Invasive MDR NTS Hotspots in Kenya: opportunities for vaccine introduction

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Background

• In Kenya invasive NTS infections, are of great public health importance, especially in poor-resource settings where clean water supply and sanitation conditions are inadequate.

• Invasive NTS, frequent in children, associated with anemia, malnutrition, malaria or HIV

• The epidemiology, transmission dynamics and spatial-geographic distribution of these infections, are critical info in instituting appropriate disease management and prevention strategies
Aims

Hypothesis: That there are unique genotypes of NTS in hotspots that cause invasive illnesses in children, perpetuated by specific host and environmental factors

- A 5-year study of population-based surveillance for invasive NTS in <16 yr olds
- Describe the spatial and spatio-temporal clustering in reference to household and environmental risk factors.
Study sites

• Mukuru informal settlement 25 km from Nairobi city centre

• One of the largest slums in the city, approx. 250,000 people (KNBS, 2010).

• Densely populated, extreme poverty, overcrowding, substandard housing, insufficient water, and inadequate sanitation, contribute to a high incidence of infectious diseases and increased mortality
METHODS

Recruitment and evaluation of patients

• <16 years of age on the date of presentation

• History of at least 3 days of fever and have an axillary temperature of at least 37.5°C or they present with a history of fever

• Three or more loose or liquid stools in the 24 hours before presentation, or one or more loose or liquid stool with visible blood.

• Controls: Age matched children from same clinic coming for routine vaccination.
Laboratory Procedures

• Blood for culture
  • 1-3 ml for children < 5 years of age and 5-10 ml for 5-16 year olds using Bactec Culture
  • **Blood for HIV-testing**- On site after counselling

• Stool cultures
  • The rectal swab or loopful of the stool specimen cultured on selenite F broth aerobically at 37°C overnight.
  • subcultured on MacConkey agar and *Salmonella-Shigella* and incubated at 37°C overnight.
Genotyping of NTS isolates and GIS mapping

• WGS of NTS from blood and stool for detection of phylogenetically informative recently acquired genetic variation.

• GIS mapping of serotypes onto DSS site and correlation with environmental and sociodemographic factors.
Results
HH Census

• 35,000 households covered in Household Census
• Data from 2,553 households from Mukuru Reuben and 970 from Mukuru kwa Njenga was missing because the occupants were away during the scheduled visits
Patient recruitment

No. of patients and controls recruited

<table>
<thead>
<tr>
<th>Year</th>
<th>Cases</th>
<th>Controls</th>
<th>Total</th>
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<tbody>
<tr>
<td>2013</td>
<td>330</td>
<td>792</td>
<td>1122</td>
</tr>
<tr>
<td>2014</td>
<td>1496</td>
<td>2107</td>
<td>3603</td>
</tr>
<tr>
<td>2015</td>
<td>1550</td>
<td>2601</td>
<td>4151</td>
</tr>
<tr>
<td>2016</td>
<td>735</td>
<td>1026</td>
<td>1761</td>
</tr>
</tbody>
</table>
Salmonella positive samples - all sites

Positives - All sites

- CsBlood
- CsStool
- Controlsst
Proportions of Salmonella positives by Age -%
Resistance Patterns of *S. Typhimurium* Isolates from 2013-2016 (N=131)
Resistance Patterns of S. Enteritidis Isolates from 2013-2016 (N=115)
Conclusion

• This is a high density slum area with endemic enteric diseases including high incidence of iNTS
• We have mapped hotspots of disease close to key water vending points and close to healthcare centres
• Rates of MDR high for both Typhimurium and Enteritidis
• We recommend these hotspots to be considered for any planned vaccine intervention.
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