Enhancing Respiratory Infection Surveillance on the Arizona-Sonora Border—BIDS Program Sentinel Surveillance Data

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*Arizona border population: 1,354,780

§Sonora border population: 774,525

*US- 2010 US Census Data
§MX- 2010 INEGI Census Data
Border Infectious Disease Surveillance (BIDS) Program

– Assess border as a single unit
– Compatible case definitions
– Syndromic and lab surveillance
– Binational data sharing
Respiratory surveillance in Arizona

• Existing surveillance data sources in Arizona
  – ILI net (Influenza-like illness in outpatient and emergency departments)
    • ILI- Defined as fever AND cough or sore throat
  – Lab confirmed cases (all facility types)
  – School surveillance (influenza-like illness in sentinel schools)
Respiratory Surveillance Objectives

• During the 2010-2011 and 2011-2012 flu season:

  1. to monitor BIDS sentinel hospital-site patients with viral respiratory testing in Pima County, AZ

  2. to monitor infecting respiratory pathogens among hospitalized patients with Severe Acute Respiratory Infection (SARI)
Severe Acute Respiratory Infection (SARI) Definition

Case Definition

For persons ≥ 5 years old:
Self-reported fever or recorded fever over 100 °F (38°C), AND
Cough or sore throat, AND
Requiring hospital admission

For children < 5 years old:
Clinical suspicion of pneumonia, AND
Requiring hospital admission
SARI Surveillance Methods

*Three surveillance sites in border region of AZ*

- Patient comes into the ER with SARI symptoms and is admitted
- Clinical team identifies and registers the case
- Physician orders BIDS panel:
  - Nasal swab- Viral results
  - Throat swab or lower respiratory specimen- Bacterial results
  - Remnant Sera sample- Coccidioidomycosis antibodies
- All samples are sent to an independent lab in Tucson, AZ
- Nurse fills out case report form- sent with samples
# Severe Acute Respiratory Infection Surveillance

Please complete the following form and place it inside the specimen collection kit. Please contact ADHS BIDS Epidemiology Coordinator at (520) 770-3179 for questions or information.

**BIDS ID Sticker**

<table>
<thead>
<tr>
<th>Gender</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
</table>

**Age**: ________

**Race/Ethnicity**

- White/Non-latino
- Native-American
- Latino/Hispanic
- African-American
- Asian
- Other: ____________

**Hospital Site**

- Patient Admitted: Yes / No
- If yes, select one:
  - Med/Surg
  - Transferred
  - Pediatrics
  - ICU
  - Long-term
  - Other: ____________

**Specimen Collection**

- Nasopharyngeal Swab: Yes / No

**Person completing form**: __________________________

**Collection date**: _____ / _____ / ______

## During the current illness, has the patient experienced:

- Fever of ≥37.8°C (100°F)
- Chills
- Cough
- Sputum production
- Sore throat
- Shortness of breath
- Body ache
- Headache
- Wheezing
- Nasal congestion
- Nausea/Vomiting
- Diarrhea
- Pneumonia

## Does patient have any of the following conditions:

- Neuromuscular disease (e.g., Multiple Sclerosis, Muscular Dystrophy)
- Metabolic Disorder (e.g., Diabetes, Thyroid)
- Immunosuppression (e.g., HIV, cancer)
- Morbidly Obese
- Pregnant
- Which trimester? 1st / 2nd / 3rd
- Cardiac Disease
- Chronic lung disease
- Other: ____________

## No. of days since symptoms began: ________

## Highest temperature in the last 24h: _____ °F

## In the last 5 days, has patient crossed US/Mexico border?

- Yes
- No
- Declined

## If yes, how often?

- everyday
- 2-4 times
- once
- unknown

## Seasonal influenza vaccine within the last 12 months?

- Yes / Date: _____ / _____ / _____
- No / Unknown

## If available, was a rapid flu test performed?

- Yes / No / Not available / Unknown

## If yes, result (mark only ONE choice):

- Positive
- Flu A
- Flu B
- Flu A & B
- Negative
- Inconclusive

## Did the patient take any medication for the current illness?

- Yes
- No

## If yes, check all that apply:

- Antivirals
- Type: ____________
- Antibiotics
- Type: ____________

## Observations:

______________________________
Specimen Testing

Bio 5 Institute Laboratory
Infectious Disease Research Core
(Tucson)

Fungal serology
Coccidioidomycosis:
- IgG
- IgM

Viral PCR Targets
- Respiratory syncytial virus: A and B
- Influenza: A, B, and A H1N1
- Parainfluenza: 1, 2, 3, 4
- Adenovirus: B and E
- Rhinovirus
- Herpes Simplex
- Enterovirus

Human metapneumovirus
Coxsackieviruses/Echovirus
Coronavirus: NL63, HKU1, 229E, OC43
Bocavirus

Naval Health Research Center
Respiratory Disease Lab (San Diego)

Viral PCR/Culture Targets
- Respiratory syncytial virus
- Influenza subtyping: A and B
- Parainfluenza: 1, 2, 3
- Adenovirus
- Rhinovirus
- Herpes Simplex: 1 and 2
- Enterovirus

Bacterial PCR/Culture targets
- B. pertussis
- C. pneuMO/ M. pneuMO/ S. pneumonia group A beta-hemolytic streptococcus (strep throat)
- H. influenzae
- Legionella
- Methicillin-resistant staphylococcus aureus (MRSA)

Cross-validation of viral results
Analyses

Data were collected on two populations:
(1) virologic data from BIDS sentinel hospital-site patients presenting with respiratory infections, and
(2) hospitalized SARI patients

Statistical Analyses:
BIDS sentinel hospital-site virologic dataset
   Graph of viral results and border ILI proportion positive by epidemiologic week

SARI dataset
   Graph of respiratory results by epidemiologic week
   Descriptive analyses on demographic and clinical data
BIDS Sentinel Hospital-Site Virologic Results vs. SARI Results
BIDS Sentinel Hospital-Site Virologic Results and Proportion of ILI Visits in AZ Border Region: October 2010 to October 2011

Number of Positive Viral Results

ILI %

- Coronavirus-HKU1
- Human Metapneumoviruses A/B
- Adenovirus (ADV)
- Coxsackieviruses/Echovirus
- RSV A
- Influenza A
- Coronavirus-229E
- Coronavirus-OC43
- Coronavirus-NL63
- Rhinovirus
- Coxsackieviruses/Echovirus or Rhinovirus
- RSV B
- Bocavirus
- Parainfluenza (1,2,3,4)
- Influenza B

N=1385
Test Results Among SARI Cases for All Sites by Week, October 2010 to October 2011

- **Influenza A (H3, pH1)**
- **RSV A**
- **Adenovirus (ADVB)**
- **RSV B**
- **Influenza B**
- **Parainfluenza (2,3)**
- **Human Metapneumovirus**
- **Coronavirus (OC43)**
- **Enterovirus**
- **Coxsackieviruses/Echovirus**
- **Group A Strep**
- **Rhinovirus**
- **Enterovirus**
- **Cocci**
- **Negative**

Number of Cases

Week Ending


N=70
BIDS Sentinel Hospital-Site Virologic Results and Proportion of ILI visits in AZ Border Region: October 8, 2011-June 30, 2012

N=923
Test Results Among 2011-2012* SARI Cases for all sites

- Influenza A (H3, pH1)
- Influenza B
- RSV type unknown
- RSV A
- Adenovirus (ADVB)
- Parainfluenza (1, 2, 3)
- Rhinovirus
- H. influenzae
- Human Metapneumoviruses A/B
- Coxsackieviruses/Echovirus
- Adenovirus (ADVB)
- Human Metapneumoviruses A/B
- Parainfluenza (1, 2, 3)
- RSV type unknown
- RSV A
- Rhinovirus
- H. influenzae
- Herpes Simplex Virus
- Cocci
- Negative

Number of SARI cases 2010-2011 (N=70)
Number of SARI cases 2011-2012 (N=39)

*Oct 8, 2011 - June 16, 2012

Week Ending
## BIDS Sentinel-Site vs. SARI
### Proportion positive by etiology

<table>
<thead>
<tr>
<th></th>
<th>2010-2011</th>
<th></th>
<th>2011-2012</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BIDS Sentinel Hospital Site Positive Results (n=1723)</td>
<td>SARI Positive Results (n=43)</td>
<td>BIDS Sentinel Hospital Site Positive Results (n=989)</td>
<td>SARI (n=29)</td>
</tr>
<tr>
<td>Influenza</td>
<td>24%</td>
<td>19%</td>
<td>37%</td>
<td>17%</td>
</tr>
<tr>
<td>RSV</td>
<td>36%</td>
<td>16%</td>
<td>15%</td>
<td>28%</td>
</tr>
<tr>
<td>Rhinovirus, Coxsackie/ Echovirus</td>
<td>26%</td>
<td>21%</td>
<td>26%</td>
<td>7%</td>
</tr>
<tr>
<td>Human meta-pneumoviruses</td>
<td>4%</td>
<td>2%</td>
<td>9%</td>
<td>24%</td>
</tr>
<tr>
<td>Parainfluenza</td>
<td>6%</td>
<td>14%</td>
<td>5%</td>
<td>14%</td>
</tr>
<tr>
<td>Coronavirus</td>
<td>4%</td>
<td>14%</td>
<td>5%</td>
<td>0%</td>
</tr>
</tbody>
</table>
SARI Surveillance Results
Percentage of SARI cases by Age Category

<table>
<thead>
<tr>
<th>Age Group</th>
<th>2010-11 (n=68)</th>
<th>2011-12 (n=38)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-4 years</td>
<td>15%</td>
<td>13%</td>
</tr>
<tr>
<td>5-24 years</td>
<td>5%</td>
<td>3%</td>
</tr>
<tr>
<td>25-49 years</td>
<td>20%</td>
<td>25%</td>
</tr>
<tr>
<td>50-64 years</td>
<td>25%</td>
<td>22%</td>
</tr>
<tr>
<td>65 years and older</td>
<td>40%</td>
<td>40%</td>
</tr>
</tbody>
</table>
Race/Ethnicity of 2010-11 SARI Cases

- Non-Hispanic White: 1%
- Hispanic: 40%
- Native American: 26%
- African American: 33%

N=70

Race/Ethnicity of 2011-2012 SARI Cases

- Non-Hispanic White: 28%
- Hispanic: 44%
- Native American: 28%
- African American: 1%

N=39
SARI cases by Gender, 2010-11

- Male: 60%
- Female: 40%

N=70

SARI cases by Gender, 2011-12

- Male: 38%
- Female: 62%

N=39
Symptoms of SARI cases

- Fever: 2010-2011 (80%), 2011-2012 (77%)
- Cough: 2010-2011 (80%), 2011-2012 (73%)
- Shortness of Breath: 2010-2011 (55%), 2011-2012 (50%)
- Chills: 2010-2011 (45%), 2011-2012 (44%)
- Pneumonia: 2010-2011 (30%), 2011-2012 (25%)
- Body ache: 2010-2011 (20%), 2011-2012 (15%)
- Wheezing: 2010-2011 (15%), 2011-2012 (10%)
- Nausea/vomiting: 2010-2011 (10%), 2011-2012 (5%)
- Headache: 2010-2011 (5%), 2011-2012 (3%)
- Nasal congestion: 2010-2011 (5%), 2011-2012 (3%)
- Sore throat: 2010-2011 (5%), 2011-2012 (3%)
- Diarrhea: 2010-2011 (1%), 2011-2012 (1%)

Sample sizes: 2010-2011 (n=70), 2011-2012 (n=39)
Comorbidities of SARI cases

Percentage of Cases

Metabolic disorder 35% (n=70)
Chronic lung disease 25% (n=39)
Cardiac disease 20% (n=70)
Hypertension 15% (n=39)
Immunosuppressed 10% (n=70)
Morbidly obese 10% (n=39)
Neuromuscular disease 5% (n=70)
Pregnant 0% (n=39)

Comorbidities

2010-11
2011-12
Additional Analyses from the SARI dataset
<table>
<thead>
<tr>
<th></th>
<th>PCR Confirmed Flu</th>
<th>PCR Negative Flu</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive Rapid Test</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Negative Rapid Test</td>
<td>10</td>
<td>55</td>
<td>65</td>
</tr>
<tr>
<td>Total</td>
<td>11</td>
<td>56</td>
<td>67</td>
</tr>
</tbody>
</table>

Sensitivity: \( \frac{1}{11} = 9\% \)
Specificity: \( \frac{57}{58} = 98\% \)
Conclusions

• Benefits to public health
• Limitations in the data
• Working towards more effective comparisons and collaborations across the border
  • Reporte Binacional de Influenza
Acknowledgements

- Arizona BIDS sentinel sites
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- Elizabeth Jacobs, PhD, MS
- K. Pogreba-Brown, MPH
- Frank Vanskike and Kristen Bratton, MPH students
Questions?

• **Border Region Background**
• **Objectives and Methods**
• **SARI Surveillance Results**
• **BIDS Sentinel Site Results**
• **SARI Additional Analyses**
• **Conclusion**
<table>
<thead>
<tr>
<th></th>
<th>Flu Positive (PCR)</th>
<th>Flu Negative (PCR)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Flu Vaccine</strong>*</td>
<td>4</td>
<td>42</td>
<td>46</td>
</tr>
<tr>
<td><strong>No Flu Vaccine</strong>*</td>
<td>7</td>
<td>33</td>
<td>40</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>11</td>
<td>75</td>
<td>86</td>
</tr>
</tbody>
</table>

Odds Ratio – \( \frac{4}{42} / \frac{7}{33} = 0.45 \)

95% confidence interval: (0.12, 1.66)

*Self-reported