Evaluation of Fever and Infection in Long-Term Care Facilities

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Evaluation of Fever & Infection in LTCF
Overview
• Prevalence of infection in LTCF
• When to evaluate?
• What general findings might suggest infection?
• What clinical evaluation should be done?
• What diagnostic testing might be useful?
• Evaluation of specific clinical syndromes.
• Relationship to Revised McGeer Criteria

World Population > 80 years

<table>
<thead>
<tr>
<th>Year</th>
<th>Percent</th>
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<tbody>
<tr>
<td>1950</td>
<td>7</td>
</tr>
<tr>
<td>2013</td>
<td>14</td>
</tr>
<tr>
<td>2050</td>
<td>19</td>
</tr>
<tr>
<td>2100</td>
<td>28</td>
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National Discharge Survey 1990-2004

http://www.cdc.gov/nchs/about/major/hdasd/nhds.htm

Chronic Care Facilities Not All The Same

Multiple populations
Many different needs
- Unskilled
- Rehabilitation
- Skilled nursing
- Sub-acute
- Ventilator
- Acute long-term
- Palliative/Hospice
- AIDS/Dementia

Infections in LTCF
Multiple-Drug Resistant Organisms

Staphylococcus aureus
- methicillin-resistant (MRSA)
- vancomycin-resistant (VRSA)

Enterococcus
- vancomycin-resistant (VRE)

ESBLs, CRE
VA LTCF Surveys
How Common Is Infection?
No change types of infection over time
2005 overall rate = 5.2%
2007 overall rate = 5.3%
2009 overall rate = 4.2%*


Nursing Homes Guideline
Evaluation of Fever & Infection
• What should trigger an evaluation?
  – symptoms
  – signs
• What clinical evaluation should be done?
• Who should do the initial evaluation?
• What diagnostic testing is useful?
• What resources are available?


LTCFs vs Hospitals
Remember-Missions & Resources Differ!
LTCFs
• Comfort
• Preservation function
• Prevention illness
• Nurse-centered care
  RN/LPN/CNA=7-13:35 per 100 beds
  Full time MDs < 20%
• MD visits infrequent
• Verbal orders common
• Diagnostics off-site
• Capitation
• Acute issues = transfer

Hospitals
• Diagnosis illness
• Rx acute illness
• MD-directed care
• Daily visits
• Written orders
• Diagnostics on-site
• Fee for service

Smith PW et al. ICHE 2008;29:785
Infection in LTCF
Clinical Evaluation

• How often is it performed/recorded?
  — received antibiotics (100%)
  — examined by physician (47%)
  — examined by RN/LPN (36%)
  — not examined (17%)
  — less common large NH, urban, community
  — does it result in better outcomes?


When Should Infection Be Suspected in LTCF?

• Generalized findings
  — subjective
    √ decline in functional status
    √ delirium
  — objective
    √ fever
    √ non-specific diagnostic findings

• Focal findings
  — predisposing factors
  — organ specific symptoms & signs
  — specific diagnostic findings

Clinical Evaluation for Infection
What to Consider?
Infections in LTCF
Why Assess Functional Status?

- Acute change in function
  - infection accounts 77% of episodes
  - increased confusion
  - decreased cooperation
  - decreased po intake
  - incontinence
  - falling, decreased mobility

Berman et al. Age Aging; 1987;16:201

Revised McGeer Criteria
Generalized Symptoms

G. Confusion Assessment Method - MS change from baseline
   1. acute onset and fluctuating course
   2. inattention AND
   3. Either disorganized thought or altered level of consciousness

D. Acute functional decline
   1. New 3 point increase in total ADL score
      a. 0-4 points per activity (0=independent, 28 = dependent)
      b. 0-28 points per total score (7 activities)
   2. Activities daily living (ADL)
      bed mobility, transfers, locomotion, dressing, eating
      toileting, personal hygiene


Fever
What is a Useful Definition?
Fever in LTCF Residents
What Threshold Suggests Infection?

- Three different thresholds
  - sensitivity
  - specificity
  - likelihood ratio

* Suggested definition fever:
  - ≥2°F over baseline
  - ≥99°F po or 99.5°F pr
  - (repeated measures)

Castle S. Aging Immunol Inf Dis, 1993;4:67

Temperatures in LTCF Residents
Non-Illness vs “Illness”

n=1107 pts
mean 97.7±0.5°F

n=1858 ATB episodes
> 99.2°F

Revised McGeer Criteria
General (Constitutional) Signs

A. Fever
1. Oral single > 37.8°C (>100°F) or
2. Oral repeated > 37.2°C [99°F] or
3. Any site* > 1.1°C (2°F) over baseline

High K et al. Clin Infect Dis 2009;48:149-171
**Suspected Infection in LTCF**

**Initial Clinical Evaluation**

- Should assess:
  - presence of fever?
  - presence of delirium/acute change in functional status?
  - predisposing factors for infection?
  - presence of poor intake(252,553),(299,570)/dehydration risk?
  - identify potential sources on physical exam:
    - respiratory rate
    - skin (sacrum, perineum, rectum)
    - oropharynx, conjunctivae
    - chest
    - heart
    - abdomen
    - indwelling devices

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**Suspected Infection in LTCF**

**Predisposing Factors**

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Potential Infection Source</th>
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<tbody>
<tr>
<td>Immobility</td>
<td>Pressure Ulcers</td>
</tr>
<tr>
<td>Diabetes</td>
<td>UTI/skin soft tissue infections</td>
</tr>
<tr>
<td>Prosthetic devices</td>
<td>Joints, valves, pacemakers</td>
</tr>
<tr>
<td>Urethral catheter</td>
<td>UTI/Bacteremia (39x risk)</td>
</tr>
<tr>
<td>IV catheters</td>
<td>BSI/phlebitis</td>
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Rudman et al. JAGS, 1988;36:726.

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**Dehydration**

**Predictor of Fever?**

- poor po intake (82%)
- rising serum Na or BUN/Cr (60%)

Weinberg. JAGS, 1994;42:968

**Physical Findings In LTCF**

**What is Useful in Older Adults?**

- Respiratory rate > 25 breaths/min
- Strongly suggests LRTI (80-90%)
- Less common pts without LRTI (3-19%)
- Otherwise little data


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**Infection in LTCF**

**Other Useful Clinical Manifestations**

- Typical signs/sx likely
  - RTI > UTI
- Pts with CXR (+):
  - RTI Sx (93%)
  - fever ≥ 38°C (44%)


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**Suspected Infection in LTCF**

**When to Pursue Diagnostic Testing**

- Review advanced directives (AD)
- Perform diagnostic testing if they:
  - are not prohibited by AD
  - are available (if not, transfer)
  - can be done in a timely manner
  - it would change management
  - if non-performance poses risk to others
What Diagnostic Testing is Helpful?  
CBC with Differential

• Older adults infected vs no infection

<table>
<thead>
<tr>
<th></th>
<th>Infection (RR)</th>
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<tbody>
<tr>
<td>leukocytosis (&gt; 14,000/mm$^3$)</td>
<td>3.7</td>
</tr>
<tr>
<td>neutrophilia (&gt; 90% PMNs)</td>
<td>4.7</td>
</tr>
<tr>
<td>% bands (&gt; 6%)</td>
<td>7.5</td>
</tr>
<tr>
<td>absolute bands (&gt; 1500/mm$^3$)</td>
<td>14.5</td>
</tr>
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Suspected Infection in LTCF
Complete Blood Count

• CBC should be done within 12-24h of onset of sx
• A careful assessment for bacterial infection should be done even without fever if:
  — WBC > 14,000 cells/mm$^3$
  — bands > 1500 cells/mm$^3$ or > 6%
• Additional testing may not be indicated for bacterial causes if:
  — no focal clinical findings
  — no fever
  — no leukocytosis or left shift

Revised McGeer Criteria
General Findings

B. Complete blood count
1. leukocytosis > 14,000 wbc/mm$^3$
2. neutrophilia > 90%
3. left shift (>6% bands or ≥1500 bands/mm$^3$)

Evaluation of UTI in LTCF Recommendations

- No UA/culture in asymptomatic pts
- Evaluate new onset or worsening sx/signs
- Non-catheterized patients (cystitis)
  — fever, dysuria, hematuria
  — frequency or incontinence
- Indwelling urethral catheters evaluate (pyelo)
  — fever, rigors, delirium, hypotension
  — obstruction present?

Evaluation of UTI in LTCF Recommendations

- If symptoms present, then...
- Non-catheterized obtain urine by:
  — men - clean catch, midstream, condom catheter
  — women - in and out catheter specimen
- Indwelling urethral catheter obtain urine after:
  — catheter change if present > 14 days
- Minimum lab evaluation UA or dipstick
- Obtain a culture and susceptibilities if:
  — leukocyte esterase + or pyuria ≥ 10 WBC hpf
Is the UA Helpful?
Pyuria-Asymptomatic Pts

- Young women 32%
- Pregnant women 30-70%
- Diabetic women 70%
- Institutionalized elderly 90%
- Hemodialysis pts 90%
- Short term catheters 30-75%
- Long-term catheters 50-100%


Pyuria
Other Causes

- Any inflammatory cause
- Tuberculosis (sterile pyuria)
- STDs
- Interstitial nephritis
  - legionella, leptospirosis, atheroemboli, granulomatous dis (sarcoid), allergy
- Irritation - stones, catheters

Diagnostic Tests in LTCF
Urinalysis (U/A)

- Pyuria not specific for UTI
  - 30% NH residents + WBC
  - degree pyuria not helpful
  - no pyuria and nitrate = no bacteriuria (NPV 100%)
  - look for a non-urinary source!

### Is a Culture Helpful?
#### Asymptomatic Bacteriuria

- Young girls ~1%
- Premenopausal married women 5%
- Pregnant women 2.7%
- Diabetic women 8-14%
- Comm-dwelling men > 75 yrs 6-15%
- Comm-dwelling women > 80 yrs > 20%
- Hemodialysis 28%
- Spinal cord patients > 50%

### Diagnostic Testing in LTCF
#### Does a (+) Culture = UTI?

- Asymptomatic bacteriuria (> 10⁵ cfu/mL) common
  - without catheters (15-50%)
  - with catheters (100%)
- Untreated asymptomatic bacteriuria-no catheter
  - persists for years
  - no morbidity or mortality with no Rx
  - no benefits with Rx
  - risk resistance/side effects with Rx


### Bacteriuria in LTCF
#### UTI = Symptoms!

- What constitutes "symptomatic" UTI?
  - fever
  - afebrile - 2 or more sx
  - new sx or worsening
  - CVA tenderness
  - dysuria, frequency, urgency
  - nocturia, incontinence
  - Low-grade temperature elevations (< 100°F),
  - Single non-specific sx
    - confusion, anorexia or functional decline
    - evaluation common
    - sx rarely due to UTI

Berman. Age Ageing 1997;16:281
Revised McGeer Criteria
UTI (No Catheter)

1. Any One of the following:
   a) Acute dysuria OR acute pain/swelling testes, epididymis, or prostate
   b) Fever OR WBC AND
      One or more of the following:
      CVA or SP pain/tenderness 
      gross hematuria
      new or marked increase:
      frequency, urgency, incontinence
   c) Two or more new or increased:
      frequency, incontinence, SP pain, new gross hematuria

AND

Revised McGeer Criteria
UTI (No Catheter)

2. Voided urine culture with
   a) \( >10^5 \) cfu/ml any bug (s)

UTI = Localizing S/S and (+) urine culture
If no S/S, (+) UTI Dx if:
- Blood & urine organisms the same
- no alternate source
- Pyuria does not differentiate
- UTI from AB
- Absence of pyuria excludes UTI Dx
- In the absence of a clear source:
- Fever or rigors & (+) urine culture often leads to Rx
- Evidence suggests that most episodes are NOT from a urinary source


Revised McGeer Criteria
UTI (Catheter*)

1. Any One of the following:
   a) Fever, rigors, GI new onset hypotension with NO alternate site of infection
   b) Either acute change MS OR acute functional decline with NO alternate diagnosis AND WBC
   c) New onset SP or CVA pain
   d) Purulent discharge around catheter or acute pain/swelling/induration/testes,
      epididymis, or pectun

AND

2. Urine has \( >10^5 \) cfu/ml any (s) organism(s).
   Obtained 2hrs catheter replaced if in \( >14 \) days

* Chronic indwelling catheters

In the absence of a clear source in the catheterised pt:
Acute confusion & (+) urine culture often leads to Rx
Evidence suggests that most episodes are NOT from a urinary source
Other localizing signs consistent with UTI are not necessary for Rx e.g.,
recent catheter trauma obstruction
new onset hematuria
Evaluation for Infection in LTCF
Respiratory Tract Infection

Respiratory Tract Infection in LTCF
Recommendations

• Perform pulse oximetry if RR > 25 breaths/min:
  – to document hypoxemia < 90%
  – assist in transfer/management decisions
• Perform CXR to:
  – identify new infiltrate compatible pneumonia
  – identify complications empyema, CHF, masses, effusions

Useful Diagnostics in LTCF
Pulse Oximetry

• Hypoxemia (P_{a}O\textsubscript{2} < 60 mm Hg):
  – predicts severity and mortality in CAP and NHAP
• Hypoxemia (O\textsubscript{2} saturation < 90%)
  – along with RR > 25 breaths/min
  – predicts impending respiratory failure

2002;324:237.
Useful Diagnostics in LTCF
Chest Radiography

- An infiltrate on chest x-ray
  - most reliable Dx method for pneumonia
  - despite poor film quality
  - lack of prior film
  - predictive hospitalization and death
- CXR confirms 75-90% suspected pneumonia

- May reveal other conditions
  - multi-lobar involvement, pleural effusions, mass lesions
  - prompt transfer to hospital
  - prompt another procedure
  - change management/prognosis?
- Does CXR improve outcomes?

Useful Diagnostics in LTCF
CXR – Other Conditions
Revised McGeer Criteria

Pneumonia

All of the following criteria must be met:
1. CXR positive for:
   a) pneumonia or new infiltrate
2. One or more resp S/S
   a) cough new/increased
   b) sputum new/increased
   c) O2 sat < 94% or reduced 3% from baseline
   d) abnl lung exam new or changed
   e) pleuritic chest pain
   f) RR > 25 breaths/min
3. One or more constitutional S/S

Absence of other conditions that could account for Sx, e.g., CHF


Respiratory Tract Infection in LTCF

Sputum Gram Stain & Culture

• No data sputum data improves outcome
• Sputum ordered in 5-10% of pneumonia pts
• Sputum samples adequate/purulent in:
  — < 30% of residents, and < 50% of specimens
• Obtain sputum if available/purulent
• Consider urine antigen pneumococcus/legionella serotype 1


Respiratory Tract Infection in LTCF

Outbreaks - Recommendations

• For a suspected URI outbreak obtain:
  — NP swabs from symptomatic pts.
  — submit for rapid testing
• PCR now available:
  — influenza, other viruses
  — bacteria

Respiratory Tract Infection in LTCF

Viruses - Recommendations

- Influenza A can cause serious outbreaks
- Attack rates ~ 20-70%
- Complications are frequent
- Reduce morbidity and mortality by:
  - isolation
  - immunization
  - chemoprophylaxis
- Other viruses associated outbreaks
  - RSV, parainfluenza, coronaviruses, metapneumovirus, & rhinovirus


Infections in LTCF

Respiratory Etiologies

- Viral* influenza*, RSV*, parainfluenza, adenovirus, rhinovirus, metapneumovirus
- Bacterial S. pyogenes*, S. pneumoniae Chlamydia pneumoniae Mycoplasma pneumoniae Hemophilus influenzae Chlamydia psittacosis Bordetella pertussis Mycobacterium tuberculosis

Infections in LTCF

Primary & Secondary SSTIs

- Abscess
- Cellulitis/Phlebitis
- Secondary Wound Infection
- Conjunctivitis
SSTI in LTCF
Primary Infections

- Group A streptococci, *S. aureus*
  - most frequent pathogens isolated
- Avoid superficial swabs cultures
- Culture pus or obtain deep tissue/biopsy
  - if initial Rx fails or unusual organism suspected.
- Tissue may be helpful in:
  - diabetic complications
  - presence of fluctuance
  - antibiotic failure


SSTI in LTCF
Secondary Wound Infections

- Always colonized with bacteria –
  - avoid superficial swab cultures
- Needle aspirates from ulcer margins:
  - low yield
  - technically difficult
  - poor specificity
- Tissue/surgical debridement optimal
- Osteomyelitis suspected?
  - MRI most sensitive
  - bone biopsy with histopath more specific


Revised McGeer Criteria
Cellulitis/Soft Tissue/Wound Infection

- One of the following criteria met:
  1. Pus present at a wound, skin, or soft tissue site.
  2. Four or more new or increasing signs or sx at the site
     a) heat
     b) redness
     c) swelling
     d) tenderness or pain
     e) serous drainage
     f) one constitutional S/S

One or more beta hemolytic streptococcal infections may suggest an outbreak

Use NHSN SSI criteria

Superficial cultures of pressure ulcers are not sufficient for Dx
Infections in LTCF
Scabies

- Cluster of unexplained rashes
  - residents
  - staff
- Transmission
  - person-to-person
  - fomites
- Clinical diagnosis difficult
  - identify all unexplained rashes
  - scrape for mites, eggs, or feces prior to any steroid use.
- Misdiagnosis pseudosoutbreaks/psychogenic scabies

Revised McGeer Criteria
Scabies

Both of the following criteria met:

1. A maculopapular and/or itching rash
   AND
2. One of the following:
   a) physician diagnosis
   b) scraping or biopsy +
   OR
   c) epidemiological linkage to a case of scabies with lab confirmation

Rule out noninfections skin conditions such as eczema, allergy, and irritation.

Epi link = common source exposure, temporally related onset, & geographic proximity
Infections in LTCF
Viral Skin Infections

* Herpes viruses (HSV & VZV)
  − diagnose by clinical presentation
  − scrape for giant cells by Tzanck prep
  − define virus by PCR or culture

McGeer Criteria - Unchanged Herpes Virus Skin Infections

1. Herpes simplex
   Both of the following criteria met:
   a) vesicular rash
      AND
   b) either physician diagnosis OR lab confirmation

2. Herpes zoster
   Both of the following criteria met:
   a) vesicular rash
      AND
   b) either physician diagnosis OR lab confirmation

Reactivation of HSV simplex and HSV zoster not considered an HAI
Primary herpes viral skin infections uncommon

Infections in LTCF
Fungal SSTIs

* Mucocutaneous fungal infection
  − KOH prep is sufficient unless refractory to Rx
  − Send culture for drug-resistant species.
Revised McGeer Criteria
Fungal Oral/Perioral/Skin Infections

1. Oral candidiasis
   Both of the following criteria met:
   a) presence of raised white patches on inflamed mucosa OR plaques on oral mucosa
   AND
   b) medical or dental diagnosis

2. Fungal infection
   a) characteristic rash or skin lesions
   AND
   b) either medical provider dx or lab confirmed smear, culture or bx

Mucocutaneous candida infections are due to comorbid conditions or antibiotics.

Non-candidal fungal infections rare & outbreaks uncommon.

Evaluation for Infection in LTCF
Diarrhea & Gastroenteritis

C. difficile
Norovirus

Infections in LTCF
Gastroenteritis Etiologies

* Toxin-mediated disease
non-foodborne*  Clostridium difficile*
food-borne  Escherichia coli O157:H7
Staphylococcus aureus
Clostridium perfringens
Bacillus cereus
Infections in LTCF
Gastroenteritis Etiologies

• Non-invasive disease
  - viral* norovirus*, rotavirus
  - parasitic Giardia lamblia

• Invasive disease
  - bacterial Salmonella, Shigella, Campylobacter
  - parasitic Entamaeba histolytica

GI Infections in LTCF
Recommendations

• Small intestine/gastroenteritis (watery diarrhea)
  - if no outbreak, no lab evaluation is required
  - pts should be followed closely for volume repletion
  - if symptoms persist > 7 days or are severe, stool may be submitted for giardia and other protozoa.

• Colitis (fever, cramps, +/- diarrhea, +/- blood or WBCs)
  - especially if antibiotics < 30 days
  - evaluate for C. difficile toxin in stool
  - if negative and no prior antibiotics submit stool for invasive enteropathogens

• Intraabdominal infections/abscesses 2nd to gi pathology
  - uncommon and severe. Transfer warranted.

GI Infections in LTCF
Diarrhea - Stool Evaluation

• Clostridium difficile-associated diarrhea
  - sporadic cases
  - outbreaks

• Dx should be suspected if:
  - antibiotic therapy in prior 30 days with
  - ≥ 3 watery or unformed stools in 24 hrs
Laboratory Tests
Diarrhea - Stool Evaluation

- Fecal WBCs
  - not an effective marker for *C. difficile*
  - not sensitive (60-75%)
  - not specific (30-39%)

- Sx invasive diarrhea with negative *C. difficile* toxin
  - fever, cramps and/or bloody diarrhea
  - *Campylobacter, Salmonella, Shigella* or ETEC


McGeer Criteria – Unchanged Gastroenteritis

One criteria must be met:
A. Two or more loose or watery stools above pt baseline in 24 hrs
B. Two or more episodes of vomiting in 24 hrs
C. Both of the following
   1. Stool specimen + for bacterial or viral pathogen
   AND
   1. At least one compatible gi symptom such as:
       - nausea, vomiting, pain, duration

Exclude non-infectious causes of symptoms due to medications or gallbladder disease

Revised McGeer Criteria Norovirus Gastroenteritis

Both criteria must be met:
A. Two or more loose or watery stools above pt baseline OR two or more episodes of unexplained vomiting in 24 hrs
B. Stool specimen + for norovirus by EM, ELISA, or molecular test (PCR)

- In an outbreak, confirm the cause
- No confirmation, assume Dx by Kaplan Criteria

All criteria must be met:
  a) vomiting > 50% affected
  b) mean (median) incubation period 24-48 hrs
  c) mean (median) duration illness 12-60 hrs
  d) no bacterial cause ID'

Revised McGeer Criteria

*Clostridium difficile* Infection

Both criteria must be met:

1. Diarrhea = 3 or more loose or watery stools above pt baseline within 24 hrs, or the presence of toxic megacolon by x-ray

2. One of the following:
   A. Stool + for toxin A or B, or by PCR.
   B. PMC found at endo-scopy, surgery, or by biopsy

1. Primary episode
   a) no prior episode or
   b) > 8 wks prior

2. Recurrent episode
   a) ≤ 8 wks prior and ss had resolved

McDonald LC et al. JCHIE 2007;28:140-145.

Bloodstream Infection in LTCF Recommendations

- Blood cultures not recommended for most pts unless:
  - highly suspected
  - access to laboratory diagnostics is rapid
  - physician response to + cultures is rapid
  - capacity to administer IV antibiotics is available
  - re-assess advanced directives
  - alters care decisions esp transfer

Diagnostic Tests

Blood Cultures

- Bloodstream infection (BSI) infrequent
  - 5-40 BSI per 100,000 pt days
  - Only 6% infections complicated by BSI

Muder, Clin Inf Dis, 1992:14:647
Diagnostic Tests

Blood Cultures

- Most older adults have fever $T \geq 100^\circ F$ (85%)
- Mortality from BSI
  - overall rates (20-35%)
  - highest in bacteremic pneumonia (50%)
  - predictors WBC > 20k, hypotension
- With appropriate Rx, 50% die within 24 hrs
- Does early ID of BSI improve survival?


Diagnostic Tests

Blood Cultures (BCs)

- In selected settings, BCs may help establish:
  - diagnosis of polymicrobial sepsis:
    - suspected urosepsis with a catheter
    - stage 3 or 4 pressure ulcers
  - suspected infection and severity illness warrants transfer, but care given in NH

Downton, et al. Age Aging,1997;41:47

Infections in LTCF Transfers

- Unstable/aggressive Rx a goal
- Diagnostic tests not available
- Appropriate monitoring cannot be done
- Appropriate Rx (route, frequency, type) not possible
- Comfort measures cannot be assured
- Infection control measures not possible
Nursing Homes
Evaluation of Fever & Infection

- Fever/function predictive infection
- Local signs/symptoms can be helpful
- Focus on most common syndromes
- Diagnostic tests can be useful
- Know the most common pathogens
- Establish when to transfer