Epidemiology of typhoid and paratyphoid: Implications for vaccine policy

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WHO prequalified TCV, but important questions persist

• Lack of strong epidemiological data, specifically in <2 y children

• Sporadic, incidence studies, small populations

• Typhoid and paratyphoid are often considered a single disease: no paratyphoid vaccine
Enteric fever surveillance in Bangladesh

Network of 4 hospitals with 1,280 beds

3 consultation clinics
Enteric fever surveillance in Bangladesh: today's presentation, 2004 - 2016

Sites:
- 2 pediatric hospital with IPD and OPD
- 3 OPD-based consultation clinics

Dataset:
- 13 years: 2004 - 2016
- 8,882 culture-confirmed cases
- Typhoid: 7,072 (80%)
- Paratyphoid: 1,810 (20%)

Saha et al, 2019, Clin Infect Dis
WHO prequalified TCV, but important questions persist

• Have the proportions of typhoid and paratyphoid changed over the past 13 years?

• What are the age distributions of these two diseases?

• How severe are these diseases, specifically in young children?
WHO prequalified TCV, but important questions persist

• Have the proportions of typhoid and paratyphoid changed over the past 13 years?

• What are the age distributions of these two diseases?

• How severe are these diseases, specifically in young children?
No change in proportion of paratyphoid in the last 13 years

Typhoid cases: $n = 7,072$
Paratyphoid cases: $n = 1,810$

Saha et al, 2019, Clin Infect Dis
Age distribution of typhoid cases

<9 m: 1.5%
<2 y: 15%
<5 y: 46%
Median age: 60 m

Saha et al, 2019, Clin Infect Dis
Age distribution of paratyphoid cases

- Paratyphoid: <2 y: 9%, <5 y: 32%, Median age: 90 months
- Typhoid: <2 y: 15%, <5 y: 46%, Median age: 60 months

Saha et al, 2019, Clin Infect Dis
Some questions we ask to guide treatment and prevention policies

• Have the proportions of typhoid and paratyphoid changed over the past 13 years?

• What are the age distributions of these two diseases?

• How severe are these diseases, specifically in young children?

Saha et al, 2019, Clin Infect Dis
Assessing severity: small numbers of severe outcomes

### Typhoid, n = 1,188

<table>
<thead>
<tr>
<th>Outcome</th>
<th>%</th>
<th>(n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discharged</td>
<td>97% (n = 1146)</td>
<td>1,146</td>
</tr>
<tr>
<td>Died</td>
<td>0.2% (n = 2)</td>
<td>2</td>
</tr>
<tr>
<td>Referred</td>
<td>0.3% (n = 4)</td>
<td>4</td>
</tr>
<tr>
<td>LAMA</td>
<td>3.0% (n = 36)</td>
<td>36</td>
</tr>
</tbody>
</table>

### Paratyphoid, n = 164

<table>
<thead>
<tr>
<th>Outcome</th>
<th>%</th>
<th>(n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discharged</td>
<td>96% (n = 157)</td>
<td>157</td>
</tr>
<tr>
<td>Died</td>
<td>0% (n = 0)</td>
<td>0</td>
</tr>
<tr>
<td>Referred</td>
<td>0% (n = 0)</td>
<td>0</td>
</tr>
<tr>
<td>LAMA</td>
<td>4.0% (n = 7)</td>
<td>7</td>
</tr>
</tbody>
</table>

Not possible to perform robust statistical analyses to compare severity by age

Saha et al, 2019, Clin Infect Dis

[Logo: Child Health Research Foundation]
Assessing severity: hospitalization and hospital duration as proxies

• Fierce competition for beds, so physicians only admit when absolutely necessary, and release ASAP
• Caregivers pay our of pocket and only agree to admit children when absolutely necessary, and leave ASAP

Proxies of severity:

1. Hospitalization
2. Duration of hospitalization

Saha et al, 2019, Clin Infect Dis
Assessing severity: younger children are at least as likely to be hospitalized as older children

**Typhoid**

- IPD: n = 1,806 (32%)
- OPD: n = 3,851 (68%)

**Paratyphoid**

- IPD: n = 238 (21%)*
- OPD: n = 917 (79%)

*Saha et al, 2019, Clin Infect Dis*
Assessing severity: younger children are hospitalized for as long as older children

Saha et al, 2019, Clin Infect Dis
Take-home messages from Bangladesh

• Typhoid is common in young children
• Early immunization with TCVs could avert substantial morbidity
  • 1.5% cases occur in children <9 m
  • 15% of typhoid cases occur in children <2 y with equivalent disease severity as seen in older children
• Paratyphoid is also common - 1 in 5 enteric fever cases
• Efforts to reduce exposure to contaminated water and food, as well as developing vaccines against paratyphoid, are important

Saha et al, 2019, Clin Infect Dis
Thank you.

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