Priorities in Rural Health: Cost-effectiveness Analysis of Fungal Meningitis Outbreak in New River Health District

Conference Phone: 877-394-0659
Conference Code: 775 483 8037#
Please remember to mute your computer speakers during the presentation.
Agenda

Welcome:  C. B. Mamaril, PhD, National Coordinating Center for PHSSR

Presenter:  Kaja Abbas, PhD, MPH, Assistant Professor, Dept. of Population Health Sciences, Virginia Tech

Commentary:

• Kerry Redican, PhD, MPH, research mentor, Professor, Virginia Tech Carilion School of Medicine
• Molly O'Dell, MD, MFA, Director, New River Health District, Virginia Department of Health

Questions and Discussion
PHSSR Research in Progress Series

Pre and Post Doctoral Research Awards (2013-4)

• 10 one-year awards with mentor & Center support
• Recordings available:
  – May 14 -- Local Health Department–Hospital Collaborations in New York State: A Natural Experiment
    Chris Maylahn, MPH, Office of Public Health Practice, New York State Dept. of Health [http://connect.uky.edu/p69fyfw4q3o/]
  – June 18 -- Health Care Reform: Colorectal Cancer Screening Expansion and Health Disparities
    Michael Preston, MPH, PhD, Cancer Control, University of Arkansas for Medical Sciences [http://connect.uky.edu/p4p2yumgqzp/]
  – Aug 13 - Quantifying the Value of Public Health Intervention
    Theresa Green, PhD, MBA, MS, Center for Community Health, U. of Rochester Medical Center [http://connect.uky.edu/p806n4ek68a/]
PHSSR Research in Progress Series

Mentored Research Development Awards (2012-4)

- 24-month awards, mentored by researchers & public health practitioners
- Recordings available:
    Jacqueline McDonald Gibson, PhD, UNC Gillings School of Global Public Health
    [https://connect.uky.edu/p3eaivn7bcy/](https://connect.uky.edu/p3eaivn7bcy/)
  - Jan 22 -- Applied Economic Modeling: Tuberculosis Control
    Thaddeus L. Miller, PhD, School of Public Health, University of North Texas Health Sciences Center
    [https://connect.uky.edu/p5sffjdzvo9](https://connect.uky.edu/p5sffjdzvo9)
  - Feb 5 -- Collaborative Governance to Support Exchange of Public Health-Relevant Data
    Holly Jarman, PhD, Center for Law, Ethics & Health, U. of Michigan School of Public Health
    [https://connect.uky.edu/p68do95av7w/](https://connect.uky.edu/p68do95av7w/)
  - Feb 12 -- Building an Evidence-Base for Social Media Use in Public Health Practice
    Jenine K. Harris, PhD, Assistant Professor, George Warren Brown School of Social Work, Washington University in St. Louis
    [http://connect.uky.edu/p8zzhvee42j/](http://connect.uky.edu/p8zzhvee42j/)
Kaja Abbas, PhD, MPH, Assistant Professor
Department of Population Health Sciences
Virginia Tech
Priorities in Rural Health: Cost-effectiveness Analysis of Fungal Meningitis Outbreak in New River Valley

Kaja Abbas
Assistant Professor of Infectious Diseases in Public Health

Public Health Program @ Virginia Tech
Department of Population Health Sciences, Virginia-Maryland College of Veterinary Medicine
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Virginia Tech
Priorities in Rural Health: Cost-effectiveness Analysis of Fungal Meningitis Outbreak in New River Valley

Kaja Abbas, PhD, MPH
Nargesalsadat Dorratoltaj, MS, MPH
Paige Bordwine, MPH
Margarat O’Dell, MD, MFA
Thomas Kerkering, MD
Kerry Redican, PhD, MSPH, MPH

Virginia Tech
Study objective

- To conduct cost-effectiveness analysis of the fungal meningitis outbreak in New River Valley from the local health department perspective.
Fungal meningitis

- Fungus
  - *Exserohilum rostratum*

- Symptoms
  - headache
  - stiff neck
  - fatigue

- Non-contagious

- Treatment drug
  - voriconazole

- New England compounding center
  - contaminated lots of methylprednisolone acetate
    - used in epidural spinal injections
Fungal meningitis outbreak

- Health facilities
  - 23 states
    - received contaminated lots
  - 20 states
    - 751 cases
    - 64 deaths

- Virginia
  - 54 cases
  - 5 deaths

CDC (2013)
Multisectoral public health response to the fungal meningitis outbreak

- CDC and FDA
- State Health Department
- Local Health Department
- Clinical: Hospitals and Pharmacies
- Immediate Caregivers: Family and Friends
- Patients
Fungal meningitis outbreak (2012)
New River Valley
94 exposed residents

Kate Corvese, 2012
Surveillance process

1. Outbreak started
2. Epidemiologist visited NRV health facility
3. Update case definition and surveillance instruction
4. Initial contact with exposed patients
5. Volunteers
6. 6 months passed from the last injection?
   - Yes: Done
   - No: 3 months passed from the last injection?
     - Yes: Follow up with the patient after a week
     - No: Contact patients' physicians
8. Met case definition?
   - Yes: Follow up with the patient after a month
   - No: Contact local emergency department
9. Approved symptoms?
   - Yes: Refer to medical care for lab tests
   - No: Follow up with the patient after a week
10. Follow up with the patient after a month

Roanoke
Incremental cost-effectiveness ratio

- Costs
- Effectiveness
- Perspective
  - Local health department

- New intervention
  - outbreak response
- Control
  - no intervention

\[
ICER = \frac{Cost_{new\ intervention} - Cost_{control}}{Effectiveness_{new\ intervention} - Effectiveness_{control}}
\]
Time & cost

**Hours**
- Epidemiologist: 57%
- Volunteer: 21%
- Director: 10%
- Planner: 5%

**Cost**
- Epidemiologist: 55%
- Director: 22%
- EH Management: 12%
- Planner: 5%
- Nurse Epi: 5%
- Clerical: 2%
# Cost

<table>
<thead>
<tr>
<th>NRHD Division</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Epidemiologists</td>
<td>$16,748.5</td>
</tr>
<tr>
<td>Director</td>
<td>$6,746.9</td>
</tr>
<tr>
<td>Planner</td>
<td>$1,558.7</td>
</tr>
<tr>
<td>EH Manager</td>
<td>$511.0</td>
</tr>
<tr>
<td>Clerical</td>
<td>$372.8</td>
</tr>
<tr>
<td>Admin</td>
<td>$240.0</td>
</tr>
<tr>
<td>Nurse Epi</td>
<td>$575.5</td>
</tr>
<tr>
<td>Volunteers</td>
<td>$3,739.5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$30,492.9</strong></td>
</tr>
</tbody>
</table>
Effectiveness - *DALY*

\[ \text{DALY} = \text{YLL} + \text{YLD} \]

- **DALY**
  - Disability Adjusted Life Year
- **YLL**
  - Years of Life Lost due to premature death
- **YLD (Years Lived with Disability)**
  - Years of Life Lost due to Disability
    - population: (prevalence) * (disability weight)
      - individual: (years with disability) * (disability weight)

One DALY equals one lost year of healthy life.
Effectiveness - **DALY**

**DALY** = YLL + YLD

**DALY**

Disability Adjusted Life Years is a measure of overall disease burden, expressed as the cumulative number of years lost due to ill-health, disability or early death.

- **YLD** = Years Lived with Disability
- **YLL** = Years of Life Lost

- Disability weight
  - fungal meningitis - 0.615
Effectiveness - **DALY**

\[ \text{DALY} = \text{YLL} + \text{YLD} \]

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Estimation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DALY</strong></td>
<td>2.87 + 97.65 = 100.52</td>
</tr>
<tr>
<td><strong>YLL (outbreak response)</strong></td>
<td>10.15 years</td>
</tr>
<tr>
<td># of potential cases</td>
<td>7</td>
</tr>
<tr>
<td>Case Fatality</td>
<td>10%</td>
</tr>
<tr>
<td>Average life expectancy in Virginia</td>
<td>79 years</td>
</tr>
<tr>
<td>Average age of exposed patients</td>
<td>57 years</td>
</tr>
<tr>
<td><strong>YLL (no response)</strong></td>
<td>107.8 years</td>
</tr>
<tr>
<td># of potential cases</td>
<td>7</td>
</tr>
<tr>
<td>Case Fatality</td>
<td>70%</td>
</tr>
<tr>
<td>Average life expectancy in Virginia</td>
<td>79 years</td>
</tr>
<tr>
<td>Average age of exposed patients</td>
<td>57 years</td>
</tr>
<tr>
<td><strong>YLL</strong></td>
<td>10.15 - 107.8 = 97.65</td>
</tr>
<tr>
<td><strong>YLD (outbreak response)</strong></td>
<td>2.87 years</td>
</tr>
<tr>
<td>Disability Weight</td>
<td>0.615, [0.613, 0.616]</td>
</tr>
<tr>
<td>Average duration of Disease</td>
<td>[3 months - 1yr]</td>
</tr>
<tr>
<td><strong>YLD (no response)</strong></td>
<td>0</td>
</tr>
<tr>
<td><strong>YLD</strong></td>
<td>2.87</td>
</tr>
</tbody>
</table>
**ICER**

### Incremental Cost-Effectiveness Ratio

- **DALY** = 100.52 DALYs averted
- **Cost of Intervention** = $30,493

**ICER** = \[ \frac{\text{Cost}_{\text{new intervention}} - \text{Cost}_{\text{control}}}{\text{Effectiveness}_{\text{new intervention}} - \text{Effectiveness}_{\text{control}}} \]

**ICER** = $303 / DALY averted

[Diagram showing decision-making based on cost and effectiveness:
- High cost and low effectiveness → Reject new intervention (Dominated)
- High cost and high effectiveness → CEA
- Low cost and low effectiveness → CEA
- Low cost and high effectiveness → Adopt new intervention (Dominant)]
Limitations

- Local health department perspective
  - partial estimation of total outbreak response costs
- No confirmed case of fungal meningitis
- Disability weight estimation of fungal meningitis
Public health significance & limitations

- **Significance**
  - Fungal meningitis epidemiological impact in Virginia
    - 54 cases
    - 5 deaths
  - New River Valley
    - 94 exposed residents

- **Implications**
  - Assist decision makers at local health department to estimate costs and effectiveness of outbreak response
  - Prioritization of limited resources
### Table 15.4 International thresholds for cost-effectiveness

<table>
<thead>
<tr>
<th>Organization/group</th>
<th>Cost-effectiveness thresholds</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia*</td>
<td>Costs per LYG &lt; AU $ 42,000 – 76,000 (costs per LYG &lt; AU $ 42,000: reimbursement likely, costs per LYG &gt; AU $ 76,000 reimbursement unlikely)</td>
<td>George et al. (2001)</td>
</tr>
<tr>
<td>The Netherlands</td>
<td>Costs &lt; € 20,000 per QALY or LYG: cost-effective* Costs &lt; € 80,000 per QALY: cost-effective**</td>
<td>Welte et al. (2004c); Raad voor de Volksgezondheid &amp; Zorg (2007)</td>
</tr>
<tr>
<td>UK National Institute of Clinical Evidence (NICE)*</td>
<td>Costs per QALY &lt; £ 20,000–30,000: cost-effective Costs per QALY &lt; £ 45,000: cost-effective</td>
<td>Devlin and Parkin (2004); Appleby and Devlin, Parkin (2007)</td>
</tr>
<tr>
<td>US Institute of Medicine (IOM)**</td>
<td>Saves money and QALYs: most favorable Costs per QALY &lt; US $ 10,000: more favorable Costs per QALY &gt; US $ 10,000 and &lt; 100,000: favorable Costs per QALY &gt; US $ 100,000: less favorable</td>
<td>Institute of Medicine (2000)</td>
</tr>
<tr>
<td>World Health Organization (WHO)**</td>
<td>Costs per DALY &lt; GDP per capita: highly cost-effective Costs per DALY = 1x – 3x GDP per capita: cost-effective Costs per DALY &gt; 3x GDP per capita: not cost-effective</td>
<td>WHO (2008)</td>
</tr>
<tr>
<td>International and especially US decision analysts**</td>
<td>Costs per QALY or LYG &lt; US $ 50,000: cost-effective</td>
<td>Grosse (2008)</td>
</tr>
<tr>
<td>US and British health economists**</td>
<td>Costs per LYG &lt; US $ 60,000: cost-effective</td>
<td>Newhouse (1998)</td>
</tr>
</tbody>
</table>

* Thresholds derived from past decisions
** Officially stated thresholds
LYG = Life year gained
QALY = Quality-adjusted life year
GDP = Gross domestic product
Related upcoming presentations

- 2014 APHA annual meeting, New Orleans
  - Nargesalsadat Dorratoltaj
    - Economic Evaluation of 2012 Fungal Meningitis Outbreak in New River Valley
      - Session 3040.0: Health administration round table: Innovations in health administration
      - Monday, November 17, 2014: 08:30 AM - 10:00 AM
      - Abstract ID: 307051
  - Kaja Abbas
    - Economic Evaluation of Outbreak Responses of Pertussis, Tuberculosis and Fungal Meningitis in New River Valley, Virginia
      - Session 5052.0: Model practices in program evaluation
      - Wednesday, November 19, 2014: 8:30 AM-10:00 AM
      - Abstract ID: 308705
Acknowledgments

● Funding
  ○ National Coordinating Center for Public Health Services and Systems Research
    ■ University of Kentucky
    ■ Robert Wood Johnson Foundation

● PHSSR Research-In-Progress Webinar
  ○ Organizers
    ■ Ann Kelly
    ■ Cezar Mamaril
  ○ Participants
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Commentary

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Professor, Virginia Tech Carilion School of Medicine

Molly O'Dell, MD, MFA
Director, New River Health District, Virginia Department of Health

Questions and Discussion
### Sept 10 – Improving HIV/STD Partner Services Performance in New York State: A Performance Management Approach

Britney Johnson, MPH, AIDS Institute/Office of Public Health Practice, New York State Department of Health

*Commentary: Sylvia Pirani, MPH, Office of Local Health Services, NYS Dept. of Health*

*James Tesoriero, PhD, HIV Prevention Director, NYS Dept. of Health*

### Sept 24 - State Health Department Foodborne Disease Outbreak Reporting

Fanta Purayidathil, PhD, Health Economics and Outcomes Research, Boehringer Ingleheim

*Commentary: Jennifer Ibrahim, PhD, MPH, Dept. of Public Health, Temple University*

### Oct 8 – Variations in the costs of delivering public health services: An analysis of local health departments in Florida

Simone Singh, PhD, University of Michigan School of Public Health

*Commentary: Patrick Bernet, PhD, Florida Atlantic University*
## Future PHSSR Research in Progress Webinars

**All webinars from 12-1 pm, ET**

<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
<th>Speakers</th>
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<tbody>
<tr>
<td>Oct 22</td>
<td>Relationship Between Public Health Workforce Competency, Provision of Services, and Health Outcomes in Tennessee</td>
<td>Robin Pendley, DrPH, <em>formerly</em> Health Services Management and Policy, College of Public Health, East Tennessee State University</td>
</tr>
<tr>
<td>Nov 12</td>
<td>Trends and Characteristics of the State and Local Public Health Workforce</td>
<td>Angela J. Beck, PhD, MPH, Associate Director, Center of Excellence in Public Health Workforce Studies, University of Michigan</td>
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<tr>
<td>Dec 10</td>
<td>Integrating Public Health and Healthcare: Lessons from One Urban County</td>
<td>Erik L. Carlton, DrPH, Health Systems Management and Policy, School of Public Health, University of Memphis</td>
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<td><strong>Commentary:</strong> Paul Erwin, MD, DrPH, Dept. of Public Health, University of Tennessee</td>
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