Environmental Sampling as a Tool for Identification of High Typhoid Risk Settings

Jason Andrews

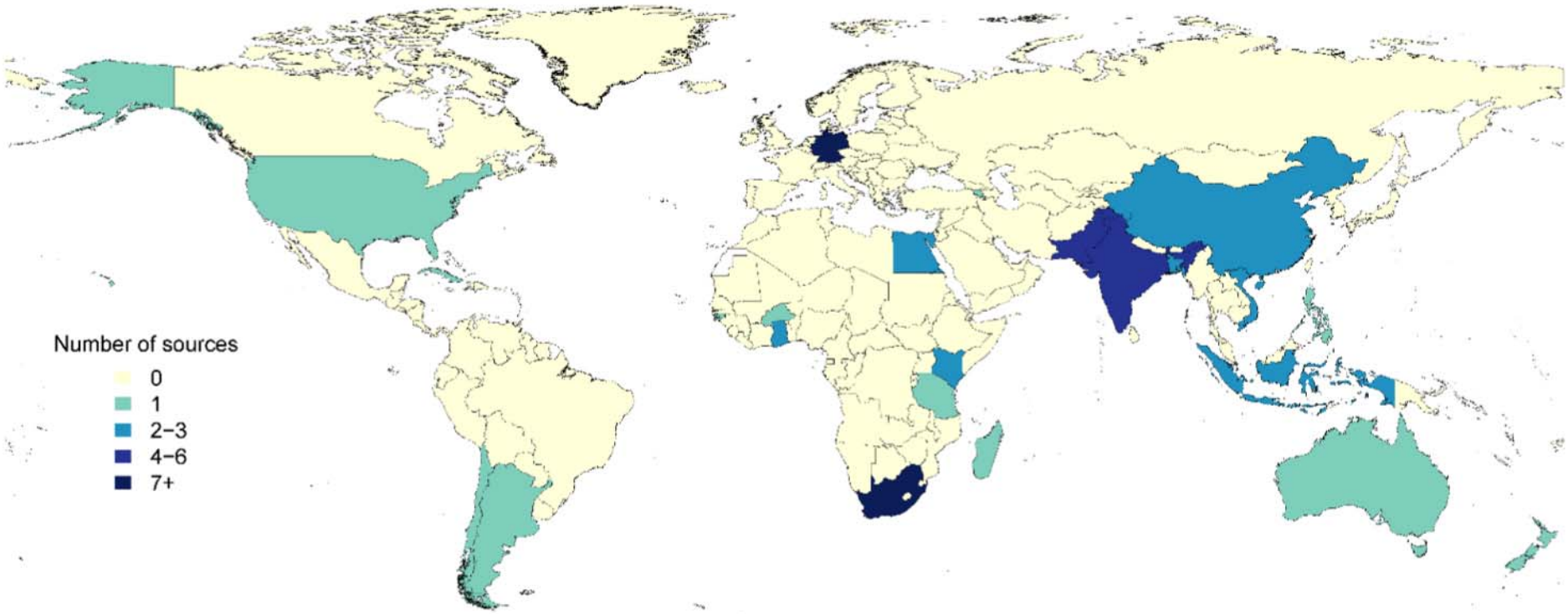
11th International Conference on Typhoid & Other Invasive Salmonelloses

Hanoi, Vietnam

March 26, 2019

The global burden of typhoid and paratyphoid fevers: a systematic analysis for the Global Burden of Disease Study 2017

*GBD 2017 Typhoid and Paratyphoid Collaborators**

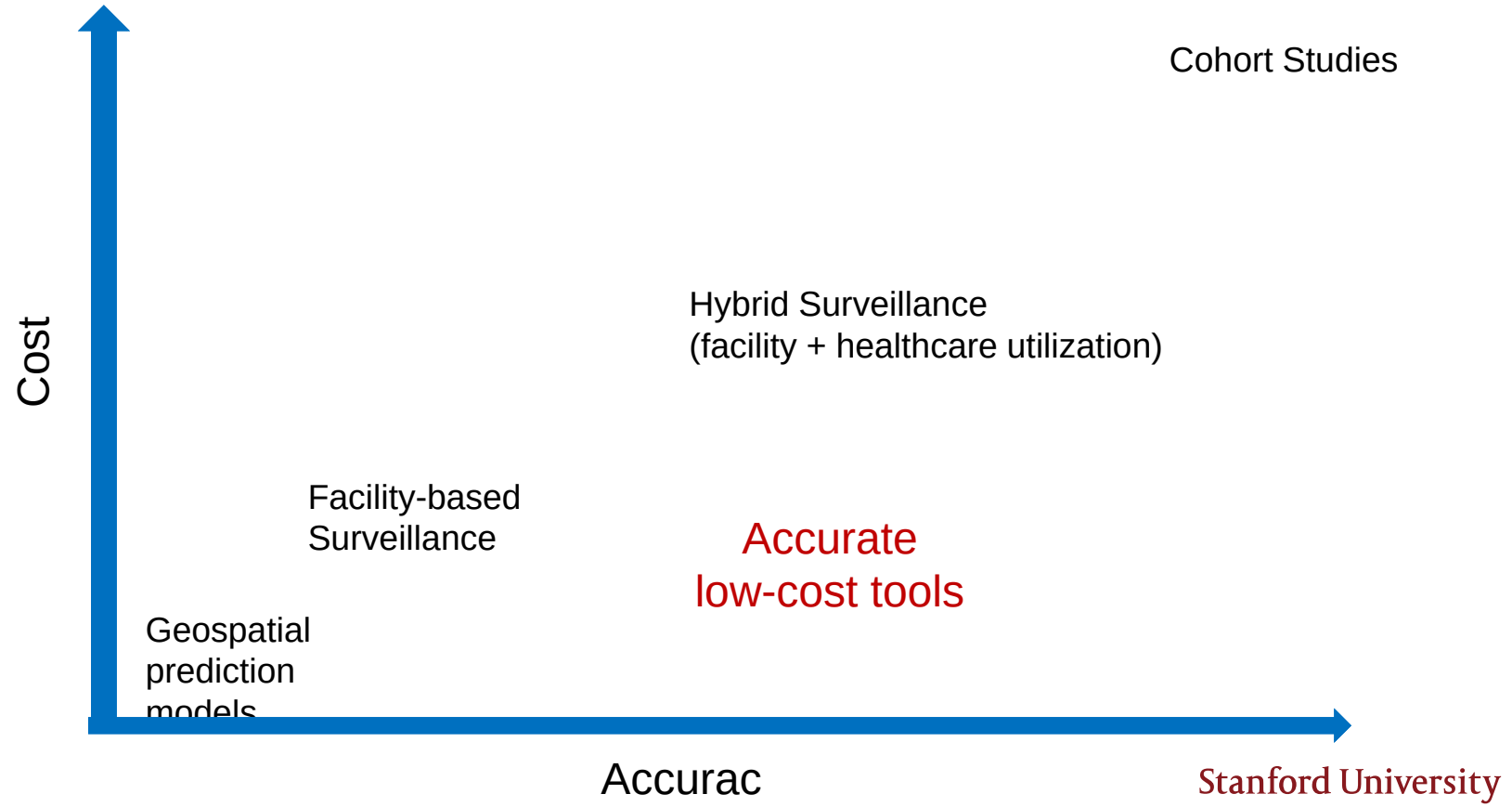


Generating more typhoid incidence data

- **Surveillance for Enteric Fever in Asia Project (SEAP) Phase II**: Bangladesh, Pakistan, Nepal
- **Severe Typhoid Fever Surveillance in Africa (SETA)**: Burkina Faso, Ghana, Nigeria, DRC, Madagascar, Ethiopia
- **Surveillance of Enteric Fever in India (SEFI)**
- **STRATAA, TyVAC**: Malawi, Nepal, Bangladesh

Most LMIC countries will need to make decisions about TCV introduction with little if any national, much less subnational, data on typhoid burden

Accuracy and Cost Trade-offs in Typhoid Burden Estimation



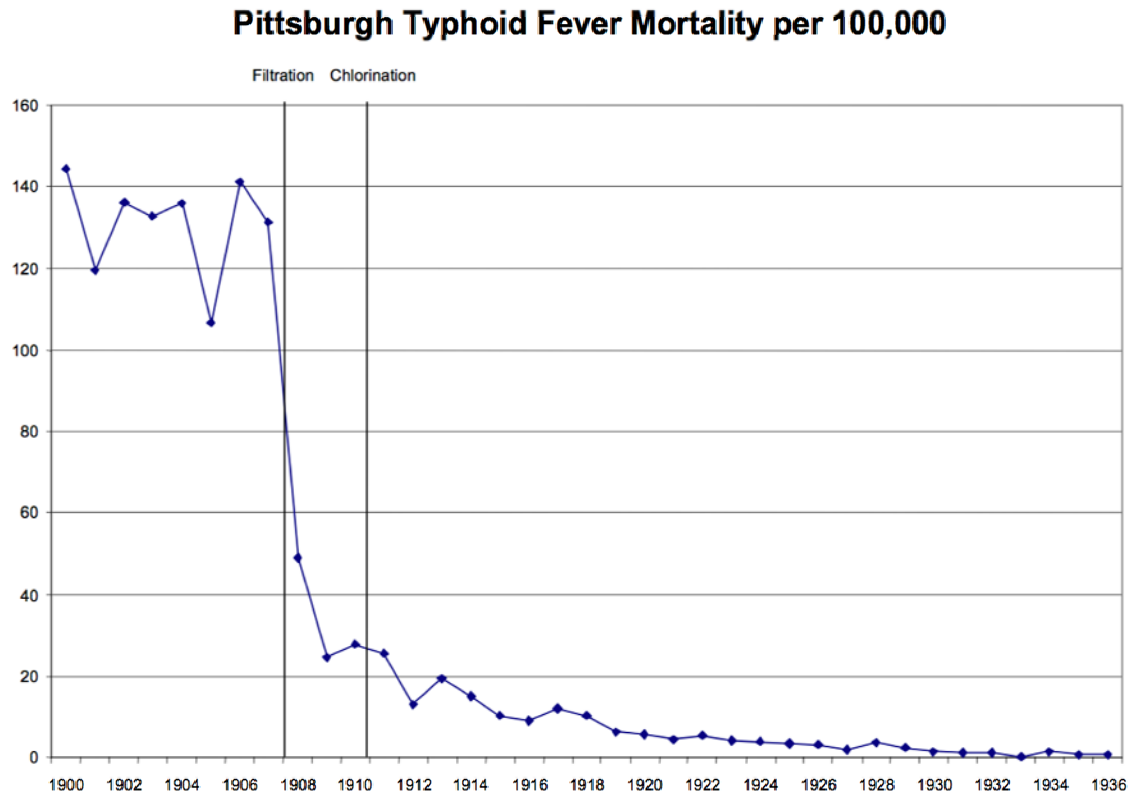
Why environmental surveillance may enable us to identify high risk settings for typhoid

1. *S.* Typhi is a human restricted pathogen

2. Municipal water contamination is essential to typhoid transmission

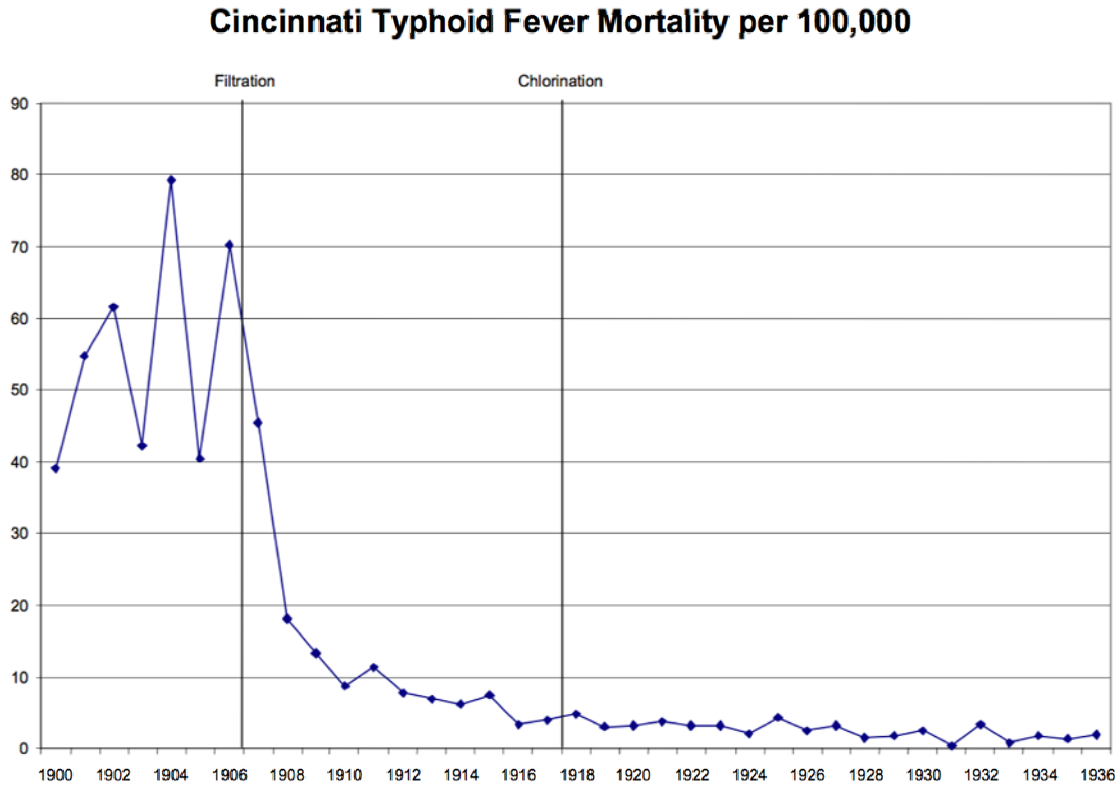
"How can typhoid fever be prevented? ... the reply to the above question may be stated in four words, namely, Stop drinking contaminated water."
– Henry Baker, 1884

Public water systems are critical to typhoid transmission



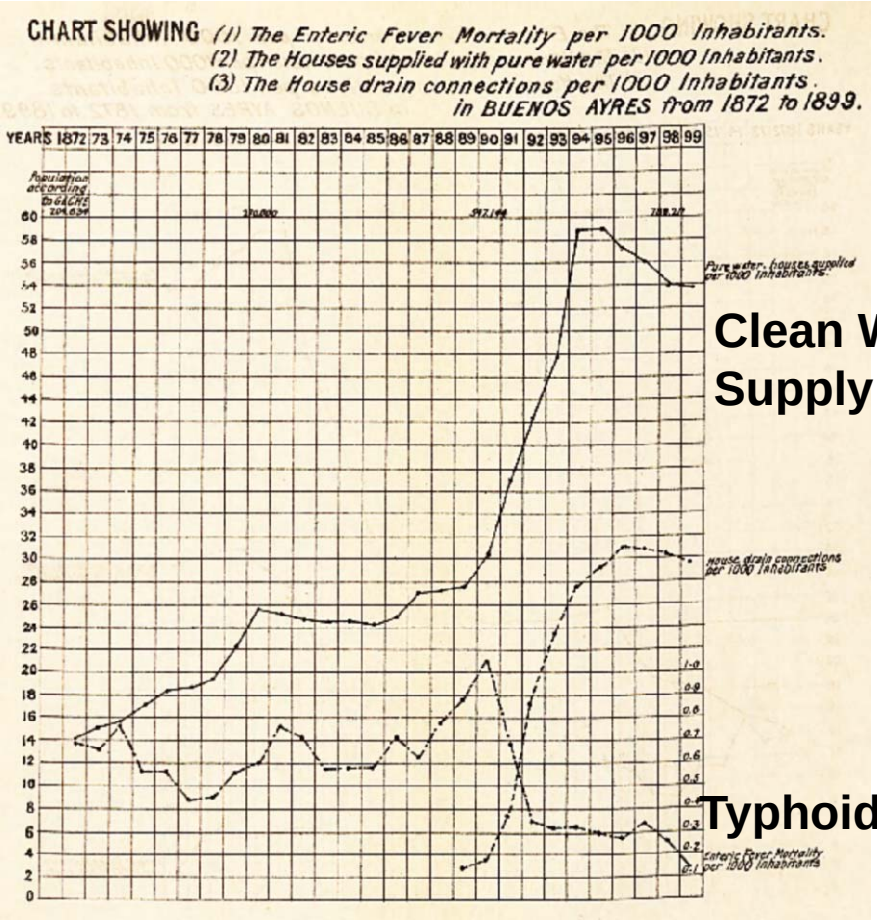
Cutler and Miller, *Demography,*

Public water systems are critical to typhoid transmission



Cutler and Miller, *Demography,*

Public water systems are critical to typhoid transmission



Buenos Aires, 1872-1899

Clean Water Supply

Typhoid

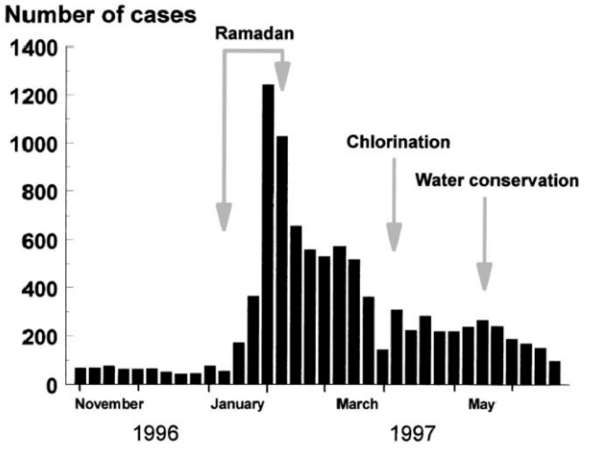
Davison J, *Trans Epi Soc London,* 1901

Water-borne Typhoid Outbreaks

A Massive Epidemic of Multidrug-Resistant Typhoid Fever in Tajikistan Associated with Consumption of Municipal Water

Jonathan H. Mermin, Rodrigo Villar, Joe Carpenter, Les Roberts, Aliev Samaridden, Larissa Gasanova, Svetlana Lomakina, Cheryl Bopp, Lori Hutwagner, Paul Mead, Bruce Ross, and Eric D. Mintz

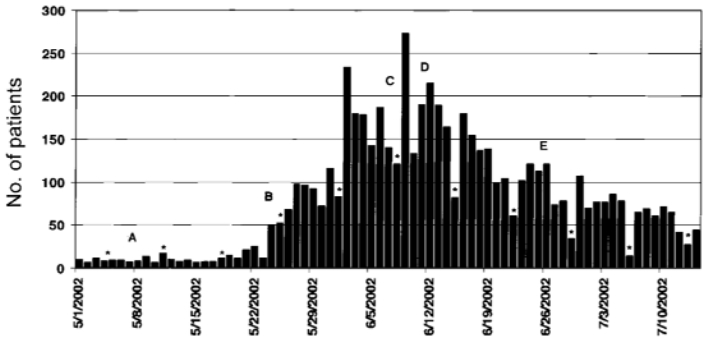
Foodborne and Diarrheal Diseases Branch, Biostatistics and Information Management Branch, and Hospital Infections Program, Division of Bacterial and Mycotic Diseases, National Center for Infectious Diseases, and Refugee Health Unit, National Center for Environmental Health, and Epidemic Intelligence Service and Division of International Health, Epidemiology Program Office, Centers for Disease Control and Prevention, Atlanta, Georgia; Dushanbe Sanitary and Epidemiology Service and Microbiology Laboratory, Hospital Number 2, Dushanbe, Tajikistan



Typhoid Fever: A Massive, Single–Point Source, Multidrug-Resistant Outbreak in Nepal

Michael D. Lewis,[1] Oralak Serichantalergs,[1] Chittima Pitarangsi,[1] Niphon Chuanak,[1] Carl J. Mason,[1] Laxmi R. Regmi,[2] Prativa Pandey,[3] Ranjan Laskar,[4] Chandrika D. Shrestha,[5] and Sarala Malla[5]

[1]Armed Forces Research Institute of Medical Sciences, Bangkok, Thailand; [2]Bharatpur Zonal Hospital, [3]CIWEC Travel Clinic, [4]Bharatpur College of Medical Sciences, and [5]Nepal National Public Health Laboratory, Kathmandu, Nepal



, Typhi is detectable in water and ewage and provides actionable data

DEMONSTRATION OF THE TYPHOID BACILLUS IN SUSPECTED DRINKING WATER BY PARIETTI'S METHOD.[1]

BY EDMOND J. McWEENEY, M.A., M.D. ROYAL UNIV.,
Professor of Pathology and Bacteriology, C.U.I.; Pathologist to the Mater Misericordiæ, and Coombe Lying-in Hospitals, Dublin; Examiner in Pathology, Royal University of Ireland.

THE DETECTION OF ENTERIC CARRIERS IN TOWNS BY MEANS OF SEWAGE EXAMINATION*

by B. MOORE, B.SC., M.B., B.CH., B.A.O.,
Director of the Public Health Laboratory, Exeter.

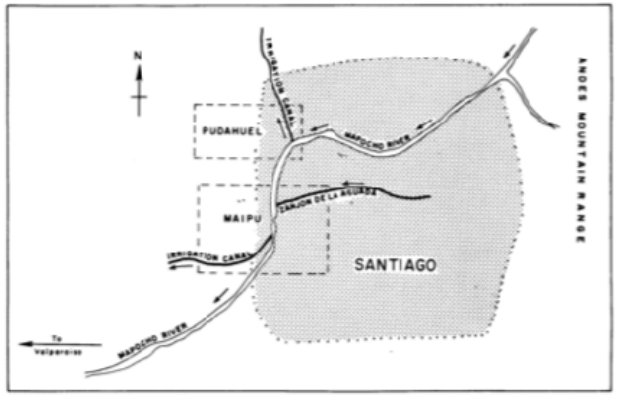
E JOURNAL OF INFECTIOUS DISEASES • VOL. 149, NO. 4 • APRIL 1984
 0022-1899/84/4904-0023$01.00

he Use of Moore Swabs for Isolation of *Salmonella typhi* from rigation Water in Santiago, Chile

D. Sears, C. Ferreccio, M. M. Levine,
M. Cordano, J. Monreal, R. E. Black,
D'Ottone, B. Rowe, and the Chilean
phoid Committee*

From the Center for Vaccine Development, University of Maryland School of Medicine, Baltimore, Maryland; the Ministry of Health, Santiago, Chile; the Institute of Public Health, Santiago, Chile; and the Central Public Health Laboratory, Division of Enteric Pathogens, Colindale, United Kingdom

Kinde and Atwill, *California Agriculture* 54(5):62-6

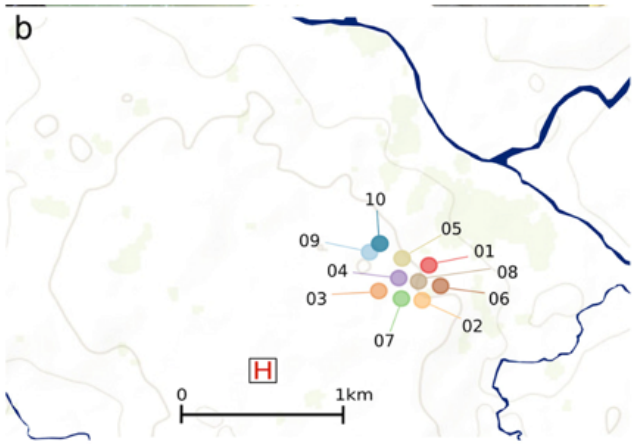


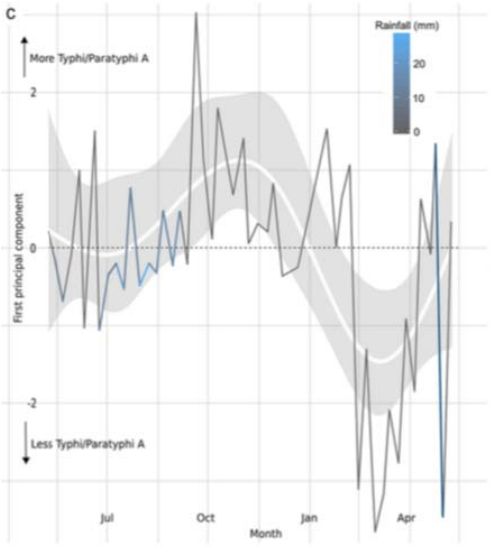
olecular Detection of *S.* Typhi in Drinking Water

ESEARCH ARTICLE

The Ecological Dynamics of Fecal Contamination and *Salmonella* Typhi and *Salmonella* Paratyphi A in Municipal Kathmandu Drinking Water

bhilasha Karkey[1☯], Thibaut Jombart[2☯], Alan W. Walker[3,4], Corinne N. Thompson[5,6], ndres Torres[7], Sabina Dongol[1], Nga Tran Vu Thieu[5], Duy Pham Thanh[5], Dung Tran Thi goc[5], Phat Voong Vinh[5], Andrew C. Singer[8], Julian Parkhill[3], Guy Thwaites[5,6], uddha Basnyat[1], Neil Ferguson[2], Stephen Baker[5,6,9]*





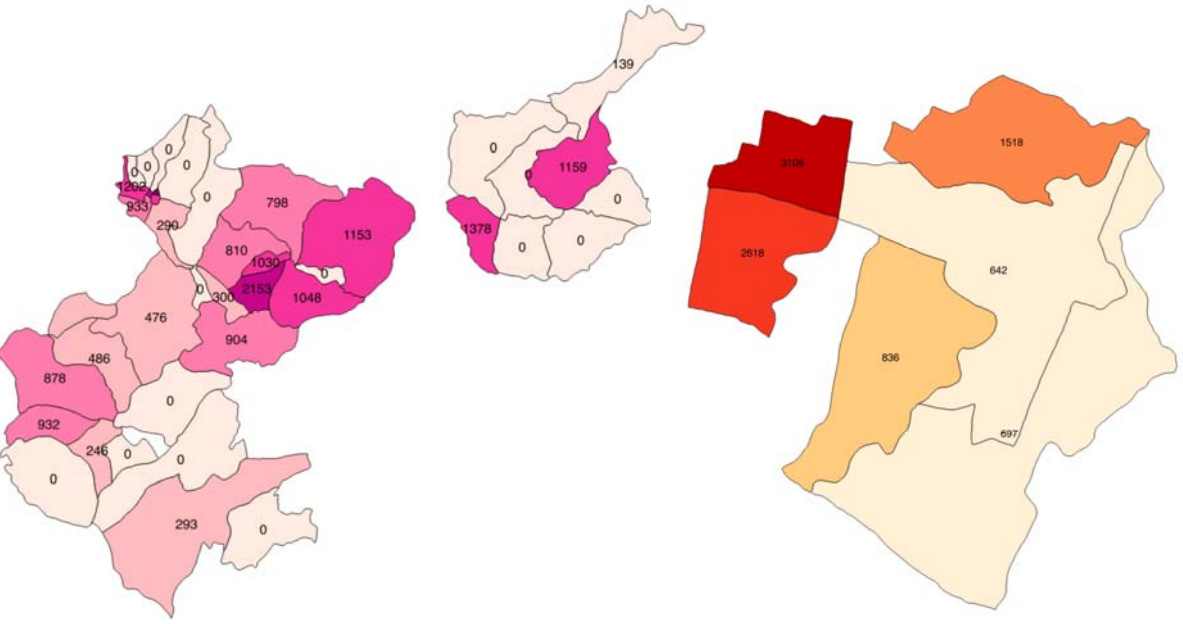
Can Environmental Surveillance for Typhoidal *Salmonella* Distinguish High from Low Typhoid Risk Communities

Sero-Epidemiology and Environmental Surveillance (SEES) study

Navi Mumbai TCV Introduction Evaluation

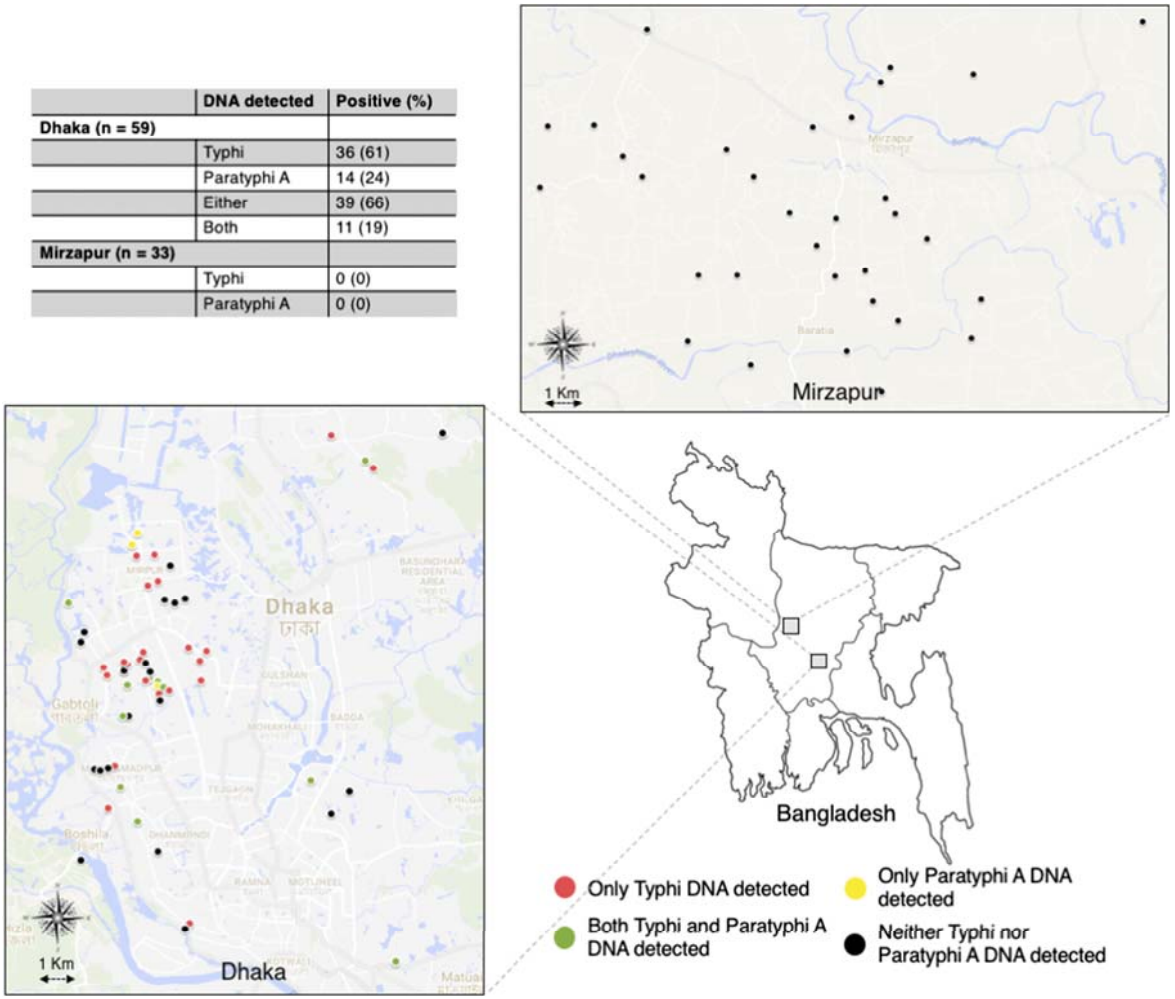
EES Study: Bangladesh, Nepal, Pakistan

- Sampling in catchment of population-based disease surveillance (SEAP)
- Leverage incidence heterogeneity
- Characterize how *S.* Typhi frequency/abundance in drinking water correlates with incidence of disease



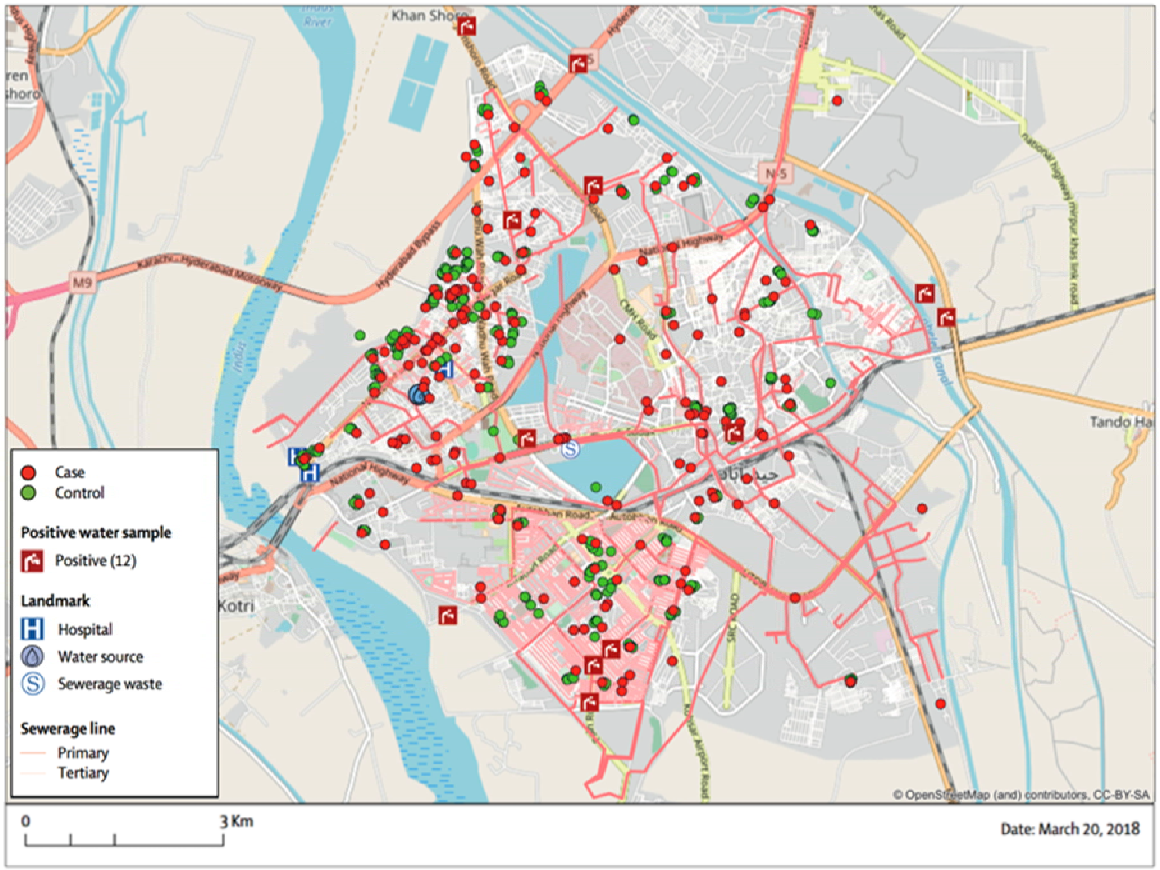
S. Typhi/Paratyphi
n urban versus
ural Bangladesh

	DNA detected	Positive (%)
Dhaka (n = 59)		
	Typhi	36 (61)
	Paratyphi A	14 (24)
	Either	39 (66)
	Both	11 (19)
Mirzapur (n = 33)		
	Typhi	0 (0)
	Paratyphi A	0 (0)



aha et al, AJTMH

. Typhi in water in
yderabad, Pakistan



yphi detected in
2% of water
amples

amar et al, *Lancet Inf Dis,* 2018

Navi Mumbai TCV Introduction

Open with

Newsband

The Dynamic Daily Newspaper of Navi Mumbai

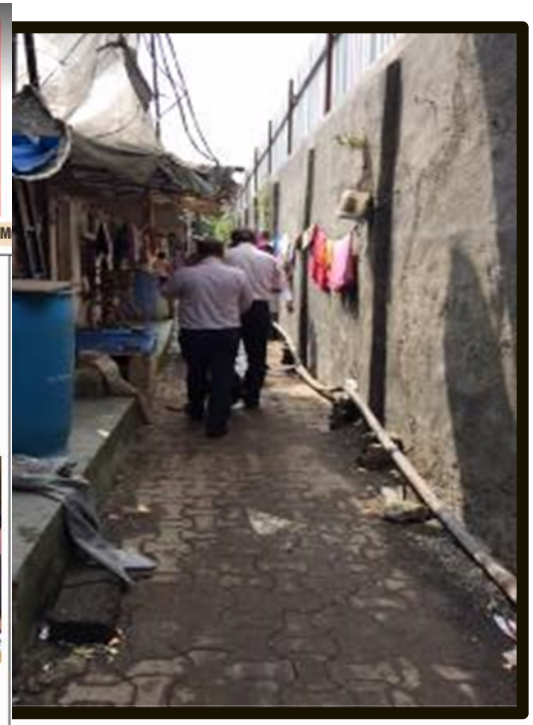
Vol. 12 • Issue 63 RNI No. MAHENG/2007/21778 | Postal Regn. No. NMB/154/2017-19/Vashi MDG Post Office Navi M

First-of-its-kind Free Typhoid Conjugate Vaccination Campaign by NMMC

By Chandrashekhar Hendve

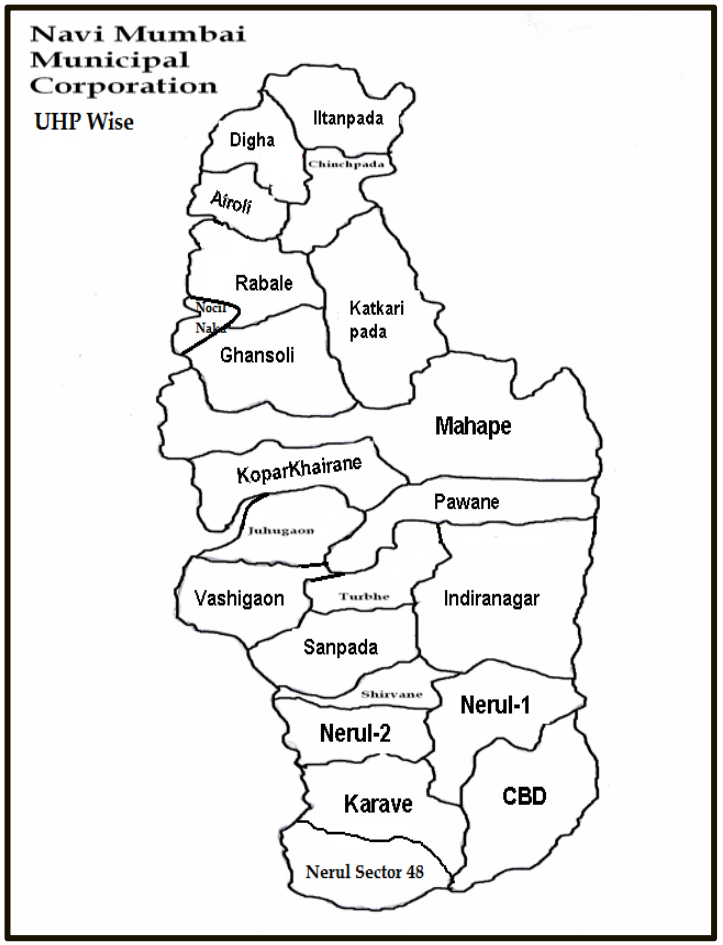
NAVI MUMBAI: In first-of-its-kind free Typhoid Conjugate vaccine (TCV) campaign in the world will be undertaken in Navi Mumbai. The initiative will be started from 14th July 2018 under the guidance of Jayawant D. Sutar, Mayor of Navi Mumbai and Municipal Commissioner Dr. Ramaswamy N. The Typhoid Conjugate Vaccine (Typbar-TCV) will be given to 2 lakh children in the first phase of the campaign, this year. The same number of children will be vaccinated next year in the second phase of the

Cont. on pg. 7



Navi Mumbai TCV Introduction

- Public sector introduction of Typbar TCV
- Step wedge cluster randomized introduction with 11 UHPs vaccinated in 2018, 11 in 2019
- **Hypothesis:** UHPs (neighborhoods) who received vaccine will have lower frequency and abundance of *S.* Typhi in water
- *S*. Paratyphi serves as a negative control outcome
- Also will evaluate geographical incidence heterogeneity and Typhi/Paratyphi frequency/abundance



ES for building political will for vaccination and improving water systems

- Complacency over fecal contamination of water
- ‘Coliforms’ don’t motivate politicians and administrators


Don't Forget G. A. R. Encampment Benefit Show, Columbia Theatre, Friday Night—All Receipts Go to G. A. R.

16 PAGES TODAY

The Evening Review.

WEATHER

TYPHOID IN WATER!

MAY RECORD SIX DEATHS

IS

WITH HOMER'S ARM AROUND HER, ONE WARM NIGHT IN APRIL, SHE WHISPERED "YES," SAID MISS JAY

$33,000 Breach of Promise Suit Against Evangelist Rademacher Now on Trial in Chicago—Defendant Writhes and Hides Blushes During Testimony.

ZIMMER, FOUND GUILTY, COLLAPSES; WILSON EXPLAINS


5 THE WORLD'S FIRST FACE TRANSPLANT RECIPIENT, FRENCHWOMAN DIED IN APRIL 'AFTER A LONG ILLNESS', A HOSPITAL SAID TUESDAY.

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International New York Times

12 WOZNIACKI WILL FACE KERBER FOR A PLACE IN US OPEN SATURDAY.

Nepal Republic Media

República

Vol. VIII, No. 119 Thursday, September 8, 2016 Bhadra 23, 2073 Nepal Samvat 1136 Re 19.53 12+20 Pages myrepublica.com Printed from Kathmandu, Nepalgunj & Birathagar

'Super bacteria' discovered in Rio's waters as Olympics near

By Flora Charner, CNN

Updated 7:17 PM ET, Tue July 5, 2016

Cholera bacteria rampant in Valley water supply: EDCD

- 90 percent of drinking water unsafe: EDCD
- 01 Ogawa bacteria found in water from stone spouts, KUKL water and water supplied by tankers
- Even hazardous bacteria like E coli, coliform found in jar water

ARJUN POUDEL
KATHMANDU, Sept 7

At a time when the health authorities are struggling to contain the spread of cholera in Kathmandu Valley, strains of the deadly disease have been found in drinking water samples collected from various Valley localities.

The deadly bacteria is found not only in water supplied by Kathmandu Upyataka Khanepani Limited (KUKL), the utility which supplies water through household taps, but also in other sources such as stone spouts and tankers.

A total of 139 people so far have been found infected with cholera in the capital this monsoon. The majority of the infected are from Lalitpur.

at EDCD, said, adding that even jar water and water collected from boring and wells is not safe to drink. He

According to Dr Sharma, the disease was also detected in stone spout water collected at Bangemukhi, tanker water at Okubahal and water supplied by KUKL at Sunakothi.

"Over 90 percent of water in the capital city is contaminated by hazardous bacteria like E coli and coliform," informed Dr Sharma. Officials at KUKL have urged the public not to rely fully on the quality of water supplied by the utility during the monsoon. During the rainy season floodwater may contaminate the water sources.

EDCD informed that

Earthquake repair work underway at Hanumandhoka on Wednesday. With the Indra Jatra and other festival approaching, repairs have taken on a new urgency.

cknowledgements

EAP/SEES Nepal
ista Vaidya
pesh Tamrakar
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ony Shrestha
aryn Bern
aac Bogoch
exander Yu
isten Aiemjoy

S Methods
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ohammad Sajib
if Tanmoy

SEAP/SEES leadership
Denise Garrett
Steve Luby
Kashmira Date
Samir Saha
Farah Qamar
Caitlin Barkume
Jessica Seidman
Ashley Tate
Bangladesh &Pakistan teams

Navi Mumbai ES Team
Nilma Hirani
Lily Horng

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Stanford University