



A NC Field Experience

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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

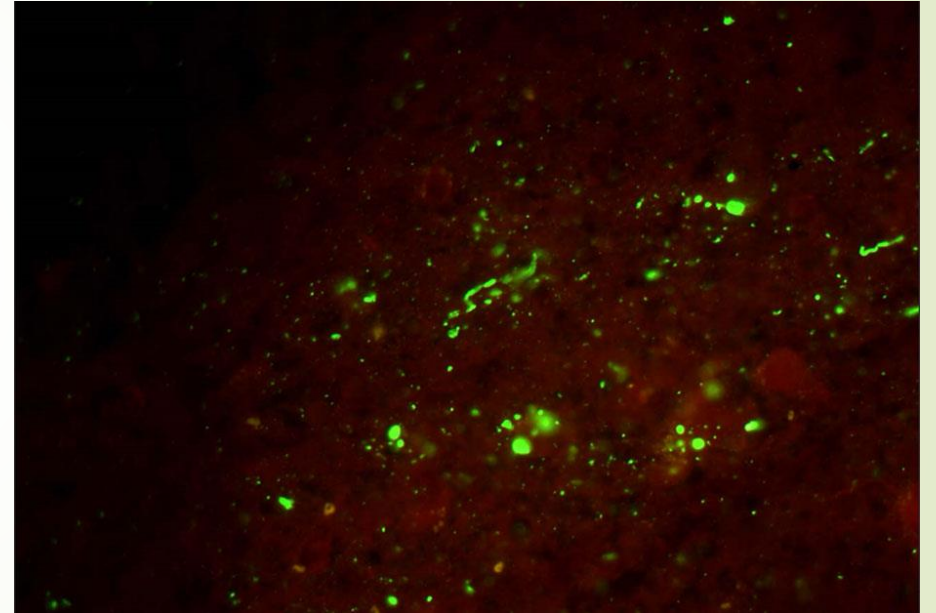


Activities Performed

- ▶ 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

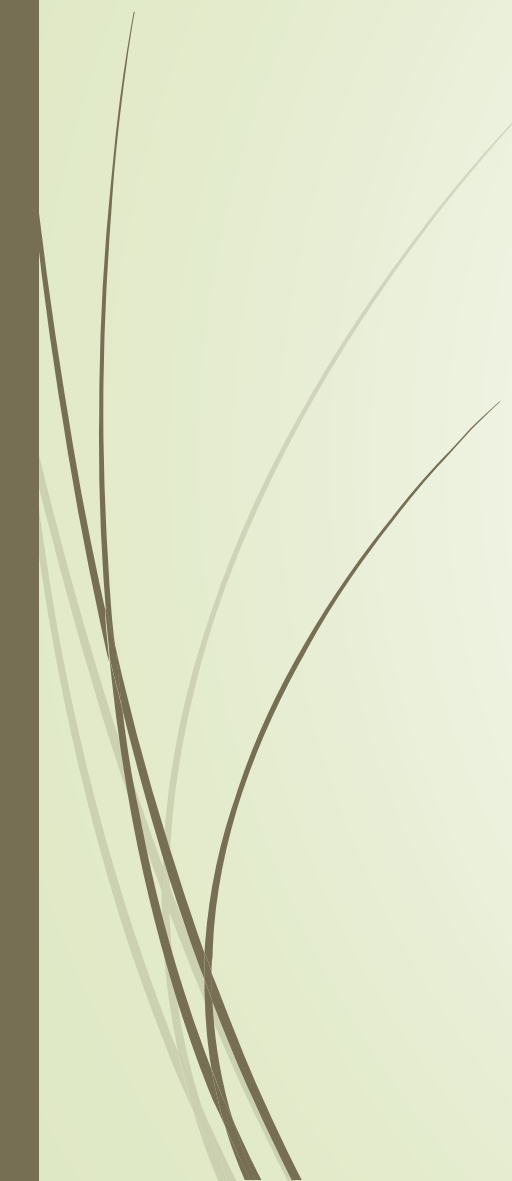
State Laboratory for Public Health

- 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
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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

Summaries in the Guide

Interpreting GI Pathogen Panels

Bacteria	
<i>Campylobacter (jejuni, coli and upsaliensis)</i>	Reportable
<i>Clostridium difficile</i> (toxin A/B)	Not Reportable
<i>Plesiomonas shigelloides</i>	Not Reportable
<i>Salmonella</i>	Reportable
<i>Yersinia enterocolitica</i>	Not Reportable
<i>Vibrio (parahaemolyticus, vulnificus and cholerae)</i>	Reportable
<i>Vibrio cholerae</i>	Reportable
Diarrheagenic E. coli/Shigella	
Enteraggregative <i>E. coli</i> (EAEC)	Not Reportable
Enteropathogenic <i>E. coli</i> (EPEC)	Not Reportable
Enterotoxigenic <i>E. coli</i> (ETEC) <i>lt/st</i>	Not Reportable
Shiga-like toxin-producing <i>E. coli</i> (STEC) <i>stx1/stx2</i>	Reportable
<i>E. coli</i> O157	Reportable
<i>Shigella</i> /Enteroinvasive <i>E. coli</i> (EIEC)	Reportable (this is <i>Shigella</i>)
Parasites	
<i>Cryptosporidium</i>	Reportable
<i>Cyclospora cayetanensis</i>	Reportable
<i>Entamoeba histolytica</i>	Not Reportable
<i>Giardia lamblia</i>	Not Reportable
Viruses	
Adenovirus F 40/41	Not Reportable
Astrovirus	Not Reportable
Norovirus GI/GII	Not Reportable
Rotavirus A	Not Reportable
Sapovirus (I, II, IV and V)	Not Reportable

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

Summary of Reportable Enteric Pathogens in North Carolina

Organism	Common Name of Illness	Onset Time After Ingestion	Signs & Symptoms	Duration	Food Sources	Diagnostic Test
Campylobacter jejuni	Campylobacteriosis	2-5 days	(Bloody) diarrhea, cramps, fever, vomiting	2-10 days	Raw and undercooked poultry, raw milk, contaminated water	Culture CIDTs (PCR, IFA, & EIA)
Ciguatera toxin	Ciguatera poisoning (marine toxin)	Minutes to 30 hours	Nausea, vomiting, diarrhea, cramps, excessive sweating, headache, muscle aches, weakness, itching, dizziness, burning ("pins and needles"), reversal of temperature sensation in mouth, nightmares, or hallucinations	1-4 weeks	Contaminated tropical reef fish (barracuda, grouper, sea bass, snapper, mullet)	Generally not applicable
Clostridium botulinum	Botulism	12-72 hours	Vomiting, diarrhea, blurred vision, double vision, difficulty swallowing, muscle weakness; respiratory failure and death	Variable	Improperly canned foods (home canned vegetables, fermented fish, baked potatoes in aluminum foil)	PCR, ELISA, MS, mouse bioassay
Clostridium perfringens	Perfringens food poisoning	8-16 hours	Intense abdominal cramps, watery diarrhea	Usually 24 hours	Meats, poultry, gravy, dried or precooked foods, time and/or temperature-abused foods	Culture, PCR,
Cryptosporidium	Intestinal cryptosporidiosis	2-10 days	(Water) diarrhea, stomach cramps, upset stomach, slight fever	3 weeks; May be remitting and relapsing over weeks to months	Uncooked food or food contaminated by an ill handler after cooking; contaminated drinking water; contact with infected animal	Biopsy, oocysts in stool, staining, microscopy, PCR, DFA, rapid card, EIA

PCR Vs Culture

RESULTS	
Gastrointestinal Pathogen Panel (fecal)	
Client Accession ID: 3297700	
Performed at: Viscor-IBT Laboratories - 1001 NW Technology Dr.	
Collected: 08/23/2016 18:57	
PATHOGEN NAME	RESULT
Campylobacter	Not Detected
Clostridium difficile Toxin A/B	Not Detected
Cryptosporidium	Not Detected
E. coli O157	Not Detected
Enterotoxigenic E. coli (ETEC)	Not Detected
Shiga Toxin-producing E. coli (STEC)	Not Detected
Giardia lamblia	Not Detected
Norovirus GI/GII	Not Detected
Rotavirus A	Not Detected
Salmonella	POSITIVE
Shigella	Not Detected

Reference value for all analytes: Not Detected

The results of this test should not be used as the sole basis for diagnosis, treatment, or other patient management decisions. xTAG(R) GPP positive results are presumptive and must be confirmed by FDA-cleared tests or other acceptable reference methods. Confirmed positive results do not rule out co-infection with other organisms that are not detected by this test, and may not be the sole or definitive cause of patient illness. Negative xTAG(R) Gastrointestinal Pathogen Panel results in the setting of clinical illness compatible with gastroenteritis may be due to infection by pathogens that are not detected by this test or non-infectious causes such as ulcerative colitis, irritable bowel syndrome, or Crohn's disease. xTAG GPP is not intended to monitor or guide treatment for C. difficile infections.

Polymerase Chain Reaction (PCR) Results

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

Unicode Name / Testcode Name	Test Results
CAMPYLOBACTER, CULTURE	Campylobacter species
CULTURE, CAMPYLOBACTER	Susceptibility testing not routinely performed on this isolate
Source: STOOL	Growth of

Campylobacter Culture (Isolation) Result

Note how specific result is (not a list of pathogens as in PCR) and mention of "susceptibility" and "isolate".

Note sample source and test

Individual Pathogen Descriptions

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 read-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

Laboratory Information

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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

Investigation Resources

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Case Definition:

http://epi.publichealth.nc.gov/cd/lhds/manuals/cd/casedefs/LISTERIOSIS_CD.pdf

Investigation Steps:

http://epi.publichealth.nc.gov/cd/lhds/manuals/cd/invest/LISTERIOSIS_LHD_STEPS.pdf

Additional Forms:

<http://www.cdc.gov/listeria/surveillance.html>



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



Registry ID _____ State/Territory ID _____

Approved
OMB No. 0920-1101
Exp. 08/31/2016

Pregnancy and Zika Virus Surveillance—Maternal Health History Form

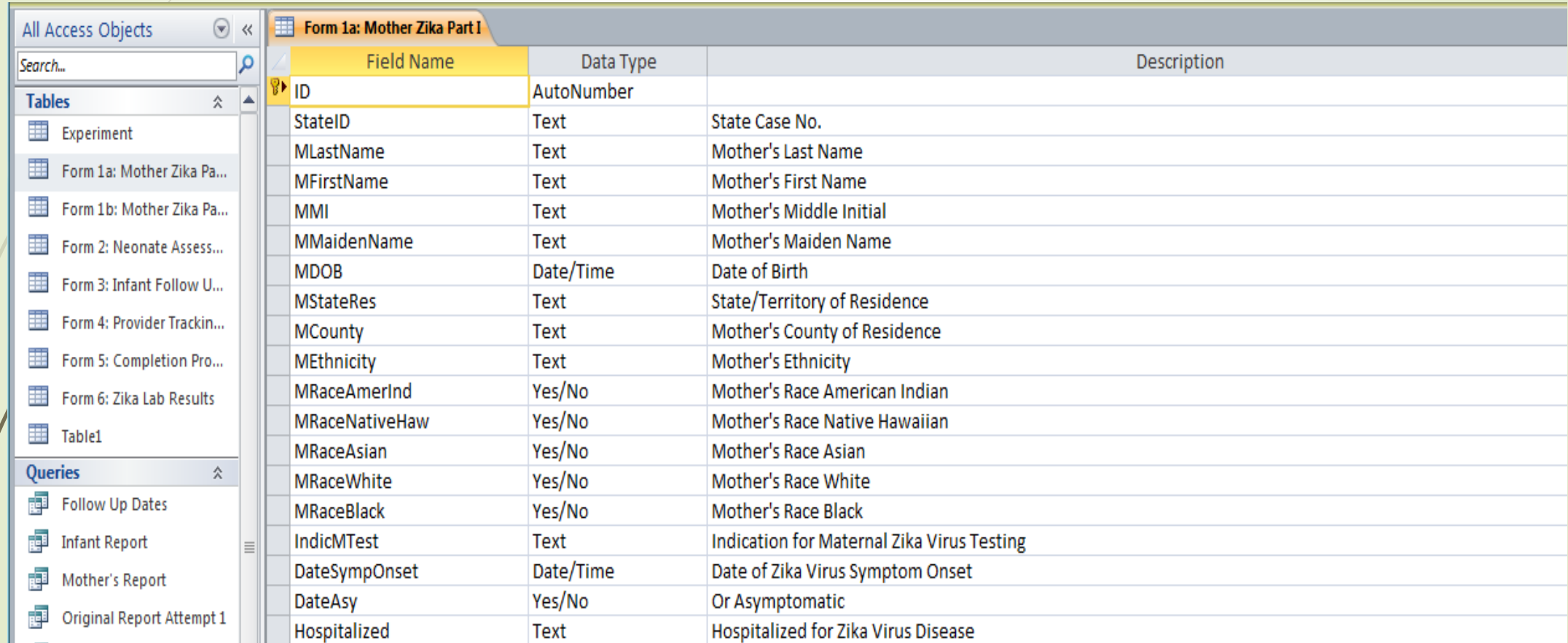
These data are considered confidential and will be stored in a secure database at the Centers for Disease Control and Prevention.

Please return completed form via SAMS or secure FTP—request access from ZIKApregnancy@cdc.gov

The form can also be sent by encrypted email to this address or by secure fax to 404-718-1013 or 404-718-2200

MHH.1. State/Territory ID: _____	MHH.2. Maternal Age at Diagnosis: _____	MHH.3. State/Territory reporting: _____ MHH.4. County reporting: _____
MHH.5. Ethnicity: <input type="checkbox"/> Hispanic or Latino <input type="checkbox"/> Not Hispanic or Latino		
MHH.6. Race (check all that apply): <input type="checkbox"/> American Indian or Alaskan Native <input type="checkbox"/> Asian <input type="checkbox"/> Black or African-American <input type="checkbox"/> Native Hawaiian or other Pacific Islander <input type="checkbox"/> White		
MHH.7. Indication for maternal Zika virus testing: <input type="checkbox"/> Exposure history only, no known fetal abnormalities <input type="checkbox"/> Exposure history and fetal abnormalities		
MHH.8. Date of Zika virus symptom onset: ____/____/____ OR MHH.9. <input type="checkbox"/> Asymptomatic		
MHH.10. If symptomatic, gestational age at onset: _____(weeks, days)		
MHH.11. If gestational age or date not known, trimester of symptom onset _____ (1 st , 2 nd , 3 rd)		
MHH.12. Symptoms of mother's Zika virus disease: (check all that apply) <input type="checkbox"/> Fever(if measured) ____°F or ____°C <input type="checkbox"/> Arthralgia <input type="checkbox"/> Conjunctivitis <input type="checkbox"/> Rash <input type="checkbox"/> Other clinical presentation _____		
MHH.13. If rash, check all that apply <input type="checkbox"/> Maculopapular <input type="checkbox"/> Petechial <input type="checkbox"/> Purpuric <input type="checkbox"/> Pruritic Describe rash distribution _____		
MHH.14. Hospitalized for Zika virus disease <input type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> Unknown		
MHH.15. Maternal Death <input type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> Unknown If yes, describe _____		
MHH.16. If yes, date of death ____/____/____		

Zika Access Example



Field Name	Data Type	Description
ID	AutoNumber	
StateID	Text	State Case No.
MLastName	Text	Mother's Last Name
MFirstName	Text	Mother's First Name
MMI	Text	Mother's Middle Initial
MMaidenName	Text	Mother's Maiden Name
MDOB	Date/Time	Date of Birth
MStateRes	Text	State/Territory of Residence
MCounty	Text	Mother's County of Residence
METHnicity	Text	Mother's Ethnicity
MRaceAmerInd	Yes/No	Mother's Race American Indian
MRaceNativeHaw	Yes/No	Mother's Race Native Hawaiian
MRaceAsian	Yes/No	Mother's Race Asian
MRaceWhite	Yes/No	Mother's Race White
MRaceBlack	Yes/No	Mother's Race Black
IndicMTest	Text	Indication for Maternal Zika Virus Testing
DateSympOnset	Date/Time	Date of Zika Virus Symptom Onset
DateAsy	Yes/No	Or Asymptomatic
Hospitalized	Text	Hospitalized for Zika Virus Disease



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

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- CDC (2017). *Parasites – Naegleria fowleri – Primary Amebic Meningoencephalitis (PAM)*. Centers for Disease Control and Prevention. Web. <<https://www.cdc.gov/parasites/naegleria/index.html>>
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- White, L.F., & Pagano, M. (2010). *Reporting errors in infectious disease outbreaks, with an application to Pandemic Influenza A/H1N1*. *Epidemiologic Perspectives & Innovations* 7(12),



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, FlickrRiver

Questions?

