Socioeconomic Disparities and Late-Onset Group B *Streptococcus*, Tennessee, 2010–2014

Cassandra Jones
August 3rd, 2016
Outline

• Field Experience
• 2015 Database Audit
  – Background
  – Methods
  – Results
  – Discussion
• Late onset group B Streptococcus
  – Background
  – Methods
  – Results
  – Discussion
• Competencies
Field Experience

• Tennessee Emerging Infections Program
  – Vanderbilt University Medical Center
    • Dr. William Schaffner
  – Tennessee Department of Health
    • Dr. Tim Jones
Emerging Infections Program

• Addressing Emerging Infectious Disease Threats: A Preventative Strategy for The United States, Executive Summary

• Founded in 1995

• Four Goals:

  – Detect, investigate, and monitor emerging pathogens, the diseases they cause, and factors influencing their emergence
  – Integrate both laboratory science and epidemiology to optimize public health practice
  – Enhance communication of public health information about emerging diseases and ensure prompt implementation of prevention strategies
  – Strengthen local, state, and federal public health infrastructures to support surveillance and implement prevention and control programs
Emerging Infections Program

History of the Emerging Infections Program

1995: Emerging Infections Program Network initiated with four states: California, Connecticut, Minnesota, Oregon


1997: Georgia, Maryland, and New York join the EIP

1999: Tennessee joins the EIP

2000: Colorado joins the EIP

2002/2003: New Mexico joins the EIP

2015: Emerging Infectious Diseases publishes a special issue on the Emerging Infections Program for its 20th anniversary.
Emerging Infections Program

• Main Programs
  – Active Bacterial Core surveillance (ABCs)
  – FoodNet
  – Influenza
  – Healthcare Associated Infections – Community Interface (HAIC)

• Minor Programs/ Projects
  – TickNET
  – HPV IMPACT
TN Emerging Infections Program

TDH
- FoodNet
- TickNet

VUMC
- ABCs
- HAIC
- FluSurv
- HPV IMPACT
• Active Bacterial Core surveillance (ABCs)
  – Collects surveillance data on invasive pathogens
    • *Nesseria meningitides*, *Streptococcus pneumoniae*,
      group A and B *Streptococcus*, *Listeria monocytogenes*,
      and *Haemophilus influenzae*
  – Largest section of the EIP
    • Total population over EIP: 42 million
    • Total population in TN: 3.95 million
• Flu–Surv Net
  – Collects surveillance on Influenza hospitalizations
  – TN catchment area:
    • Eight middle Tennessee counties
    • Encompasses > 1.6 million people
  – Submits data to the CDC for FluView Report
• HPV– IMPACT
  – Evaluates the impact of the HPV vaccination program and HPV vaccine efficacies
  – Limited to Davidson County
  – Surveillance on CIN2+ events in women
Internship Activities

• Attended meetings at TDH
  – Weekly Surveillance Meeting
  – Monthly meeting with field surveillance

• Assisted in extracting information from medical records for Case Report Forms (HPV, ABCs)

• Edited and reviewed the 2017 EIP grant application for VUMC sections
  – ABCs, Candidemia, Flu, HPV
Pneumococcal Carriage Study

- 4/10 EIP sites
- Objectives:\n  - Define Prevalence and serotype distribution of *S. pneumoniae* in adults \( \geq 65 \) prior to widespread use of PCV-13
  - Assess risk factors for colonization
  - Provide baseline data to assess the impact of the new ACIP recommendation on carriage rates in the same patient population through later surveys
- Cross sectional study that involved naso– and oropharyngeal swabs
- Assisted in enrolling patients prior to being swabbed by the nurse
Internship Activities

• Flu-Surv Net
  – CDC site visit
  – Society of Clinical Research Associates
    • Completed poster and abstract for annual meeting in October
Minor Project–
2015 ABCs Database Audit
Under the current grant cycle, the CDC does not require the EIP to perform audits.

Starting in 2017, each site will be required to perform audits on each database (ABCs, HPV, HAIC, etc.).

This year, the ABCs database was housed in REDCap, previous years were in Access.

- REDCap is a secure web application created by Vanderbilt for building and managing online surveys and databases.¹⁴
Objectives

• Create a database to house future audit information that can be merged with current database
• Complete a 10% audit of the 2015 ABCs database
• Assess the program’s data entry protocol and highlight areas that need revisions or reeducation
Methods – Database

• Utilized REDCap to create a database to house the ABCs audit information
  – Can be merged with current and future ABCs databases

• Can enter up to 10 discrepancies per CRF
  – Two types of errors
• Data Entry Error
  – An error in which an item is entered into the electronic database incorrectly
    • Spelling errors, checking incorrect boxes, correcting errors on a form without updating database

• Data Omission Error
  – An error in which an element of the hard copy CRF is not entered into the database

• Comments
• Section for data entry manager includes:
  – A place to answer if the error was corrected
  – Date of correction
  – Initials
  – Comments on correction
### Error/Correction log

**State ID:** TNK0000

<table>
<thead>
<tr>
<th>State ID</th>
<th>TNK0000</th>
</tr>
</thead>
</table>

#### Case Year

- **Case Year:** 2015

**Has the case been audited?**
- Yes
- No

**Was there an error?**
- Yes
- No

### Error 1

#### Nature of Error 1

- Omitted Error
- Data Entry Error

**Comments on Error 1**

**Was Error 1 corrected?**
- Yes
- No

**Date of Correction**

**Editor's Initials**

**Comments on Correction**
Methods – Audit

• Random 10% of cases was pulled using SAS 9.4 from the 2015 database
• Errors were marked on CRF using post–it flags
• Question error was on and what the discrepancy was were annotated in the ‘Comments on Error’ box
• 129 Case Report Forms were audited
• All contained at least one error

<table>
<thead>
<tr>
<th>Number of Errors</th>
<th>Omitted Errors</th>
<th>Entry Errors</th>
<th>Total</th>
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<td>129</td>
</tr>
<tr>
<td>2</td>
<td>54</td>
<td>63</td>
<td>117</td>
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<td>3</td>
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<td>10</td>
<td>82</td>
</tr>
<tr>
<td>6</td>
<td>52</td>
<td>8</td>
<td>60</td>
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<tr>
<td>7</td>
<td>32</td>
<td>2</td>
<td>34</td>
</tr>
<tr>
<td>8</td>
<td>15</td>
<td>1</td>
<td>16</td>
</tr>
<tr>
<td>9</td>
<td>11</td>
<td>1</td>
<td>12</td>
</tr>
<tr>
<td>10</td>
<td>7</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>Total</td>
<td>458</td>
<td>202</td>
<td>660</td>
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</tbody>
</table>

Average/CRF: 3.55, 1.57, 5.12
Results

- There were sections of the CRF that were routinely flagged

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<tr>
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<td>37</td>
<td>28.7</td>
</tr>
<tr>
<td>Underlying Conditions</td>
<td>33</td>
<td>25.6</td>
</tr>
<tr>
<td>Submitted By</td>
<td>81</td>
<td>62.8</td>
</tr>
<tr>
<td>Date</td>
<td>85</td>
<td>65.9</td>
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Middle Initial Omitted

| Conditions          | 93     | 25.6|
| Submitted By        | 81     | 62.8|
| Date                | 85     | 65.9|
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10. SEX:
1 [X] Male
2 [ ] Female

24a. At time of first positive culture, patient was:
1 [ ] Pregnant
2 [ ] Postpartum
3 [X] Neither
9 [ ] Unknown
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Submitted By: __________________________  Phone No.: (___) ___________ Date: ____/___/____
Physician’s Name: __________________________

Phone No.: (___) __________________________
• Easy to use interface
  – Decent reporting

• Needs new error type
  – Blank CRF field

• Needed drop down menu for Question Number
  – Added; needs to be refined
Discussion

• Audit
  – Met with Data Entry Manager and Lead SO
    • CDC needs vs. Site needs
    • Standardization and reeducation on parts of the CRF for data manager and SOs
      – Hospital ID codes
      – Bacteremia without focus
      – Pregnancy status for Males
  – Fully paperless in the future
    • If information isn’t entered into electronic database, then it is lost
Socioeconomic Disparities and Late Onset Group B Streptococcus, Tennessee, 2010–2014
Late Onset Group B *Streptococcus*

- Analysis of Tennessee’s late onset group B *Streptococcus* (GBS) data from 2010–2014

- Provide an in depth look into raw data as a pilot study for future analyses
Background

• GBS emerged as the leading cause of neonatal sepsis in the 1970’s

• *Streptococcus agalactiae* is a gram positive bacterium that inhabits the GI tract
  – Secondary colonization site in the urogenital tract

• Causes invasive disease in infants, pregnant or post partum women, and the elderly

• Highest incidence is in neonates under 3 months of age
Two classifications in Neonates

- Early Onset (EO): Less than 7 days of age
- Late Onset (LO): 7–89 days of age

Early onset is a result of vertical transmission

Late onset is caused by environmental sources

Infant infection can cause:

- Primarily: Sepsis, pneumonia, and meningitis
  - Meningitis can result in long term sequelae
- Less: focal infection including osteomyelitis, septic arthritis, and cellulitis
Background

Early Onset Risk Factors\textsuperscript{5,6}

- Maternal colonization with GBS in the urogenital tract
- Prolonged rupture of membrane
- Preterm delivery
- GBS bacteriuria during pregnancy
- Birth of a previous child with GBS
- Maternal chorioamnionitis
- Young maternal age
- Black race
- Hispanic Ethnicity
- Low levels of GBS antigen specific antibodies

Late Onset Risk Factors\textsuperscript{7}

- Male
- Black Race
- Maternal Colonization with GBS
- Having a twin with LO GBS
- Extreme Prematurity
• Intrapartum Prophylaxis (IPP) with penicillin best prevention method for EO disease and maternal illness\textsuperscript{7}

• The CDC created guidelines for the identification of candidates to be treated with IPP:
  – 1996– guidelines based on the 1992 recommendations from the American Academy of Pediatrics (AAP) and the American College of Obstetricians and Gynecologists (ACOG)\textsuperscript{8}
  – 2002– Unified universal screening\textsuperscript{9}
  – 2010– Current guidelines\textsuperscript{10}
• Current Incidence (2014)\textsuperscript{11}
  – Early Onset: 0.25/1000 live births
  – Late Onset: 0.28/1000 live births
• Proportion of LO cases has risen from 25% to 50%
Objectives

- Clean and summarize raw LO GBS data
- Decide what risk factors to consider for analysis
- Evaluate data to assess risk factors at individual- and neighborhood level
- Serve as a pilot for a larger, more in depth study of late onset GBS in Tennessee and other EIP locations
Methods – Data Collection

• GBS is collected under ABCs
  – Encompasses 20 counties and comprised of 3.95 million people (60% of total population)
Case ascertainment is active-, lab-, and population based

Case Definition
- Isolation of GBS from a normally sterile site
- Special Circumstances
  - Isolation from placenta and/or amniotic fluid with fetal demise
- Resident within catchment area at the time of positive culture

Methods – Data Collection

- Receive reports
  - From Hospital Labs, Diagnostic Labs, audits and Infection Preventionist

- Meet Case Definition?

- Medical Chart Review to complete CRF

- Neonatal Expanded Form
### Maternal Information

11. Maternal admission date & time: ______/_____/____/______

12. Maternal age at delivery (years): ______

13. Maternal blood type: A(1) B(2) AB(3) O(4)

14. Did mother have a prior history of preeclampsia? Yes (1) No (0)

15. Was there a previous maternal history of anaphylaxis noted? Yes (1) No (0)

16. Date & time of membrane rupture: ______/_____/____/______

17. Was duration of membrane rupture greater than or equal to 18 hours? Yes (1) No (0) Unknown (9)

18. If membranes ruptured at less than 37 weeks, did membranes rupture before onset of labor? Yes (1) No (0) Unknown (9)

19. Type of delivery:
   - Vaginal (1)
   - Vaginal after previous C-section (1)
   - Emergency C-section (1)
   - Repeat C-section (1)
   - Forceps (1)
   - Vacuum (1)
   - Unknown (9)

20. Intrapartum fever (T > 100.4 F or 38.0 C): Yes (1) No (0) Unknown (9)

21. Were antibiotics given to the mother intrapartum? Yes (1) No (0) Unknown (9)

### Maternal Antimicrobial Use

#### Antimicrobial 1
- Drug: ______
- Start date: ______/_____/____/______
- Stop date: ______/_____/____/______
- Dose administered: ______

#### Antimicrobial 2
- Drug: ______
- Start date: ______/_____/____/______
- Stop date: ______/_____/____/______
- Dose administered: ______

#### Antimicrobial 3
- Drug: ______
- Start date: ______/_____/____/______
- Stop date: ______/_____/____/______
- Dose administered: ______

#### Antimicrobial 4
- Drug: ______
- Start date: ______/_____/____/______
- Stop date: ______/_____/____/______
- Dose administered: ______

#### Antimicrobial 5
- Drug: ______
- Start date: ______/_____/____/______
- Stop date: ______/_____/____/______
- Dose administered: ______

#### Antimicrobial 6
- Drug: ______
- Start date: ______/_____/____/______
- Stop date: ______/_____/____/______
- Dose administered: ______

#### Antimicrobial 7
- Drug: ______
- Start date: ______/_____/____/______
- Stop date: ______/_____/____/______
- Dose administered: ______

#### Antimicrobial 8
- Drug: ______
- Start date: ______/_____/____/______
- Stop date: ______/_____/____/______
- Dose administered: ______

#### Antimicrobial 9
- Drug: ______
- Start date: ______/_____/____/______
- Stop date: ______/_____/____/______
- Dose administered: ______

#### Antimicrobial 10
- Drug: ______
- Start date: ______/_____/____/______
- Stop date: ______/_____/____/______
- Dose administered: ______

#### Antimicrobial 11
- Drug: ______
- Start date: ______/_____/____/______
- Stop date: ______/_____/____/______
- Dose administered: ______

#### Antimicrobial 12
- Drug: ______
- Start date: ______/_____/____/______
- Stop date: ______/_____/____/______
- Dose administered: ______

#### Antimicrobial 13
- Drug: ______
- Start date: ______/_____/____/______
- Stop date: ______/_____/____/______
- Dose administered: ______

#### Antimicrobial 14
- Drug: ______
- Start date: ______/_____/____/______
- Stop date: ______/_____/____/______
- Dose administered: ______

#### Antimicrobial 15
- Drug: ______
- Start date: ______/_____/____/______
- Stop date: ______/_____/____/______
- Dose administered: ______

#### Antimicrobial 16
- Drug: ______
- Start date: ______/_____/____/______
- Stop date: ______/_____/____/______
- Dose administered: ______

#### Antimicrobial 17
- Drug: ______
- Start date: ______/_____/____/______
- Stop date: ______/_____/____/______
- Dose administered: ______

#### Antimicrobial 18
- Drug: ______
- Start date: ______/_____/____/______
- Stop date: ______/_____/____/______
- Dose administered: ______

#### Antimicrobial 19
- Drug: ______
- Start date: ______/_____/____/______
- Stop date: ______/_____/____/______
- Dose administered: ______

#### Antimicrobial 20
- Drug: ______
- Start date: ______/_____/____/______
- Stop date: ______/_____/____/______
- Dose administered: ______

#### Antimicrobial 21
- Drug: ______
- Start date: ______/_____/____/______
- Stop date: ______/_____/____/______
- Dose administered: ______

#### Antimicrobial 22
- Drug: ______
- Start date: ______/_____/____/______
- Stop date: ______/_____/____/______
- Dose administered: ______

#### Antimicrobial 23
- Drug: ______
- Start date: ______/_____/____/______
- Stop date: ______/_____/____/______
- Dose administered: ______
22. Interval between receipt of 1st antibiotic and delivery: _______ (hours) _______ (minutes) _______ (days)*
   *Day variable should only be completed if the number of hours ≥ 24

23. What was the reason for administration of intrapartum antibiotics? (Check all that apply)
   - GBS prophylaxis (1)
   - Prolonged latency (1)
   - Mitr valve prolapse prophylaxis (1)
   - Suspected amnionitis (1)
   - C-sect prophylaxis (1)
   - Other (1)
   - Unknown (1)

24. Did mother have chorioamnionitis or suspected chorioamnionitis?
   - Yes (1)
   - No (0)

**Questions 25–33 should only be completed for early and late-onset GBS cases**

25. Did mother receive prenatal care?
   - Yes (1)
   - No (0)
   - Unknown (9)

26. Please record the following: the total number of prenatal visits AND the first and last visit dates to the prenatal care as recorded in the labor and delivery chart
   - No. of visits ________
   - First visit: _______ month _______ day _______ year (6 digits)
   - Last visit: _______ month _______ day _______ year (6 digits)
   - Unknown (1)

27. Estimated gestational age (EGA) at last documented prenatal visit _______ (weeks)

28. GBS bacteriuria during this pregnancy?
   - Yes (1)
   - No (0)
   - Unknown (9)

   IF YES, what order of magnitude was the colony count?
   - <10,000 (2)
   - 10,000–25,000 (3)
   - 25,000–50,000 (4)
   - 50,000–75,000 (5)
   - 75,000–100,000 (6)
   - 100,000+ (7)
   - Unknown (9)

29. Previous infant with invasive GBS disease?
   - Yes (1)
   - No (0)
   - Unknown (9)

30. Previous pregnancy with GBS colonized?
   - Yes (1)
   - No (0)
   - Unknown (9)

31a. Was maternal group B strep colonization screened for BEFORE admission (in prenatal care)?
   - Yes (1)
   - No (0)
   - Unknown (9)

   IF YES, list dates, test type, and test results below:
   - Test date: ______
   - Test type: ______
   - Test result: ______

31b. If the most recent test was GBS positive was antimicrobial susceptibility performed AFTER admission?
   - Yes (1)
   - No (0)
   - Unknown (9)

   IF YES, was the isolate resistant to clindamycin?
   - Yes (1)
   - No (0)
   - Unknown (9)

   IF YES, was the isolate resistant to erythromycin?
   - Yes (1)
   - No (0)
   - Unknown (9)

32a. If the most recent test was GBS positive, was antimicrobial susceptibility performed AFTER admission?
   - Yes (1)
   - No (0)
   - Unknown (9)

   IF YES, was the isolate resistant to clindamycin?
   - Yes (1)
   - No (0)
   - Unknown (9)

   IF YES, was the isolate resistant to erythromycin?
   - Yes (1)
   - No (0)
   - Unknown (9)

33. Were GBS test results available to care givers at the time of delivery?
   - Yes (1)
   - No (0)
   - Unknown (9)

34. COMMENTS: ________

35. National Infection Expansion 3.0 Form Tracking Status:
   - Complete (1)
   - Partial (2)
   - Chart Unavailable (3)
   - Edited & Corrected (4)
Methods – Data Cleaning

- 2010-2014 ABCs Cases (N=5312)
- ABCs Cases with GBS (N=1530)
- Late Onset GBS (N=112)
- Cases with Matching Neonatal GBS forms, (N=111)
• Geocoding
  – Needed for neighborhood level analyses
  – According to the mother’s residence at time of culture
  – Clean addresses and assign to a Census Tract using ArcMap
  – Merge with American Community Survey data
Census Tract

- Small, relatively permanent statistical subdivision of a county or equivalent entity
- Populations ranges from 1,200–8,000 people, optimum 4,000
- Harvard Geocoding Project recommends the CT poverty measures the most apt for monitoring socioeconomic inequalities\textsuperscript{12,13}
Methods– Geocoding

• ACS
  – US Census Bureau’s American Census Survey
  – Provides annual information about the nation and communities, aggregated over 5 years (2010–2014)
  – Extracted socioeconomic indicators at such as percent living below poverty, percent of population educated, etc.
  – Merge by CT

Case ➔ Census Tract ➔ Breakdown of SES factors/ population within CT
Calculated crude average incidence rates (IR) of LO GBS in Tennessee from 2010-2014

Individual Level

- Gender, Race
- Denominator: live birth data

Neighborhood Level

- Population density, % below poverty level, % college educated, % employed, % with female head of household
- Denominator: population less than 5 years of age in census tract

Calculated Rate Ratio and Rate Difference

Age standardization was not possible due to small age range
Methods – Data Analysis

- **Incidence Rate (IR)**
  - \# new cases / population at risk in a given time

- **Incidence Rate Ratio (RR)**
  - Incidence Rate of disease in exposed group / Ratio of disease in unexposed (reference) group

- **Rate Difference (RD)**
  - Rate of disease in exposed group – Rate of disease in unexposed (reference) group
Results

Gestational Age at Birth

- Preterm: 46
- Early Term: 21
- Full Term: 41
- Late Term: 3

Birth Weight

- Low: 30
- Normal-High: 33

- Weight in grams:
  - 500-1499: 14
  - 1500-2499: 14
  - 2500-3499: 8
  - 3500-4499: 1

Delivery Type

- Vaginal: 64
- Other: 47

Breast Fed

- Yes: 50
- No: 42
- Not Noted: 11
### Results

#### Insurance Type

<table>
<thead>
<tr>
<th>Insurance</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medicaid</td>
<td>63.1%</td>
</tr>
<tr>
<td>Private</td>
<td>24.3%</td>
</tr>
<tr>
<td>Other</td>
<td>12.6%</td>
</tr>
</tbody>
</table>

#### Mother's Age at Birth

<table>
<thead>
<tr>
<th>Age Range</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>16-20</td>
<td>37%</td>
</tr>
<tr>
<td>21-25</td>
<td>22%</td>
</tr>
<tr>
<td>26-30</td>
<td>22%</td>
</tr>
<tr>
<td>31-35</td>
<td>20%</td>
</tr>
<tr>
<td>36-41</td>
<td>9%</td>
</tr>
</tbody>
</table>

#### Race

<table>
<thead>
<tr>
<th>Race</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black</td>
<td>63%</td>
</tr>
<tr>
<td>White</td>
<td>42%</td>
</tr>
<tr>
<td>Other</td>
<td>6%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Insurance</th>
<th>Mother's Age</th>
<th>Race</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medicaid</td>
<td>16-25</td>
<td>Black</td>
<td>56.6%</td>
</tr>
<tr>
<td>Private</td>
<td>26-35</td>
<td>White</td>
<td>37.8%</td>
</tr>
<tr>
<td>Other</td>
<td>36+</td>
<td>Other</td>
<td>5.6%</td>
</tr>
</tbody>
</table>
### Cases Per County

<table>
<thead>
<tr>
<th>County</th>
<th>Cases</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anderson</td>
<td>1</td>
<td>0.9</td>
</tr>
<tr>
<td>Blount</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Cheatham</td>
<td>2</td>
<td>1.8</td>
</tr>
<tr>
<td>Davidson</td>
<td>21</td>
<td>18.9</td>
</tr>
<tr>
<td>Dickson</td>
<td>1</td>
<td>0.9</td>
</tr>
<tr>
<td>Grainger</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Hamilton</td>
<td>8</td>
<td>7.2</td>
</tr>
<tr>
<td>Jefferson</td>
<td>3</td>
<td>2.7</td>
</tr>
<tr>
<td>Knox</td>
<td>10</td>
<td>9.0</td>
</tr>
<tr>
<td>Loudon</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Madison</td>
<td>4</td>
<td>3.6</td>
</tr>
<tr>
<td>Roane</td>
<td>1</td>
<td>0.9</td>
</tr>
<tr>
<td>Robertson</td>
<td>2</td>
<td>1.8</td>
</tr>
<tr>
<td>Rutherford</td>
<td>5</td>
<td>4.5</td>
</tr>
<tr>
<td>Sevier</td>
<td>1</td>
<td>0.9</td>
</tr>
<tr>
<td>Shelby</td>
<td>45</td>
<td>40.5</td>
</tr>
<tr>
<td>Sumner</td>
<td>3</td>
<td>2.7</td>
</tr>
<tr>
<td>Union</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Williamson</td>
<td>4</td>
<td>3.6</td>
</tr>
<tr>
<td>Wilson</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>111</strong></td>
<td><strong>100.0</strong></td>
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</table>

### Cases Per Year

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<tr>
<th>Year</th>
<th>Cases</th>
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<tr>
<td>2010</td>
<td>24</td>
<td>21.6</td>
</tr>
<tr>
<td>2011</td>
<td>21</td>
<td>18.9</td>
</tr>
<tr>
<td>2012</td>
<td>25</td>
<td>22.5</td>
</tr>
<tr>
<td>2013</td>
<td>19</td>
<td>17.1</td>
</tr>
<tr>
<td>2014</td>
<td>22</td>
<td>19.8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>111</strong></td>
<td><strong>100.0</strong></td>
</tr>
<tr>
<td>Sex</td>
<td>Cases, no. (%) N=111</td>
<td>Incidence* (95% CI)</td>
</tr>
<tr>
<td>-----</td>
<td>----------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>M</td>
<td>56 (50.5)</td>
<td>4.34 (3.2- 5.65)</td>
</tr>
<tr>
<td>F</td>
<td>55 (49.6)</td>
<td>4.47 (3.73- 5.31)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Race</th>
<th>Cases, no. (%) N=111</th>
<th>Incidence* (95% CI)</th>
<th>Rate Ratio (95% CI)</th>
<th>Rate Diff. (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>42 (37.8)</td>
<td>2.45 (1.63- 3.27)</td>
<td>Ref.</td>
<td>Ref.</td>
</tr>
<tr>
<td>Black</td>
<td>63 (57.8)</td>
<td>8.82 (7.38- 10.27)</td>
<td>3.64 (2.47- 5.38)</td>
<td>6.37 (4.71- 8.03)</td>
</tr>
<tr>
<td>Other</td>
<td>6 (5.4)</td>
<td>6.58 (2.5- 10.67)</td>
<td>2.69 (1.14- 6.28)</td>
<td>4.13 (-0.05- 8.31)</td>
</tr>
</tbody>
</table>

* Per 10,000 population
## Results – Individual Level

<table>
<thead>
<tr>
<th>Cases, no. (%)</th>
<th>Incidence* (95% CI)</th>
<th>Rate Ratio (95% CI)</th>
<th>Rate Diff. (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>N=111</strong></td>
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</tr>
<tr>
<td><strong>Sex</strong></td>
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</tr>
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<tr>
<td></td>
<td></td>
<td></td>
<td>0.13 (-1.23- 1.36)</td>
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</tr>
</tbody>
</table>

* Per 10,000 population
## Results – Individual Level

<table>
<thead>
<tr>
<th></th>
<th>Cases, no. (%) N=111</th>
<th>Incidence* (95% CI)</th>
<th>Rate Ratio (95% CI)</th>
<th>Rate Diff. (95% CI)</th>
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<tbody>
<tr>
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<td>Ref.</td>
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<tr>
<td><strong>Race</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
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<td>2.45 (1.63 - 3.27)</td>
<td>Ref.</td>
<td>Ref.</td>
</tr>
<tr>
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<td>3.64 (2.47 - 5.38)</td>
<td>6.37 (4.71 - 8.03)</td>
</tr>
<tr>
<td>Other</td>
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<td>6.58 (2.5 - 10.67)</td>
<td>2.69 (1.14 - 6.28)</td>
<td>4.13 (-0.05 - 8.31)</td>
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</tbody>
</table>

* Per 10,000 population
<table>
<thead>
<tr>
<th>% Below Poverty</th>
<th>Cases, no. (%)</th>
<th>Incidence* (95% CI)</th>
<th>Rate Ratio (95% CI)</th>
<th>Rate Diff. (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;5.0</td>
<td>12 (11.0)</td>
<td>6.21 (1.79 - 10.64)</td>
<td>Ref.</td>
<td>Ref.</td>
</tr>
<tr>
<td>5.0-9.9</td>
<td>20 (18.4)</td>
<td>6.44 (3.80 - 9.08)</td>
<td>1.04 (0.51 - 2.12)</td>
<td>0.23 (-4.92 - 5.39)</td>
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<tr>
<td>10.0-19.9</td>
<td>22 (20.2)</td>
<td>5.99 (3.82 - 8.15)</td>
<td>0.96 (0.48 - 1.94)</td>
<td>-0.22 (-4.89 - 4.47)</td>
</tr>
<tr>
<td>≥20</td>
<td>55 (50.5)</td>
<td>6.96 (6.28 - 7.64)</td>
<td>1.12 (0.77 - 1.63)</td>
<td>0.75 (-4.17 - 5.67)</td>
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</tbody>
</table>

* per 10,000 population
<table>
<thead>
<tr>
<th>Pop. Density Person/sq.mi.</th>
<th>Cases, no. (%) N=109</th>
<th>Incidence* (95% CI)</th>
<th>Rate Ratio (95% CI)</th>
<th>Rate Diff. (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-&lt;200 Rural</td>
<td>39 (35.8)</td>
<td>6.85 (5.09- 8.60)</td>
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</tr>
<tr>
<td>200-699 Suburban</td>
<td>54 (49.5)</td>
<td>7.15 (5.21- 9.09)</td>
<td>1.04 (0.69- 1.57)</td>
<td>0.30 (-2.31- 2.92)</td>
</tr>
<tr>
<td>≥700 Urban</td>
<td>16 (14.7)</td>
<td>4.76 (0.7- 8.8)</td>
<td>0.70 (0.29- 1.24)</td>
<td>-2.09 (-6.51- 2.33)</td>
</tr>
</tbody>
</table>

* Per 10,000 population
Results – Neighborhood Level

<table>
<thead>
<tr>
<th>% of Population with a College Education</th>
<th>Cases, no. (%) N=109</th>
<th>Incidence* (95% CI)</th>
<th>Rate Ratio (95% CI)</th>
<th>Rate Diff. (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15.0-24.9</td>
<td>2 (1.8)</td>
<td>7.63 (0-16.8)</td>
<td>Ref.</td>
<td>Ref.</td>
</tr>
<tr>
<td>25.0-39.9</td>
<td>25 (22.9)</td>
<td>7.34 (4.93-9.74)</td>
<td>0.96 (0.23-4.05)</td>
<td>-0.29 (-9.77-9.19)</td>
</tr>
<tr>
<td>≥40.0</td>
<td>82 (75.2)</td>
<td>6.33 (5.63-7.04)</td>
<td>0.83 (0.56-1.33)</td>
<td>-1.3 (-10.50-7.90)</td>
</tr>
</tbody>
</table>

* Per 10,000 population
### Results - Neighborhood Level

#### % of Population Employed

<table>
<thead>
<tr>
<th>% Employed</th>
<th>Cases, no. (%)</th>
<th>Incidence* (95% CI)</th>
<th>Rate Ratio (95% CI)</th>
<th>Rate Diff. (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;50</td>
<td>75 (68.8)</td>
<td>6.93 (6.52 - 7.33)</td>
<td>Ref.</td>
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<tr>
<td>50.0 - 65.9</td>
<td>34 (31.2)</td>
<td>5.88 (3.18 - 8.58)</td>
<td>0.85 (0.57 - 1.27)</td>
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<tr>
<td>&gt;66</td>
<td>0 (0)</td>
<td>-</td>
<td>-</td>
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* Per 10,000 Population

* Cases, no. (N=109)
## Results – Neighborhood Level

### % Female Head of Household

<table>
<thead>
<tr>
<th>% Female Head of Household</th>
<th>Cases, no. (%)</th>
<th>Incidence* (95% CI)</th>
<th>Rate Ratio (95% CI)</th>
<th>Rate Diff. (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;20.0</td>
<td>21 (19.2)</td>
<td>5.96 (3.57 - 8.36)</td>
<td>Ref.</td>
<td>Ref.</td>
</tr>
<tr>
<td>20.0 - 39.9</td>
<td>34 (31.2)</td>
<td>6.95 (4.09 - 9.81)</td>
<td>1.17 (0.68 - 2.00)</td>
<td>0.99 (-2.74 - 4.72)</td>
</tr>
<tr>
<td>40.0 - 59.9</td>
<td>22 (20.2)</td>
<td>6.31 (4.72 - 7.90)</td>
<td>1.06 (0.57 - 1.88)</td>
<td>0.35 (-2.52 - 3.23)</td>
</tr>
<tr>
<td>≥60.0</td>
<td>32 (29.4)</td>
<td>6.91 (6.06 - 7.75)</td>
<td>1.16 (0.67 - 2.00)</td>
<td>0.95 (-1.59 - 3.49)</td>
</tr>
</tbody>
</table>

* Per 10,000 population
Discussion

• Black race as a risk factor was reflected in analysis
• Male gender as a risk factor was not reflected
• College education (75%) and low employment (68.8%)
• Sample size was not large enough to definitively define any neighborhood level risk factors
Limitations

• Abbreviated time period of 2010–2014
• Descriptive statistics instead of inferential
• Does not take into account interaction between variables
• Need for larger dataset
Future Directions

• Larger study encompassing all 10 EIP sites, 2010–Current

• Case–controlled study utilizing outpatient data
  – 4:1 control vs. case
  – Match on age, county

• Include same factors plus insurance type

• Logistic regression/ odds ratio
Core Competencies

- **Biostatistics**
  - Descriptive statistics
- **Epidemiology**
  - Measures of Association (IR, RR) and Effect (RD)
  - Collection and maintenance of data
- **Environmental Health**
  - HAIC
  - Environmental Factors of LO GBS (Breast feeding, Co–sleeping)
- **Social and Behavioral Public Health**
  - SES of LO GBS cases
- **Healthcare Administration**
  - TDH regional meetings
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References


