

Surveillance for Enteric fever in Asia Project (SEAP)

Kashmira Date

U.S. Centers for Disease Control and Prevention (CDC)

**9th International Conference on Typhoid and Invasive
Non-Typhoidal *Salmonella* Disease, Indonesia
May 1, 2015**

Global Immunization Division
Center for Global Health



ENTERIC FEVER IN ASIA WHAT WE KNOW

Enteric Fever Disease Burden Estimates, 1986–2015

- ❑ R. Edelman, M.M. Levine. Summary of an international workshop on typhoid fever. *Rev Infect Dis*, 8 (1986)
- ❑ J.A. Crump, S.P. Luby, E.D. Mintz. The global burden of typhoid fever. *Bull World Health Organ*, 82 (2004)
- ❑ G.C. Buckle, C.L. Walker, R.E. Black. Typhoid fever and paratyphoid fever: systematic review to estimate global morbidity and mortality for 2010. *J Glob Health*, 2 (2012)
- ❑ R. Lozano, M. Naghavi, K. Foreman, S. Lim, K. Shibuya, V. Aboyans, *et al.* Global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet*, 380 (2012)
- ❑ C.J. Murray, T. Vos, R. Lozano, M. Naghavi, A.D. Flaxman, C. Michaud, *et al.* Disability-adjusted life years (DALYs) for 291 diseases and injuries in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet*, 380 (2012).
- ❑ V. Mogasale, B. Maskery, R.L. Ochiai, J.S. Lee, V.V. Mogasale, E. Ramani, *et al.* Burden of typhoid fever in low-income and middle-income countries: a systematic, literature-based update with risk-factor adjustment. *Lancet Glob Health*, 2 (2014), pp. e570–e580
- ❑ World Health Organization. Foodborne Diseases Burden Epidemiology Reference Group (2014)
- ❑ M. Naghavi, H. Wang, R. Lozano, A. Davis, X. Liang, M. Zhou, *et al.* Global, regional, and national age-sex specific all-cause and cause-specific mortality for 240 causes of death, 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet*, 385 (2015).

Enteric Fever Disease Burden Estimates, 1986–2015

Year	World	Asia
1986	12.5 million	6.98 million
2004	21.65 million typhoid, 5.41 million paratyphoid 216,500 typhoid deaths	10.1 million typhoid, 1.35 million paratyphoid 101,000 typhoid deaths
2010	13 million enteric fever episodes	6.9 million enteric fever episodes
2014	11.8 million typhoid cases, 128,000 typhoid deaths	8.6 million typhoid cases 93,000 typhoid deaths

Antimicrobial Resistance Studies, 2007–2014

Table 1
Antimicrobial resistance patterns of *Salmonella enterica* serovar Typhi and Paratyphi A isolated post 2007 in selected studies from Asia and Africa. Studies were selected where the number of isolates was at least 15 and where the resistance results could be divided by serovar.

Country	Years	Serovar	No of isolates	% of isolates resistant to antimicrobial ^a							Reference	
				Chlor	Amp	Sxt	MDR	Cip ^{NSb}	Cip ^c	Cro		AzmNS ^d
India	2007–9	Typhi	191	–	–	–	14	73	9	0	–	Menezes [63]
India	2008–10	Typhi	257	0.4	68	2	–	100	25	0	–	Gupta (2013)
India	2009–13	Typhi	77	22	18	23	18	99	20	0	0	Dutta [94]
India	2010–12	Typhi	266	10	13	5	3	96	35	0.3	–	Jain (2013)
India	2011	Typhi	61	20	8	15	–	5	–	3	–	Vala (2014)
Pakistan	2008–10	Typhi	131	72	99	47	–	17	–	1	–	Abdullah (2012)
Pakistan	2009–11	Typhi	2576	67	66	67	66	88	–	0.08	–	Qamar (2014)
Nepal	2008	Typhi	29	3	7	7	–	66	3	0	–	Acharya [73]
Nepal	2011–12	Typhi	56	0	2	0	–	91	0	–	–	Chand (2014)
Bangladesh	2007	Typhi	38	58	68	58 ^e	–	82	40	0	–	Chiou (2014)
Sri Lanka	2009–10	Typhi	19	28	28	25	–	–	50	0	–	ARSP (2013)
Indonesia	2007–9	Typhi	55	4	2	2	–	2	0	0	–	Chiou (2014)
Vietnam	2007–8	Typhi	51	80	80	80	–	20	0	0	–	Chiou (2014)
Cambodia	2007–11	Typhi	20	–	–	–	75	90	0	0	5	Vlieghe
Cambodia	2006–9	Typhi	41	56	56	56	56	81	0	0	0	Kasper (2010)
Cambodia	2007–11	Typhi	148	86	85	85	85	90	0	0	0	Emary (2012)
Kenya	2001–8	Typhi	136	–	–	–	77	12	–	–	–	Kariuki [93]
Uganda	2007–09	Typhi	27	5	76	76	0	0	0	–	–	Neil [72]
Uganda	2011	Typhi	18	83	83	83	83	6	0	0	–	Walters (2014)
Tanzania	2007–08	Typhi	28	28	89	–	–	0	0	0	–	Crump [54]
Tanzania†	2009–10	Typhi	46	22	23	22	19	1	0	0	–	Thriemer (2012)
Malawi-Mozambique	2009	Typhi	46	100	100	100	100	10	0	–	–	Lutterloh [71]
Zambia	2010–12	Typhi	94	83	83	83	83	4	0	0	0	Hendriksen (2015)
DRC	2007–11	Typhi	201	41	65	58	30	15	0	0	1	Lunguya (2012)
DRC	2011–12	Typhi	18	33	72	72	33	0	0	0	0	Phoba (2014)
Nigeria	2008–09	Typhi	21	42	41	52	–	0	0	0	–	Obaro (2011)
Ghana	2007–8	Typhi	37	73	70	71	–	0	0	0	–	Marks (2010)
Ghana	2009	Typhi	15	100	100	100	100	0	0	–	–	Groß (2011)
Egypt	2011–12	Typhi	30	–	–	–	–	–	–	–	–	Saleh (2014)
India	2008–10	Paratyphi A	45	2	49	4	–	100	2	0	–	Gupta (2013)
India	2009–13	Paratyphi A	25	0	0	0	0	96	20	0	28	Dutta [94]
India	2010–12	Paratyphi A	77	0	3	0	0	100	49	1	–	Jain (2013)
Pakistan	2008–10	Paratyphi A	71	62	99	21	–	18	–	7	–	Abdullah (2012)
Pakistan	2009–11	Paratyphi A	1726	3	2	3	–	84	–	0	–	Qamar (2014)
Nepal	2008	Paratyphi A	30	3	10	3	–	93	10	0	–	Acharya (2011)
Nepal	2011–12	Paratyphi A	30	3	0	0	0	90	3	–	–	Chand (2014)
Sri Lanka	2009–10	Paratyphi A	73 ^e	0	22	0	0	–	92	2	–	ARSP (2013)

Source: Antimicrobial resistance and management of invasive *Salmonella* disease. Kariuki S, Gordon MA, Feasey N, Parry CM. *Vaccine*. 2015 Apr 23

Antimicrobial Resistance among Selected Asian Countries

A three-year review of antimicrobial resistance of *Salmonella enterica* serovars Typhi and Paratyphi A in Pakistan. Qamar FN, Azmatullah A, Kazi AM, Khan E, Zaidi AK. *J Infect Dev Ctries*. 2014 Aug 13

“The majority of isolates were *S. Typhi* (59.6%). Over three years, the incidence of multidrug-resistant (MDR) *S. Typhi* remained high, ranging from 64.8%-66.0%, while MDR *S. Paratyphi A* decreased from 4.2% to 0.6%. Fluoroquinolone resistance increased for *S. Typhi* from 84.7% to 91.7%. Cefixime- and **ceftriaxone-resistant *S. Typhi* were isolated in two children.**”

Antimicrobial resistance, virulence profiles and molecular subtypes of *Salmonella enterica* serovars Typhi and Paratyphi A blood isolates from Kolkata, India during 2009-2013. Dutta S, Das S, Mitra U, Jain P, Roy I, Ganguly SS, Ray U, Dutta P, Paul DK. *PLoS One*. 2014 Aug 6

“An increase in isolation of MDR *S. Typhi* was noticed from 2009 (13.6%) to 2013 (25%). Isolation of NaR isolates remained constant (85%) in both the serovars throughout the study period and all NaR isolates were either CiR or showed DCS. Overall around 20% isolates of both the serovars were resistant to ciprofloxacin.

Most of the study isolates were likely to be virulent due to the presence of virulence markers.”

Febrile Illness Surveillance Pyramid (Crump et al, 2003)

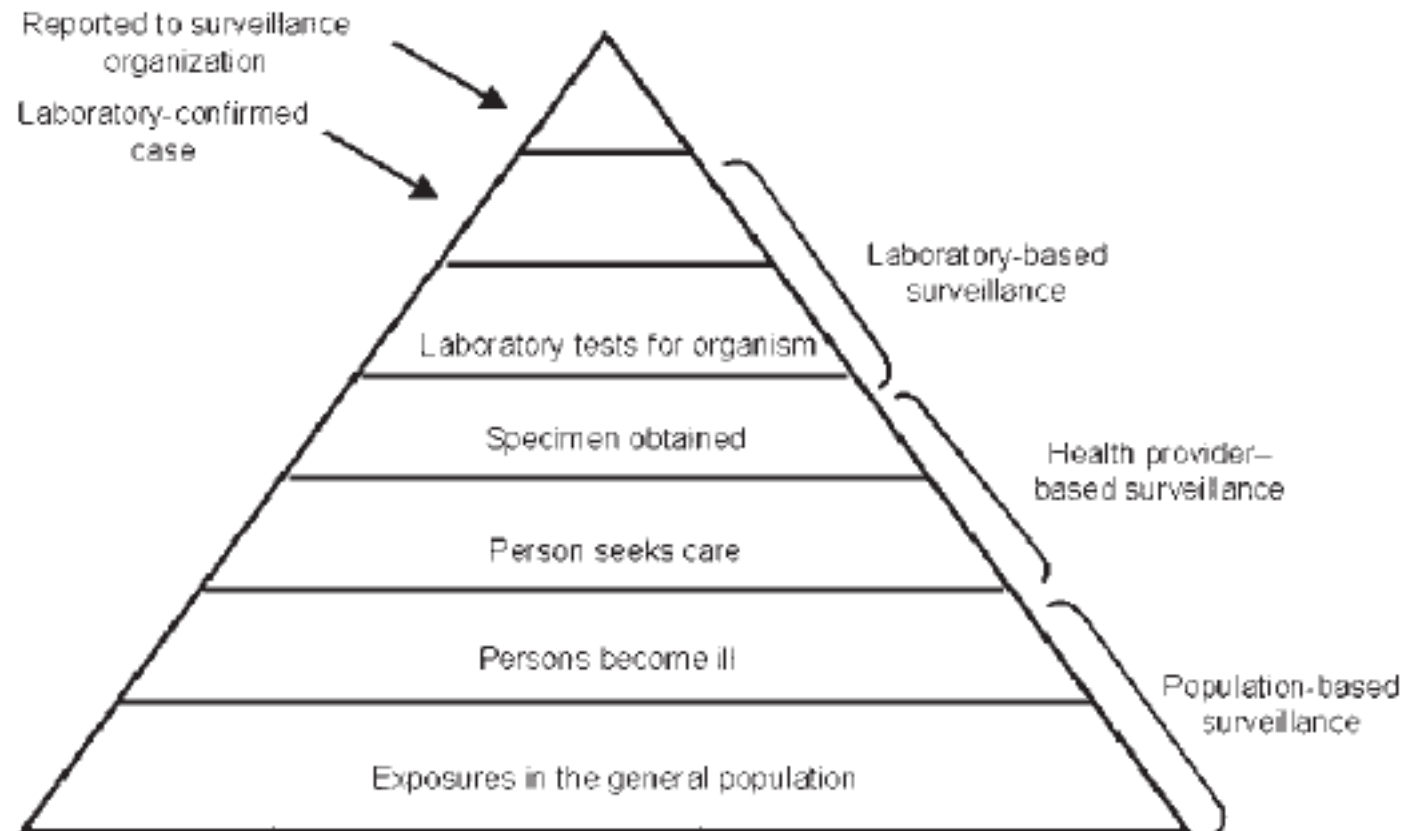


Figure. Febrile illness surveillance pyramid.

**ENTERIC FEVER IN ASIA
WHAT WE DON'T KNOW**

Enteric Fever Illness Pyramid

Enteric fever deaths



Severe and complicated enteric fever



Ill with enteric fever who die

Ill with enteric fever who develop complications

Ill with enteric fever severe enough to be admitted to a hospital

Ill with enteric fever who seek care at outpatient clinics

Ill with enteric fever (acute febrile illness)

SURVEILLANCE FOR ENTERIC FEVER IN ASIA PROJECT (SEAP)

Goals

- ❑ Use sentinel surveillance sites for enteric fever
- ❑ Address shortcomings of previous studies and knowledge gaps through collection and synthesis of existing and prospective information on enteric fever
- ❑ Inform global policy recommendations and pave the way for typhoid fever conjugate vaccine use and the development of next generation enteric fever vaccines

Objectives

□ Primary

- Estimate the population-burden of enteric fever - disease incidence, severity and mortality stratified by geography, age group, health care access, organism and antimicrobial resistance in selected Asian countries.

□ Secondary

- Develop and test epidemiologic tools (rapid assessment tools) to estimate community burden of enteric fever (typhoid/paratyphoid) in other non-SEAP sites.
- Characterize enteric fever severity and mortality from hospital-based data and long term follow-up of confirmed enteric fever cases.
- Based on available clinical information, identify proxy indicator(s) for enteric fever severity in the Asian population

Partners

- ❑ **Funded by the Bill and Melinda Gates Foundation**
- ❑ **SEAP HQ team: Sabin Vaccine Institute (SVI), US Centers for Disease Control and Prevention (CDC)**
- ❑ **Consultants: Stanford University; Hospital for Sick Children (Canada)**
- ❑ **World Health Organization**
- ❑ **Sites**
 - **Dhaka, Bangladesh:** Child Health Research Foundation and Dhaka Shishu hospital
 - **Karachi, Pakistan:** Aga Khan University
 - **Kathmandu, Nepal:** Group for Technical Assistance
 - **India:** To be determined
 - **Indonesia:** To be determined
- ❑ **Scientific Advisory Panel for SEAP and a similar project in Africa (SETA/TSAP-II): Emory Global Health Institute with 7 experts from different organizations**

SEAP Implementation Plans (1)

□ Phase I (9–12 months)

- Form a local stakeholder committee on enteric fever control and prevention, involving stakeholders from all relevant governmental and non-governmental sectors including health, water and sanitation
- Assess health facilities and select surveillance sites (sentinel site)
- Determine the catchment population
- Conduct retrospective review of existing data (if and where available) at the selected health facilities
- Conduct a community-based health care utilization survey to assess health seeking behaviors

SEAP Implementation Plans (2)

□ Phase 2 (24 months)

- Establish standardized enrollment criteria, case definitions and laboratory protocols
- Collect prospective information on enteric fever cases, clinical and laboratory-confirmed, who seek health care (outpatient and inpatient [medical/pediatric/surgical] facilities)
- Conduct a second health care utilization survey
- Conduct longer-term follow-up of severe enteric fever cases to characterize long-term sequelae (under discussion)
- Conduct a cost of illness study to estimate the economic impact of enteric fever on the health system and society (under discussion)

Acknowledgements

□ **SEAP-Nepal team**

- Deepak Bajracharya
- Shyamraj Upreti
- Anil Thapa
- Mahesh Puri
- Kshitij Karki
- GTA colleagues

□ **SEAP-Bangladesh team**

- Samir Saha
- Maksuda Islam
- Arif Tanmoy
- Jamal Uddin
- Shampa

□ **SEAP-Pakistan team**

- Farah Qamar
- Tahir Yousafzai
- Shazia Sultana

□ **Bill and Melinda Gates Foundation**

- Anita Zaidi
- Debbi Burgess
- Duncan Steele
- Zoey Diaz
- Megan Carey

□ **Emory SAPORT Panel**

- Rob Breiman
- Keriann Conway
- Thomas Cherian (WHO)
- Eric Mintz (CDC)
- Sam Kariuki (KEMRI)
- Hope Johnson (Gavi)
- Dennis Chao
- Jeff Stanaway (IHME)
- Jacob John (CMC Vellore)

□ **IVI, S. Korea**

- Florian Marks
- Se Eun Park
- Vittal Mogasale

SEAP HQ Team

Sabin Vaccine Institute

- Imran Khan
- Nicole Bradstreet
- Stacy Davlin

CDC - Atlanta

- Kathleen Wannemuehler
- Matthew Mikoleit

Stanford University

- Steve Luby

Hospital For Sick Children

- Zulfiqar Bhutta

WHO

- Adwoa Bentsi-Enchill

Thank You!

For more information please contact Centers for Disease Control and Prevention

1600 Clifton Road NE, Atlanta, GA 30333

Telephone, 1-800-CDC-INFO (232-4636)/TTY: 1-888-232-6348

E-mail: cdcinfo@cdc.gov Web: www.cdc.gov

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

Global Immunization Division

Center for Global Health

