Shelter-based Meningococcal Disease Outbreak: Working together to vaccinate, treat, and investigate

Lena Cardoso, BA
Denise De Las Nueces, MD, MPH
April Donahue, RN
Barbara Giles, RN
Boston Health Care for the Homeless Program
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BHCHP: Delivering Care Since 1985

- Founded 30 years ago by the Robert Wood Johnson Foundation and Pew Charitable Trusts
- Maintains strong partnerships with the Boston medical community, homeless service organizations, and city and state government
- Provides care to more than 11,000 homeless men, women and children every year
Our Services

- Medical and nursing care
- Substance use and mental health services
- Oral health care
- HIV education and treatment
- Medical respite care
- Family case management services
- Street outreach
- Housing support outreach
Outreach-Based Services

- More than 50 direct care clinics at outreach sites throughout Boston, including most Boston-based shelters
- Integrated clinics at Massachusetts General Hospital
- Street Team
- Family Team
- Home visits for formerly homeless patients
Outline

- Background on Meningococcal Disease
- Outbreak
- Response
- Investigation
- Results
- Discussion
Meningococcal Disease

- Rare, vaccine-preventable disease
- Most common clinical presentations:
  - Meningitis, meningococcemia, pneumonia
- Signs and symptoms:
  - High fever, headache, stiff neck, confusion, rash
- 10-20% case-fatality ratio\(^1\)
- Up to 20% permanent sequelae\(^2\)
  - Cognitive deficits, hearing loss, or amputations

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Photo by D. Scott Smith, MD, taken at Stanford University Hospital (http://emedicine.Medscape.com/article/221473-clinical)

Slide courtesy of John O. Otshudiema, MD, MPH from the Center for Disease Control, Epidemiology Intelligence Service
Meningococcal Conjugate Vaccine and Recommendations

- Meningococcal conjugate vaccines
  - Protection is serogroup-specific
  - Conjugate vaccine introduced in 2005
    - Specific for 4 serogroups (A, C, W, Y) - MenACWY

- MenACWY routine recommendations:
  - Adolescents aged 11-18 years
  - All persons ≥ 2 months of age at increased risk including during outbreaks
Humans are only reservoir
- Asymptomatic nasopharyngeal carriage of the bacteria
- Spread through close contact
  - Respiratory or oral secretions
  - Ill or asymptomatic carriers
- Incubation period
  - Within 4 days after exposure, range 1-10 days
- Infectious period
  - 7 days before onset of disease until 24 hours after initiation of appropriate antibiotic therapy
Historic Risk Factors for Meningococcal Disease

- **Age**¹
  - Infants <5 years, adolescents and young adults 16–21 years, adults ≥65 years
- **Crowded living conditions**²,³
- **Certain medical conditions**
  - asplenia,⁶ HIV⁷,⁸
- **Recent upper respiratory infections**⁹
- **Certain behaviors**
  - Smoke exposure,¹⁰ >1 kissing partner¹¹

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3. Bruce MG, et al. JAMA.  


Slide courtesy of John O. Otshudiema, MD, MPH from the Center for Disease Control, Epidemiology Intelligence Service
Meningococcal Disease Outbreaks

- Outbreak definition
  - 3 cases of the same serogroup in <3 months;
  - Same community, affiliation or organization, but no close contact
  - Attack rate of 10 per 100,000
- Only ~2-5% of U.S. cases are outbreak related
- State/local health departments investigate cases and declare outbreaks
Recent Meningococcal Disease Outbreaks

- Most commonly occur in university setting
- Among men who have sex with men
- Outbreaks in other settings are rare
- One report of meningococcal disease among adults experiencing homelessness
  - Los Angeles County, 2011
Outbreak in Boston Homeless Shelters
Cases of Meningococcal Disease Among Adults Experiencing Homelessness  
Boston, 2016

Number of Cases

Jan-16

Feb-16

Mar-16

Month of Illness Onset

Serogroup C  
Deceased Case

Serogroup Y

Slide courtesy of John O. Otshudiema, MD, MPH from the Center for Disease Control, Epidemiology Intelligence Service
• Distribution of meningococcal disease cases among adults experiencing homelessness in Boston Metro Area, Massachusetts
Brief Break-Out Exercise

What would you do in response to a similar outbreak at your health centers?

What would be the key elements of your response?
BHCHP’s Response
Number of Cases

Jan-16: 2 (Serogroup C) 1 (Deceased Case)
Feb-16: 3
Mar-16: 5 (4 Serogroup C, 1 Deceased Case)

Initiation of Close Contact Investigation

Outbreak declared, Vaccination initiated

Month of Illness Onset

Serogroup C  Deceased Case
Serogroup Y
Massachusetts Department of Public Health (MDPH), Boston Public Health Commission (BPHC), and Boston Health Care for the Homeless Program (BHCHP):
- Performed contact investigations
- Developed education and awareness campaign
- Provided antibiotic prophylaxis to close contacts
- Initiated a mass vaccination campaign with MenACWY vaccine to adults experiencing homelessness and shelter staff in Boston
BHCHP clinical leadership notified by BPHC about case

BHCHP leadership contacted affected shelter and BHCHP clinicians at shelter clinic

BHCHP obtained bed roster to determine patient’s bed assignments during infectious period

Close contacts (defined as shelter clients who slept within 4-bed-perimeter of index patient for each case) identified
Shelter directors notified to help locate close contacts, to place alert at point of shelter entry, and to help direct close contacts to shelter clinic

Pop-up alert placed in BHCHP EMR

Pharmacy leadership contacted to secure needed supply of antibiotics for prophylaxis

Patients screened by shelter clinicians, prophylaxis and vaccination administered if asymptomatic, patients referred to ER if red flag sx present
Core clinical champions identified

Vaccine supply secured

Strategy to facilitate delivery of vaccine to patients developed
  Standing order authorizing RNs to administer vaccine without need for direct presence of MD/NP/PA
  Standardized screening form
Review of close contacts of meningococcal meningitis

Name__________________________
DOB__________________________
Date__________________________

Surgical mask should be worn within 3 feet of patient during screening.

Symptom check:

Have you had any of the following in the past 10 days?

☐ Fever > 100 degrees
☐ N/V
☐ Headache
☐ Neck stiffness
☐ Severe myalgias
☐ Pharyngitis
☐ Rash (bright red/purple)

Vital signs:

☐ Temp__________________________
☐ Pulse__________________________
☐ BP__________________________
☐ RR__________________________
☐ Sat__________________________

Allergies:______________________

Prophylaxis:

☐ Preferred, Cipro 500mg orally x 1, administered
☐ Alternative, in case of allergy: Rifampin 600mg qd BID x 2 days

Signature

Evaluate for Meningococcal Vaccination

Name__________________________
DOB__________________________
Allergies:______________________
Date__________________________

Site__________________________  Staff  YES NO

You have given me the opportunity to receive the meningococcal vaccine at no charge to myself. I have received, read and understand the information about the risks and benefits of the vaccine.

☐ I would like to have the meningococcal vaccine given to me.

Please answer the following questions:

1. Have you had a fever in the past 3 days?  YES NO

   (If yes, please defer vaccination until the illness resolves)

2. Are you pregnant?  YES NO

   (Pregnancy is not a contraindication for the vaccine; if patient has concern, please advise that she discuss vaccination with her OB/GYN or primary care provider)

I hereby certify that the foregoing history is true and complete to the best of my knowledge.

Signature:______________________ Date:______________________

<table>
<thead>
<tr>
<th>Vaccine Name</th>
<th>Menactra (MC/4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ordering Provider</td>
<td>Denise De Las Vueses, MD</td>
</tr>
<tr>
<td>Manufacturer</td>
<td>Sanofi</td>
</tr>
<tr>
<td>Vi Date</td>
<td>10/4/11</td>
</tr>
<tr>
<td>Route</td>
<td>IM</td>
</tr>
<tr>
<td>Site</td>
<td>LDeltoid R Deltoid</td>
</tr>
<tr>
<td>Dose</td>
<td>0.5ml</td>
</tr>
</tbody>
</table>
Meningococcal Vaccine Campaign

- Key stakeholders to whom to target communication identified
  - Consumers
  - Shelter partners
  - BHCHP staff
  - Shelter staff
- Stakeholder communication strategy developed
Meningococcal Vaccine Campaign

- Vaccine Clinics held at several sites
  - Nursing-led
  - Flexible hours
  - Scheduled and as requested by shelters
  - Messaging to shelter clients and staff
CDC’s Epi-Aid: Understanding Risk Factors for Disease Acquisition
Objective: To evaluate factors that may be contributing to increased risk for meningococcal disease among adults experiencing homelessness in Boston

Matched case-control

Population
- Adults (≥18 years old) experiencing homelessness* in Boston metro-area
- Registered patients of BHCHP

5 controls matched to each case by:
- Sex
- Age group (≤30 years old; >30 years old)
- Presence at the same homeless facility** during the same timeframe as the case during his/her infectious period (7 days prior the clinical onset of the disease symptoms)

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* Individual who is living in a place not meant for human habitation, in emergency shelter, in transitional housing, or are exiting an institution where they temporarily resided

** Any facility including but not limited to shelter that provides any service to a population experiencing homelessness

Slide courtesy of John O. Otshudiema, MD, MPH from the Center for Disease Control, Epidemiology Intelligence Service
Isolation of *N. meningitidis* from a normally sterile body site by culture or detection of *N. meningitidis*-specific nucleic acid by Polymerase Chain Reaction (PCR)

- Adult experiencing homelessness in the Boston-metro area
- Illness onset on or after May 1, 2015

### Case Exclusion Criteria

- An adequate proxy for deceased case was not identified
- Unable to be interviewed
- Refused to participate
- Unable to communicate in English or Spanish
Control Exclusion Criteria

- Identified as having received chemoprophylaxis for meningococcal disease at any point during the infectious period of the matched case
- Unable to communicate in English or Spanish
- Not a registered patient of BHCHP
Case Control Questionnaire

Investigation of Meningococcal Disease Cases Among Homeless Adults in Boston, 2015-2016

Case-Control Questionnaire

Part 1. Participant information

Recruiter initials: _____ Interviewer initials: _____ Date of interview (mm/dd/yr): ______/____/_____

Status: ☐ Case (0) ID #: _______ (Case # - 00) ☐ Control (1) ID #: _______ (Case # - Control #)

Meningococcal vaccine history (from BHCNP EMR):
☐ Yes (1)
☐ No: _______________ (2)
☐ Unknown (88)

Interviewer read: Thank you again for agreeing to speak with us today. Any information you provide will be helpful for us to figure out why some people have recently become sick with meningitis. We appreciate your answers, and anything you tell us will be kept confidential. Some of the questions we will ask are sensitive. It’s ok if you choose not to answer them, but we want to remind you that your honest answers will help us. Your participation in this survey is not related to any service you receive here and will not affect your ability to receive services in the future in any way.

Part 2. Demographics

1. How old are you? _____ years old
   ☐ Don’t know (88)
   ☐ Refused (99)

2. What is your sex?
   ☐ Male (1)
   ☐ Female (2)
   ☐ Other (specify) (3)
   ☐ Don’t know (88)
   ☐ Refused (99)

3. What is the highest level of education you received?
   ☐ Less than high school (1)
   ☐ High school/GED (2)
   ☐ More than high school/GED (3)
   ☐ Other (specify) (4)
   ☐ Don’t know (88)
   ☐ Refused (99)

Part 5. Medical history

22. Generally during [reference period, month], did you travel in and out of:
   ☐ Boston? ☐ Yes (1) ☐ No (2) ☐ Don’t know (88) ☐ Refused (99)
   ☐ Massachusetts? ☐ Yes (1) ☐ No (2) ☐ Don’t know (88) ☐ Refused (99)
   ☐ The country? ☐ Yes (1) ☐ No (2) ☐ Don’t know (88) ☐ Refused (99)

   If yes for any of these questions, please list all places visited: __________________________

23. I’m going to read a list of medical conditions. Please tell me whether or not you have ever had any of them.

<table>
<thead>
<tr>
<th>Type of medical condition</th>
<th>Yes</th>
<th>If yes, date of onset</th>
<th>No</th>
<th>Unknown</th>
<th>Refused</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cancer, type</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Illnesses that cause compromised immune system such as HIV/AIDS, lupus, rheumatoid arthritis, Crohn’s</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kidney disease</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No spleen</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sickle cell disease</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transplant recipient, type</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other, Specify</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other, Specify</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other, Specify</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

24. I’m going to read a list of medications. Please tell me whether or not you take any of them.

<table>
<thead>
<tr>
<th>Type of medication</th>
<th>Yes</th>
<th>No</th>
<th>Unknown</th>
<th>Refused</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steroids</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Antiretrovirals</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Antibiotics</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other medications that you have been told will alter your immune system, specify if you can:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other, specify</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other, specify</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

25. For cases "besides yourself" Since [reference period, month], as far as you know, have you had close contact with anyone with meningitis? Close contact would mean someone you’ve kissed or had sexual contact with, or someone who’s spent time in the same shelter as you, for example.

   | Yes (1) | No (2) | Don’t know (88) | Refused (99)
   |---------|--------|-----------------|--------|

25a. If yes, do you know what your contact with this person was (i.e., sharing cups, sleeping space, etc.)?
Identification of Homeless Facilities

Receipt of Roster

Random selection of 15 control for each case

Registration

Scan of ID Card

Bed Request

Evaluation: Introduction and consent

Interview

Investigation team alerted

Slide by John O. Otshudiema, MD, MPH from the Center for Disease Control, Epidemiology Intelligence Service
Enrollment of Cases and Controls

- 5 cases
  - includes 2 proxies
- 75 controls
  - 50 controls not enrolled
  - 25 controls enrolled
could not be found or did not complete interview

Slide courtesy of John O. Otshudiema, MD, MPH from the Center for Disease Control, Epidemiology Intelligence Service
## Results

<table>
<thead>
<tr>
<th>Case #</th>
<th>Age (yr)</th>
<th>Sex</th>
<th>Race</th>
<th>Time Homelessness</th>
<th>N. meningitidis Serogroup</th>
<th>Immuno-suppressive Condition</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>60</td>
<td>Male</td>
<td>Black</td>
<td>11 months</td>
<td>C</td>
<td>Diabetes</td>
<td>Recovered</td>
</tr>
<tr>
<td>2</td>
<td>60</td>
<td>Male</td>
<td>Other</td>
<td>15 years</td>
<td>C</td>
<td>Diabetes, HIV</td>
<td>Recovered</td>
</tr>
<tr>
<td>3</td>
<td>20</td>
<td>Male</td>
<td>Black</td>
<td>7 weeks</td>
<td>Y</td>
<td>Unknown</td>
<td>Deceased</td>
</tr>
<tr>
<td>4</td>
<td>23</td>
<td>Female</td>
<td>Black</td>
<td>9 months</td>
<td>Y</td>
<td>Lupus</td>
<td>Deceased</td>
</tr>
<tr>
<td>5</td>
<td>46</td>
<td>Male</td>
<td>Black</td>
<td>3 years</td>
<td>Y</td>
<td>Diabetes</td>
<td>Recovered</td>
</tr>
</tbody>
</table>
Summary of Key Results

- One factor significantly associated with disease:
  - History of an immunosuppressive condition (HIV, lupus, or diabetes)
- Not statistically significant but compared to controls, a higher proportion of cases:
  - Were Black
  - Experienced homelessness for less than one year
  - Had ≥1 kissing partner
  - Had at least high school education
  - Slept in a room with ≥50 people
- No association of meningococcal disease with historic risk factors:
  - Crowded living conditions
  - Passive and/or active smoking
  - Having >1 kissing partner
Limitations

- Small sample size
  - Multivariate analysis not possible
- Recall bias
- Sensitive or taboo topics – impact truthfulness of responses
Discussion
Net Results of Outbreak Response Efforts

- 307 close contacts were screened for the 5 cases, with 286 close contacts prophylaxed successfully.

- Reaching vaccine saturation
  - From 2/16/16 to 4/6/2016, a total of 3621 vaccines administered
  - More than total number of flu vaccines given during entire 2015-2016 flu season

- Halting meningococcal-related mortality
  - No more patient deaths after first 2 cases

- Deepened understanding of disease patterns in our patient population
Factors that Led to Success

- Partnerships
- Relationships
- Dedicated staff
“The established, trusting relationships with our patients, as well as with the Public Health Commission, Mass DPH and our shelter partners, were the elements that enabled us to be successful.”

Source: Barb Giles, RN, Director of Nursing at BHCHP.
Questions?

Primary Contact:
Denise De Las Nueces, MD, MPH
ddelasnueces@bhchp.org
Thank you

• Centers for Disease Control and Prevention
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