Current Challenges and Emerging Evidence in Infection Prevention in Adult and Pediatric Long-term Care Facilities

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“Nothing to Disclose”
Prevalence of Common Endemic Infections in Nursing Homes (NHs)

<table>
<thead>
<tr>
<th>Infection</th>
<th>Range per 1,000 Resident Days</th>
<th>Annual Number of Cases in US* (in millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower respiratory track</td>
<td>0.3 - 4.7</td>
<td>0.16 - 2.57</td>
</tr>
<tr>
<td>Symptomatic urinary tract</td>
<td>0.19 - 2.2</td>
<td>0.1 - 1.2</td>
</tr>
<tr>
<td>Skin and soft tissue</td>
<td>0.1 - 2.1</td>
<td>0.05 - 1.15</td>
</tr>
<tr>
<td>Acute gastroenteritis</td>
<td>0.1 - 2.5</td>
<td>0.05 - 1.37</td>
</tr>
<tr>
<td>Bacteremia</td>
<td>0.2 - 0.36</td>
<td>0.11 - 0.2</td>
</tr>
<tr>
<td>All</td>
<td>1.8 - 13.5</td>
<td>0.98 - 7.38</td>
</tr>
</tbody>
</table>

*Based on the assumption that there are 1.5 million residents, 365 days per year.

HAIs in NHs are an Important Patient Safety Issue

• Both endemic and epidemic infections in NHs are increasing including
  – *Clostridium difficile* colitis
  – Multiple drug resistant organisms (MDRO)
    • Vancomycin-resistant *enterococci* (VRE)
    • Methicillin-resistant *Staphylococcus aureus* (MRSA)

• *Just being a resident of a NH puts someone at high risk for being colonized or infected with a MDRO*
Consequences of HAI in NH

- Infections are the reason for 27 to 63 percent of all resident transfers to hospitals
- An elderly resident transferred to a hospital has a high probability of death, functional decline, delirium or other adverse patient safety event
- Cost is estimated to be between $673 million to $2 billion annually
Infection Control in Acute Care and NH

• No SENIC study for NHs
• While there are similarities, there are also differences
• Residents are not patients
• Focus of NH is comfort and dignity
• Shared spaces and group activities
• Frequent transfers back and forth between NHs and hospitals
## Category I Infection Control Recommendations in NHs

### Structure of Program

- Active infection control program
- Oversight by
  - IP
  - Administration
  - Nursing
  - Physician
- One program director with written authority to institute emergency measures

### Functional Processes of Program

- Surveillance using standard definitions
- Outbreak control
- Antibiotic stewardship program
- Facility management functions including separation of clean and soiled utility areas

### Employee Processes

- Employee health program including vaccinations
- Employee education on infection control

### Resident Care Processes

- Isolation procedures and policies
- Asepsis and hand hygiene programs
- Resident care, i.e., program to prevent UTIs
- Resident health program, i.e., vaccinations
Infection Control Deficiencies

Distribution of Infection Control Deficiency Citations in 2007 (citations per NH by state)

Key Points

• 15% of all NHs receive a deficiency citation for infection control

• Tercile distribution of the average number of deficiency citations for infection control by state

• Nurse staffing is related to citations

Contextual Changes for HAI Control in NHs

Key:

- Reporting HAI in NHs (Voluntary and Mandatory)
- Initiated HAI reduction collaborative funded by ARRA (2009)
- Both
Updated McGeer Criteria

Surveillance Definitions of Infections in Long-Term Care Facilities: Revisiting the McGeer Criteria

Nimalie D. Stone, MD; Muhammad S. Ashraf, MD; Jennifer Calder, PhD; Christopher J. Crnich, MD; Kent Crossley, MD; Paul J. Drinka, MD; Carolyn V. Gould, MD; Manisha Juthani-Mehta, MD; Ebbing Lautenbach, MD; Mark Loeb, MD; Taranisia MacCannell, PhD; Preeti N. Malani, MD; Lona Mody, MD; Joseph M. Mylotte, MD; Lindsay E. Nicolle, MD; Mary-Claire Roghmann, MD; Steven J. Schweon, MSN; Andrew E. Simor, MD; Philip W. Smith, MD; Kurt B. Stevenson, MD; Suzanne F. Bradley, MD for the Society for Healthcare Epidemiology Long-Term Care Special Interest Group
Aim 1
Describe the incidence of HAI in NHs across the nation and associated state level characteristics, facility level characteristics and resident care processes.

Aim 2
Investigate the relationship between HAI rates in NHs, state and facility level characteristics and resident care processes.

Aim 3
Use a descriptive exploratory approach to describe the phenomenon of infection control in NHs.

Aim 4
Determine the comparative effectiveness of current infection control structures and processes in preventing HAIs in elderly residents.

Aim 5
Determine the cost-effectiveness of efficacious infection control processes in NHs.

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Prevention of Nosocomial Infections & Cost Effectiveness in Nursing Homes
The P-NICE-NH Study

Columbia University
School of Nursing

DEPARTMENT of Health Policy & Management
University of Pittsburgh | Graduate School of Public Health

NATIONAL INSTITUTE of NURSING RESEARCH
RAND CORPORATION

www.cumc.columbia.edu/studies/pnice/nursinghomes
Acknowledgements

• Funded by the National Institute of Nursing Research
  – Prevention of Nosocomial Infections and Cost Effectiveness Analysis Refined (PNICER, R01NR010107)
  – Prevention of Nosocomial Infections and Cost Effectiveness in Nursing Homes (PNICE-NH, R01NR013687)
Intro to the other talks

• Infection Prevention in Long-Term Care for Older Adults: A Systematic Review of Randomized and Non-Randomized Trials
• Estimates of Antibiotic Resistance in Nursing Homes: A Systematic Review of the Literature
• Unique Challenges of Infection Prevention and Surveillance in Pediatric Long-Term Care
Infection Prevention in Long-Term Care for Older Adults: A Systematic Review of Randomized and Non-Randomized Trials

May Uchida, MSN, GNP-BC
Background

Infections in Long-Term Care (LTC):

- **Common**
  - 1.6 to 3.8 million infections occur each year
  - Institutionalized adults > age 65 years account for a disproportionate number of infections
  - Lead to approximately 388,000 deaths
  - Most common reasons for hospitalizations-> account for 27 to 63% of all transfers

- **Costly**
  - Cost estimates range from $673 million to $2 billion annually

- **Preventable**
  - Despite such high mortality and costs associated with infections, a large proportion is often preventable
Gaps

- Evidence surrounding infection prevention and control in LTC are inadequate
- Most interventions in LTC predominantly adapted from those designed for hospitals
- Little is known about infection prevention interventions in LTC
  - Previous systematic reviews limited to certain types of infections
  - No study has examined the utilization of planned intervention studies in LTC
  - Quality of currently available evidence is unknown
Objective

- To critically review and synthesize current evidence and the methodological quality of infection prevention interventions in LTC
Methods

- To establish clarity and standardized reporting of findings, the PRISMA checklist was used.

- PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) Statement
  - Developed by international group of experts.
  - 27-item checklist ensures standard method for transparent and complete reporting.
  - Increasingly being endorsed by and adhered to for journal submissions.
## PRISMA Checklist

### TITLE

**Title**
1. Identify the report as a systematic review, meta-analysis, or both.

### ABSTRACT

**Structured summary**
2. Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and data collection; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.

### INTRODUCTION

**Rationale**
3. Describe the rationale for the review in the context of what is already known.

**Objectives**
4. Provide an explicit statement of questions being addressed with reference to participants, interventions, comparators, outcomes, and study design (PICOS).

### METHODS

**Protocol and registration**
5. Indicate if a review protocol exists, and where it can be accessed (e.g., Web address), and, if unavailable, provide registration information including registration number.

**Eligibility criteria**
6. Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.

**Information sources**
7. Describe all information sources (e.g., databases with dates of coverage, contact with study authors) used as the basis for identifying, including any limits used, such as date last searched.

**Search**
8. Present all electronic search strategies for at least one database, including any limits used, such that it could be repeated.

**Study selection**
9. State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).

**Data collection process**
10. Describe methods of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.

**Data items**
11. List and define all variables for which data were sought (e.g., PICOS, timing, data sources) and any assumptions made.

**Risk of bias in individual studies**
12. Describe methods used for assessing risk of bias of included studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.

**Summary measures**
13. State the principal summary measures (e.g., risk ratio, difference in means).

**Synthesis of results**
14. Describe the method of handling data and combining estimates of effect, if done, including measures of consistency (e.g., I²) for each meta-analysis.
Methods
Two reviewers systematically searched: Medline, PubMed, and Cochrane Controlled Trials Register

**Inclusion Criteria**
- Intervention studies published in English from January 2001 to June 2011
- Interventions conducted in LTC (i.e., nursing homes) with elderly (i.e., population ≥65 years age)
- Interventions’ primary outcomes were infection rates and reductions of risk factors known to be related to infections

**Exclusion Criteria**
- Outbreaks, editorials, commentaries
- Interventions in which outcomes focused only on healthcare workers
- Interventions dealing with systemic antibiotics other than vaccines
- Interventions that only evaluated the efficacy or immunogenicity of vaccines
Methods

- Outcome Measures:
  - Infection rates and reductions of risk factors related to infections
  
  For instance,
  
  - **INCLUDED**: studies evaluating pneumonia incidence rates
  - **INCLUDED**: studies evaluating outcomes such as cough reflex sensitivity, a known risk factor for pneumonia
  - **EXCLUDED**: studies that only evaluated non-specific infection outcomes such as hospitalization rates, mortality and antibiotic prescription usage
  - **EXCLUDED**: studies that only evaluated outcomes for healthcare workers
Methods

Assessment of Methodological Quality
Study quality was assessed by 2 reviewers using a validated standardized quality assessment tool

– Originally tool consists of 27 criteria; evaluates both randomized and non-randomized trials
– Slightly modified tool as done in other studies
– Scores grouped into 4 categories ranging from excellent→good→fair→poor

Establishing Inter-rater reliability

– Compared independently scored ratings
– Quality scores within 2 points of each other were considered to be in agreement
### Downs & Black Quality Assessment Tool

<table>
<thead>
<tr>
<th>Article (Author, Year):</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Subscales</td>
<td>Items</td>
<td>Scores</td>
</tr>
<tr>
<td><strong>Reporting</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Is the hypothesis/aim/objective of the study clearly described?</td>
<td>Yes</td>
<td>1</td>
</tr>
<tr>
<td>2. Are the main outcomes to be measured clearly described in the Introduction or Methods Section?</td>
<td>Yes</td>
<td>1</td>
</tr>
<tr>
<td>3. Are the characteristics of the patients included in the study clearly described? (Inclusion/Exclusion Criteria are clear)</td>
<td>Yes</td>
<td>1</td>
</tr>
<tr>
<td>4. Are the interventions of interest clearly described?</td>
<td>Yes</td>
<td>1</td>
</tr>
<tr>
<td>5. Are the distributions of principal confounders in each group of subjects to be compared clearly described?</td>
<td>Yes</td>
<td>2</td>
</tr>
<tr>
<td>6. Are the main findings of the study clearly described?</td>
<td>Yes</td>
<td>1</td>
</tr>
<tr>
<td>7. Does the study provide estimates of the random variability in the data for the main outcomes?</td>
<td>Yes</td>
<td>1</td>
</tr>
<tr>
<td>8. Have all important adverse events that may be a consequence of the intervention been reported?</td>
<td>Yes</td>
<td>1</td>
</tr>
<tr>
<td>9. Have the characteristics of the participants lost to follow-up been described?</td>
<td>Yes</td>
<td>1</td>
</tr>
<tr>
<td>10. Have actual probability values been reported? (e.g., 0.035 rather than &lt;0.05) for the main outcomes except where the probability value is less than 0.001?</td>
<td>Yes</td>
<td>1</td>
</tr>
<tr>
<td><strong>External Validity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Were the subjects asked to participate in the study representative of the entire population from which they were recruited?</td>
<td>Yes</td>
<td>1</td>
</tr>
<tr>
<td>12. Were those subjects who were</td>
<td>Yes</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>11</td>
</tr>
</tbody>
</table>

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#APIC2013 Annual Educational Conference & International Meeting 40th周年纪念 FT. LAUDERDALE, FL JUNE 8-10
Data Analysis

- Heterogeneity in type of interventions and outcome measures reported

- Individual studies are presented in tabular format without statistical pooling
Results

Articles identified in PubMed, Medline-OVID and Cochrane Controlled Trials Register n= 1978

Articles excluded based on removal of duplicates n= 58

Abstracts screened for eligibility n= 1920

Articles excluded per title screening and abstract review based on inclusion criteria n= 1889

Articles included per hand searching reference lists, expert consultation n= 3

Full text articles retrieved for detailed evaluation n= 34

Articles excluded: based on inclusion criteria n= 8, feasibility studies by the same author n=2

Articles eligible for final inclusion in this review n= 24
## Results

### Table 1. Select Study Characteristics and Quality of Included Studies

<table>
<thead>
<tr>
<th>Source</th>
<th>Infection Type</th>
<th>Objective</th>
<th>Study Design</th>
<th>Sample</th>
<th>Type of Intervention</th>
<th>Intervention Measures</th>
<th>Outcome</th>
<th>Results</th>
<th>Statistically Significant</th>
<th>Mean Quality Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Banding et al.</td>
<td>Respiratory</td>
<td>To determine effectiveness of microwave energy to disinfect dentures compared with conventional soaking</td>
<td>RCT, intervention duration 14 days, 3 months follow up</td>
<td>34 residents, mean age 81 with upper dentures from 3 institutions</td>
<td>Therapy</td>
<td>Both groups received topical antifungal for 14 days; all dentures scrubbed with antimicrobial soap on days 1, 5, and 10. Intervention group dentures microwave; control dentures soaked in conventional solution</td>
<td><em>C. albicans, staphylococcus species</em></td>
<td>Microwave treatment is more effective than conventional soak treatment for eradicating <em>C. albicans</em> on dentures</td>
<td>(+)</td>
<td>15</td>
</tr>
<tr>
<td>Washinton</td>
<td>Urinary</td>
<td>To determine effects of 1 time instillation of 3% hydrogen peroxide versus distilled vinegar in drainage bags to reduce bacterium</td>
<td>RCT, one time instillation, bags sampled at 24-hour intervals over 4 days</td>
<td>20 residents, mean age 89.9 from 5 skilled care facilities</td>
<td>Therapy</td>
<td>Instillation of urinary drainage bags with 50ml of hydrogen peroxide or 50 ml of distilled vinegar, control group bags instilled with water</td>
<td><em>Bacteriuria</em></td>
<td>Urine cultures obtained at only the 48-hour interval showed reduction in bacteriuria for bags irrigated with vinegar</td>
<td>(++)</td>
<td>14.5</td>
</tr>
<tr>
<td>Adachi et al.</td>
<td>Respiratory</td>
<td>To evaluate effectiveness of professional oral care on oral microorganisms related to pneumonia</td>
<td>RCT, 24 months</td>
<td>141 residents, mean age 84 from 2 NHs</td>
<td>Therapy</td>
<td>Professional oral care weekly by dental hygienists; control received usual care</td>
<td><em>C. albicans, staphylococcus species</em></td>
<td>Professional oral care by dental hygienists reduced microorganisms related to pneumonia</td>
<td>(++)</td>
<td>13</td>
</tr>
</tbody>
</table>
Results - Study Characteristics

- Most conducted in the United States (n= 9; 37.5%)
- Many were randomized control trials (n= 16; 67%)
  - 8 studies were quasi-experimental
- Most frequently reported type of infection was respiratory (n=15; 62.5%)
  - Of these pneumonia was the most commonly reported infection (n=12; 50%); oral hygiene studies.
- 50% of the reviewed studies tested multiple interventions. More than half (n= 15; 62.5%) were multisite studies
- Approximately three fourths of the studies required direct resident participation (n= 18; 75%)
Results - Study Characteristics

- Most studies (n= 21; 87.5%) compared 2 study groups.

- Intervention frequency varied across all and within similar studies ranging from weekly to as long as 1 year.

- Wide range of follow up durations from 4 days to longer than 1 year.
Results - Continued

- **Participants**
  - Sample sizes varied—ranged from 20 to 1006 residents
  - 4 studies had sample sizes less than 50
  - Some studies did not clearly report sample size; instead reported number of units

- **Outcomes**
  - 13 studies (54%) reported statistically significant results in favor of interventions
  - Many studies defined outcome measures—but varied
  - No standardized definition of infections
  - 3 studies explicitly or indirectly mentioned using definitions derived from the McGeer Criteria
Results - Methodological Quality

- Methodological quality of evidence varied
- Quality scores ranged from 11 to 27; mean quality assessment score of the averaged ratings between the 2 reviewers was 18.8
- Majority of studies were rated as ‘fair’ quality
Discussion: Interventions

- Studies reviewed varied—content, intensity and duration; lack of standardized reporting of interventions
- Lack of clarity in definitions of outcome measures
- Majority of interventions were randomized control trials
  - Many studies lacked proper allocation concealment, power calculations
  - Future studies to consider utilizing cluster randomized trial designs
- Few interventions targeted urinary tract infections
- Only one study reported costs/feasibility of conducting the intervention in a LTC setting
Limitations

• English language, published after 2001
  – Possible publication bias

• Narrow selection focus: may have resulted in exclusion of some effective interventions.

• Did not include interventions that focused on healthcare workers and their rates of hand-hygiene compliance and vaccinations.

• Excluded outbreak reports
Conclusions

- Gaps and inconsistencies surrounding interventions in LTC are evident
- Quality of evidence surrounding LTC interventions is weak
- Future interventional studies need to enhance methodological clarity using clearly defined outcome measures and standardized reporting of findings
  - Use of TREND, CONSORT
Recommended Site

http://www.equator-network.org/resource-centre/
Acknowledgements

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• CIRI and my doctoral colleagues

• Jonas Center for Nursing Excellence
Monika Pogorzelska-Maziarz, MPH, PhD

Estimates of Antibiotic Resistance in Nursing Homes: A Systematic Review of the Literature
Research Objective

• To estimate the prevalence and/or incidence of colonization with MDRO and C. difficile in the long-term care setting.

  – Paucity of data on the overall burden of colonization in this setting
Methods

• Used PRISMA checklist to establish clarity and standardized reporting of findings

• Key words
  ‘Clostridium difficile’/exp OR ‘Vancomycin Resistance’/exp OR ‘Methicillin Resistant Staphylococcus aureus’/exp OR ‘Drug Resistance, Microbial’/exp
  AND
  ‘Nursing Homes’/exp OR ‘Long-Term Care’/exp OR ‘Skilled Nursing Facilities’/exp
Inclusion and Exclusion criteria

• **Inclusion criteria**
  • Peer-reviewed
  • Published in English from 2000 through August 2012
  • Reported original research in which investigators provide incidence or prevalence of MDRO and/or *C. difficile* colonization in the long-term care setting
  • Specifically focused on elderly patients

• **Types of studies included:**
  • Cross-sectional, cohort and case control studies
  • Interventional studies with baseline data (RCTs, pre- and post- intervention)

• **Exclusion criteria**
  • Outbreaks
  • Long-term acute care hospitals and extended or LTC units within hospitals
  • Nursing homes that are part of a hospital system
  • Studies that identified colonization/infection through clinical cultures
  • Studies primarily focusing on the molecular epidemiology or antibiotic susceptibility of organisms with no estimates of overall burden of infections
Selection and abstraction process

• Search conducted in Medline by primary reviewer
  – Retrieved titles and abstract screened for potentially relevant studies that met the inclusion criteria

• Abstracts and full text of these potentially relevant studies reviewed by two secondary reviewers to confirm eligibility
  – Disagreements discussed by all three reviewers

• Reference lists of retrieved articles and relevant review articles assessed for additional studies
317 records identified through MEDLINE database search

297 records screened after duplicates removed

131 full text articles assessed for eligibility

41 studies selected for inclusion in systematic review

15 full text articles assessed per hand searching reference lists

90 full-text articles removed
90 full-text articles removed:

- Antibiotic susceptibility studies based on clinical cultures/isolates (n=13)
- Case control, cohort or RCT study with no overall prevalence data or based on clinical cultures/isolates (n=6)
- Studies based on MDS or survey data (n=3)
- No data specific to nursing homes (n=4)
- Facility/unit that is part of a hospital/medical center (n=15)
- Includes hospitalized patients only (n=4)
- Includes data on residents with MDRO infection/colonization only and no data on overall prevalence (n=3)
- Insufficient detail (n=6)
- Molecular characterization study (n=19)
- Outbreak investigation (n=3)
- Redundant (n=8)
- Post acute care facility, SNF, or nursing home serving a specific population (n=3)
- Results based on number of isolates/not individual residents (n=2)
- Examined infection, not colonization (n=1)
Data Extraction

**Descriptive**
- Author
- Date of Publication
- Country
- Sample Size

**Study Design**
- Type of study
- Multisite
- Description of NH(s)
- Eligibility
- Study period
- Sampling method

**Screening Methods**
- Diagnostic Method
- Definitions Specified (if any)
- Specimen Sites
- Additional Info on Specimen collection

**Results**
- Participation Rate
- Prevalence/Incidence
- Risk Factors Presented
- Antibiotic Susceptability Data
- Quality Score
Quality appraisal

• Checklist adapted from a systematic review conducted by Dulon and colleagues

1. Outcome definition: Was a valid definition given of the outcome for the outcome for prevalence, colonization and infection?
2. Time unit: Was the endpoint calculated for a standardized time unit (daily, monthly, yearly)?
3. Target population: Was the target population specified by inclusion or eligibility criteria?
4. Participants: Was the number of included cases reported, e.g. by describing the numbers and reasons for non-participation?
5. Observer bias: Were sources of potential imprecision reported and/or have consequences been discussed?
6. Screening procedure: Were measures described that has been undertaken for standardization of screening measurements?

Characteristics of 41 Included Studies

• Geography
  – 8 U.S.
  – 24 Europe (5 Germany, 4 UK, 4 Ireland, 3 Belgium, 2 Italy, 1 each in Finland, France, Slovenia, Spain, Sweden, The Netherlands)
  – 3 Australia & New Zealand
  – 3 Israel
  – 2 Asia (Hong Kong, Taiwan)
  – 1 Turkey

• Setting & Sample size:
  – 9 single site (42 – 270 participants)
  – 32 multi site (79 – 3236 participants, 2 - 69 facilities)
**Focus of studies**

<table>
<thead>
<tr>
<th>Organism under study</th>
<th>Number of studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRSA</td>
<td>29 (25)</td>
</tr>
<tr>
<td>MDR GNBs</td>
<td>10 (5)</td>
</tr>
<tr>
<td>VRE</td>
<td>7 (2)</td>
</tr>
<tr>
<td><em>C. difficile</em></td>
<td>4 (3)</td>
</tr>
<tr>
<td><em>H. influenzae</em></td>
<td>1</td>
</tr>
<tr>
<td>Multiple organisms</td>
<td>5</td>
</tr>
</tbody>
</table>

Numbers in parentheses present number of studies focusing exclusively on that given organism.
Characteristics of MRSA studies (n = 29)

- 26 (90%) of studies used a cross-sectional design
  - 3 were series cross-sectional
- Sampling
  - 4 random sample
  - 1 convenience sample
  - 1 with no information
  - 1 combination
  - 22 all eligible/consenting residents
- Specimen Sites
  - 12 (41%) collected nasal cultures only
  - 17 (59%) collected cultures from multiple sites
MRSA studies in the US (n = 5)

<table>
<thead>
<tr>
<th>Author</th>
<th>Multisite</th>
<th>Participation Rate</th>
<th>Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mody, 2007</td>
<td>Yes (14 NH)</td>
<td>80%</td>
<td>55% (55/100) in device group 29% (29/100) in control group</td>
</tr>
<tr>
<td>Pop-Vicas, 2008</td>
<td>No</td>
<td>53%</td>
<td>28% (24/84)</td>
</tr>
<tr>
<td>Reynolds, 2008</td>
<td>Yes (10 NH)</td>
<td>Not provided</td>
<td>31%, range 7-52%</td>
</tr>
<tr>
<td>O’Fallon, 2009</td>
<td>No</td>
<td>95%</td>
<td>11% (18/161)</td>
</tr>
<tr>
<td>Fisch, 2012</td>
<td>Yes (15 SNFs)</td>
<td>37%</td>
<td>63% (52/82)</td>
</tr>
</tbody>
</table>

- Prevalence of MRSA colonization ranged from 11-63%
MRSA studies in Europe (n = 21)

- 20 cross-sectional, 1 RCT

<table>
<thead>
<tr>
<th>Country</th>
<th># of studies</th>
<th>Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belgium</td>
<td>3</td>
<td>5%, 20%, 26%</td>
</tr>
<tr>
<td>Finland</td>
<td>1</td>
<td>1%</td>
</tr>
<tr>
<td>Germany</td>
<td>5</td>
<td>0%, 1%, 5%, 8%, 8%, 1.1%,</td>
</tr>
<tr>
<td>Ireland</td>
<td>2</td>
<td>9%, 23%</td>
</tr>
<tr>
<td>Italy</td>
<td>2</td>
<td>8%, 19%</td>
</tr>
<tr>
<td>Slovenia</td>
<td>1</td>
<td>9%</td>
</tr>
<tr>
<td>Spain</td>
<td>1</td>
<td>34%</td>
</tr>
<tr>
<td>Sweden</td>
<td>1</td>
<td>0%</td>
</tr>
<tr>
<td>The Netherlands</td>
<td>1</td>
<td>0.4%</td>
</tr>
<tr>
<td>UK</td>
<td>4</td>
<td>8%, 17%, 20%, 22%,</td>
</tr>
</tbody>
</table>
## Characteristics of MDR GNB studies (n = 10)

<table>
<thead>
<tr>
<th>Organism</th>
<th># of studies</th>
<th>Country</th>
<th>Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDR GNB</td>
<td>3</td>
<td>U.S.</td>
<td>23%, 31%, 51%</td>
</tr>
<tr>
<td>MDR <em>E. coli</em></td>
<td>2</td>
<td>New Zealand, Ireland</td>
<td>39%, 41%</td>
</tr>
<tr>
<td>Ceftazidime-resistant GNB</td>
<td>2</td>
<td>U.S.</td>
<td>24% in device group and 5% in controls, 26%</td>
</tr>
<tr>
<td>Ciprofloxacin-resistant GNB</td>
<td>2</td>
<td>U.S.</td>
<td>54% in device group and 37% in controls, 72%</td>
</tr>
<tr>
<td>ESBLE</td>
<td>2</td>
<td>Australia, France</td>
<td>2%, 2%</td>
</tr>
</tbody>
</table>

- All studies cross-sectional
- Participation rates ranging from 28-96%
### Characteristics of C. diff studies (n = 4)

<table>
<thead>
<tr>
<th>Author</th>
<th>Country</th>
<th>Study Design</th>
<th>Multisite</th>
<th>Participation Rate</th>
<th>Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rivera, 2003</td>
<td>U.S. (OH)</td>
<td>C-S</td>
<td>No</td>
<td>100%</td>
<td>5% (2/42)</td>
</tr>
<tr>
<td>Ryan, 2010</td>
<td>Ireland</td>
<td>C-S</td>
<td>No</td>
<td>57%</td>
<td>17% (17/100)</td>
</tr>
<tr>
<td>Stuart, 2011</td>
<td>Australia</td>
<td>C-S</td>
<td>Yes (3 RACFs)</td>
<td>73%</td>
<td>1% (1/119)</td>
</tr>
<tr>
<td>Arvand, 2012</td>
<td>Germany</td>
<td>C-S</td>
<td>Yes (11 NH)</td>
<td>31.5%</td>
<td>4.6% (11/240)</td>
</tr>
</tbody>
</table>

- *C. diff* colonization prevalence ranging from 1-17%
### Characteristics of VRE studies (n = 7)

<table>
<thead>
<tr>
<th>Author</th>
<th>Country</th>
<th>Study Design</th>
<th>Multisite</th>
<th>Participation Rate</th>
<th>Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Padiglione, 2001</td>
<td>Australia</td>
<td>C-S</td>
<td>Yes (8 NH)</td>
<td>74%</td>
<td>3.1% (9/292)</td>
</tr>
<tr>
<td>Stuart, 2011</td>
<td>Australia</td>
<td>C-S</td>
<td>Yes (3 RACFs)</td>
<td>73%</td>
<td>2% (2/119)</td>
</tr>
<tr>
<td>Benenson, 2009</td>
<td>Israel</td>
<td>C-S</td>
<td>Yes (9 NH)</td>
<td>66%</td>
<td>9.6% (77/802)</td>
</tr>
<tr>
<td>Mody, 2007</td>
<td>US (MI)</td>
<td>Cohort</td>
<td>Yes (14 NH)</td>
<td>80%</td>
<td>9% (9/100) in both device &amp; control groups</td>
</tr>
<tr>
<td>Pop-Vicas, 2008</td>
<td>US (MA)</td>
<td>C-S</td>
<td>No</td>
<td>53%</td>
<td>4% (3/84)</td>
</tr>
<tr>
<td>O’Fallon, 2009</td>
<td>US (MA)</td>
<td>C-S</td>
<td>No</td>
<td>95.3%</td>
<td>0.6% (1/161)</td>
</tr>
<tr>
<td>Fisch, 2012</td>
<td>US (MI)</td>
<td>C-S</td>
<td>Yes</td>
<td>37%</td>
<td>18% (15/82)</td>
</tr>
</tbody>
</table>

- VRE colonization prevalence ranging from 1-18%
Conclusions

• Prevalence of colonization varied greatly
  – Differences in prevalence across geographic regions
  – Methodological differences between studies

• Standardization of surveillance methods and outcomes is needed to allow for comparisons between different studies
Limitations

• Potential for publication bias
• Only included studies published in English in peer-reviewed literature
• Search of only one database using keywords
• Excluded studies based on clinical isolates
Acknowledgements

• Supported by the National Institute of Nursing Research (R01 NR013687)
• Columbia University team (Dr. Elaine Larson, Kimberly Alvarez)
Unique Challenges of Infection Prevention and Surveillance in Pediatric Long-Term Care

Bevin Cohen, MPH
Unique Population

- Population is growing
  - Improved survival rates for premature infants, infants with congenital disorders, children with acute conditions and trauma
- Population receives complex care
  - Many children require ventilator assistance, gastronomy tubes, central venous catheters, etc.
  - Children receive intensive therapy including physical therapy, occupational therapy, respiratory therapy, and other complimentary and alternative therapies (e.g., massage, aroma)
Unique Surveillance Challenges

• Adult infection definitions may not be applicable to the pediatric population
  • Symptoms used to detect infection may require communication from resident (e.g., pain)
  • Complex medical conditions associated with signs and symptoms of infections (e.g., elevated respiratory secretions, fluctuations in body temperature)
Meeting HAI Criteria

• Chart reviews in a 54-bed facility over a 2-month period (Sept-Oct 2012)
  • 39 clinician-diagnosed HAIs (35 respiratory, 2 UTI, 1 skin/soft tissue)
  • Only 10/39 (26%) met the SHEA/CDC surveillance definitions for long-term care

• Chart reviews in 3 facilities (341 children) over a 6-month period (Sept 2012-Feb 2013)
  • 15 clinician-diagnosed UTIs
  • Only 3/15 (20%) had fever >38ºC
Unique Community Interactions

• School
  • Many facilities have on-site schools, some with other children from the community
  • Some children leave the facility daily for school

• Visitors
  • Family visitation may be frequent and prolonged
  • Visitors may be very ‘hands-on’ (participate in changing diapers, wiping respiratory secretions, etc.)
  • Some children go home for extended family stays
Unique Atmosphere

• Staff
  • Many key staff other than healthcare workers including teachers, activity leaders, child life specialists, etc.

• Group play
  • Children involved with many different group activities each day
  • Children share toys and equipment

• Family-like rapport
  • Lots of hugs, kisses, and high fives!
Unique Population, Common Problem…

- Adherence to hand hygiene protocol is a challenge!
Observational Study of Hand Hygiene Opportunities

- 8 different children at 4 facilities observed for 16 hours each
  - Total of 128 hours of observation over a 3-month period (Jun-Aug 2011)
- Recorded all hand hygiene opportunities and adherence based on the WHO 5 Moments
Observation Form - Outpatient/Home-based/Long-term Care Observation of the 5 Moments

<table>
<thead>
<tr>
<th>Facility:</th>
<th>Period Number:</th>
<th>Session Number:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service:</td>
<td>Date: (dd/mm/yy)</td>
<td>Page No.:</td>
</tr>
<tr>
<td>Department:</td>
<td>Start/End time: (hh:mm)</td>
<td>Observer: (initials)</td>
</tr>
<tr>
<td>Session duration:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Prof. cat Code</th>
<th>Prof. cat Code</th>
<th>Prof. cat Code</th>
<th>Prof. cat Code</th>
<th>Prof. cat Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

http://www.who.int/gpsc/5may/EN_GPSC1_PSP_HH_Outpatient_care/en/
## Characteristics of Study Sites

<table>
<thead>
<tr>
<th></th>
<th>Site A</th>
<th>Site B</th>
<th>Site C</th>
<th>Site D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of beds</td>
<td>97</td>
<td>44</td>
<td>92</td>
<td>135</td>
</tr>
<tr>
<td>Mean length of stay (range)</td>
<td>0.3 yr (0.2 yr– 0.3 yr)</td>
<td>2.8 yr (7 d– 8 yr)</td>
<td>0.2 yr (14 d– 0.8 yr)</td>
<td>1.5 yr (7 d– 21 yr)</td>
</tr>
<tr>
<td>Residents Age (range)</td>
<td>14 d– 20 yr</td>
<td>0.5 yr– 20 yr</td>
<td>0.1 yr– 20 yr</td>
<td>7 d– 21 yr</td>
</tr>
<tr>
<td>Residents with devices (%)</td>
<td>29%</td>
<td>30%</td>
<td>33%</td>
<td>51%</td>
</tr>
<tr>
<td>Tracheostomy</td>
<td>29%</td>
<td>30%</td>
<td>33%</td>
<td>51%</td>
</tr>
<tr>
<td>Central venous catheter</td>
<td>6%</td>
<td>2%</td>
<td>10%</td>
<td>0%</td>
</tr>
<tr>
<td>Feeding tubes</td>
<td>78%</td>
<td>77%</td>
<td>42%</td>
<td>85%</td>
</tr>
<tr>
<td>Residents hospitalized at acute care facilities per year</td>
<td>25%</td>
<td>25%</td>
<td>20%</td>
<td>U</td>
</tr>
</tbody>
</table>

Hand Hygiene Adherence

Targeted Improvement

- Better hand hygiene adherence with traditional nursing tasks
- Challenges with non-traditional activities
  - Hand-over-hand group activities
  - Transportation to and from activities
Strategy: Workflow Diagrams

• Interdisciplinary workgroups conduct peer hand hygiene observations and identify barriers to performing hand hygiene
• Brainstorm routine tasks
  • Respiratory therapy session
  • Physical therapy session (one-on-one)
  • Diaper change and dressing for school
  • Hand-over-hand group activity
  • Infant massage
  • Oral feeding
Group Activity

Clean all toys and materials to be used during group activity

Transfer first child to activity area and clean his/her hands

Transfer next child to activity area and clean his/her hands
(Repeat these steps until all children are transferred)

Conduct activity and perform hand hygiene if contact with body fluids occurs

Clean first child’s hands and transfer back to his/her room

Clean next child’s hands and transfer back to his/her room
(Repeat these steps until all children are transferred)
Future Directions

• Enhancing the Care of the Child Who is Medically Complex Conference attendees surveyed
  • 35/41 (85%) reported needing infection control policies specific to pediatric LTC
  • 35/41 (85%) and 33/41 (80%) reported needing pediatric LTC-specific best practice guidelines for respiratory and gastrointestinal infections, respectively
Acknowledgements

- Supported by the Agency for Healthcare Research and Quality R01HS021470.
- Hand hygiene adherence study funded by Deb Worldwide Healthcare, Inc.
- Staff and families at participating facilities
- Columbia University research team