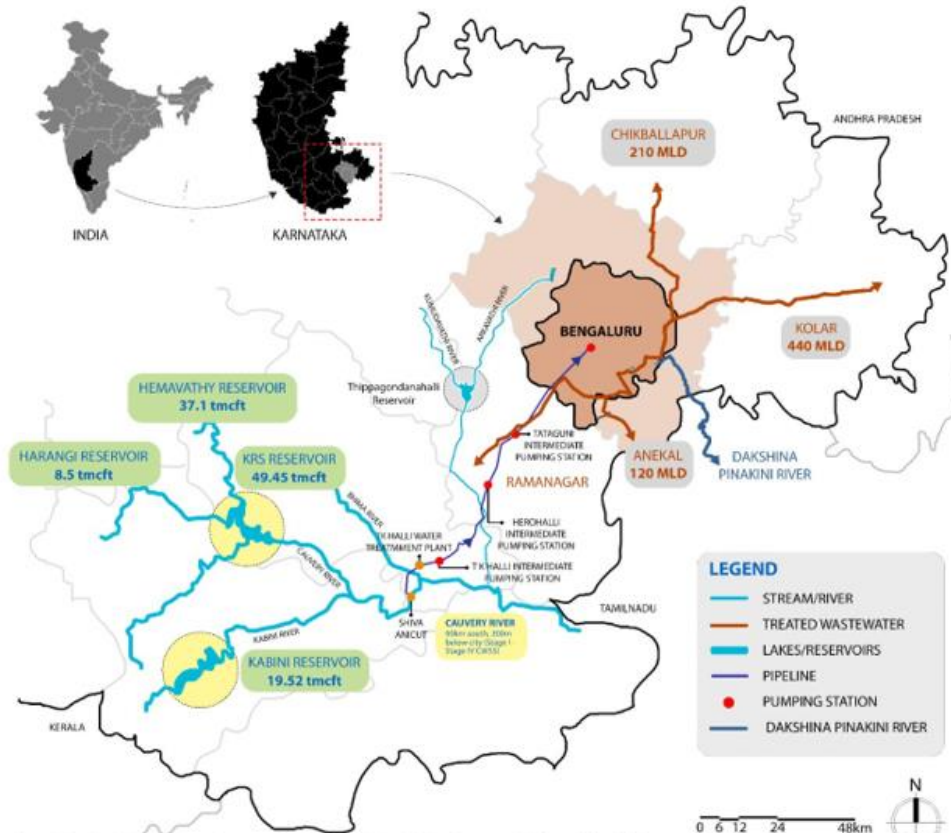
# Hypothesis 2: WW is a carrier of AMR

The Kere Sanjeevani (Lake Revival) Program: World's 2nd largest groundwater recharging program using treated WW

#COVID  
ActionCollab

## BENGALURU - ITS WATER & WASTEWATER

Linking the metropolis to its drought-prone hinterland



**1294 sqkm** Bengaluru Municipal area

**13 million** population as of 2018 (projected to be 20 million in 2031)

**1440 MLD** is the total amount of water officially sourced from river Cauvery

**700 MLD** is the deficit water demand met by groundwater - via borewells & tankers

**1640 MLD** is the quantity of wastewater generated, estimated at 80% of water supplied

**29 STPs** with total 1182.5 MLD capacity owned by BWSSB (with increased capacity to 1726.5 MLD by 2023)

**770 MLD** of treated wastewater **TRANSFER** to the drought-prone districts of Kolar (440 MLD), Chikballapur (210 MLD) & Anekal for agriculture reuse through groundwater recharge 210 MLD to



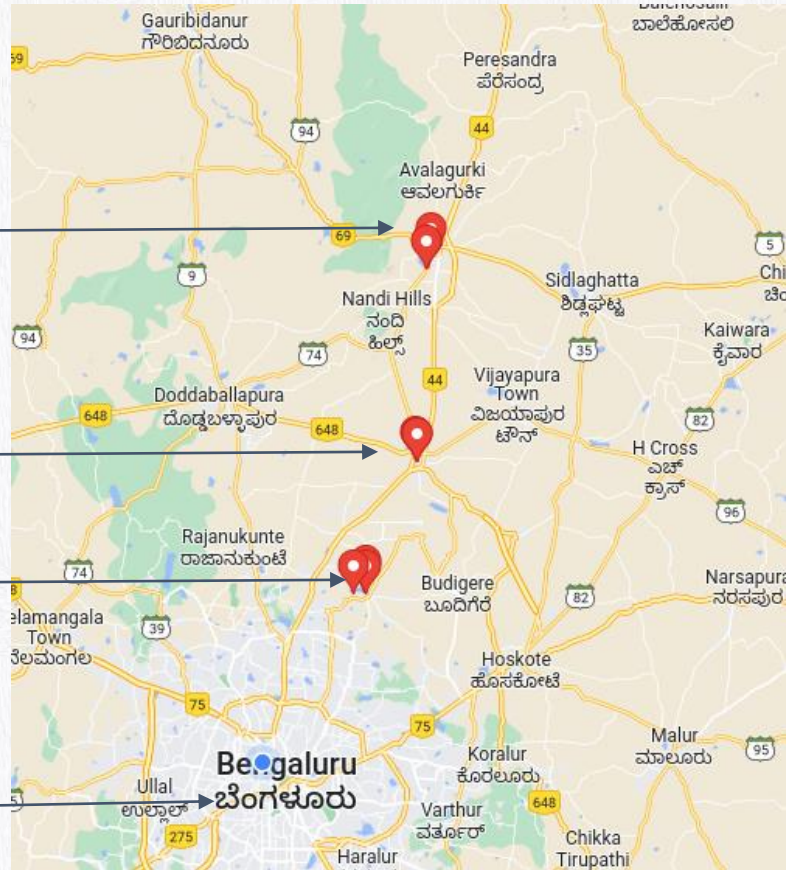
# AMR bacteria were absent. Antibiotics were present

~ 250ng of  
isoniazid

~ 150ng of  
isoniazid

~ 150ng of  
isoniazid

~ 100ng of  
isoniazid



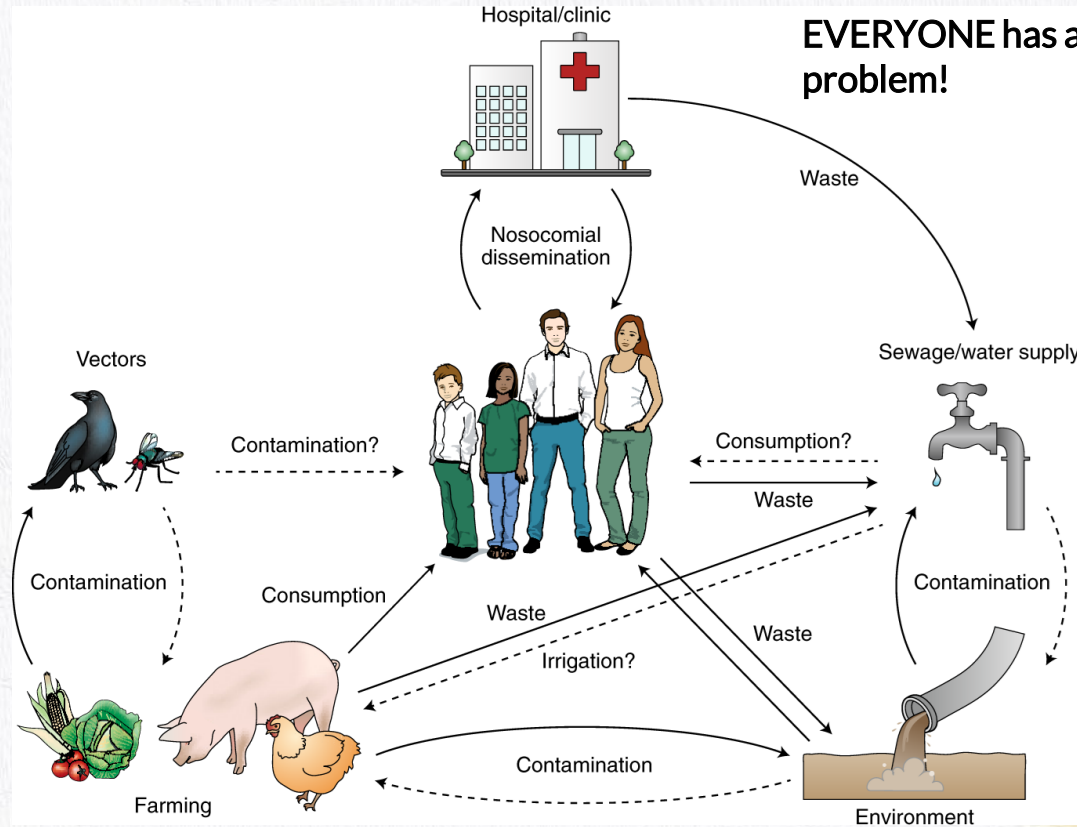
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# Objectives:

- a) Introduce the Wastewater Surveillance (WWS) work done by our Consortium
- b) Showcase the need for diversity in consortia
- c) Highlight the importance of businesses in the business of surveillance
- d) Throw a shout-out to interested collaborators and funders!

# AMR: a WICKED (VUCA) problem





# Players in the Bangalore Expt: Embracing Chaos and Uncertainty

Principal Scientific Adviser's Office:  
Dr. Sindhura Ganapathi  
NCBS: Dr. Uma Ramakrishnan  
Dr. Shannon Olson  
ICMR (NIMHANS, Dr. Reeta Mani)

BBMP:

**Administrator** Shri Rakesh Singh

**Chief Commissioners:** Shri Anil Kumar, Shri Gaurav Gupta, Shri Tushar Giri Nath

**Spl Commissioners:** Shri Ranadeep Singh  
Shri Thrilok Chandra

**CHOs:** Dr Vijendra  
Dr. Balasundar

**DSOs:** Dr. Suresh  
Dr. Madhusudhan

**Covid War Room:** Dr. Bhaskar, Dr. Maheshwari, Dr. Deepak

Central Govt  
Institutions

GoK TAC  
State Govt  
Institutions

Local Govt  
Institutions

Indian NGOs

Indian for  
profit  
companies

CSR

Service  
venders

Foreign  
for-profit  
companies

Foreign Govt  
Institutions

TIGS: Dr. Farah, Dr.

Sanjay, Dr. Rakesh and  
teams

Biome Environmental: Mr.  
Vishwanath

Swasti Health Catalyst:  
Dr. Angela and team

CDD Society: Ms. Rohini  
and team

IDRF: Dr. Chitra, Mr. Pais

Skoll Foundation  
Rockefeller Foundation  
USAID  
SwissNex  
Schmidt Futures

Foreign NGOs

MSCH, PCMH Wellness,  
Neshaju, GenePath, Achira,  
Cloudkrate

Tenders

#COVID

# Communication is Everything: Risk Communication and Community Engagement are Key

**Table 2: Conversation summarized**

Definition of conversation	Emphasize qualities of conversation that improve sensemaking and learning	Avoid conversation that inhibits sensemaking and learning	Recommendations for enhancing the role of conversation in improving interventions
What it is <ul style="list-style-type: none"> <li>• Collaboration</li> <li>• Meaning making</li> <li>• Improvisation</li> </ul> What it is not <ul style="list-style-type: none"> <li>• Instruction-giving</li> <li>• Information exchange</li> <li>• Speeches</li> <li>• Talk that elicits no real meaning</li> </ul>	<ul style="list-style-type: none"> <li>• Trust</li> <li>• Responsive interaction</li> <li>• Empathetic listening</li> <li>• Diversity of perspectives</li> <li>• Intimate exchange</li> <li>• Disciplined debate</li> <li>• Creative dialogue</li> </ul>	<ul style="list-style-type: none"> <li>• Lack of time and space</li> <li>• Failure to listen</li> <li>• Too much agreement</li> <li>• Dominant discourses diminish diverse perspectives</li> <li>• Siloed specialties</li> </ul>	<ul style="list-style-type: none"> <li>• Evaluate the potential of an intervention to generate conversation</li> <li>• Look for and leverage unexpected conversation</li> <li>• Create space within which conversation can unfold</li> <li>• Use conversation to help people manage uncertainty</li> <li>• Use conversation to help reorganize relationships</li> <li>• Build social interaction competence</li> </ul>

## *Role of Conversations in Healthcare Interventions*

Jordan et al (2009) Implementation Science



# From data to policy: Sense-making workshop



Special Commissioner Health, BBMP

@BBMPSpiHealth

Chaired a workshop on [#EnvironmentalSurveillance](#) with PPHS, [@PrecisiOnHealth](#), CovidCollab, TIGS, Swasth, to undrstd current findings & chalk out plans for building structured [#Covid19](#) prediction model, also evaluate usability of EWS for other diseases of public health interest.



## Focus on sewage surveillance to detect emerging variants

This will provide early warning on impending local surge of COVID-19

AFSHAN YASMEEN  
BENGALURU



SSAC meeting was held on June 11, he said the committee has representation of all

**TIMES CITY**

## Mahadevapura has highest viral load: Sewage analysis

It's Followed By East Zone, Bommanahalli

Farheen Hussain  
@timesgroup.com

**Bengaluru:** With Covid-19 infections rising in the city, wastewater surveillance has revealed the largest number of positive cases is likely to have been reported from Mahadevapura, followed by East zone and Bommanahalli.

The precision public health surveillance system

### DAILY COVID COUNT IN KARNATAKA UP 25%

For the first time after February 25, 2022, Karnataka on Thursday reported over 400 new Covid-19 cases. The number (471) seen in a 24-hour window was 25% more than Wednesday's 376 cases. Bengaluru accounted for 458 cases, a 28% jump from the previous day's 358 fresh infections.

The state's daily test positivity rate went up from 1.6% on Wednesday to 2.1% on Thursday. This has taken the total number of active Covid cases in the state to 2,880 and in the city to 2,776. However, the



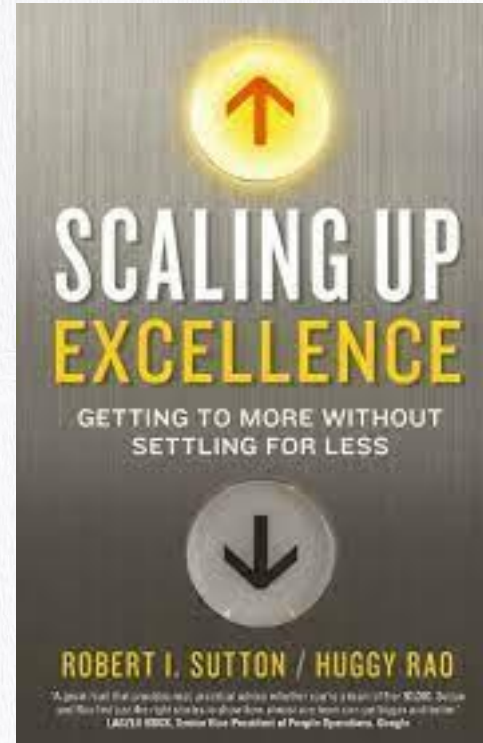
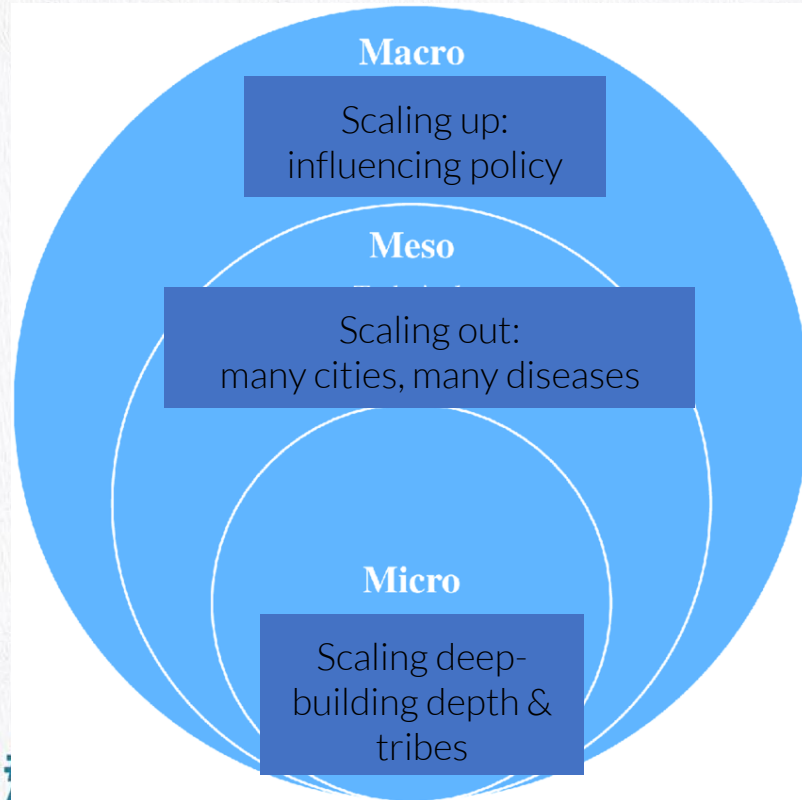
File photo of a swab sample being collected for testing and there has been no spike in

department of health and family welfare, said non-compliance with Covid protocols like masking and crowding may be driving the spike. He said the other possibility is sub-lineages of the Omicron variant.

Stressing that there is still no confirmation, Randeep said the department is waiting for reports from the Indian SARS-CoV-2 Genomics Consortium to see if BA.4 or BA.5 are behind these rise in cases.

"However, there are no formations of worrisome clusters, spikes in hospitalisations or deaths, which gives us

# Scaling the Platform and Consortium







Indian Alliance for  
**Public Health  
Preparedness**

# Scaling up: The Formation and Work of IAPHP

WORLD  
SCIENCE  
NOW



## Work We Do



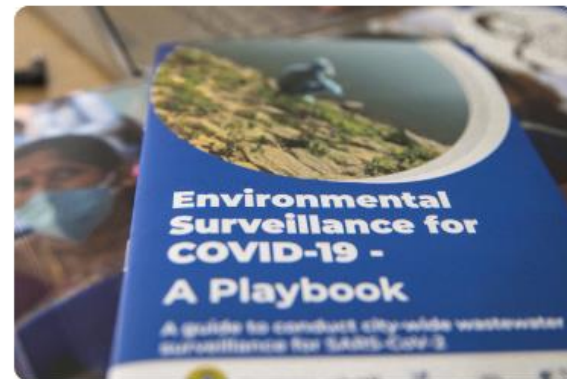
### POLICY SHAPING

Engage with national, state and municipal governments to build momentum for the adoption, implementation and regulation of environmental surveillance.



### RESEARCH

With the expertise of researchers, academics and scientists the Alliance will identify opportunities for new research, facilitate collaborations and build a body of evidence for environmental surveillance as a tool for public health.



### COMMUNICATION

Create awareness and educate stakeholders on the relevance, effectiveness and efficiency of environmental surveillance for health equity.



Indian Alliance for  
**Public Health  
Preparedness**

# Scaling out: Multi-city Scaling of the Program

<http://www.esallianceforpublichealth.org/>

**#COVID**  
ActionCollab



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# The Role of Indian Businesses in our Consortia

- Beyond just vendors or contractors
- Agility, nimbleness and freedom to operate
- Resilience to adapt to local contexts- protocols that were developed by our lab during lockdowns made use of locally available resources and were designed for ultimate use by local government labs
- Customized solutions
- Need to build business pushes for scale





# Commercial Implications

- Increasing interest from water departments of governments to test and track quality of drinking water supplies, particularly to track GI infections and outbreaks.
- Interest from small local governments to set up mini-wastewater surveillance systems at town level or district level for viral and bacterial pathogens.
- Integrated dashboards like ours help
  - pharma companies target their sales better.
  - government drug purchase committees buy and allot antibiotics better

# Key Messages

- Successful integration of WWS into routine disease surveillance requires multiple players and constant attention to communication.
- Businesses often get overlooked in consortia (other than as vendors or contractors), but have key roles to play in scale and capacity building
- Complex issues like AMR require consortia with representation from all fields



# In conclusion:

Let us co-design, co-discover, co-implement, & co-grow

Invest in us for wider scale and range of Wastewater Surveillance in India and other countries.

**Join us as partners, collaborators and funders!**

# Acknowledgements



**COMMUNITY  
ACTIONCOLLAB**  
Catalysing a resilient world



**skoll**  
FOUNDATION

**CMS** <sup>TM</sup> **SOCIAL  
IMPACT  
SPECIALISTS**

**RESIL**



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**CR SPR  
B TS**



Consortium for  
DEWATS  
Dissemination  
Society

