OPTIMIZING SURVEILLANCE AND INTERVENTIONS TO ADVANCE NATIONAL XDR TYPHOID CONTROL - PAKISTAN

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TYPHOID IN PAKISTAN

1. Background
2. Establishment and standardization of surveillance
3. Surveillance results
   I. Epidemiology
   II. Impact of TCV introduction
   III. XDR Typhoid
4. Conclusions
BACKGROUND: AN OUTBREAK THAT LED TO TYPHOID CONJUGATE VACCINE [TCV] INTRODUCTION IN PAKISTAN

• November 2016 - December 2018:
  • 8,188 confirmed typhoid fever cases reported in Sindh province
    • 5274 (64%) were Extensive Drug Resistant (XDR)
      • 69% in Karachi
      • 27% in Hyderabad
      • 4% in other districts
  • Pakistan included TCV in the routine schedule in multiple phases from 2019-2022
    1. Initial TCV campaign to improve immunity in larger groups (9M<15years) in urban cities
    2. Introduction of TCV in routine immunization (1 dose at 9 months of age)

Total vaccinated: 35,816,071
SURVEILLANCE: ESTABLISHMENT OF TYPHOID SENTINEL SITES

**Timeline**
- May 2020: WHO established typhoid sentinel surveillance sites
- 2020-2023: Gradual expansion to include 21 sites

**Objectives:**
- Describe typhoid epidemiology by time, place and person
- Evaluate the impact of TCV introduction
- Estimate the proportion of Extensive Drug Resistance (XDR) among cases

**Criteria of site selection:**
- Referral (tertiary) hospitals
- Adequate number and qualification of lab staff
- Well-equipped laboratory
CASE DEFINITION AND TESTING

**WHO definitions:**

**Suspected cases:** *
- Fever for at least 3 out of 7 consecutive days.

**Confirmed cases:** *
- Suspected cases with positive blood culture

**Discarded cases:**
- Suspected cases with negative blood culture

**Laboratory tests used for surveillance**
- Blood culture (using Bactec bottles)

Development/adjustments of:

- Typhoid sentinel site surveillance guidelines
- Typhoid case-investigation form
- Typhoid dashboard
- Monthly analysis and updates.

Plans:

- Online reporting of cases from the sentinel site
- EPI Management information system (EPI-MIS)
SUPPORT TO TYPHOID SENTINEL SITES

**Incentive**
- Surveillance coordinator
- Microbiologist
- Lab. technician
- Phlebotomist
- Data entry operator

** Provision of Bactec bottles**

**In some sites, one-time procurement of Bactec machine**

**One-time procurement of desktops and printers**
- Provision of case investigation forms
SURVEILLANCE RESULTS (JAN-JUN 2023)
EPIDEMIOLOGY: NUMBER OF DISCARDED, CONFIRMED AND NOT TESTED CASES BY PROVINCE, JAN-JUN, 2023

28,251 suspected typhoid cases reported through sentinel sites

- **99% (27,964) Tested**
  - 76% (21,331) discarded cases
  - 24% (6,633) laboratory-confirmed typhoid
    - 81% (5361) from Sindh
    - 96% (5155) of Sindh cases from Karachi
  - 1% (287) not lab tested, not included in the analysis
EPIDEMIOLOGY: LABORATORY-CONFIRMED TYPHOID CASES, BY MONTH OF CASE REPORTING, PAKISTAN, 2021 –JUNE 2023

The line graph shows the number of typhoid cases reported by month for the years 2021, 2022, and 2023. The y-axis represents the number of typhoid cases, while the x-axis represents the months from January to December.

- In 2021, the number of cases was relatively stable, with a slight increase in May and June.
- In 2022, the number of cases showed a significant increase in May, followed by a decrease in June.
- In 2023, the number of cases increased steadily from January to May, with a notable peak in May.

The graph indicates a trend of increasing cases in May for all three years, with fluctuations in other months.
### EPIDEMIOLOGY: DISTRIBUTION OF TYPHOID CASES BY AGE GROUP, PAKISTAN, JAN-JUN 2023

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Proportion of Cases (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-&lt;9M</td>
<td>10%</td>
</tr>
<tr>
<td>9M-&lt;2yrs</td>
<td>10%</td>
</tr>
<tr>
<td>2-&lt;5yrs</td>
<td>20%</td>
</tr>
<tr>
<td>5-&lt;10yrs</td>
<td>30%</td>
</tr>
<tr>
<td>10-&lt;15yrs</td>
<td>40%</td>
</tr>
<tr>
<td>15-20yrs</td>
<td>40%</td>
</tr>
<tr>
<td>20-25yrs</td>
<td>40%</td>
</tr>
<tr>
<td>&gt;25yrs</td>
<td>60%</td>
</tr>
</tbody>
</table>

- **50%** - Age group can be covered by the TCV campaigns.
- **44%** - Not receiving any vaccine.
- **10%** - Age group: covered by routine immunization + EOAs.
**Epidemiology:** Typhoid cases vaccination status, by age group from all reporting sites Jan-Jun, 2023

24% of cases received 1 dose of TCV
IMPACT OF TCV INTRODUCTION: TYPHOID CASES REPORTED IN LAST QUARTER, PUNJAB, 2020-2022

Feb & July 2021; Phases 1 & 2 of TCV campaign.

71% decrease
PROPORTION OF XDR CASES: DISTRIBUTION OF TYPHOID CASES BY RESISTANCE PATTERN, PAKISTAN, 2023

- 2016-2018, Before TCV vaccine:
  - 64% of cases were XDR

- In 2023: XDR cases = 44%
  - 35% of XDR cases received 1 TCV dose
  - 75% are <15 years

- Other antibiotic resistance:
  - 2.2% (148 cases) resistant to Azithromycin
  - 0.4% (29 cases) resistant to Meropenem
CONCLUSION

- Surveillance is crucial for countries that introduced/plan to introduce Typhoid vaccine
- Surveillance enhance the evidence-informed decision making
  - Epidemiology
  - Impact of vaccine introduction
  - AMR typhoid
CONCLUSION: TYPHOID EPIDEMIOLOGY

TIME
- After 2022 floods; >2-fold increase in Typhoid cases in 1st half of 2023, compared to 2022

PLACE
- 81% of reported cases in 2023 are from Sindh province, and 96% are from Karachi district

PERSON: predominance of children, but cases in older age groups
- 56% of cases are <15 years

(Plans for TCV campaign in Karachi Sindh in 2024)
**CONCLUSION- TCV INTRODUCTION**

- TCV introduction resulted in a 71% decrease in typhoid cases in 2021 compared to the same period in 2020.
- No evidence of vaccine failure, but the age groups covered may limit the impact at the population immunity level.

(Enhancing TCV in RI through EOA in different provinces)
CONCLUSION- XDR TYPHOID

- The proportion of XDR typhoid decreased in 2023 but it remains predominant
- Azithromycin and Meropenem typhoid resistance is alarming
THANK YOU
OPERATIONAL CHALLENGES

Health facility related

• Turnover of staff, staff strike
• Shift of priority to other diseases (i.e., COVID-19)

Suspected case definition highly sensitive

• Covers a wide spectrum of diseases
• Many suspected cases
• Laboratory confirmation expensive

Supplies

• Limited number of Bactec bottles in the local market; long process of international procurement

Sustainability: *Measures are taken to improve government ownership of typhoid surveillance*

• Memorandum of understanding between the provincial EPI and sites
• Surveillance review at the Federal Directorate of EPI
• Sentinel sites must contribute with laboratory supplies beyond Bactec bottles
• No hiring of external staff

Laboratory quality control:

• NIH conducts quality assurance limited to several surveillance sites
LIMITATIONS

- Union council (UCs) level data is not available for most cases, where addresses are recorded, which is not easy to analyze. Hence, the inability to:
  - Identify clusters of cases
  - Conduct UCs level analysis
- In 2023, 38% of typhoid cases have incomplete AMR tests
- Incomplete data of line list (patient outcome, complications, water source...etc.)
- Sentinel data limits the usefulness of time trends