Severe Typhoid Fever Surveillance in Africa Programme (SETA): Patient Cost of Illness Preliminary Results

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Economic Evaluation of Disease Burden and Vaccination Strategies: New Evidence, Future Methods and Implications for Vaccination Decision-Making

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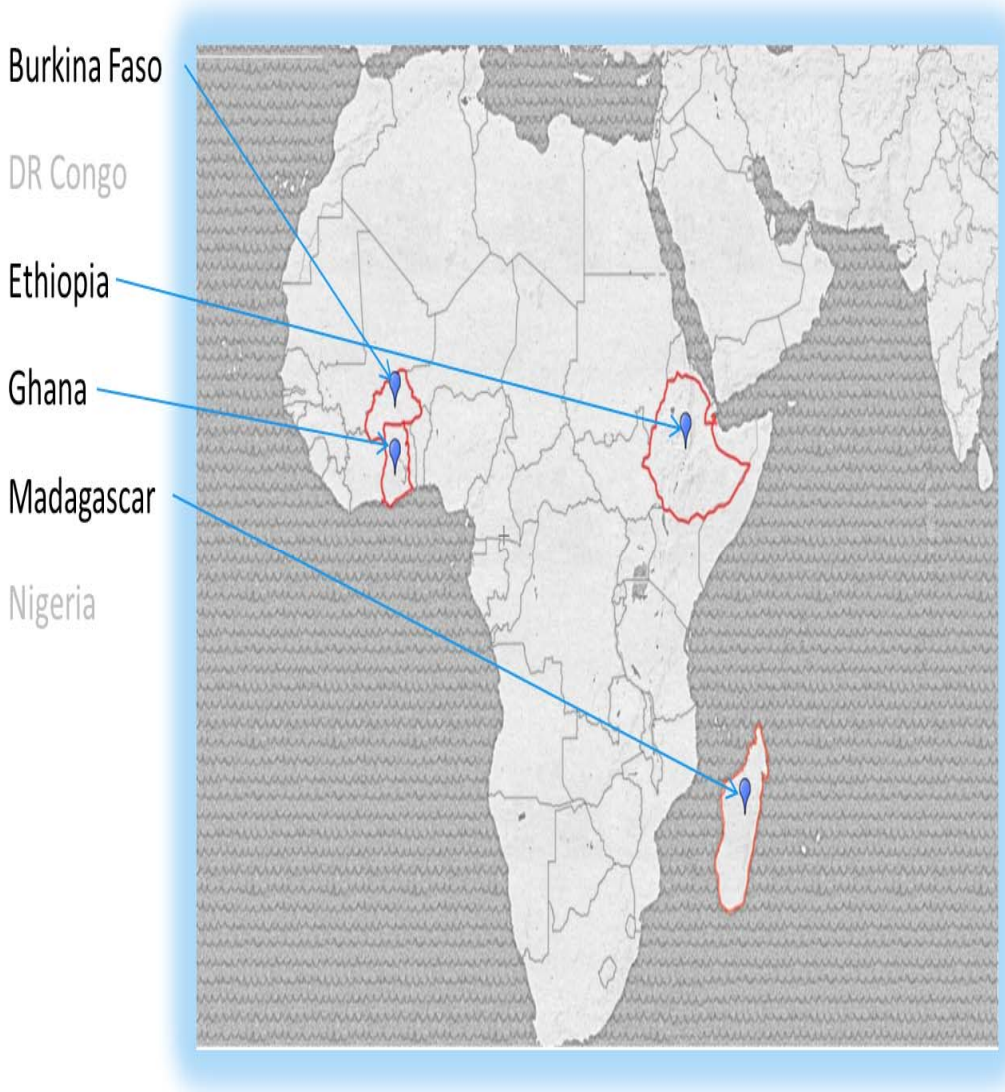
International Vaccine Institute

SETA-Health Economics Study Countries



Objectives: COI and LT-SES

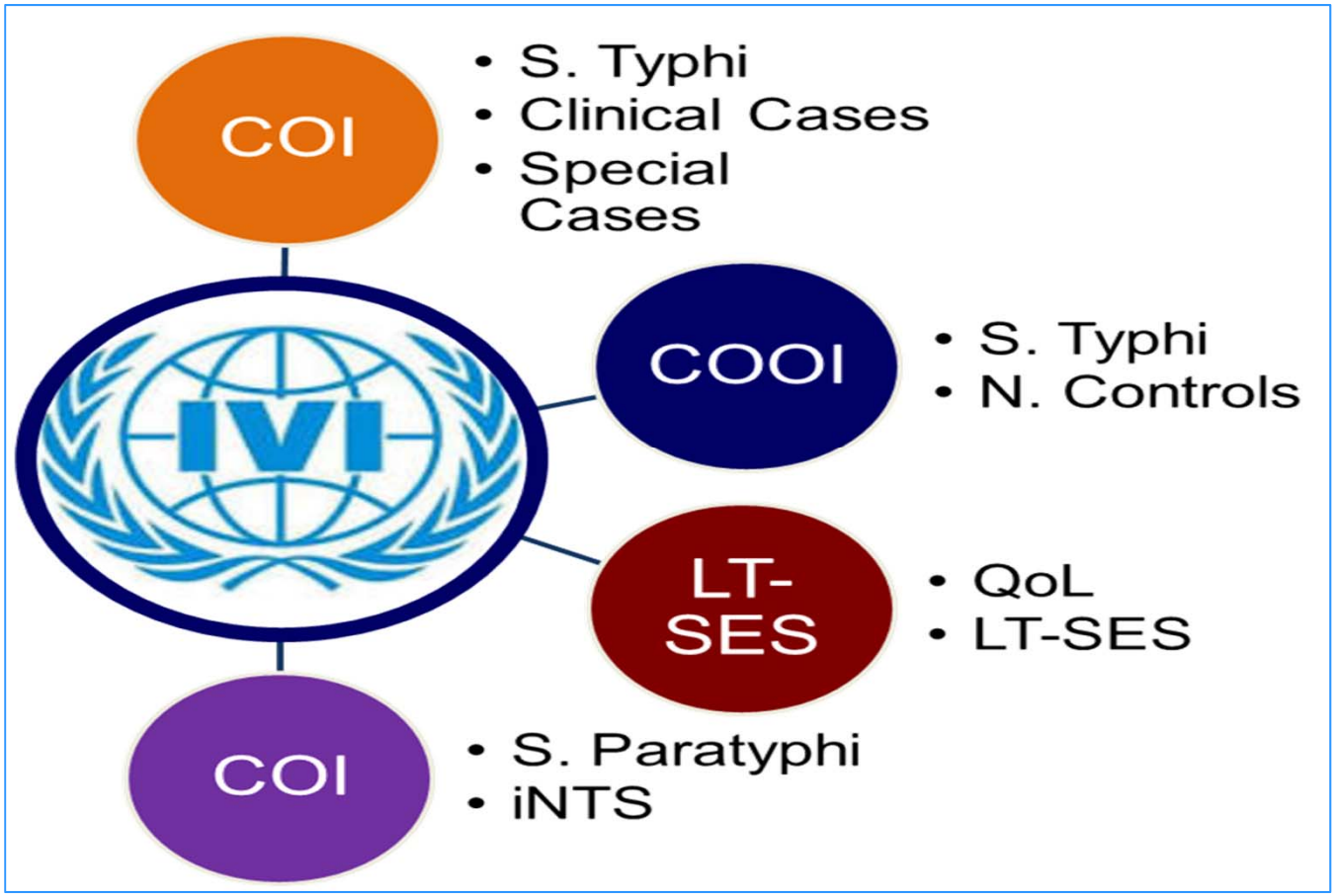
- To estimate **cost of illness (COI) due to *S.* Typhi** in SETA sites. This will include **direct costs** to individuals and health care system as well **loss of productivity due to illness**.

- To estimate **long-term socio-economic impact of typhoid fever** related to illness and its complications in comparison with healthy community controls.

SETA-Health Economics' Project Team

- **Study Participants in all four study countries**
- **Africa-SETA Health Economics Collaborators**
  - Dr. Mekonnen Teferi, Prof. Raphael Rakotozandrindrainy, Prof. Ellis Owusu- Dabo, Prof. Yaw Adu-Sarkodie, Prof. Abdramane Soura
- **Advisory Committee**
  - Prof. Chistopher Parry, Prof. Dr. Christine Faeber, Dr. Raymond Hutubessy, Dr. Wilm Quentin, Prof. Dr. Reinhard Busse
- **IVI-SETA Project PIs & Project Coordinator**
  - Dr. Vittal Mogasale – PI for SETA-Health Economics Study
  - Dr. Florian Marks – PI for SETA Program
  - Mr. Enusa Ramani – PC SETA-Health Economics Study
- **IVI-SETA Health Economics Team**
  - SeEun Park, Trevor Toy, Ursula Panzner, Justin Im, Gi Deok Pak, Hyonjin Jeon, Ligia Maria Cruz Espinoza

Components of SETA health economic studies

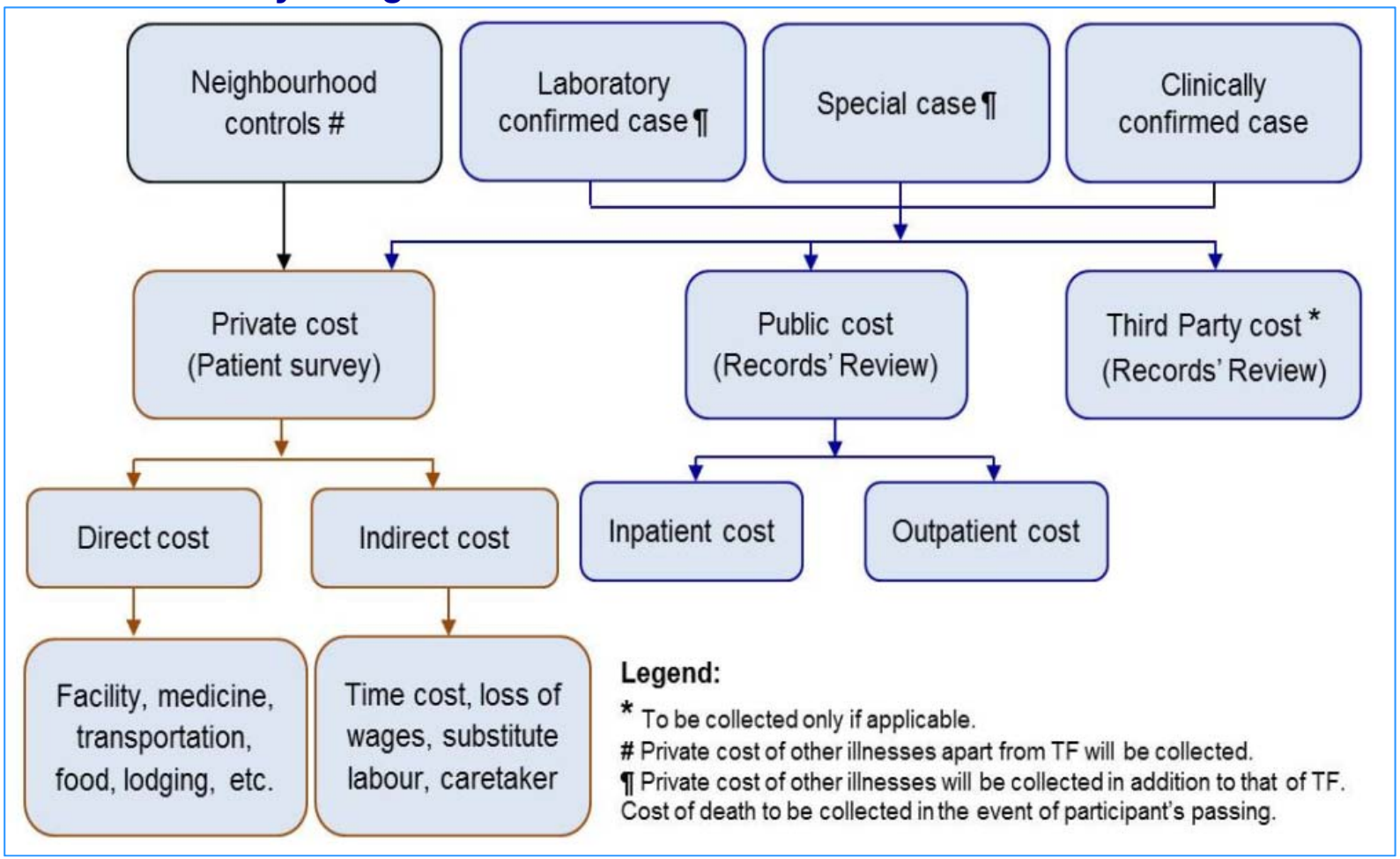


Ratio: 1:1:4
Three arms: For S. Typhi
One arm: For S. Paratyphi and iNTS

COI= cost of illness; COOI= cost of other illness; QoL= Quality of Life
LT-SES= Long-term socio-economic study; iNTS= invasive Non-typhoidal salmonella

Methodology

SETA-COI Study design

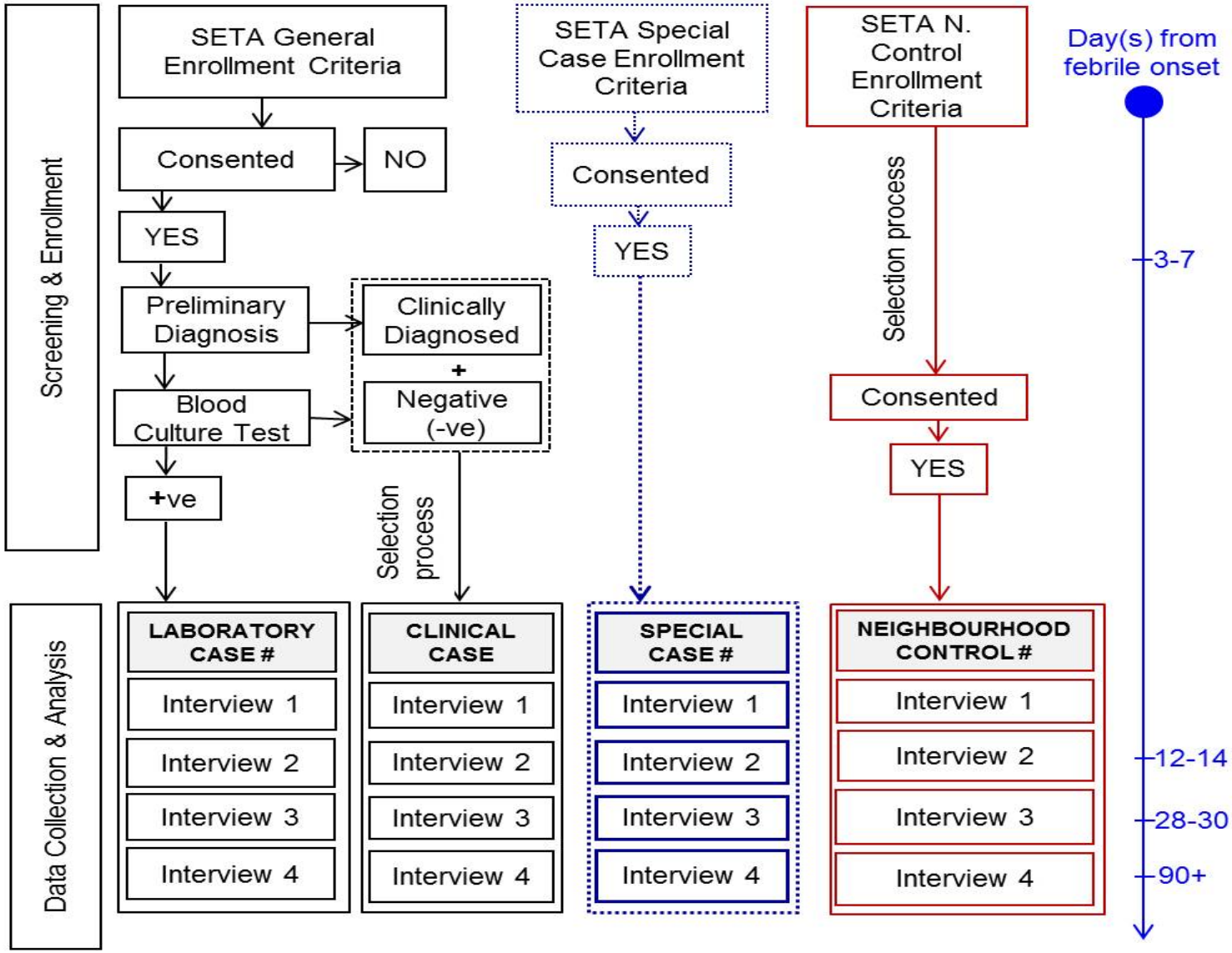


Survey

Hospital records

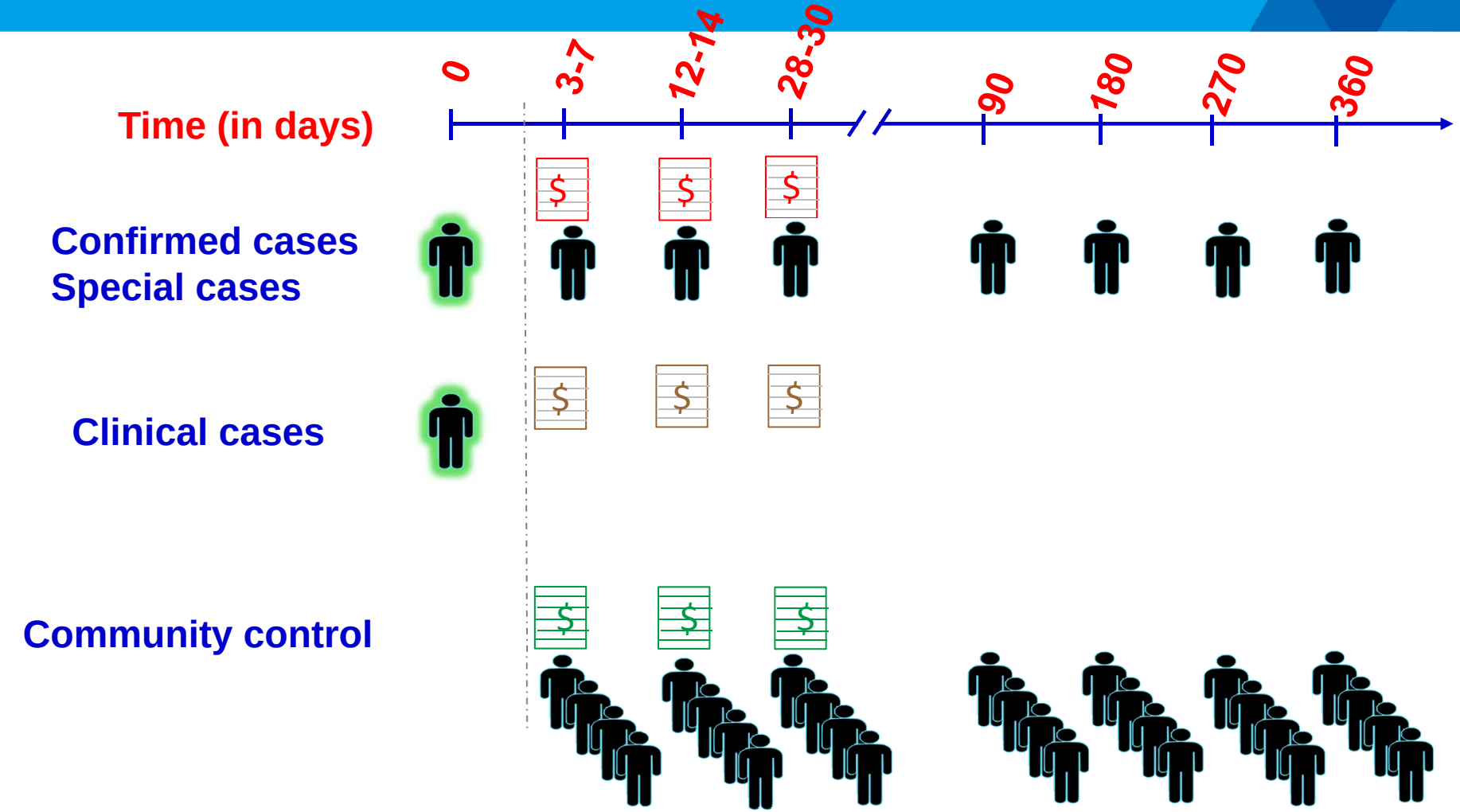
Note: Participant/family level out of pocket costs will be presented here !

SETA-COI participants' selection process



Continues into long-term follow-up study (LT-SES)

Follow-up plan procedure

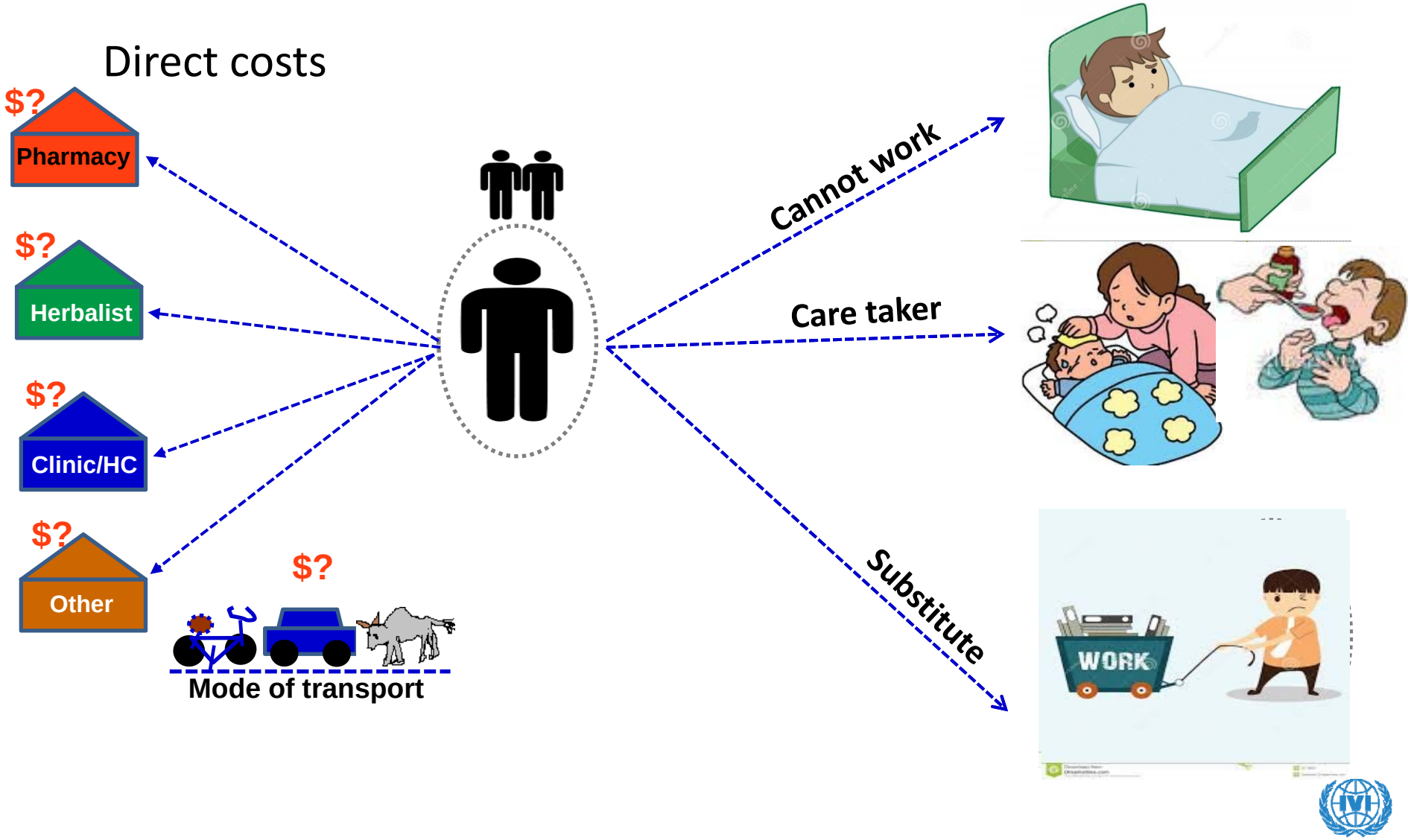


COI for Index, Clinical control

LT-SES: QoL Survey

LT-SES for Index and control

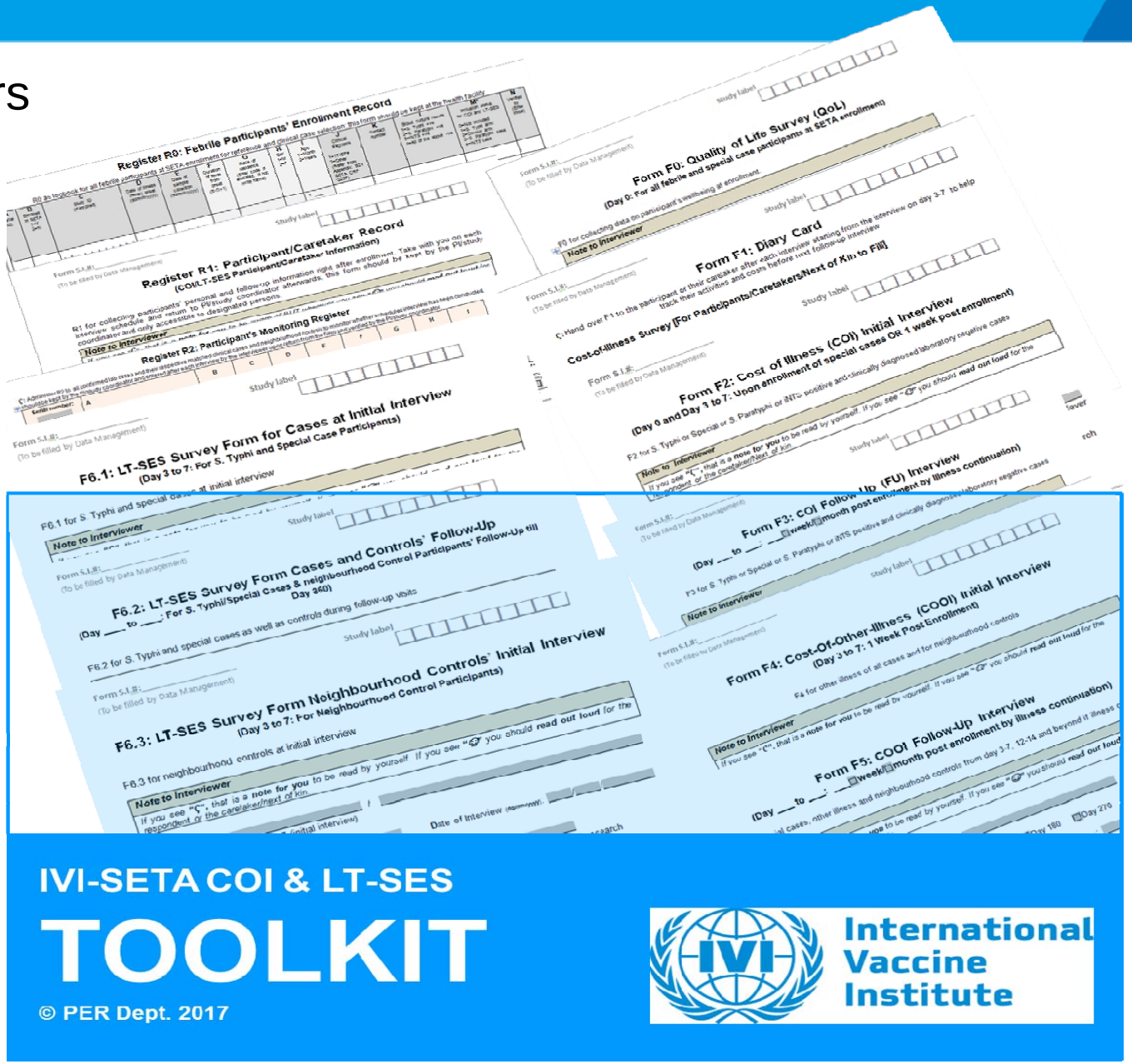
Direct and indirect costs



SETA-COI and LT-SES Tools

Registers

Forms



IVI-SETA COI & LT-SES

TOOLKIT

International Vaccine Institute

Results: enrolment status

	Ghana	Madagascar	Burkina	Ethiopia	All
Surv. Start date	May 2016	Feb. 2016	May 2016	July 2017	2016-2017
COI Start date	Feb. 1, 2017	Mar. 9, 2017	Mar. 15, 2017	Oct. 13, 2017	2017
COI End date	March 2019	May 2019	June 2019	October 2019	2019
Last report date	Feb., 2019	Feb., 2019	Feb., 2019	Feb., 2019	
Special case	35	7	5	10	57
S. Typhi	43	34	9	5	91
Clinical cases	47	18	0	1	66
Controls	63	89	33	16	201
S. Paratyphi	0	0	1	0	1
iNTS	9	0	13	0	22

Follow-up status: SETA-COI Study Countries

Ghana & Madagascar Only	Interviewed By 0-10 day	Interviewed By 11-35day (28)	Interviewed By 36-97 day (90)
S. Typhi cases GH	11	25	4
S.Typhi cases MGA	24	28	3
S. Typhi BF	2	2	0
S. Typhi ETH	0	0	0
Total	**37**	**55**	**7**
Special cases GH	24	31	1
Special cases MGA	1	2	0
Special cases BF	0	0	0
Special cases ETH	0	0	0
Total	**25**	**33**	**1**
Clinical cases GH	5	5	0
Clinical cases MGA	3	10	5
Clinical cases BF	0	0	0
Clinical cases ETH	0	0	0
Total	8	15	5
iNTS GH	4	6	0
iNTS MGA	0	0	0
iNTS BF	0	0	0
iNTS ETH	0	0	0
Total	4	6	0

Enrollment Information

- Male and female participants are equally represented with each gender having 87 (50%) participants amongst all the groups represented in the table below.

Study Country & Diagnosis Group

	Ghana		Madagascar		Burkina Faso		Ethiopia		All countries	
Group	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**
S. Typhi	32	36.25	55	68.75	2	100	1	100	90	47.33
Special	42	46.15	9	11.25	0	0	0	0	51	31.30
iNTS	12	13.19	0	0	0	0	0	0	12	5.34
Clinical	5	5.49	16	20.00	0	0	0	0	21	16.03
Total	**91**	**100**	**80**	**100**	**2**	**100**	**1**	**100**	**174**	**100**

Out of pocket costs: preliminary results

	SETA-Health Economics Study Countries			
Study Arm	**Ghana**	**Madagascar**	**Burkina Faso**	**Ethiopia**
S. Typhi Case	Mean (SD); n	Mean (SD); n	Mean (SD); n	Mean (SD); n
Direct med cost				
≤ D30 FU	24.00 (35.00); n=24	5.00 (8.93); n=28	3.72 (NA); n=2	NA
≥30 & ≤ D90 FU	71.08 (81.21); n=4	1.45 (0.02); n=3	NA	NA
Direct nonmed cost				
≤ D30 FU	4.51 (7.21); n=24	3.09 (11.77); n=16	0.17 (NA); n=2	NA
≥30 & ≤ D90 FU	2.46 (1.82); n=4	0.20 (0.17); n=3	NA	NA
Total direct med cost				
≤ D30 FU	27.34 (36.71); n=25	6.75 (16.85); n=28	3.89 (NA); n=2	NA
≥30 & ≤ D90 FU	73.54 (82.80); n=4	1.64 (0.18); n=3	NA	NA
Special Case				
Direct med cost				
≤ D30 FU	209.31 (175.90); n=30	192.30 (56.16); n=2	NA	NA
≥30 & ≤ D90 FU	548.27 (NA); n=1	NA	NA	NA
Direct nonmed cost				
≤ D30 FU	67.03 (62.68); n=30	31.43 (8.08); n=2	NA	NA
≥30 & ≤ D90 FU	101.09 (NA); n=1	NA	NA	NA
Total direct med cost				
≤ D30 FU	267.42 (220.29); n=31	223.74 (64.24); n=2	NA	NA
≥30 & ≤ D90 FU	649.36 (NA); n=1	NA	NA	NA

Oanda.com historicals rate (LCU per US$, 2018 period average): USD 1 = GHS 5.49 / MGA 3,499.55 / XOF 576.93 / ETB 28.24 #World Bank: GDP per capita (Constant 2010 US$)

Out of pocket costs: preliminary results

	SETA-Health Economics Study Countries			
Study Arm	**Ghana**	**Madagascar**	**Burkina Faso**	**Ethiopia**
Clinical Case	Mean (SD); n	Mean (SD); n	Mean (SD); n	Mean (SD); n
Direct med cost				
≤ D30 FU	NA	2.04 (0.89); n=10	NA	NA
≥30 & ≤ D90 FU	NA	1.09 (0.75); n=5	NA	NA
Direct nonmed cost				
≤ D30 FU	NA	0.95 (1.65); n=3	NA	NA
≥30 & ≤ D90 FU	NA	0.14 (0.25); n=3	NA	NA
Total direct med cost				
≤ D30 FU	NA	2.33 (1.18); n=10	NA	NA
≥30 & ≤ D90 FU	NA	1.17 (0.89); n=5	NA	NA

Oanda.com historicals rate (LCU per US$, 2018 period average): USD 1 = GHS 5.49 / MGA 3,499.55 / XOF 576.93 / ETB 28.24 #World Bank: GDP per capita (Constant 2010 US$)

A LOOK AT PRODUCTIVITY LOSS INDICATORS

PRIOR STEPS TO INDIRECT COST ESTIMATION

Lost productivity: preliminary results

	SETA-Health Economics Study Countries			
In Days	Ghana	Madagascar	Burkina Faso	Ethiopia
S. Typhi	Mean (SD); n	Mean (SD); n	Mean (SD); n	Mean (SD); n
Participants' lost productivity				
≤ D30 FU	6.30 (3.96); n=23	10.54 (9.44); n=28	NA	NA
≥30 & ≤ D90 FU	7.5 (1.80); n=3	10.75 (0.35); n=3	NA	NA
Caretakers' lost productivity				
≤ D30 FU	17.57 (7.15); n=15	17.69 (10.78); n=26	NA	NA
≥30 & ≤ D90 FU	NA	21.75 (3.18); n=2	NA	NA
Substitute Labour work				
≤ D30 FU	14.75 (13.33); n=4	26.5 (17.39); n=3	NA	NA
≥30 & ≤ D90 FU	NA	NA	NA	NA
Special Case				
Participants' lost productivity				
≤ D30 FU	13.57 (7.41); n=27	1 (NA); n=1	NA	NA
≥30 & ≤ D90 FU	12 (NA); n=1	NA	NA	NA
Caretakers' lost productivity				
≤ D30 FU	43.14 (25.92); n=26	4.5 (NA); n=1	NA	NA
≥30 & ≤ D90 FU	31.5 (NA); n=1	NA	NA	NA
Substitute Labour work				
≤ D30 FU	63.63 (13.44); n=4	NA	NA	NA
≥30 & ≤ D90 FU	NA	NA	NA	NA

Lost productivity: preliminary results

	SETA-Health Economics Study Countries			
In Days	Ghana	Madagascar	Burkina Faso	Ethiopia
Clinical Case	Mean (SD); n	Mean (SD); n	Mean (SD); n	Mean (SD); n
Participants' lost productivity				
≤ D30 FU	5.25 (2.48); n=2	3.30 (1.74); n=10	NA	NA
≥30 & ≤ D90 FU	NA	2.80 (2.28); n=5	NA	NA
Caretakers' lost productivity				
≤ D30 FU	3.00 (NA); n=1	5.75 (3.83); n=8	NA	NA
≥30 & ≤ D90 FU	NA	4.00 (5.32); n=5	NA	NA
Substitute Labour work				
≤ D30 FU	NA	NA	NA	NA
≥30 & ≤ D90 FU	NA	NA	NA	NA

Summary

- Direct out of pocket (OOP) expenses was identified as major cost driver for participants treated for S. Typhi, Special Case and Clinical enteric fever compared to indirect OOP.
- Participants with duration of illness more than 30 days incur some extra OOP treatment costs.
- Indirect OOP expenses were generally lower than direct OOP but typhoid complicated cases (Special Case) experience increased costs as their illness prolongs.
- Participants in Ghana seeking treatment for any of the three diagnosis groups incur higher OOP cost.
- Generally, typhoid fever complicated cases (Special Cases) experienced higher treatment costs.

Limitations

- **Follow-up of typhoid complicated cases was constrained by location of participants and their movements.**

Acknowledgement

IVI Health Economics Study Collaborators

Health Economics: Policy and Economic Research Dept.
Epidemiology: Epidemiology Dept.
Data Mgt. & Statistics: Biostatistics & Data Management Dept.
Ethical Review: IVI-Institutional Review Board
Travel Support: Procurement and Travel Team

International Vaccine Institute

Donors & Funders

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Core Funding 2: Government of Sweden

BILL & MELINDA GATES foundation

SETA Study Countries Collaborators

Burkina Faso

Institut Supérieur des Sciences de la Population (ISSP), Ouaga

Ethiopia

Armauer Hansen Research Institute (AHRI), Addis Ababa

Ghana

Kumasi Center for Collaborative Research (KCCR), Kwame Nkrumah University of Science and Technology (KNUST), Kumasi

KCCR KNUST

Madagascar

Université d'Antananarivo, Tana

SETA-PER External Advisors

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UK and Japan

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Health Economics & -Systems

Germany

Dept. Health Care Management, School of Economics and Management, Berlin University of Technology

Health Economics

Switzerland

World Health Organization Initiative for Vaccine Research, Geneva

Social Research & Health Policy

Germany

Dept. of Health Sciences, Faculty of Life Sciences, Hamburg University of Applied Sciences, Hamburg

HAW Hamburg

Tribute to Late Prof. Dr. Christine Faeber

„Die Freiheit, du selbst zu sein, mit allen Ecken und Kanten.
Dein eigentliches Leben verwirklichen, ist die größte Freiheit überhaupt."
Deine Freiheit ist viel zu früh zu Ende gegangen.

Prof. Dr. Christine Färber

* 5. 12. 1964 † 26. 12. 2018

Wir werden dich vermissen und trauern mit Robert, Lisa und Yannic.
Langjährige Weggefährtinnen aus GEW-Frauen-Zeiten (die „alte E4")
Dr. Karin Fischer-Bluhm, Dr. Brigitte Vollmer-Schubert,
Vera Reiß (Staatsministerin a.D.), Prof. Dr.
Friederike Heinzel, Prof. Dr. Ingeborg Wender

Cảm ơn bạn !

Thank you ! / Merci !

고맙습니다 / Danke schön !

Naa gode ! / Me da ase !

Summary of typhoid fever follow-up studies

* Cost of illness interview will only continue by persistent illness

Purpose of COI and LT-SES

- COI study can improve economic burden estimation of typhoid:
  - How much is spent on treating typhoid fever?
  - What is socio-economic consequences of typhoid fever and its complications?
- Important for country/regional specific cost-effectiveness analysis
- Helps in resource allocation and policy decisions