Outline

• Different surveillance strategies for typhoid burden estimation
• Description of the healthcare utilization study, sampling and maps
• Preliminary data
• Challenges
Approaches to estimating Typhoid incidence

Approach 1: Community-based active surveillance
- Establish large cohort
- Actively follow 1-2x /week and track fevers
- Collect blood and test for typhoid
- Advantages and disadvantages exist

Approach 2: Facility based surveillance
- Capture all patients who come to facility with fever
- Collect blood and test for typhoid
- Follow outcomes
- Advantages and disadvantages exist

Deaths from typhoid

All cases of typhoid
A hybrid approach to typhoid surveillance

• Use facility-based surveillance
• Understand bottom of pyramid using a household survey to understand healthcare utilization
• Estimate incidence once you know the multipliers

Luby S., Saha S., Andrews J., Vaccine 2015
Estimating incidence using the pyramid

Crude incidence estimate = $\frac{50}{100,000}$
Estimating incidence using the pyramid

Adjusted incidence estimate = 50 * 5 / 100,000 = 250 per 100,000
Hybrid (Pyramid) Approach

• Advantages:
  • Less resource-intensive
  • Captures severe cases and complications
  • Better estimate of population case rate

• Disadvantages:
  • May fail to capture more mild cases
  • Introduces uncertainties (potential biases in measuring healthcare utilization, etc)
  • Still requires blood cultures, laboratory infrastructure
Healthcare utilization Study

• Cross-sectional household survey
• Understand proportion who:
  • Seek care when febrile
  • Seek care at our facilit(ies)

• Determining catchment area for survey:
  • Retrospective review
  • Identify where 60-80% of cases originate

Map of Kavrepalanchok district
Random cluster sampling

• Overlay a grid with equal sized squares
• Randomly choose clusters
Sampling within clusters

• Goal is to sample every house
• Three attempts for each house
• Keep track of progress
  • Real-time GPS
  • Sync between surveyors
Different approach in Kathmandu

- Far greater density
- Grid with squares creates arbitrary boundaries
- Can use streets for natural boundaries

Kathmandu city
Red lines = streets
Green = water

Overview of Kathmandu catchment area
Zoomed view of street boundaries
Logistical Challenges

• Terrain
  • Travel
  • Safety
• People away from home
• Satellite resolution
• GPS precision
Biases and sampling issues

• Potential biases in responses:
  • Longer recall period (8 weeks) makes survey more efficient but could introduce recall biases
  • If surveyors identify as being from an institution, they risk biasing responses
  • Female head of household primary respondent for all members of household

• We may be sampling less severely ill patients
  • Attempts to adjust for severity
Preliminary data

- Completed 2234 houses from January 26-March 26th 2017
- 35 declined (1.5%)
- 16 unreachable after three attempts (0.7%)
- 67 return pending (3%)

---------------------

- Response rate of 95% approached
Proportion of population with fever, by age and sex

<table>
<thead>
<tr>
<th>Age</th>
<th>Number sampled</th>
<th>Proportion of age group with fever</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 4</td>
<td>434</td>
<td>13%</td>
</tr>
<tr>
<td>5 to 14</td>
<td>1195</td>
<td>4%</td>
</tr>
<tr>
<td>15 to 29</td>
<td>2376</td>
<td>2%</td>
</tr>
<tr>
<td>30 to 49</td>
<td>2052</td>
<td>3%</td>
</tr>
<tr>
<td>50+</td>
<td>1449</td>
<td>4%</td>
</tr>
<tr>
<td>All ages</td>
<td>7506</td>
<td>4%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Percent of sampled population</th>
<th>Cases of Fever</th>
<th>Proportion with fever, by sex</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>48%</td>
<td>115</td>
</tr>
<tr>
<td>Female</td>
<td>52%</td>
<td>189</td>
</tr>
</tbody>
</table>

- Of those who had a fever, 81% were taken to a healthcare facility.
- Of those, only 16% were taken to Dhulikhel hospital.

Kavre district preliminary data, January 26-March 21st
Acknowledgements

○ The team:
  • Jason Andrews
  • Caryn Bern
  • Isaac Bogoch
  • Rajani Shakya
  • Dipesh Tamrakar
  • Krista Vaidya

○ On the ground:
  • Bikram Adhikari
  • Madhavi Bhandari
  • Devi Dhital
  • Swekshya Karmacharya
  • Subhadra Khadka
  • Rupesh Khadka

○ SEAP leadership:
  • Caitlin Barkume
  • Kashmira Date
  • Denise Garrett
  • Steve Luby
  • Samir Saha
  • Farah Qamar

○ The whole SEAP team

○ The Stanford Geospatial Center and Stace Maples

○ Special thanks to the Sabin Vaccine Institute and The Bill and Melinda Gates Foundation for their support and funding