Outbreak of Severe Histoplasmosis Among Tunnel Workers — Dominican Republic, 2015

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Brigham Young University

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Outbreak in Dominican Republic

**Sep 4**: potential outbreak of febrile illness (leptospirosis) in Sabana Iglesia reported to Ministry of Health (MoH)
- 30 previously healthy men
Tavera-Bao Dam
Outbreak in Dominican Republic

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Histoplasma Capsulatum

- Spores reproduce in soil with high nitrogen content
  - Bat guano, bird droppings
  - Caves, tunnels, under trees
  - Released when soil is disturbed
  - Endemic to Americas
H. Capsulatum → Histoplasmosis

- Spores in soil
- Inhaled
- Infection
Histoplasmosis

- Severity of illness depends on
  - Amount of H. capsulatum (i.e., inoculum)
  - Immune status of infected person
- Develop respiratory illness 3-17 days after exposure
- Treat with appropriate antifungal medication

<table>
<thead>
<tr>
<th>Asymptomatic</th>
<th>Acute Pulmonary</th>
<th>Disseminated</th>
</tr>
</thead>
<tbody>
<tr>
<td>No symptoms</td>
<td>Cough, fever, chills, fatigue, headache, etc.</td>
<td>Fever, gastrointestinal symptoms, bone marrow suppression, hepatosplenomegaly, lymphadenopathy</td>
</tr>
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</table>

Asymptomatic: No symptoms

Acute Pulmonary: Cough, fever, chills, fatigue, headache, etc.

Disseminated: Fever, gastrointestinal symptoms, bone marrow suppression, hepatosplenomegaly, lymphadenopathy
Outbreaks of Histoplasmosis in U.S.

- 77% in settings with birds, bats, or their droppings
- 41% occupational exposure
- 15% hospitalized
- 1% died
Outbreak in Dominican Republic

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**Sep 17:** DR MoH requests U.S. CDC assistance to investigate outbreak in tunnel cleaning workers

**Sep 21:** CDC staff arrive in Santo Domingo and spend 10 days assisting DR MoH with outbreak investigation
Histoplasmosis kills 3, sickens 20 more in the Dominican Republic

Posted by Robert Herriman on September 21, 2015 // 2 Comments

Dozens of workers at the Tavera dam in Santiago province, Dominican Republic have contracted the serious fungal disease, histoplasmosis, in which three people have lost their lives.

The workers were infected while cleaning a pipe vent that serves the dam, according to a El Veedor Digital report (computer translated). In addition to the three fatalities, more than 20 workers that currently fighting for their
Our Assignment

• Investigate outbreak
• Identify cause
• Recommend preventive measures
Study Design and Planning

- Retrospective cohort study
  - All men who worked in tunnels

- Data collection instruments/methods
  - Worker interviews
  - Medical chart abstraction
  - Laboratory tests
Worker Interviews

• Demographics
• Comorbidities
• Tunnels
• Work conditions and behaviors
• Work history
• Personal protective equipment
Demographics and Comorbidities

- 36 men
- Ages 18-62 (median: 32)

![Asthma Bar Chart]

Percent

Asthma

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
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<tbody>
<tr>
<td>No</td>
<td>85</td>
</tr>
<tr>
<td>Yes</td>
<td>15</td>
</tr>
</tbody>
</table>
Demographics and Comorbidities

- Current cigarette smoking:
  - No: 57%
  - Yes: 43%

- Illicit drug use (non-injection):
  - No: 61%
  - Yes: 39%
Tunnels

- Constructed 1972, last cleaned 1982
- Allow access for dam inspection
- 1-2 km long
- 1-2 feet deep of bat guano throughout
Work on Tunnels

• 3 of 5 tunnels partially cleaned

• 2-4 hours/day, 5 days/week, Jul 30-Sep 2
  • 1-25 (median: 24) days in tunnels

• Shovel guano into wheelbarrow, dump outside

• Substitutions in workers
Type and Tunnel of Work

- **Type of Work**
  - Shovel only: 43%
  - Transport only: 14%
  - Shovel and transport: 31%
  - Supervise: 9%
  - Other: 3%

- **Tunnel of Work**
  - Tunnel 1 only: 29%
  - Tunnel 2 only: 20%
  - Tunnels 1 and 2: 51%
Personal Protective Equipment

- Hard hats
- Boots
- Gloves
- Masks/respirators

[Bar chart showing percent of mask/respirator use: 48% never, 42% sometimes, 9% always]
Medical Chart Abstraction

- Symptoms
- Dates of onset, hospitalization, etc.
- Diagnostic tests
- Laboratory tests
- Treatment
Medical Chart Abstraction

- Workers were seen in
  - Local hospital in Sabana Iglesia
  - 5 hospitals throughout Santiago
Case Definition

• Person who worked in the tunnels Jul 30-Sep 2:
  • Fever
  • ≥ 2 of following:
    • Headache
    • Chills
    • Malaise
    • Fatigue
    • Myalgias
  • Cough
  • Nausea
  • Vomiting
  • Diarrhea
  • Respiratory difficulty
Symptoms

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fever</td>
<td>83</td>
</tr>
<tr>
<td>Cough</td>
<td>77</td>
</tr>
<tr>
<td>Headache</td>
<td>70</td>
</tr>
<tr>
<td>Malaise</td>
<td>50</td>
</tr>
<tr>
<td>Myalgia</td>
<td>37</td>
</tr>
<tr>
<td>Shortness of breath</td>
<td>37</td>
</tr>
<tr>
<td>Diarrhea</td>
<td>27</td>
</tr>
<tr>
<td>Weakness</td>
<td>20</td>
</tr>
<tr>
<td>Vomiting</td>
<td>17</td>
</tr>
<tr>
<td>Chills</td>
<td>17</td>
</tr>
<tr>
<td>Arthralgia</td>
<td>13</td>
</tr>
</tbody>
</table>
Epidemic Curve

Number

Date of Symptom Onset

27-Aug 28-Aug 29-Aug 30-Aug 31-Aug 1-Sep 2-Sep 3-Sep 4-Sep 5-Sep 6-Sep 7-Sep 8-Sep 9-Sep 10-Sep 11-Sep 12-Sep 13-Sep
Epidemic Curve

First patient at hospital in Sabana Iglesia
Epidemic Curve

First patient at hospital in Sabana Iglesia

Work on tunnels stopped

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MoH notified of increase in suspected Leptospirosis

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- First patient at hospital in Sabana Iglesia
- Work on tunnels stopped
- MoH notified of increase in suspected Leptospirosis
- Company transfers all patients to Santiago; Histoplasmosis suggested; anti-fungal treatment initiated

Date of Symptom Onset

Number

27-Aug, 28-Aug, 29-Aug, 30-Aug, 31-Aug, 1-Sep, 2-Sep, 3-Sep, 4-Sep, 5-Sep, 6-Sep, 7-Sep, 8-Sep, 9-Sep, 10-Sep, 11-Sep, 12-Sep, 13-Sep
Epidemic Curve

First patient at hospital in Sabana Iglesia
Work on tunnels stopped
MoH notified of increase in suspected Leptospirosis
Company transfers all patients to Santiago; Histoplasmosis suggested; anti-fungal treatment initiated
First death
Results

36 exposed
Results

36 exposed
30 symptomatic
Results

- 36 exposed
- 30 symptomatic
- 28 hospitalized
Results

36 exposed
30 symptomatic
28 hospitalized
9 in the ICU
Results

36 exposed
30 symptomatic
28 hospitalized
9 in the ICU
6 intubated
Results

36 exposed
30 symptomatic
28 hospitalized
9 in the ICU
6 intubated
3 died

Case fatality = 10%
Complications

• All 6 intubated patients had ventilator-assisted pneumonia
Treatment

- 1-11 (median: 6) days to treatment with any antifungal
- Ideal medication for critically ill patients (amphotericin B) not available for 2 weeks
Laboratory Tests

• No diagnostic capabilities for Histoplasmosis in country

• Blood and urine samples sent to CDC in Atlanta
Laboratory Tests: Serum

- Serum antigen: 34 workers

- Serum antibody: 31 workers
Laboratory Tests: Urine and Total

- Urine antigen: 29 workers
- Total: 34 workers
Risk Factors for Histoplasmosis and ICU

- No demographic, comorbid, clinical, or occupational risk factors for developing histoplasmosis identified

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>ICU Admission</th>
<th>Unadjusted OR</th>
<th>Exact 95% CI</th>
<th>Exact p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difficulty breathing</td>
<td>6 (67%)</td>
<td>5 (24%)</td>
<td>5.95</td>
<td>0.89, 51.67</td>
</tr>
<tr>
<td>Days worked in tunnelsa</td>
<td></td>
<td>1.18</td>
<td>1.00, 1.59</td>
<td>0.07</td>
</tr>
</tbody>
</table>

a Per additional day worked
## Summary of Results

<table>
<thead>
<tr>
<th>Environmental</th>
<th>Occupational</th>
</tr>
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<tbody>
<tr>
<td>• Insufficient waste disposal</td>
<td>• Inadequate worker protection</td>
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<tr>
<th>Clinical</th>
<th>Laboratory</th>
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<tr>
<td>• Limited awareness among clinicians</td>
<td>• Lack of diagnostic capability</td>
</tr>
<tr>
<td>• Delay in treatment</td>
<td>• Confirmed diagnosis</td>
</tr>
</tbody>
</table>
Environmental Safety Recommendations

• Existing waste partially treated with formaldehyde
• Additional waste requires biohazard site disposal
  • Strongly suggest hiring professional remediation firm
• Adequate security to prevent access to tunnels
• Minimize human contact with bats
Occupational Health Recommendations

• Need for planning before initiating work
• Adequate personal protective equipment
• Appropriate training of workers
• Enforcement of local laws and regulations surrounding:
  • Work sites
  • Disposal of waste
  • Work conditions
Clinical/Laboratory Recommendations

• Improve diagnostic capability and support for histoplasmosis and other fungal diseases
• Improve access to antifungal treatment
  • Critically ill patients require Amphotericin B
• Increase screening for HIV
Summary

• First Histoplasmosis outbreak in Dominican Republic
• Called attention to environmental/occupational health
• Highlighted lack of diagnostic and treatment capability
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