Haemophilus influenzae in Alaska: surveillance, outbreaks, and response

- Hi Surveillance and the Arctic Investigations Program: Tammy Zulz
- Case Investigation and Chemoprophylaxis: Stephanie Massay
- *Haemophilus influenzae* serotype a Outbreak: Leisha Nolen
Invasive *Haemophilus influenzae* Surveillance in Alaska

Tammy Zulz, MPH
Arctic Investigations Program, Centers for Disease Control & Prevention
ALPHA Health Summit
January 21, 2020
Surveillance for Disease Caused by Invasive *Haemophilus influenzae* in Alaska

Partnership between:

- CDC’s Arctic Investigations Program (AIP)
- State of Alaska Division of Public Health, Section of Epi (SOE)
Surveillance System Components

1. Objective (what is being tracked)
2. Case definition (provides structure)
3. Population (scope of surveillance)
4. Data (data sources, collection methods)
5. Monitoring/analysis (timeliness of review)
6. Dissemination (reporting findings)
7. Usefulness (public health impact)
1. Objective (what is being tracked)
   • Invasive *Haemophilus influenzae*
   • Gram negative bacteria
   • Categorized by
     • Serotype (a-f)
     • Non-typeable
   • Colonizes the back of the throat
   • Causes severe disease (e.g., meningitis, pneumonia, septic arthritis)
   • Vaccine preventable (Hib)
2. Case definition (provides structure)

*Isolation of surveillance organism from a normally sterile site (e.g., blood, CSF, joint fluid) drawn from a resident of the State of Alaska*
3. Population (scope of surveillance)

State of Alaska
Total population: 736,000
4. Data (data sources, collection methods)

- Clinicians/labs report to SOE
- Labs submit isolates to AIP
  - Confirmation and serotyping
  - Antimicrobial susceptibility testing
- Clinical and demographic information collected from medical records
5. Monitoring/analysis (timeliness of review)

• Ongoing reporting and annual case reconciliation with SOE
• Quarterly review of data
• Annual audits for missing cases
Invasive Hib Disease, Children Aged <5 Years, Alaska, 1980 - 2019

Hi Typing Results, Alaska, 2000-2019
6. Dissemination (reporting findings)

- Conferences
- Annual reports
- Epi Bulletins
- Publications
7. Usefulness (public health impact)

- Inform public health policy
  - Provide data for vaccine effectiveness
- Inform public health response
  - Provide data for potential outbreak response
Invasive *Haemophilus influenzae* case investigation and chemoprophylaxis guidelines

Stephanie C. Massay, MPH, MT(ASCP)
Epidemiology Specialist/VPD Surveillance Coordinator
Section of Epidemiology, Infectious Disease Program

2020 Alaska Public Health Association Conference
Anchorage, AK
Invasive Hi Case Investigation - Alaska

- AK-SOE collaborates with local public health nursing staff for case investigations
- Clinical notes are obtained
- Initial epi info is gathered while the isolate/sample is being forwarded to AIP for confirmation and serotype testing.
### Invasive Hi Case Investigation - Alaska

**Reporting Hospital:**

**Physician:**

**Isolate sent to CDC-AIP for Serotyping:**
- [ ] Y
- [ ] N
- [ ] Unknown
- If Yes, Date:

### Hib Vaccination History

<table>
<thead>
<tr>
<th>Dose</th>
<th>Date Given</th>
<th>Vaccine Name</th>
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### Epidemiologic Information

- Has the patient had contact with a known case of Hib disease in the two months prior to symptom onset? Y [ ] N [ ] Unknown [ ]
- If yes, specify type of contact and name of contact (if available):

- Does the patient attend day care*? Y [ ] N [ ] Unknown [ ]
- If yes, specify name of facility, location, and phone number (if available):

*Defined as a supervised group of 2 or more unrelated children for at least 4 hours per week

- Does the patient reside in a congregate or long-term care facility? Y [ ] N [ ] Unknown [ ]
- If yes, specify name of facility, location, and phone number (if available):

- Has the patient had recent travel history? Y [ ] N [ ] Unknown [ ]
- If yes, specify location and date(s):

- Has the patient had recent contact with any visitors from another village/city/state? Y [ ] N [ ] Unknown [ ]
- If yes, specify location and date(s):

[Link](http://dhss.alaska.gov/dph/Epi/id/SiteAssets/Pages/HFlu/HfluCaseQuestionnaire.pdf)
# Invasive Hi Case Investigation - Alaska

Household and close contacts\(^1\) (provide information on any additional contacts on a separate sheet)

<table>
<thead>
<tr>
<th>Name</th>
<th>DOB</th>
<th>Relationship to case</th>
<th>Household Member? (Y, N)</th>
<th>Hib Vaccination History (dates)</th>
<th>Prophylaxis Recommended? (Y, N)</th>
<th>Prophylaxis Provided? (Y, N, U and date if Y)</th>
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\(^1\) Household or close contacts are defined as people residing with the index patient or nonresidents who spent 4 or more hours with the index patient for at least 5 of the 7 days preceding the day of hospital admission of the index case.

[http://dhss.alaska.gov/dph/Epi/id/SiteAssets/Pages/HFlu/HfluCaseQuestionnaire.pdf](http://dhss.alaska.gov/dph/Epi/id/SiteAssets/Pages/HFlu/HfluCaseQuestionnaire.pdf)
Invasive Hi Case Investigation - Alaska

Defined as: people residing w/index patient or others who spent > 4 hrs. w/index patient for at least 5 of the 7 days prior to illness onset or hospitalization

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AIP Surveillance Lab Testing Results

<table>
<thead>
<tr>
<th>Serotype results</th>
<th>Public Health Control Measure Indications and Guidelines*</th>
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<tbody>
<tr>
<td>□ Hia</td>
<td>□ Hia</td>
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<td>□ Hib</td>
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<td>□ Not typeable</td>
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Management of contacts: Prophylaxis

- Rifampin eradicates Hi from the pharynx in approximately 95% of carriers and decreases the risk of secondary invasive illness in exposed household contacts.

- Rifampin dosage 20 mg/kg, with maximum dose of 600 mg, orally, once daily for 4 days.
Hib: Chemoprophylaxis for Contacts

**Rifampin chemoprophylaxis is recommended for:**

- For all household contacts when there is:
  - At least 1 contact <4 years of age, other than the index case, who is unimmunized or incompletely immunized for Hib
  - A child younger than 12 months who has not completed the primary Hib vaccine series
  - An immunocompromised child, regardless of that child’s immunization status or age
- For index patient, if aged <2 years or of household with a susceptible contact and treated with a regimen other than cefotaxime or ceftriaxone, chemoprophylaxis at the end of therapy for invasive infection

**Chemoprophylaxis is not recommended for:**

- For households contacts when there are no children aged <4 years other than the index patient
- For preschool and childcare contacts of index patient
- For pregnant women
- For healthcare personnel

Hia: Chemoprophylaxis for Contacts
Rifampin chemoprophylaxis should be considered for:

- For all household contacts when there is:
  - At least one contact <4 years of age, other than the index case
  - An immunocompromised child, regardless of that child’s age
- For preschool and child care centers when two or more cases of Hia invasive disease have occurred within 60 days
- For index patient, if aged <2 years or of household with a susceptible contact and treated with a regimen other than cefotaxime or ceftriaxone, chemoprophylaxis at the end of therapy for invasive infection

Chemoprophylaxis Not Recommended for:

- For occupants of households with no children aged <4 years other than the index patient
- For preschool and childcare contacts of index patient
- For pregnant women
- For healthcare personnel

Management of contacts: Prevention

Household and close contacts1 (provide information on any additional contacts on a separate sheet)

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1Household or close contacts are defined as people residing with the index patient or nonresidents who spent 4 or more hours with the index patient for at least 2 of the 7 days preceding the day of hospital admission of the index case.
Public Health Response to an *Haemophilus influenzae* a Outbreak

Arctic Investigations Program, Centers for Disease Control and Prevention
Section of Epidemiology, Division of Public Health, Alaska Department of Health and Social Services
Yukon-Kuskokwim Health Corporation
All infants under 2 years old
All from different households without clear contact
All cases were flown to Anchorage to receive intensive care
One infant died
Outbreak Response

Three organizations

- State of Alaska’s Department of Health and Social Services
  - Section of Epidemiology
  - Section of Public Health Nursing

- The Centers for Disease Control and Prevention’s Arctic Investigation Program (AIP)

- The Yukon-Kuskokwim Health Corporation (YKHC)
Goals of the outbreak response:

• Prevent additional cases of invasive Hia

• Try to understand why so many cases occurred in one small village

• Evaluate the impact of prophylaxis on Hia carriage
Preventing additional cases

The American Academy of Pediatrics Red Book added permissive language for prophylaxis after a case of Hia disease:

“Clinicians may consider prophylaxis of contacts of index cases of invasive Hia disease”
Prevention

Who should we prophylax?

Who’s at highest risk?
People at Risk

• Contacts of sick children
  People with patient contact ≥4 hours 5 days in the week preceding hospitalization

• Children
  Most likely to become sick with Hia
  Thought to be most likely to carry Hia
Medication Distribution

2 Visits

Rifampin: Daily for 4 days
    First dose observed by public health team

22 Contacts treated at this visit
    18 Contacts had been treated earlier
110 Children under 10 years old
Goals of the outbreak response:

• Prevent additional cases of invasive Hia
  ~66% of contacts received prophylaxis
  ~89% of children <10 years old received prophylaxis
  No additional cases of Hia have occurred in this village

• Try to understand why so many cases occurred in one small village

• Evaluate the impact of prophylaxis on Hia carriage
Hypothesis: This cluster of cases was due to high overall carriage of Hia in the community

Typical village carriage

Outbreak village carriage
Test for carriage

• Collect throat swabs to test for Hia carriage

403 people were swabbed
  • This is 62% of the entire community
Who carried *Haemophilus influenzae* in the community?

- All throat swabs were tested for Hi
  - Serotype a to f and nontypeable

<table>
<thead>
<tr>
<th>Type</th>
<th>Percent Carrying</th>
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<tbody>
<tr>
<td>HiA</td>
<td>0%</td>
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<tr>
<td>HiB</td>
<td>5%</td>
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<tr>
<td>HiE</td>
<td>10%</td>
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<tr>
<td>HiF</td>
<td>10%</td>
</tr>
<tr>
<td>NT</td>
<td>25%</td>
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**Low Hia Carriage!**
The only Hi type that was significantly different between the contacts and community members was Hia.

P = 0.004
Age of people carrying Hia at any time

Child contacts were significantly more likely to carry Hia than community members or adult contacts.
Goals of the outbreak response:

• Prevent additional cases of invasive Hia
  No additional cases of Hia have occurred in this village
  ~66% of contacts received prophylaxis
  ~89% of children <10 years old received prophylaxis

• Try to understand why so many cases occurred in one small village
  Overall carriage was not high in the village
  • Contact households did have high carriage, especially the children

• Evaluate the impact of prophylaxis on Hia carriage
Long term impact of Rifampin prophylaxis

Throat swab 8 weeks after rifampin prophylaxis distribution

8 weeks after mass rifampin prophylaxis there was no significant change in carriage

Percent of people carrying Hia

- 0%
- 5%
- 10%
- 15%
- 20%
- 25%
- 30%

Community Members

Contacts

Pre prophylaxis distribution

Post prophylaxis distribution
Long term impact by age

Older contacts gained Hia 8 weeks after the rifampin prophylaxis

P = 0.03
Why did carriage remain after prophylaxis?

• Hypothesis – moving bacteria
Why did carriage remain after prophylaxis?

• Hypothesis – moving bacteria
Goals of the outbreak response:

• Prevent additional cases of invasive Hia
  • No additional cases of Hia have occurred in this village
    • ~66% of contacts received prophylaxis
    • ~89% of children <10 years old received prophylaxis

• Try to understand why so many cases occurred in one small village
  • Overall carriage was not high in the village
    • Contact households did have high carriage, especially the children

• Evaluate the impact of prophylaxis on Hia carriage
  • Carriage continued in contacts in the long term
    • Carriage appeared to move to contacts ≥10 years
Public Health Conclusions from Response

Non-contacts were unlikely to carry Hia
- Treatment of non-contacts unlikely to be beneficial
- Supporting AAP Redbook Recommendations

Child contacts are most likely to carry Hia at baseline
  Adult contacts can gain Hia carriage
- Suggests need to treat both children and adult contacts
- Suggests need to treat all contacts at once
Thanks

• To the community that came together to help stop this infection
• To the Alaska Public Health team – the Section of Epidemiology and the public health nurses
• To the Arctic Investigations Program – laboratory, data management, and nurse-epi teams
• To the YKHC – translators, pharmacists, and health providers