Respiratory and GI Outbreaks in Long Term Care
Dr. Chesley Richards, Centers for Disease Control & Atlanta VA Hospitals
A Webber Training Teleclass

Objectives
• Review elements of outbreak investigation in long term care facilities
• Discuss infection control approaches in LTCFs for outbreaks
• Discuss key clinical and epidemiologic features of respiratory and gastrointestinal infectious disease outbreaks in LTCFs

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National Center for Infectious Diseases
Centers for Disease Control and Prevention

Hosted by Paul Webber
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www.webbertraining.com

How common are infections in LTCFs?

<table>
<thead>
<tr>
<th>Infection</th>
<th>per 1000 pt-days per yr.</th>
<th>100 bed NH</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTIs</td>
<td>0.3 to 4.7</td>
<td>73</td>
</tr>
<tr>
<td>UTIs</td>
<td>0.2 to 2.2</td>
<td>37</td>
</tr>
<tr>
<td>SST</td>
<td>0.1 to 2.1</td>
<td>37</td>
</tr>
<tr>
<td>GI</td>
<td>0.1 to 2.5</td>
<td>37</td>
</tr>
<tr>
<td>BS</td>
<td>0.2 to 0.4</td>
<td>11</td>
</tr>
</tbody>
</table>

RTIs (respiratory tract infections), UTIs (urinary tract infections), SST (skin & soft tissue infections), GI (gastrointestinal infections), BS (bloodstream infections)

Adapted from Strausbaugh et al. Infections in Residents of Long Term Care Facilities in Mayhall CG, Hospital Epidemiology and Infection Control

Risk factors for infections in LTCF residents
• Individual
  – Decreased immunity to infections
  – Malnutrition
  – Chronic disease
  – Functional impairment (e.g., diminished cough reflex, urinary and fecal incontinence, immobility)
  – Medications (e.g., CNS suppressants)
  – Invasive devices (e.g., catheters, I.V.s, NGTs)


What are risk factors for infections in LTCF residents?
• Institutional
  – Larger LTCFs
  – Group activities
  – Low immunization rates
  – Excessive antimicrobial use
  – Widespread colonization, antibiotic resident bacteria
  – Single nursing units, or multiple units with a single nursing station


Unique challenges for investigating and managing outbreaks in LTCFs
• Cognitive impairment complicates data collection, communication and interventions
• Multiple comorbidities, group exposures
• What are appropriate outcomes?
  – Preventing death?
  – Preventing hospitalization?
  – Maintaining health status, function, quality of life are probably more important

Unique challenges for investigating and managing outbreaks in LTCFs

- Residence vs health care setting
  - “Residents” not “patients”
- Nurse staffing is suboptimal
- Limited
  - Medical provider presence
  - Medical record documentation
  - Laboratory diagnostic studies
- In the U.S., for-profit industry

Key aspects of outbreak investigation and control in LTCFs

- Have an infection control plan and program
- Ask 2 important questions
  - Is this surveillance artifact?
  - Is an epidemiologic investigation needed?
- Develop a case definition and line listing, ascertain cases
- Determine person, place, time
- Develop preliminary hypotheses and evaluate
- Implement interventions
- Evaluate the impact of interventions


Epidemic Curves

Some questions to ask about your Infection control plan and program

- Is there an ICP? Is the ICP trained? Does the ICP train staff?
- Who really provides care for the residents?
- What’s the reporting chain?
- How would handle isolation? Cohorting?
- How would handle mass treatment/vaccination?
- How do you monitor/restrict visitors?
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**CDC Infection Control Precautions**

<table>
<thead>
<tr>
<th>Component</th>
<th>Standard</th>
<th>Contact</th>
<th>Droplet</th>
<th>Airborne</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hand hygiene</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Room</td>
<td>Any</td>
<td>Private or Cohort</td>
<td>3 feet</td>
<td>Negative pressure</td>
</tr>
<tr>
<td>Gowns</td>
<td>Optional</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Mask</td>
<td>Optional</td>
<td>Surgical</td>
<td>Surgical</td>
<td>N-95</td>
</tr>
<tr>
<td>Eyewear</td>
<td>Optional</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Equipment</td>
<td>Not dedicated</td>
<td>Dedicated</td>
<td>Dedicated</td>
<td>Dedicated</td>
</tr>
</tbody>
</table>

_Garner JS. Am J Infect Control 1996;24:24-52._

**Respiratory Infection Outbreaks in LTCFs**

- 5 LTCFs, Ontario, 3 years
- 37% of residents affected
- Year-round, no seasonal pattern
- Pathogens
  - Influenza, para-influenza, RSV
  - Legionella, Chlamydia pneumoniae


**Influenza**

- Influenza virus
  - Single stranded RNA virus
  - Virus type: A or B
- Epidemics reported since 1510
  - 21 million deaths during 1918-19 pandemic
- Clinical characteristics
  - Incubation period 1-3 days
  - Respiratory transmission with viral shedding 5-10 days
  - Fever, non-productive cough, myalgias, sore throat, headache
- 95% of deaths are in people 65 and older
- Antivirals for treatment and prophylaxis

**Influenza Vaccine Efficacy in the Elderly**

<table>
<thead>
<tr>
<th>For preventing</th>
<th>Estimate</th>
<th>95% C.I.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respiratory illness</td>
<td>56%</td>
<td>39 to 68</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>53%</td>
<td>35 to 66</td>
</tr>
<tr>
<td>Hospitalization</td>
<td>50%</td>
<td>28 to 65</td>
</tr>
<tr>
<td>Death</td>
<td>68%</td>
<td>56 to 76</td>
</tr>
</tbody>
</table>

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**Why Vaccinate LTC Residents?**

- Residents are at risk for complications from influenza and pneumococcal disease
  
  (ACIP, MMWR 1997, ACIP, MMWR 2000)
- These diseases have outbreak potential and group living conditions foster outbreaks
  
  (Nuorti, NEJM 1998; ACIP, MMWR 1997; ACIP, MMWR 2000)
- Antibiotic-resistance of Streptococcus pneumoniae is increasing
  
  (Whitney C, NEJM 2000)

**Influenza Outbreaks**

- Outbreak definitions
  
  - No universally agreed definition
  
  - 10% of a ward or LTCF with ILI
  
  - 2-3 residents within 48 to 72 hours
- If outbreak occurs
  
  - Chemoprophylaxis should be considered
  
  - Revaccination
  
  - Reinforce standard precautions
  
  - Isolation/cohorting for residents with ILI
  
  - Limit group activities and visitors
  
  - Close LTCF or ward to new admissions

**Antiviral prophylaxis or testing?**

- Prophylaxis
  
  - For the entire season for individuals who cannot be vaccinated
  
  - Following suspected exposure or when community activity increased
  
  - 70-90% effective in preventing illness
- Treatment
  
  - Within 48 hours of the onset of influenza like symptoms

**Steps to prevention and control of influenza**

- Hand hygiene/respiratory etiquette
- Antiviral medications/prophylaxis
- Vaccination
- Droplet precautions
- Antiviral treatment

**Respiratory/Cough Etiquette**

- Cover the nose/mouth when coughing or sneezing
- Use tissues to contain respiratory secretions
- Perform hand hygiene after contact with respiratory secretions or contaminated objects/materials.
- Healthcare facilities should
  
  - Provide tissues and no-touch waste receptacles
  
  - Provide conveniently located dispensers of alcohol-based hand rub or sinks with adequate supplies

Indications for antiviral therapy

- Prophylaxis
  
  - For the entire season for individuals who cannot be vaccinated
  
  - Following suspected exposure or when community activity increased
  
  - 70-90% effective in preventing illness
- Treatment
  
  - Within 48 hours of the onset of influenza like symptoms

http://www.cdc.gov/flu/professionals/infectioncontrol/resphygiene

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Drugs for Influenza

<table>
<thead>
<tr>
<th>Agent</th>
<th>Influenza Virus Affected</th>
<th>Administration</th>
<th>Primary Side Effects</th>
<th>Treatment</th>
<th>Prophylaxis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amantadine</td>
<td>Influenza A</td>
<td>Oral</td>
<td>CNS/GI</td>
<td>100mg twice daily</td>
<td>100mg twice daily</td>
</tr>
<tr>
<td>Rimantadine</td>
<td>Influenza A</td>
<td>Oral</td>
<td>CNS/GI</td>
<td>100mg twice daily</td>
<td>100mg twice daily</td>
</tr>
<tr>
<td>Zanamivir</td>
<td>Influenza A&amp;B</td>
<td>Oral inhalation</td>
<td>Respiratory</td>
<td>100mg twice daily</td>
<td>NA*</td>
</tr>
<tr>
<td>Oseltamivir</td>
<td>Influenza A&amp;B</td>
<td>Oral</td>
<td>GI</td>
<td>75mg twice daily</td>
<td>75mg twice daily</td>
</tr>
</tbody>
</table>

Nursing home acquired pneumonia

- Incidence
  - 13 to 44% of infections in LTCFs
  - Up to 44% mortality
- Risk factors
  - Swallowing difficulty, inability to take p.o. meds; witnessed aspiration
  - Lack of influenza vaccination
  - Sedative-hypnotic drug use
  - Cognitive impairment
- In residents with influenza, post-viral bacterial pneumonia is a major cause of morbidity/mortality
  - S. pneumoniae is leading cause of bacterial pneumonia in LTCF residents

**Predictors of mortality**

- Activities of Daily Living (ADL) dependence
- Hypothermia
- Increased blood urea nitrogen
- Infiltrate on chest xray
- Tachypnea

**Invasive Pneumococcal Disease Burden by Age, 1998**

- Incidence four-fold higher in LTCFs
  - 194 vs 44 per 100,000 (RR 4)
- Levofoxacin non-susceptible S. pneumoniae five-fold higher in LTCF
  - 4.2 vs 0.4 (RR 10)
- The majority of S. pneumoniae serotypes for both LTCF and community-living older adults covered by the current vaccine

**Acute Pneumonia Mortality in Long Term Care Residents:**

**Invasive Streptococcus pneumonia in older adults in LTCF and Community**

- Incidence four-fold higher in LTCFs
  - 194 vs 44 per 100,000 (RR 4)
- Levofoxacin non-susceptible S. pneumoniae five-fold higher in LTCF
  - 4.2 vs 0.4 (RR 10)
- The majority of S. pneumoniae serotypes for both LTCF and community-living older adults covered by the current vaccine


**Muder et al. Arch Intern Med 1996; 156:2365**

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Antibiotic Rx in 6 LTCFs
Atlanta GA, 2000
(n=103 antibiotic courses)

- FQ
- Cephs
- PCNs
- Macrolides
- TMP/SULFA
- Vanco
- Others

Richards C, et al. (in press, JAMDA)

Respiratory Infection Outbreaks
Key points
- Influenza, pneumococcal vaccination
- Active surveillance strategy
- Institutional preparation and commitment
  - Rapid testing
  - Institution of antiviral prophylaxis
  - Infection control isolation
- Secondary bacterial pneumonia

GI Outbreaks in LTCFs

Non-infectious causes
- Hyperosmolar solutions
- Laxatives
- Antacid
- Antibiotics
- Impaction
- Ischemic bowel
- Functional disorders

Infectious causes
- Norovirus/Rotavirus
- Foodborne
  - Salmonella, Shigella,
  - Campylobacter, E. coli
- Parasites
  - Giardia, Cyclospora
  - Cryptosporidium, etc.
- Clostridium difficile

Etiologic agents of GI outbreaks in LTCFs

- Viruses
  - Caliciviridae
  - Rotavirus
  - Adenoviridae
  - Astroviridae
- Bacteria
  - Salmonella
  - Shigella
  - Staphylococcus
  - Clostridium difficile
  - E. coli 0157:H7
  - Aeromonas hydrophilia
  - Campylobacter
  - Bacillus cereus

- Parasites
  - Entamoeba histolytica
  - Giardia lamblia
  - Cryptosporidium

Selected Foodborne Outbreaks in LTCF

- Salmonella hadar in TN LTCF
  - 14% residents (250 bed) developed diarrhea
  - 244 HCW, attack rates
    - 27% laundry workers, 3% nurses, 4% kitchen staff
- Clostridium perfringens in Australia LTCF
  - 25 residents affected; pureed food not reheated
- Campylobacteriosis at a Senior Center
  - Hawaiian Luau allowed for cross-contamination between raw meat and vegetables

Viral outbreaks: Selected Cases

- **Norovirus**
  - Washington LTCF: 57% residents, 39% HCWs
  - Molecular typing: debilitated residents, HCW transmission
- **SRSV**
  - Maryland LTCF: 51% residents, 47% HCWs
  - Index case: Nurse working ill x several days

**Rotavirus**

- Diarrhea in aged-care facilities in Australia
  - 13% Rotavirus
  - 44% Norovirus
  - 2% Astrovirus
- Mid-winter to mid-spring
- Diarrhea, vomiting 1-5 days


**Clostridium difficile diarrhea**

- 25% of antibiotic associated diarrhea
- 300,000 cases per year
- Most frequent antibiotics: Clindamycin, Ampicillin, Amoxicillin, Cephalosporins
- Can occur with any antibiotic
- **Colonization**
  - Occurs in 21% hospitalized patients
  - 2/3 asymptomatic
  - Spores: person-to-person transmission


**Pathophysiology**

Disruption of fecal flora (antibiotic tx)

- Colonization
  - Spores
  - Nontoxigenic strain
  - Toxigenic strain
  - Toxin A chemotaxis
  - Toxin B fluid secretion
  - Other toxins

No disease


**Diagnosis and Treatment**

- Diagnosis
  - Stool culture, Cytotoxin assay, ELISA
  - Endoscopy
- Treatment
  - **STOP** inciting antibiotic
  - Avoid anti-peristaltic drugs, opiates
  - Antibiotic treatment:
    - Metronidazole p.o. 250 mg QID, 10-14 days
    - Vancomycin p.o. 125 mg QID, 10-14 days
  - Retreatment as needed

*Mylonakis E. Arch Int Med 2001;161:525-533

**C. Difficile Outbreak Associated with Gatifloxacin in LTCF**

- Gatifloxacin replaced Levofloxacin on LTCF formulary in October 2001
- C. difficile attack rate
  - Jan 2001-Sep 2001 17%
  - Oct 2001- Jun 2002 30%
- Formulary changed back to Levofloxacin with return to lower rates of C. diff
- **Hypothesis:** Gatifloxacin has expanded anaerobic coverage

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**Controlling GI outbreaks**

- Diarrhea and/or vomiting
- Dehydration is common and deadly
- Transmission may occur rapidly
  - Consider contact precautions, universal gloving
- Hand hygiene and standard precautions among residents and HCWs MUST be emphasized!
- Engage all staff including environmental staff
- HYDRATION! HYDRATION! HYDRATION!

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**Infection control considerations for outbreaks in LTCFs**

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**LTC facilities have increased infection control efforts, but are programs sufficient?**

- Survey of 136 skilled LTC facilities (>25 beds) in NE states
- 98% report having a “designated” ICP
- 60% perform other jobs in addition to IC
- Average 8 hours per week doing IC tasks
- 52% received IC training
- 24% of facilities have MD with IC interest/responsibilities

Goldrick, BA, ICHE, 1997

**Practical Considerations**

- Emphasize hand hygiene
- Consider universal glove use for all resident care
- Respiratory etiquette protocol

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**Hand Hygiene Adherence**

<table>
<thead>
<tr>
<th>Year of Study</th>
<th>Adherence Rate</th>
<th>Hospital Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>1994 (1)</td>
<td>29%</td>
<td>General and ICU</td>
</tr>
<tr>
<td>1995 (2)</td>
<td>41%</td>
<td>General</td>
</tr>
<tr>
<td>1996 (3)</td>
<td>41%</td>
<td>ICU</td>
</tr>
<tr>
<td>1998 (4)</td>
<td>30%</td>
<td>General</td>
</tr>
<tr>
<td>2000 (5)</td>
<td>48%</td>
<td>General</td>
</tr>
</tbody>
</table>


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**Self-Reported Factors for Poor Adherence with Hand Hygiene**

- Handwashing agents cause irritation and dryness
- Sinks are inconveniently located/lack of sinks
- Lack of soap and paper towels
- Too busy/insufficient time
- Understaffing/overcrowding
- Patient needs take priority
- Low risk of acquiring infection from patients

Adapted from Pittet D., Infect Control Hosp Epidemiol 2000;21:381-386.

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Efficacy of Hand Hygiene Preparations in Killing Bacteria

Good Better Best
Plain Soap Antimicrobial soap Alcohol-based handrub

Ability to Kill Bacteria on Hands

<table>
<thead>
<tr>
<th>Time after disinfection (minutes)</th>
<th>Bacterial Reduction (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Plain soap</td>
</tr>
<tr>
<td>0</td>
<td>99.9</td>
</tr>
<tr>
<td>60</td>
<td>99.0</td>
</tr>
<tr>
<td>180</td>
<td>90.0</td>
</tr>
<tr>
<td></td>
<td>Alcohol-based handrub</td>
</tr>
<tr>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>60</td>
<td>0.0</td>
</tr>
<tr>
<td>180</td>
<td>0.0</td>
</tr>
</tbody>
</table>


Effect of Alcohol Handrub on Skin Condition

<table>
<thead>
<tr>
<th>Self-reported skin score</th>
<th>Epidermal water content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>Alcohol rub</td>
</tr>
<tr>
<td>0</td>
<td>27</td>
</tr>
<tr>
<td>1</td>
<td>25</td>
</tr>
<tr>
<td>2</td>
<td>23</td>
</tr>
<tr>
<td>3</td>
<td>21</td>
</tr>
<tr>
<td>4</td>
<td>19</td>
</tr>
<tr>
<td>5</td>
<td>17</td>
</tr>
<tr>
<td>6</td>
<td>15</td>
</tr>
</tbody>
</table>

Baseline 2 weeks

Epidermal water content

~ Alcohol-based handrub is less damaging to the skin ~

Time Spent Cleansing Hands:

one nurse per 8 hour shift

- Hand washing with soap and water: 56 minutes
  - Based on seven (60 second) handwashing episodes per hour
- Alcohol-based handrub: 18 minutes
  - Based on seven (20 second) handrub episodes per hour

~ Alcohol-based handrubs reduce time needed for hand disinfection ~


Recommended Hand Hygiene Technique

- Handrubs
  - Apply to palm of one hand, rub hands together covering all surfaces until dry
  - Volume: based on manufacturer
- Handwashing
  - Wet hands with water, apply soap, rub hands together for at least 15 seconds
  - Rinse and dry with disposable towel
  - Use towel to turn off faucet


Time Spent Cleansing Hands:

one nurse per 8 hour shift

- Hand washing with soap and water: 80 minutes
  - Based on three (80 second) handwashing episodes per hour
- Alcohol-based handrub: 20 minutes

~ Alcohol-based handrubs reduce time needed for hand disinfection ~

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Summary

- Respiratory and GI outbreaks can be deadly in the vulnerable LTCF population
- Prior planning is crucial
  - Surveillance for outbreaks
  - Infection control plan
  - Authority to take rapid action
- Simple interventions can make a big difference
  - Immunization, hand hygiene, respiratory etiquette

Other 2005 Teleclasses
For more information, refer to www.webbertraining.com/schedule.cfm

- March 10 - Biocide Use in a Healthcare Environment with Dr. Jean-Yves Mailard
  Sponsored by JohnsonDiversey  www.johnsondiversey.com
  Prevention Healthcare Associated Infection; A Worldwide Strategy
  with Dr. Didier Pittet
- March 24 - Infection Control in Pre-Hospital Care with Margaret McKenzie
- March 31 - Voices of CHICA Free Teleclass
- April 7 - Root Cause Analysis for the Infection Control Professional
  with Dr. Denise Murphy
- April 14 - Disinfectants and Environmental Impact with Dr. Franz Daschner

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