Impact Assessment of Typhoid Conjugate Vaccine in Sindh, Pakistan

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Outline

➢ Background

➢ Methods

➢ Results
  o Time series of overall culture confirmed cases from Pakistan
  o Impact of TCV from lab network data in Sindh (interrupted time series)
  o Impact of TCV from hospital-based surveillance data in Karachi

➢ Conclusion

➢ Acknowledgement
Background

- Typhoid is a significant public health problem globally
- XDR outbreak in 2016 → limited treatment options in Pakistan
- TCV introduction in Pakistan in 2019/20 in Sindh, 2021 in Punjab and 2022 in other provinces
- Routine immunization at 9 months
- Catch up campaign 9 mo to 15 years (Nov-Dec 2019 in Sindh)
- SEAP study (2016 to 2019) and ITRIPP study (2020 to 2023) provides data for impact assessment in Karachi
Study methods

- Sentinel sites surveillance
- Suspected and culture confirmed cases
- Typhoid complications
- TIPS (ileal perforations)

- Lab Networks cases data
- Culture confirmed cases
- Pre and post TCV Data
- Isolates

Characterize healthcare seeking behaviors of the catchment area population.
• Aga Khan University Lab network (AKU)
• Liaquat University of Medical and Health Sciences (LUMHS)
• Chughtai Laboratory Network (CLL)
• Shaukat Khanum memorial hospital and research center lab (SKMCH)
• Shifa Labs
Trend of culture confirmed typhoid in Pakistan 2017-2023

TCV campaign Sindh: 18th Nov - 7th Dec 2019

TCV campaign Punjab: 1st - 17th Feb 2021

COVID-19
Trend of AMR in typhoid in Pakistan 2017-2023

TCV campaign Sindh: 18th Nov - 7th Dec 2019

TCV campaign Punjab: 1st - 17th Feb 2021

Cases of S. Typhi

Percentage of XDR cases

XDR: Resistant to Ampicillin, Co-trimoxazole, chloramphenicol, ciprofloxacin and ceftriaxone/cefidine
MDR: Resistant to Ampicillin and chloramphenicol
MDR+Cipro: Resistant to Ampicillin, Co-trimoxazole, chloramphenicol and ciprofloxacin
FQR: Resistant to Ciprofloxacin only
Sensitive: Sensitive to Ampicillin, Co-trimoxazole, chloramphenicol, ciprofloxacin and ceftriaxone/cefidine
Laboratory surveillance catchment in Sindh

n = 47,854,510
Interrupted Time Series Regression measuring impact of TCV in Sindh (2017-2023)

- 32% reduction in incidence level (IRR 0.68; 95% CI: 0.55, 0.83)
- 2% reduction in overall trend (IRR 0.98; 95% CI: 0.97, 0.99)
- COVID 19 related lockdown had transient effect
Interrupted Time Series Regression measuring impact of TCV in age ≤ 18 years in Sindh (2017-2023)

- 33% reduction in incidence level (IRR 0.67; 95% CI: 0.55, 0.82)
- 2% reduction in overall trend (IRR 0.98; 95% CI: 0.97, 0.99)
- COVID 19 related lockdown had transient effect
Interrupted Time Series Regression measuring impact of TCV in age > 18 years in Sindh (2017-2023)

- 29% reduction in incidence level (IRR 0.71; 95% CI: 0.55, 0.92)
- 2% reduction in overall trend (IRR 0.98; 95% CI: 0.97, 0.99)
- COVID 19 related lockdown had transient effect
Hospital surveillance catchment in Karachi

n = 3,411,794
## Incidence rate ratios of typhoid before and after TCV introduction in Karachi (Oct 2017 to Sep 2023)

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Pre vaccine period (2017 – 2019)</th>
<th>Post vaccine period (2020 – 2023)</th>
<th>IRR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cases</td>
<td>Population</td>
<td>Incidence*</td>
</tr>
<tr>
<td>&lt; 2</td>
<td>157</td>
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<tr>
<td>2 - 4</td>
<td>351</td>
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<td>87.1</td>
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<td>5 - 18</td>
<td>533</td>
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<td>30.9</td>
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<tr>
<td>19 - 25</td>
<td>77</td>
<td>782033</td>
<td>9.8</td>
</tr>
<tr>
<td>&gt; 25</td>
<td>81</td>
<td>2808208</td>
<td>2.9</td>
</tr>
</tbody>
</table>

*unadjusted incidence per 100,000

1/3rd reduction in health seeking among age group ≥ 18 yrs post TCV time as compared pre-TCV period – resulting in 1/3 decrease in typhoid cases
### Incidence rate ratios of paratyphoid before and after TCV introduction in Karachi (Oct 2017 to Sep 2023)

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Pre vaccine period (2017 – 2019)</th>
<th>Post vaccine period (2020 – 2023)</th>
<th>IRR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cases</td>
<td>Population</td>
<td>Incidence*</td>
</tr>
<tr>
<td>&lt; 2</td>
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<td>2 - 4</td>
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<tr>
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<tr>
<td>&gt; 25</td>
<td>7</td>
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</tr>
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</table>

*unadjusted incidence per 100,000
Incidence rate ratios of typhoid at OPD before and after TCV introduction in Karachi (Oct 2017 to Sep 2023)

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Pre vaccine period (2017 – 2019)</th>
<th>Post vaccine period (2020 – 2023)</th>
<th>IRR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cases</td>
<td>Population</td>
<td>Incidence*</td>
</tr>
<tr>
<td>&lt; 2</td>
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*unadjusted incidence per 100,000
### Incidence rate ratios of typhoid in hospitalized cases after TCV introduction in Karachi (Oct 2017 to Sep 2023)

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Pre vaccine period (2017 – 2019)</th>
<th>Post vaccine period (2020 – 2023)</th>
<th>IRR (95% CI)</th>
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</thead>
<tbody>
<tr>
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<td>Cases</td>
<td>Population</td>
<td>Incidence*</td>
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<tr>
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<td>1.9</td>
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*unadjusted incidence per 100,000
Conclusion

- TCV has a 60% to 85% impact against culture confirmed typhoid in Karachi.

- Impact in ≥ 18 years is attributed to 1/3rd reduction in healthcare seeking post TCV introduction.

- TCV leads to overall decline in culture confirmed cases irrespective of severity.

- Further analysis with adjustment for healthcare seeking is needed.

- Strengthening of routine immunization coverage is a key.
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• EPI Sindh, Punjab and Federal
• Provincial disease surveillance & response units
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