Long-term Acute Care Hospitals

*Infection Control Issues*

**SHEA 2007**

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**Disclosure:** Nothing to disclose
Long-term Acute Care Hospitals

- Defined by CMS as hospitals with average length of stay ≥ 25 days

- LTACH patients:
  - Have multiple complicated medical conditions
  - Require skilled, complex medical care
  - Cannot be managed under lesser level of care
Patients in LTACHs differ from those in other long-term settings:

- Require continuous intensive acute care services
- Higher severity of illness
- Multisystem complications (e.g. ventilator dependence)
- Goal is medical recovery and return home
Long-term Acute Care Hospitals

Examples of conditions appropriate for LTACH:

- Prolonged ventilator weaning
- Intensive respiratory care
- Chronic renal failure requiring dialysis complicating other medical conditions
- Complex medical regimen (e.g. multiple IV meds, TPN, frequent transfusions)
- Complex wound care
Common Diagnoses

- CV disease
- Ventilator-dependence
- Tracheotomies with complications
- Peripheral vascular disease
- Pressure wounds
- Surgical recuperation
- Burns
- Trauma
- Complicated fractures
- Head/spinal cord injuries
- Stroke
LTACHs: An Expanding Healthcare Setting

- Aging population
- New technology
- Economic forces
  - Prospective payment system for acute care hospitals
Long-term Acute Care Hospitals: History

- 1984: Medicare implemented acute care hospital prospective payment system
  - Long-term care exemption
- 1988-1996: Average annual growth rate 31%
- 1993: 58 LTACHs in 20 states
- 2003: 280 LTACHs in 40 states
Long-term Acute Care Hospitals

- Freestanding or “hospitals within hospitals”
  - “host” hospital leases unused space to LTACH
- Separate governing body, administration, and medical staff
- Must meet same health and safety standards as acute care hospitals
LTACH Role in Continuum of Care

Acute → Long term Acute → Acute rehab → Subacute skilled & rehab → Ambulatory

Home care
- Home health
- Assisted living
- Hospice

Community prevention & wellness

Adapted from Matarelli. Case Manager 2001;12:79
Infection Control Issues in LTACHS

- Unique population and environment
- What do we know?
- How do we apply current infection control recommendations?
Infection Control Challenges in LTACHs

- High risk patient population
- High prevalence of MDROs
- Availability of private rooms for isolation
- Logistics of isolating and cohorting patients
- Adequate infection control resources
- Active surveillance capabilities
- Antibiotic pressure
Antibiotic resistance and antibiotic use patterns in 45 LTACHs (2002-2003)

- Data obtained from corporation that manages LTACHs in U.S.
  - Geographically diverse
  - Most were hospitals within hospitals
Colonization on admission: Active surveillance at one LTACH, 2003

263 patients admitted

135 known colonized or infected

128 unknown

Surveillance cultures

33 positive

95 negative

168 colonized/Infected (64%)

42% MRSA
16% VRE
6% MRSA+VRE

26% of “clean” patients found to be colonized on admission

Gould, Rothenberg, Steinberg. ICHE 2006;27:923-5
Colonization pressure

“...compliance for hand washing significantly in excess of reported levels, or the cohorting of nursing staff, are needed to prevent nosocomial transmission of VRE in endemic settings.”

Austin DJ et al. Proc Natl Acad Sci USA 1999;96:6908-13
VRE acquisition in relation to colonization pressure and antibiotic pressure

<table>
<thead>
<tr>
<th>Colonization pressure</th>
<th>Antibiotic pressure</th>
<th>Time to acquisition</th>
</tr>
</thead>
<tbody>
<tr>
<td>75%</td>
<td>75%</td>
<td>5 days</td>
</tr>
<tr>
<td>75%</td>
<td>25%</td>
<td>6 days</td>
</tr>
<tr>
<td>25%</td>
<td>75%</td>
<td>16 days</td>
</tr>
<tr>
<td>25%</td>
<td>25%</td>
<td>19 days</td>
</tr>
</tbody>
</table>

Antibiotic pressure = % of days with cephalosporin use

Device Utilization

- 45 LTACHs:
  - Central line utilization rate\(\dagger\): 56%
  - Ventilator utilization rate\(\ddagger\): 18%
- 2 LTACHs, 93 ventilator-dependent patients:
  - Central line utilization rate: 75%

\(\dagger\) Central line days/patient days
\(\ddagger\) Ventilator days/patient days

Gould et al. ICHE 2006;27:923-5
Wolfenden et al. ICHE 2007;28:105-6
### Device Use rates in LTACHs compared to NNIS Medical ICUs (2002-2003)

<table>
<thead>
<tr>
<th></th>
<th>Medical ICUs</th>
<th>45 LTACHS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10%</td>
<td>25%</td>
</tr>
<tr>
<td>Central Line Utilization</td>
<td>0.3</td>
<td>0.37</td>
</tr>
<tr>
<td>Ventilator Utilization</td>
<td>0.24</td>
<td>0.35</td>
</tr>
</tbody>
</table>

NNIS data are from Jan 1995 to June 2003

Am J Infect Control 2003;31:481-98
Gould et al. ICHE 2006;27:923-5
Data on Nosocomial Infections in LTACHs

- Cohort of 93 patients with respiratory failure in 2 LTACHs Nov 04 - Jul 05

<table>
<thead>
<tr>
<th></th>
<th>LTACH patients</th>
<th>90th percentile in NNIS medical ICUs (2002-04)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central Line use rate</td>
<td>75%</td>
<td>75%</td>
</tr>
<tr>
<td>CR-BSI rate</td>
<td>16.4</td>
<td>8.8</td>
</tr>
</tbody>
</table>

Central line use rate = Central line days/total patient-days

CR-BSI rate = BSI Cases per 1000 central line days

Wolfenden LL et al. ICHE 2007;28:105-6
Am J Infect Control 2004;32:470-85
# Pathogens isolated from 33 LTACH Patients with CR-BSI

<table>
<thead>
<tr>
<th>Organism</th>
<th>No (%) of isolates (n=40)</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Enterococcus</em> species</td>
<td>13 (32)</td>
</tr>
<tr>
<td>Coagulase-negative <em>staphylococci</em></td>
<td>12 (29)</td>
</tr>
<tr>
<td><em>Staphylococcus aureus</em></td>
<td>5  (12)</td>
</tr>
<tr>
<td><em>Candida</em> species</td>
<td>5  (12)</td>
</tr>
<tr>
<td><em>Klebsiella oxytoca</em></td>
<td>3  (8)</td>
</tr>
<tr>
<td><em>Acinetobacter baumannii</em></td>
<td>1  (3)</td>
</tr>
<tr>
<td><em>Alcaligenes xylosoxidans</em></td>
<td>1  (3)</td>
</tr>
</tbody>
</table>

Wolfenden LL et al. ICHE 2007;28:105-6
## Composite Antibiogram from 45 LTACHs (2002-2003)

<table>
<thead>
<tr>
<th>Organism</th>
<th>Antibiotic</th>
<th>Median % resistant</th>
<th>Range %</th>
</tr>
</thead>
<tbody>
<tr>
<td>S. aureus</td>
<td>Oxacillin</td>
<td>86*</td>
<td>57-100</td>
</tr>
<tr>
<td>Enterococcus</td>
<td>Vancomycin</td>
<td>32</td>
<td>2-69</td>
</tr>
<tr>
<td>Pseudomonas</td>
<td>Piperacillin</td>
<td>23</td>
<td>2-52</td>
</tr>
<tr>
<td></td>
<td>Fluoroquinolones</td>
<td>60*</td>
<td>28-89</td>
</tr>
<tr>
<td></td>
<td>Imipenem</td>
<td>31</td>
<td>0-69</td>
</tr>
<tr>
<td>Klebsiella</td>
<td>Ceftazidime</td>
<td>12*</td>
<td>0-81</td>
</tr>
<tr>
<td>E. coli</td>
<td>Fluoroquinolones</td>
<td>45*</td>
<td>8-86</td>
</tr>
</tbody>
</table>

* >90th percentile of resistance rates in NNIS ICUs (Jan 1998-June 2003)

Gould et al. ICHE 2006;27:923-5
Am J Infect Control 2003;31:481-98
## Antibiotic use rates in LTACHs compared to Medical ICUs

<table>
<thead>
<tr>
<th>Antimicrobial Class</th>
<th>Percentile of distribution of use rates in NNIS medical ICUs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt; 10th</td>
</tr>
<tr>
<td>Antipseudomonal Penicillins</td>
<td></td>
</tr>
<tr>
<td>Third-generation Cephalosporins</td>
<td>77.6</td>
</tr>
<tr>
<td>Carbapenems</td>
<td></td>
</tr>
<tr>
<td>Fluoroquinolones</td>
<td></td>
</tr>
<tr>
<td>Vancomycin IV</td>
<td></td>
</tr>
</tbody>
</table>

**LTACH pooled mean use rates in DDD/1000 pt-days; n = 45, 2002-03**

Gould et al. ICHE 2006;27:923-5
Am J Infect Control 2003;31:481-98
Distribution of Vancomycin usage among LTACHs, 2003

Gould et al. ICHE 2006;27:923-5
Annual prevalence of imipenem resistance in *P. aeruginosa* vs. carbapenem use rate

% Imipenem-resistant *P. aeruginosa* vs. Carbapenem Use Rate

\[ r = 0.41, \ p = .004 \] (Pearson correlation coefficient)

45 LTACHs, 2002-03 (59 LTACH years)

Gould et al. ICHE 2006;27:923-5
Multivariable logistic regression analysis

Outcome: Imipenem resistance prevalence in *P. aeruginosa* isolates (45 LTACHs)

<table>
<thead>
<tr>
<th>Covariates*</th>
<th>Odds ratio (95% CI)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbapenem use rate</td>
<td>11.88 (1.42-99.13)</td>
<td>.02</td>
</tr>
<tr>
<td>Median length of stay</td>
<td>26.19 (2.46-279.1)</td>
<td>.007</td>
</tr>
<tr>
<td>Fluoroquinolone-R in <em>P. aeruginosa</em></td>
<td>17.02 (1.74-167.0)</td>
<td>.02</td>
</tr>
<tr>
<td>Piperacillin-R in <em>P. aeruginosa</em></td>
<td>9.36 (1.12-77.89)</td>
<td>.04</td>
</tr>
</tbody>
</table>

* Variables that remained in model after backwards stepwise logistic regression

Gould et al. ICHE 2006;27:923-5
Conclusions of study

- Antibiotic resistance in LTACHs is high
  - High MDRO prevalence on admission
  - Transmission within LTACH likely significant
  - Antibiotic pressure is high
    • Antibiotic use comparable to ICUs
    • Limited correlation with resistance prevalence
Limitations of study

Limited Data

- Antibiograms
  - No standardized protocols
  - Data often combined with host hospital
- Device-related infection rates
  - Unknown criteria/definitions
- Prevalence of MDRO colonization
  - Active surveillance not done at most facilities
- Infection control practices
- Staffing ratios
Antibiotic Resistance in LTACHs the “Perfect Storm”

- Very high rate of MDRO colonization at time of admission
- Compromised patients
- Multiple sources of infection, invasive devices
- High rate of antibiotic use
- Prolonged hospitalizations
Questions proposed

- What infection control strategies should be used in LTACHs to prevent transmission?
- How much antibiotic usage is inappropriate?
  - Treatment of colonization?
  - Variation in prescribing practices
- What are the infection risks of colonization?
  - Infection rates compared to ICUs
  - Compared to an LTACH benchmark
Infection Control Strategies in LTACHs

Overview of CDC/HICPAC Recommendations to Prevent Transmission of MDROs

- Administrative measures
- Education and training of healthcare personnel
- Judicious use of antimicrobial agents
- Surveillance
- Infection control precautions
- Environmental measures

CDC/HICPAC, 2006
Infection Control Strategies in LTACHs

1. Administrative Measures
   - Make MDRO prevention an organizational patient safety priority
   - Provide fiscal and human resources
     - Dedicated, trained IC professionals
   - Provide communication and feedback system
2. Education and training of healthcare personnel
   • Periodic training on prevention strategies
   • Include organization-specific experience with MDROs
3. **Judicious use of antimicrobial agents**
   - Review and provide feedback on hospital-specific antimicrobial utilization and susceptibility patterns (antibiograms)
   - Implement antimicrobial management systems
   - Provide appropriate review of prescribed antimicrobials (e.g. “report cards”) and suggestions for improving use
Infection Control Strategies in LTACHs

4. Surveillance

- Ensure standardized laboratory methods for antimicrobial susceptibility testing
- Provide *facility-specific* antibiograms at least annually using CLSI standards
Infection Control Strategies in LTACHs

4. Surveillance, continued
   • Develop protocols for active surveillance for targeted MDROs
     • At time of admission
     • Weekly point prevalence surveys
   • Exchange information about MDROs with referring hospitals
Infection Control Strategies in LTACHs

5. Infection control precautions
   - Follow **standard precautions** for all patient encounters
   - Contact precautions for patients with MDROs
   - Implement contact precautions until results of surveillance cultures reported negative
   - All LTACH rooms should be private
5. Infection control precautions, continued
   - Cohort patients with same MDRO in designated areas with assigned staff
   - Need for future study: universal gloves and gowns as an alternative to active surveillance
Infection Control Strategies in LTACHs

6. Environmental measures
   • Implement patient-dedicated or single-use equipment
   • Monitor adherence and reinforce training of environmental staff
   • Monitor cleaning performance of high-touch surfaces
12 Steps to Prevent Antimicrobial Resistance: Hospitalized Adults

1. Vaccinate
2. Get the catheters out
3. Target the pathogen
4. Access the experts
5. Practice antimicrobial control
6. Use local data
7. Treat infection, not contamination
8. Treat infection, not colonization
9. Know when to say “no” to vanco
10. Stop treatment when cured
11. Isolate the pathogen
12. Break the chain

Prevent Transmission
Use Antimicrobials Wisely
Diagnose & Treat Effectively
Prevent Infections
Future Directions

- Incorporation of LTACHs into National Healthcare Safety Network (NHSN)
  - Standardized protocols for measuring device-associated infection rates, device utilization
  - Surveys specific for LTACHs
  - Risk adjustment of infection rates
  - Feedback of data for performance improvement
  - Access to prevention tools, best practices
The findings and conclusions are those of the author(s) and do not necessarily represent the view of the Centers for Disease Control and Prevention.