A NC Field Experience

Sara Alves
MPH Candidate – Infectious Diseases/Zoonoses
Field Experience Site

- Division of Public Health, Communicable Disease Branch of the North Carolina Department of Health and Human Services
  - 13 June 2016 – 22 July 2016
- Preceptor: Nicole Lee, MPH
- Capstone Project: Laboratory Guide to the Interpretation of Enterics
Activities Performed

- Participated in outbreak investigations
  - N. fowleri, Salmonella, E. coli
- Updated Investigation steps for communicable diseases
- Visited State Laboratory – Rabies
- Worked on a plan to transfer outbreak investigation data to NORS
State Laboratory for Public Health

- Rabies sampling/testing
- Direct Fluorescent Antibody (DFA) testing
- Variant typing (PCR)
Products Developed

- Guide to the Laboratory Interpretation of Enteric Pathogens
- Zika Registry Database
- N. fowleri Talking Points
- Outbreak Investigation Survey Template
Capstone Project – Laboratory Guide to the Interpretation of Pathogens

- Epidemiology reporting in NC
  - North Carolina Electronic Disease Surveillance System (NC EDSS)
  - Requires local health department participation
  - Communicable Disease Branch analyzes surveillance

- Errors in reporting
  - Misclassification of various laboratory tests
Capstone Project – Laboratory Guide to the Interpretation of Pathogens

- Methods
  - Consolidated resources from CDC & NC DPH
  - Communicable Disease Manual
  - Interviews with State nurses & State laboratory representatives
Capstone Project – Laboratory Guide to the Interpretation of Pathogens

- Final
  - Testing methods used
  - Turnaround time
  - Examples of testing utilized
  - Pathogen reference sheets
### Interpreting GI Pathogen Panels

#### Bacteria

<table>
<thead>
<tr>
<th>Organism</th>
<th>Common Name of Illness</th>
<th>Onset Time After Ingestion</th>
<th>Signs &amp; Symptoms</th>
<th>Duration</th>
<th>Food Sources</th>
<th>Diagnostic Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Campylobacter jejuni</td>
<td>Campylobacteriosis</td>
<td>2-5 days</td>
<td>Diarrhea, cramps, fever, vomiting</td>
<td>2-10 days</td>
<td>Raw and undercooked poultry, raw milk, contaminated water</td>
<td>Culture (CFTs, PCR, IF, FA, ELISA)</td>
</tr>
<tr>
<td>Enterotoxigenic E. coli (ETEC)</td>
<td>Diarrhea</td>
<td>1-4 weeks</td>
<td>Vomiting, diarrhea, cramps, abdominal pain, headache, muscle aches, weakness</td>
<td></td>
<td>Contaminated tropical raw fish (barbecued, seafood, pasta, soup, meat)</td>
<td>Generally not applicable</td>
</tr>
<tr>
<td>Enteropathogenic E. coli (EPEC)</td>
<td>Diarrhea</td>
<td>1-4 weeks</td>
<td>Vomiting, diarrhea, cramps, abdominal pain, headache, muscle aches, weakness</td>
<td></td>
<td>Contaminated tropical raw fish (barbecued, seafood, pasta, soup, meat)</td>
<td>Generally not applicable</td>
</tr>
<tr>
<td>Shigella/Enteroinvasive E. coli (EIEC)</td>
<td>Diarrhea</td>
<td>1-4 weeks</td>
<td>Vomiting, diarrhea, cramps, abdominal pain, headache, muscle aches, weakness</td>
<td></td>
<td>Contaminated tropical raw fish (barbecued, seafood, pasta, soup, meat)</td>
<td>Generally not applicable</td>
</tr>
<tr>
<td>E. coli O157</td>
<td>Diarrhea</td>
<td>1-4 weeks</td>
<td>Vomiting, diarrhea, cramps, abdominal pain, headache, muscle aches, weakness</td>
<td></td>
<td>Contaminated tropical raw fish (barbecued, seafood, pasta, soup, meat)</td>
<td>Generally not applicable</td>
</tr>
<tr>
<td>Shigella</td>
<td>Diarrhea</td>
<td>1-4 weeks</td>
<td>Vomiting, diarrhea, cramps, abdominal pain, headache, muscle aches, weakness</td>
<td></td>
<td>Contaminated tropical raw fish (barbecued, seafood, pasta, soup, meat)</td>
<td>Generally not applicable</td>
</tr>
</tbody>
</table>

#### Parasites

<table>
<thead>
<tr>
<th>Organism</th>
<th>Common Name of Illness</th>
<th>Onset Time After Ingestion</th>
<th>Signs &amp; Symptoms</th>
<th>Duration</th>
<th>Food Sources</th>
<th>Diagnostic Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cryptosporidium</td>
<td></td>
<td></td>
<td>Nausea, vomiting, diarrhea, cramps, abdominal pain, headache, muscle aches, weakness</td>
<td></td>
<td>Contaminated tropical raw fish (barbecued, seafood, pasta, soup, meat)</td>
<td>PCR, ELISA, MS, mouse bioassay</td>
</tr>
<tr>
<td>Cyclospora</td>
<td></td>
<td></td>
<td>Nausea, vomiting, diarrhea, cramps, abdominal pain, headache, muscle aches, weakness</td>
<td></td>
<td>Contaminated tropical raw fish (barbecued, seafood, pasta, soup, meat)</td>
<td>PCR, ELISA, MS, mouse bioassay</td>
</tr>
<tr>
<td>Entamoeba histolytica</td>
<td></td>
<td></td>
<td>Nausea, vomiting, diarrhea, cramps, abdominal pain, headache, muscle aches, weakness</td>
<td></td>
<td>Contaminated tropical raw fish (barbecued, seafood, pasta, soup, meat)</td>
<td>PCR, ELISA, MS, mouse bioassay</td>
</tr>
<tr>
<td>Giardia lamblia</td>
<td></td>
<td></td>
<td>Nausea, vomiting, diarrhea, cramps, abdominal pain, headache, muscle aches, weakness</td>
<td></td>
<td>Contaminated tropical raw fish (barbecued, seafood, pasta, soup, meat)</td>
<td>PCR, ELISA, MS, mouse bioassay</td>
</tr>
</tbody>
</table>

#### Viruses

<table>
<thead>
<tr>
<th>Organism</th>
<th>Common Name of Illness</th>
<th>Onset Time After Ingestion</th>
<th>Signs &amp; Symptoms</th>
<th>Duration</th>
<th>Food Sources</th>
<th>Diagnostic Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adenovirus F-40/41</td>
<td></td>
<td></td>
<td>Nausea, vomiting, diarrhea, cramps, abdominal pain, headache, muscle aches, weakness</td>
<td></td>
<td>Contaminated tropical raw fish (barbecued, seafood, pasta, soup, meat)</td>
<td>PCR, ELISA, MS, mouse bioassay</td>
</tr>
<tr>
<td>Astrovirus</td>
<td></td>
<td></td>
<td>Nausea, vomiting, diarrhea, cramps, abdominal pain, headache, muscle aches, weakness</td>
<td></td>
<td>Contaminated tropical raw fish (barbecued, seafood, pasta, soup, meat)</td>
<td>PCR, ELISA, MS, mouse bioassay</td>
</tr>
<tr>
<td>Norovirus GI/GII</td>
<td></td>
<td></td>
<td>Nausea, vomiting, diarrhea, cramps, abdominal pain, headache, muscle aches, weakness</td>
<td></td>
<td>Contaminated tropical raw fish (barbecued, seafood, pasta, soup, meat)</td>
<td>PCR, ELISA, MS, mouse bioassay</td>
</tr>
<tr>
<td>Rotavirus A</td>
<td></td>
<td></td>
<td>Nausea, vomiting, diarrhea, cramps, abdominal pain, headache, muscle aches, weakness</td>
<td></td>
<td>Contaminated tropical raw fish (barbecued, seafood, pasta, soup, meat)</td>
<td>PCR, ELISA, MS, mouse bioassay</td>
</tr>
<tr>
<td>Sapovirus B, II, IV and V</td>
<td></td>
<td></td>
<td>Nausea, vomiting, diarrhea, cramps, abdominal pain, headache, muscle aches, weakness</td>
<td></td>
<td>Contaminated tropical raw fish (barbecued, seafood, pasta, soup, meat)</td>
<td>PCR, ELISA, MS, mouse bioassay</td>
</tr>
</tbody>
</table>

#### Note

- GI Pathogen Panels are polymerase chain reaction (PCR) tests and should be marked as such in the lab package of NCEDSS. These tests are not cultures.

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Summaries in the Guide
PCR Vs Culture

Gastrointestinal Pathogen Panel (GPP) suggests a PCR

Note sample source (fecal)

A list of pathogens usually suggests a PCR or ELISA was run; note no distinguishing between bacterial types (e.g., Salmonella enterica vs. Salmonella typhi).

TAG is associated with PCR tests

Note sample source and test

Note how specific results (not a list of pathogens as in PCR) and mention of "susceptibility" and "isolate".
Listeriosis
Listeria monocytogenes

Listeriosis is a zoonotic disease caused by anaerobic, Gram-positive coccobacillus. *L. monocytogenes* can grow at low temperatures (even in refrigerators). It is found normally in nature.

**Exposure:** Ingestion of

Consumption of unpasteurized milk, unpasteurized soft cheeses, and ready-to-eat deli meats

**Incubation Time:** 9-48 hours
**Duration of Illness:** Variable

Unpasteurized milk, unpasteurized soft cheeses, ready to eat deli meats; in rare cases transplacental transmission. It incubates for 9-48 hours.

**Symptoms:** Fever, muscle aches, nausea, diarrhea; flu-like symptoms in pregnant women in addition to premature birth, stillbirth, and abortion. Meningitis can also occur. Listeriosis has a high mortality rate.

**Testing:** Culture is the preferred diagnostic; usefulness of fluorescent antibody testing or PCR is not established; atypical testing with NC state lab

**Communicability:** Can be spread from mother to child during pregnancy and childbirth; zoonotic

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**Laboratory Information**

- **Reportable:** within 24 hours
- **Sample:** Blood or spinal fluid
- **Test Usually Run:** Culture
- **Turn Around Time:** 7-10 business days (state); 8 weeks (CDC)

**Culture is the Gold Standard**

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**Investigation Resources**

- **Case Definition:**
- **Investigation Steps:**
- **Additional Forms:**
  http://www.cdc.gov/hanonia/war/
Which courses contributed?

- **DVM Courses**
  - Parasitology
  - Bacteriology and Mycology
  - Virology

- **MPH Courses**
  - Epidemiology
  - Administration of Health Care Organization
  - Social and Behavioral Bases of Public Health
  - Food Protection & Defense
  - Overview of Food Safety & Security
Zika Registry Database

- Create duplicates of Zika Virus reporting forms on Microsoft Access
  - Generate data faster
  - Better follow-up with mothers and infants with exposure/disease
Zika Form Example

Pregnancy and Zika Virus Surveillance — Maternal Health History Form

These data are considered confidential and will be stored in a secure database at the Centers for Disease Control and Prevention.

Please return completed form via SAMS or secure FTP—request access from ZikaSurveillance@cdc.gov.
The form can also be sent by encrypted email to this address or by secure fax to 404-718-1015 or 404-718-2200.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>MHH.4. County reporting:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MHH.5. Ethnicity:</th>
<th>☐ Hispanic or Latino</th>
<th>☐ Not Hispanic or Latino</th>
</tr>
</thead>
<tbody>
<tr>
<td>MHH.6. Race (check all that apply):</td>
<td></td>
<td></td>
</tr>
<tr>
<td>American Indian or Alaskan Native</td>
<td>☐ Asian</td>
<td>☐ Black or African-American</td>
</tr>
<tr>
<td>Native Hawaiian or other Pacific Islander</td>
<td>☐ White</td>
<td></td>
</tr>
<tr>
<td>MHH.7. Indication for maternal Zika virus testing:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>☐ Exposure history only, no known fetal abnormalities</td>
<td>☐ Exposure history and fetal abnormalities</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MHH.8. Date of Zika virus symptom onset: <em><strong>/</strong></em>/____</th>
<th>☐ OK</th>
<th>MHH.9. ☐ Asymptomatic</th>
</tr>
</thead>
<tbody>
<tr>
<td>MHH.10. If symptomatic, gestational age at onset: ___________(weeks, days)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MHH.11. If gestational age or date not known, trimester of symptom onset ____________ (1st, 2nd, 3rd)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MHH.12. Symptoms of mother’s Zika virus disease: (check all that apply)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>☐ Fever (if measured) ___°F or ___°C</td>
<td>☐ Arthralgia</td>
<td>☐ Conjunctivitis</td>
</tr>
<tr>
<td>☐ Other clinical presentation: ____________________________</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MHH.13. If rash, check all that apply:</td>
<td>☐ Maculopapular</td>
<td>☐ Petechial</td>
</tr>
<tr>
<td>Describe rash distribution: ____________________________</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MHH.14. Hospitalized for Zika virus disease</td>
<td>☐ No</td>
<td>☐ Yes</td>
</tr>
<tr>
<td>MHH.15. Maternal Death</td>
<td>☐ No</td>
<td>☐ Yes</td>
</tr>
<tr>
<td>MHH.16. If yes, date of death <em><strong>/</strong></em>/____</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Zika Access Example

#### All Access Objects

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID</td>
<td>AutoNumber</td>
<td></td>
</tr>
<tr>
<td>StateID</td>
<td>Text</td>
<td>State Case No.</td>
</tr>
<tr>
<td>MLastName</td>
<td>Text</td>
<td>Mother's Last Name</td>
</tr>
<tr>
<td>MFirstName</td>
<td>Text</td>
<td>Mother's First Name</td>
</tr>
<tr>
<td>MMId</td>
<td>Text</td>
<td>Mother's Middle Initial</td>
</tr>
<tr>
<td>MMaidenName</td>
<td>Text</td>
<td>Mother's Maiden Name</td>
</tr>
<tr>
<td>MDOB</td>
<td>Date/Time</td>
<td>Date of Birth</td>
</tr>
<tr>
<td>MStateRes</td>
<td>Text</td>
<td>State/Territory of Residence</td>
</tr>
<tr>
<td>MCounty</td>
<td>Text</td>
<td>Mother's County of Residence</td>
</tr>
<tr>
<td>MEthnicity</td>
<td>Text</td>
<td>Mother’s Ethnicity</td>
</tr>
<tr>
<td>MRaceAmerInd</td>
<td>Yes/No</td>
<td>Mother’s Race American Indian</td>
</tr>
<tr>
<td>MRaceNativeHaw</td>
<td>Yes/No</td>
<td>Mother’s Race Native Hawaiian</td>
</tr>
<tr>
<td>MRaceAsian</td>
<td>Yes/No</td>
<td>Mother’s Race Asian</td>
</tr>
<tr>
<td>MRaceWhite</td>
<td>Yes/No</td>
<td>Mother’s Race White</td>
</tr>
<tr>
<td>MRaceBlack</td>
<td>Yes/No</td>
<td>Mother’s Race Black</td>
</tr>
<tr>
<td>IndicMTest</td>
<td>Text</td>
<td>Indication for Maternal Zika Virus Testing</td>
</tr>
<tr>
<td>DateSymptomsOnset</td>
<td>Date/Time</td>
<td>Date of Zika Virus Symptom Onset</td>
</tr>
<tr>
<td>DateAsy</td>
<td>Yes/No</td>
<td>Or Asymptomatic</td>
</tr>
<tr>
<td>Hospitalized</td>
<td>Text</td>
<td>Hospitalized for Zika Virus Disease</td>
</tr>
</tbody>
</table>
Which courses contributed?

- Veterinary
  - Virology
- MPH
  - Quantitative Analysis
  - Social and Behavioral Bases of Public Health
N. Fowleri Outbreak

- Death of 18 year old Ohio female
- Primary Meningoencephalitis
  - Freshwater exposures?
    - National White Water Center
    - Fresh water lakes in NC
- Incubation period?
  - 1-9 days
  - Was out of state in NC during potential exposure time
N. Fowleri Investigation

- CDC involved
  - High publicity and multiple states involved
  - Sent team to get water samples from exposure sites

- Samples
  - No positives from Catawaba River
  - 11 samples from Whitewater Center positive
    - Whitewater Center closes to facilitate investigation
    - Regulation change?
N. Fowleri - Communications

- Responsible for researching “Talking Points”
  - Distributed to Local Health Department officials for consistency with the public
  - Updated with the facts of the case
  - Researched papers involved in government and Whitewater citations

- Common questions
  - How is PAM transmitted? Symptoms?
  - Responsibility of Whitewater Center?
  - Exposure risks?
  - How to protect the public?
Which courses contributed?

- Veterinary
  - DMP Two Minute Talk History
  - Epidemiology
- MPH
  - Administration of Health Care Organizations
  - Environmental Toxicology
  - Intermediate Epidemiology
  - Social and Behavioral Bases of Public Health
Core Competencies Overview

- Biostatistics
- Environmental Health Sciences
- Epidemiology
- Health Service Administration
- Social and Behavioral Science
References

Image References

- Rabies DFA, CDC “Rabies”
- N. fowleri image by D.T. John & T.B. Cole, Visuals Unlimited
- National Whitewater Center, TripAdvisor.com
- Bacteria Question, FlickRiver
Questions?