Urban Infant Foodscape

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Overview

• Background - Foodborne disease
• Urban Infant Foodscapes
  • Aims
  • Study sites
  • Domains – child, household, market, producers
  • Data collection
  • Results
  • Next steps
Food Borne Disease Burden

- FBD causes ~550 million cases of illness, death, or disability each year
- Children < 5 account for 40% of all FBD burden
  **Young children at disproportionately high risk of FBD**
- Up to 70% all diarrhoea in low- & middle-income countries is foodborne
- Diarrhoea second most common cause of preventable illness and death among children <5, especially in LMICs.
- Risk of diarrheal increases as children go from exclusive breastfeeding to consumption of food & water due to decreases in passive protection from breastmilk and exposure to contaminated food
Food Borne Disease causes

• FBD results from ingestion of foods contaminated with microorganisms or chemicals.

• Contamination of food may occur at any stage in the process from food production to consumption (“farm to fork”)

• Can result from environmental contamination, including pollution of water, soil or air by:

<table>
<thead>
<tr>
<th>Bacteria:</th>
<th>Viruses:</th>
<th>Parasites:</th>
<th>Chemicals:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Campylobacter**</td>
<td>Rotavirus</td>
<td>Cryptosporidium**</td>
<td>Aflatoxins</td>
</tr>
<tr>
<td>Salmonella**</td>
<td>Norovirus**</td>
<td>Giardia **</td>
<td>Cassava cyanide</td>
</tr>
<tr>
<td>E.coli (ETEC)**</td>
<td>Adenovirus</td>
<td>Entamoeba histolytica</td>
<td>Dioxins</td>
</tr>
<tr>
<td>Shigella**</td>
<td>Hepatitis A</td>
<td></td>
<td>Toxins in fish (from toxin producing bacteria or algae)</td>
</tr>
<tr>
<td>C. difficile</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V. cholerae</td>
<td></td>
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</tbody>
</table>

Pathogens
FBD Risk Factors

- Poor personal hygiene
- Inadequate sanitation
- Poor food hygiene
- Animal contact
- Contaminated water
- Cross-contamination
Urban Infant Foodscape Project

AIMs

1. Estimate the FBD burden in young children in a low-income, high density, urban environments - both disease (i.e., diarrhoea) and enteric carriage (i.e., pathogen presence in the gut)

2. Measure the microbial contamination in food consumed by young children

3. Understand the risk factors for FBD in young children in the household, local market, and in the food supply/production chain

4. Design, implement, and evaluate a locally appropriate intervention that addresses early childhood exposure to microbially contaminated foods

PHASE ONE

PHASE TWO
Study Sites

Kenya, Nairobi
Dagoretti South Subcounty

Mozambique, Maputo
Polana Caniço A and B

Low-income informal settlements
Overcrowding, limited WASH infrastructure, livestock keeping, regulatory challenges for food & environmental hygiene

→ High risk food borne disease
UIF PHASE ONE: FBD in 4 domains

- **CHILD (6-24 months)**
- **HOUSEHOLD**
- **MARKET**
- **PRODUCTION**
CHILD and household

STUDY DESIGN

- All active Community Health Volunteers (CHVs) identified n=259
- 100 CHVs randomly selected
- CHVs provide list of all eligible households (those with child <2)
- 7 households randomly selected from each CHV list
Child and household - Data Collection Methods

- Household survey (collected using a tablet)
- Collection of a food sample from the household
- Collection of a water sample from the household
- Collection of a blood spot from child
- Collection of a stool sample from the child
- Faecal samples of livestock in the compound
- Observations of household food preparation
- Focus group discussions
- Observations, food sampling & interviews in daycare centers
Local Market

MARKET

- Food purchasing observations & subsequent interviews with caregivers
- Collection of food samples after purchasing
- Observations of food vendors & subsequent interviews
Production and Supply

PRODUCTION

OBSERVATIONS OF FOOD HANDLING BY PRODUCERS & SUPPLIERS

COLLECTION OF FOOD SAMPLES DIRECTLY FROM PRODUCERS/SUPPLIERS

KEY INFORMANT INTERVIEWS WITH PRODUCERS & SUPPLIERS
## Sample and data analysis

<table>
<thead>
<tr>
<th>DATA COLLECTED</th>
<th>ANALYSIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Household survey</td>
<td>Quantitative analysis of socio-economic status, child foods, purchasing habits, hygiene practices</td>
</tr>
<tr>
<td>Food samples</td>
<td>Tested in-country for: <em>Salmonella</em>, <em>Shigella</em>, <em>E. coli</em>, <em>Campylobacter</em> (culture) &amp; <em>Cryptosporidium</em>, <em>Norovirus</em> (PCR)</td>
</tr>
<tr>
<td>Stool samples</td>
<td>Tested later in UK by LSHTM for gastroenteric pathogens (TaqMan)</td>
</tr>
<tr>
<td>Household water sample</td>
<td>Tested in-country for fecal indicator bacteria (<em>E. coli</em>)</td>
</tr>
<tr>
<td>Blood spot samples</td>
<td>Tested later in UK by LSHTM for antibodies to pathogens</td>
</tr>
<tr>
<td>Livestock samples</td>
<td>Tested in-country for: <em>Salmonella</em>, <em>E. coli</em>, <em>Campylobacter</em></td>
</tr>
<tr>
<td>FGDs &amp; interviews with caregivers/vendors/producers</td>
<td>Qualitatively analysed to understand food purchasing and handling practices and FBD risks</td>
</tr>
</tbody>
</table>
## Results – data and samples collected

<table>
<thead>
<tr>
<th>Participants</th>
<th>Activity</th>
<th>Survey</th>
<th>Stool Sampling</th>
<th>Blood Sampling</th>
<th>Food Sampling</th>
<th>Observation</th>
<th>SSIs</th>
<th>FGDs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Young Children</td>
<td></td>
<td></td>
<td>547</td>
<td>570</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caregivers</td>
<td></td>
<td>590</td>
<td></td>
<td>590</td>
<td>HH- 109</td>
<td>106</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Daycare centers</td>
<td></td>
<td>10</td>
<td></td>
<td>10</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vendors</td>
<td></td>
<td>97</td>
<td></td>
<td>84</td>
<td>84</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Producers</td>
<td></td>
<td>36</td>
<td></td>
<td>36</td>
<td>36</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suppliers</td>
<td></td>
<td>26</td>
<td></td>
<td>26</td>
<td>26</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

HH – household observations  PP - Post purchasing observation
# Preliminary laboratory results

<table>
<thead>
<tr>
<th></th>
<th>Children n=541</th>
<th>Food n=850</th>
<th>Cattle n=28</th>
<th>Sheep n=44</th>
<th>Goats n=41</th>
<th>Pigs n=55</th>
<th>Poultry n=128</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Campylobacter</strong></td>
<td>26 (5%)</td>
<td>0</td>
<td>4 (14%)</td>
<td>13 (30%)</td>
<td>9 (22%)</td>
<td>21 (38%)</td>
<td>77 (60%)</td>
</tr>
<tr>
<td><strong>E. coli (0157)</strong></td>
<td>16 (3%)</td>
<td>3 (0.4%)</td>
<td>5 (18%)</td>
<td>2 (5%)</td>
<td>4 (10%)</td>
<td>8 (15%)</td>
<td>21 (16%)</td>
</tr>
<tr>
<td><strong>Shigella</strong></td>
<td>6 (1%)</td>
<td>4 (0.5%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Salmonella</strong></td>
<td>9 (2%)</td>
<td>5 (0.6%)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1 (2%)</td>
<td>1 (1%)</td>
</tr>
<tr>
<td><strong>E. coli</strong></td>
<td>466 (86%)</td>
<td>149 (18%)</td>
<td>28 (100%)</td>
<td>43 (98%)</td>
<td>40 (98%)</td>
<td>53 (96%)</td>
<td>125 (98%)</td>
</tr>
</tbody>
</table>
Discussion

• Prevalence of diarrhoeagenic bacterial in children (1-5%) consistent with previous cross-sectional (non-clinical) studies
• Contamination of food lower than expected
  • sample analysis ongoing
• Prevalence of bacteria in livestock consistent with previous studies
  • Low prevalence of non-typhoidal *Salmonella* in Kenya
  • High prevalence of *Campylobacter* in chickens and pigs
Next steps

• Finalise laboratory analysis
  • Pathotyping
  • AMR – phenotypic and genotypic
  • TaqMan Array Card – food, stool
  • Serology – DBS

• Risk factor analysis

• Value chain assessment of risks

• Phase 2 – Intervention design and testing
  
  Locally appropriate intervention
  
  Guided by key stakeholders
  
  Evaluated in proof-of-concept study
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