Coccidioidomycosis Surveillance in Arizona: A Comparison of 2007 and 2011 Data

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Surveillance: Cocci Case Definition

• Council for State and Territorial Epidemiologists (CSTE)
  – Updated in 2007
    • Clinical case definition
    • Lab criteria*

• Arizona Department of Health Services (ADHS)
  – Since 1997
    • No clinical symptoms required
    • Lab criteria*

*Lab criteria for diagnosis includes either detection of IgM by immunodiffusion (ID), enzyme immunoassay (EIA), latex agglutination, or tube precipitin OR IgG by ID, EIA, or complement fixation (CF) OR cultural, histopathologic, or molecular evidence of Cocci species
Rates of Reported Cocci Cases, Arizona, 1990-2011

Change in EIA Reporting

Lab Reportable

Reported cases per 100,000

Year of Onset or Diagnosis


7 8 11 12 12 12 12 16 27 31 37 45 57 48 63 58 89 75 73 155 186 256

Health and Wellness for all Arizonans
Methods

• Study compared all 2007 data and 2011 data from 2/14/2011 to 12/31/11
  – Beginning in February 2011, ADHS began entering every positive cocci test result

• Multiple sub-sets were cleaned, created, compared, and analyzed using SAS statistical software
2007 Total Data
n=4,832

2011 Total Data
n=16,446

2011 Total Data
(2/14/11 – 12/31/11)
n=14,146

EIA Alone
n=10,819
• EIA IgM
• EIA IgG
• EIA IgG + EIA IgM

Combination Positives
n=3,327
• EIA IgM + other
• EIA IgG + other
• EIA IgG + EIA IgM + other
• Other (ID, Culture, etc.)
# Reported Cocci Cases, Age and Gender

<table>
<thead>
<tr>
<th>Year</th>
<th>Age (median, mean)</th>
<th>Gender (% female)</th>
<th>p-value (Gender) 2007 vs. Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>52, 51</td>
<td>46%</td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td>51, 50</td>
<td>48%</td>
<td>$p = 0.0516$</td>
</tr>
<tr>
<td>2009</td>
<td>47, 47</td>
<td>54%</td>
<td>$p &lt; 0.0001$</td>
</tr>
<tr>
<td>2010</td>
<td>48, 47</td>
<td>57%</td>
<td>$p &lt; 0.0001$</td>
</tr>
<tr>
<td>2011 (2/14-12/31)</td>
<td>47, 47</td>
<td>58%</td>
<td>$p &lt; 0.0001$</td>
</tr>
<tr>
<td>EIA Alone</td>
<td>46, 46</td>
<td>62%</td>
<td>$p &lt; 0.0001$</td>
</tr>
<tr>
<td>Combination Positives</td>
<td>52, 50</td>
<td>43%</td>
<td>$p = 0.07$</td>
</tr>
</tbody>
</table>

*p value was determined using total female and male case numbers and not percentages*
Percentage of Reported Cocci Cases by Age Group

- 2011 Total Data
- 2007 Total Data
- 2011 Combination Positives
Total Cases By Age Group, 2011

Reported Cases

- 2011 Total Cases
- Total Female EIA IgM Alone
- Total Male EIA IgM Alone
Reported Cocci Cases by Month, and Data Group,
Combination Positives Data 2011

Reported Cases

- EIA IgG & IgM
- EIA IgG
- EIA IgM
- EIA not Positive

Female
Male
Lab A Total Cases
Years Lived in Arizona

Cases

n= 133

Health and Wellness for all Arizonans

n= 133
Antifungal Prescription

n = 133, 4 missing
Conclusions

• Including cocci cases positive by EIA only resulted in a significant shift in the data
  – Mostly females and younger populations
• 77% of all cases are EIA Alone, 65% of which are IgM positive
• The rate of patient treatment is highest for those who are positive by both EIA AND another test
• Additional studies are needed to establish the role of EIAs in cocci surveillance
Limitations

• Negative results are not required to be reported, resulting in the inability to determine if the non-presence of a test result is due to a negative result or it not being ran.

• Possible data entry errors, i.e. incorrect result being recorded.

• The possibility of recall bias exists within case interviews.
Future Steps

• Examine EIA IgMs and EIA IgGs, respectively and single EIA positives that are positive only one time without additional positive EIA results

• Investigate EIA Alone cases through interviews and medical record reviews to look at clinical symptoms

• Educate laboratories in reporting complete cocci test results

• Educate providers in interpreting cocci test results
Acknowledgments

• ADHS
  – Clarisse Tsang
  – Shoana Anderson
  – Jessica Rigler
  – Peter Kelly
  – Ken Komatsu
  – Sara Imholte
  – Cara Christ
  – IDES Data Entry/Epis

• VFCE
• CDC
• Reporting laboratories and providers
Questions

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Additional Slides
CSTE Definition

Clinical Description

• Influenza like signs and symptoms
• Pneumonia or other pulmonary lesion
• Erythema nodosum or erythema multiforme rash
• Meningitis
• Involvement of bones joints etc. by dissemination

Laboratory Criteria

• Cultural, histopathologic, or molecular evidence of infection
• Positive serologic test for Cocci antibodies in serum CS fluid or other bodily fluid
Cocci Symptoms

- Influenza like symptoms
  - Fever, chest pain, cough, myalgia, arthralgia, fatigue, and headache
- Night sweats
- Chills
- Shortness of breath
- Rash or skin lesions
- Stiff neck
- Hemoptysis
- Weight loss
- Nodules in the lungs
Total Number and Rate of Reported Cocci Cases, 1999-2011

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Cases</th>
<th>Rate per 100,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999</td>
<td>1812</td>
<td>31</td>
</tr>
<tr>
<td>2000</td>
<td>1917</td>
<td>37</td>
</tr>
<tr>
<td>2001</td>
<td>2301</td>
<td>45</td>
</tr>
<tr>
<td>2002</td>
<td>3118</td>
<td>57</td>
</tr>
<tr>
<td>2003</td>
<td>2695</td>
<td>48</td>
</tr>
<tr>
<td>2004</td>
<td>3665</td>
<td>63</td>
</tr>
<tr>
<td>2005</td>
<td>3515</td>
<td>58</td>
</tr>
<tr>
<td>2006</td>
<td>5535</td>
<td>89</td>
</tr>
<tr>
<td>2007</td>
<td>4815</td>
<td>75</td>
</tr>
<tr>
<td>2008</td>
<td>4768</td>
<td>73</td>
</tr>
<tr>
<td>2009</td>
<td>10233</td>
<td>155</td>
</tr>
<tr>
<td>2010</td>
<td>11888</td>
<td>186</td>
</tr>
<tr>
<td>2011</td>
<td>16446</td>
<td>257</td>
</tr>
</tbody>
</table>
Rate of Reported Cocci Cases by Top 3 Counties

- Maricopa
- Pima
- Pinal

<table>
<thead>
<tr>
<th>Year</th>
<th>Maricopa</th>
<th>Pima</th>
<th>Pinal</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2011 EIA Alone</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2011 Combination</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Rate per 100,000
Reported Cocci Cases by Month, Arizona, 2008-2011

The graph shows the number of reported Cocci cases by month for Arizona from 2008 to 2011. The data is categorized by type, with separate lines for:

- All 2011
- 2011 EIA only
- 2011 other positives
- 2010
- 2009
- 2008

The x-axis represents the months from January to December, while the y-axis represents the number of cases ranging from 0 to 1800.
Reported Cocci Cases by Month, Arizona, 2/14/11-12/8/11

Graph showing the number of reported cocci cases by month from February 14, 2011 to December 8, 2011. The cases are categorized into three groups: 'All', 'EIA only', and 'Other positive results'. The graph indicates fluctuations in the number of cases throughout the year, with peaks in August and November and troughs in February and March.
Total Reported Cocci Cases by County, 2007 and 2011

<table>
<thead>
<tr>
<th>Year</th>
<th>Maricopa</th>
<th>Pima</th>
<th>Pinal</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Total Cases by Gender and Year

- **2011**: Male: 6000, Female: 8000
- **EIA Alone**: Male: 4000, Female: 6000
- **Non-EIA Alone**: Male: 1000, Female: 1000

Legend:
- Blue: Male
- Red: Female
Rates of Reported Cocci Cases by Race

Rate per 100,000

<table>
<thead>
<tr>
<th>Year</th>
<th>Amer. Indian</th>
<th>Asian</th>
<th>African American</th>
<th>White</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>45</td>
<td>35</td>
<td>60</td>
<td>25</td>
</tr>
<tr>
<td>2007</td>
<td>20</td>
<td>30</td>
<td>40</td>
<td>15</td>
</tr>
<tr>
<td>2011 Non EIA</td>
<td>10</td>
<td>20</td>
<td>30</td>
<td>10</td>
</tr>
</tbody>
</table>
## Major Commercial Lab Reported Data

<table>
<thead>
<tr>
<th></th>
<th>2011</th>
<th>2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Cases</td>
<td>10859</td>
<td>1449</td>
</tr>
<tr>
<td>EIA Alone</td>
<td>8899</td>
<td>*</td>
</tr>
<tr>
<td>Non-EIA Alone</td>
<td>1960</td>
<td>*</td>
</tr>
</tbody>
</table>
EIA Alone vs. Combination Positives (2007, 2011)
EIA Alone Data 2011

Number Of Cases

- Female
- Male
- Major Lab Total Cases Male
- Major Lab Total Cases Female

Cases Male

Cases Female
Rate of Cases per age group by month

Rate per 100,000
Patient Diagnosis and Test Awareness

<table>
<thead>
<tr>
<th>Percent</th>
<th>Not Aware of Positive Test Result</th>
<th>Aware of Positive Test, Not Diagnosed</th>
<th>Diagnosed</th>
</tr>
</thead>
<tbody>
<tr>
<td>CP. Not EIA Positive</td>
<td>CP, EIA IgM</td>
<td>CP, EIA IgG</td>
<td>CP, EIA IgG &amp; IgM</td>
</tr>
<tr>
<td>CP, EIA IgG</td>
<td>EIA Alone IgM</td>
<td>EIA Alone IgG</td>
<td>EIA Alone IgG &amp; IgM</td>
</tr>
</tbody>
</table>

n = 133, 1 missing
Common Questions 1

• Why did you choose to use 2007 data as a comparison?
  – Gives buffer room since 2008 data is too close to 2009 data, where the change in reporting was done

• Why weren’t all positive cocci results entered prior to 2011?
  – AZ did not have the resources to enter all positive cocci results since we get thousands of cases/year but in 2011, we wanted to investigate the impact of EIAs further so we started entering all positive cocci results
• Can you compare the 2011 EIA data to 2007 EIA data?
  – We did not have the resources to enter all positive cocci test results prior to 2011 so we would not know if there were other positive test results (aside from EIAs) in previous years’ data. Negative results are not reportable to the state.
Common Question 3

• Why did you not look at EIA IgMs and EIA IgGs, respectively?
  – We did not have the resources to differentiate the two. It is a very time intensive process especially since the method between reporting positive cocci test results is not standardized. We plan on investigating this in the future.
Common Questions 4

• Do you think that the recent large dust storms (haboobs) have caused an increase in cocci cases?
  – If you look at slide 19, we can see that in early 2011, we were already seeing an increase in cocci cases even before the haboob hit. There may be many factors to why cocci is increasing (increase in susceptible population, increase in testing and awareness, construction, etc.). It is hard to directly correlate to dust storms. *ADHS has looked into monitoring cocci in air filters; however cocci has not been able to be detected in the air filters, even during the haboobs.*