The Epidemiology of Healthcare-Associated Infections (HAIs) in Long Term Care

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HEALTH CARE ASSOCIATED INFECTIONS (HAIs)

- 25 Million people will be treated in U.S. hospitals this year.
- Approx. 2 million will develop nosocomial infections
- Approx. 90,000 will die!
- LOS will be increased by 8 million days & cost will be increased by $3-7 billion dollars!
**HHS ACTION PLAN**

- Phase I – Hospitals
- Phase II – Ambulatory Care Settings
- Phase III – Long Term Care

**The Extent of the HAI Problem in LTC**

- Difficult to assess due to:
  - Heterogenicity
  - Oversight differences
  - Staffing
  - Payment incentives
- Nursing Home – provides primarily long-term maintenance & restorative care for those needing support with activities of daily living.
- Skilled Nursing Facility – offer more intensive medical & nursing services but not as much as acute care hospitals.
The Extent of the HAI Problem in NH/ SNFs

- NH/SNF - the vast majority of certified NHs in the US provide this combination of services therefore this is the group the current Action Plan is focusing on.
- Recent estimates suggest that the rates of HAIs occurring in this population ranges between 1.4 to 5.2 infections per 1000 resident-care days.
- This means that out of the 1.5 million adults living in NH/SNF -765,000- 2.8 million infec. every year in the U.S.

OUTBREAKS IN NH/ SNF’s

- Outbreaks are very common (1966-2008 - 37 pathogens associated with 206 outbreaks)*
  - Every year reports of Influenza and Streptococcus pneumonia respiratory outbreaks are recorded
  - Clostridium difficile and norovirus cause most GI outbreaks
  - Skin & soft tissue infection outbreaks are most commonly associated with MRSA, or Gr A Beta Strep
  - UTIs with multi-drug resistant enteric bacteria have recently been identified along with
  - Outbreaks of disease such as Hepatitis B & C associated with improper injection practices.  * Age Ageing, 2010 May; 39(3):299-305
Human Demographics
Elderly

Problem likely to get worse.

- 2009 – 84.8% of residents in CMS certified NHs/SNFs were 65yr old or older and 36.9% were 85 or older.

- By 2030 – >65 age group is projected to reach 71.5 million people
  - Estimated 20% of U.S. population

U.S. Census Bureau

2013 National Action Plan for LTC - 5 Areas of Focus

1. NHSN Enrollment
2. UTI/CAUTI
3. C. Diff. Infection (CDI)
4. Resident Flu & Pneumococcal Vaccination
5. Health Care Personnel Flu Vaccination
Factors That Predispose the Elderly to Infection

- Impaired Host Defenses
  - Aging of the Immune System
  - Chronic diseases
  - Medications
  - Malnutrition
  - Anatomic & functional changes
  - Degree of exposure to infections

Healthcare-Associated Infections

- Not present on admission & develop after 48 hrs.
- Incidence is greater in elderly than any other age group
- Not all preventable
WHAT IS PREVENTABLE

- Up to 70% ????
- If only 30-50% of NI are preventable.
- This equals:
  - 600,000 to 1 million infections;
  - 30,000-50,000 deaths

Most Common HAI's seen in NHs/ SNFs

- Urinary tract infections
- Lower Respiratory Infections
  - Pneumonia and influenza-like illness
- Blood stream infections
- Skin and Soft Tissue Infections infections
- Gastroenteritis
  - C. diff., norovirus
EPI DEMOGRAPHICAL TRIANGLE

(For an infection to occur you need three elements: A Source of Infection, a Means of Transmission, and a Susceptible Host)

SOURCES OF INFECTION

- Inanimate objects in environment that have become contaminated
- PEOPLE: Patients, Personnel, Visitors
  - Those with outward signs and symptoms of infection.
  - Those who are simply colonized or carrying an infectious agent
HOST

(Resistance to infections varies markedly.)

- Immune-suppressed patients
  - lymphomas, leukemia, agranulocytosis, chemotherapy, irradiation, corticosteroids
- Organ Transplant patients
- Diabetics
- Patients on antibiotics*
- Those suffering trauma
- Elderly patients-chronic debilitating disease

<table>
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<tr>
<th>4 PRIMARY MEANS OF TRANSMISSION</th>
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<td>VECTOR</td>
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<tr>
<td>VEHICLE</td>
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<tr>
<td>AIRBORNE</td>
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<td>CONTACT</td>
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**Vectorborne Diseases**

- Transmitted by various biting insects such as mosquitoes and ticks. (examples)
  - West Nile
  - Lyme Disease
  - Babesiosis
  - Ehrlichiosis
  - Yellow Fever
  - Malaria
  - Dengue
  - Zika

**Vehicle Transmission**

- Transmitted through ingestion or injection.
  - Bloodborne Pathogens
    - Hepatitis B
    - Hepatitis C
    - HIV
    - Arboviruses (i.e. West Nile, WWV, WEE etc.)
  - Enteric pathogens
    - Salmonella
    - Shigella
    - 0157 E. coli
    - Norovirus
Airborne Transmission

- Inhaled into the lungs or upper respiratory tract
  - Varicella (Chickenpox)
  - Measles
  - Tuberculosis

CONTACT TRANSMISSION

- DROPLET - (e.g. common cold, “flu”)
- INDIRECT - contaminated devices
- DIRECT - skin to skin contact (85% of Healthcare-associated infections)
EXAMPLES - DISEASES FREQUENTLY UNDIAGNOSED OR WHICH HAVE A CARRIER STATE

- HIV
- HEPATITIS B & C
- HERPES SIMPLEX
- SALMONELLA
- STAPH AUREUS
- MRSA, VRE etc.

- GRAM NEGATIVES
- MENINGITIS
- GROUP A STREP
- H.FLU
- C.DIFF
Bloodborne Pathogens

- Hepatitis B and C *
- HIV *
- Malaria
- Babesiosis
- Syphilis
- Etc.

Hepatitis B and C

<table>
<thead>
<tr>
<th></th>
<th>Transmission</th>
<th>Incubation</th>
<th>Carriers</th>
<th>Prevention</th>
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</thead>
<tbody>
<tr>
<td>Hepatitis B</td>
<td>Sex, Peri-natal, Parenteral</td>
<td>60-90days</td>
<td>5-10%</td>
<td>Pre or post exposure Vaccine/HBIG</td>
</tr>
<tr>
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<td>Parenteral, Sexual</td>
<td>2wks-6 mos</td>
<td>75-85%</td>
<td>No vaccine New treatment</td>
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HIV

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<tr>
<th></th>
<th>Sexual, parenteral, peri-natal</th>
<th>Weeks</th>
<th>95%</th>
<th>No vaccine/Post exposure anti-retrovirals</th>
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</table>
**Vehicle Transmission**

**Hepatitis B & C Outbreaks**

1998-2014

- Overall 44 HAI viral hepatitis outbreaks were investigated by CDC
- 42/44 occurred in non-hospital setting
- The vast majority were associated with infection control breaks (82%)
- 17 of these outbreaks occurred in LTC

http://www.cdc.gov/hepatitis/Statistics/HealthcareOutbreakTable.htm

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**UNIVERSAL PRECAUTIONS**

- “Treat all Blood and bloody body fluids and OPIM* as though they are infectious”
  
  *OPIM = saliva in dentistry, internal fluids such as joint fluids, amniotic fluid etc. Does not include Urine, saliva, feces etc. unless they are bloody.

- Universal Precautions have been replaced!! Term no longer used!!!
Prevention and Control Techniques

- Standard Precautions
  - The minimum infection prevention practices that apply to all patient care regardless of the infection status of the patient.

Prevention and Control Techniques

- Standard Precautions
  - Designed to protect both the patient and the Healthcare worker.
    - Hand Hygiene
    - PPE
    - Safe Injection Practices
    - The safe handling of equipment and the environment
    - Respiratory Hygiene/cough etiquette
Colonization

- Most transmission-based isolation systems ignore the fact that:
  - OPENINGS - mouth, nose, vagina, rectum are always colonized with bacteria capable of causing infection.
  - SKIN LESIONS - are also normally colonized as well.

Colonized Body Fluids

- Feces
- Airway secretions These fluids are always contaminated
- Wound drainage
- Blood ?
- Urine ? Sometimes contaminated but hard to determine
- Internal fluids?body fluids
“DIAGNOSIS DRIVEN” SYSTEM OF ISOLATION

CHART ➔ DIAGNOSIS ➔ SIGN ON DOOR ➔ GOWN, GLOVES, MASKS

(The above graphic represents how transmission-based precautions work. They often fail because the patient is undiagnosed and therefore there is no sign on the door. Following Standard Precautions for all patients overcomes this flaw.)

STANDARD PRECAUTIONS

- Implement Standard Precautions for all patients not just for someone you know or suspect to be infected!
- Personal Protective Equipment
  - GLOVES
  - PROTECTIVE FACE & EYEWARE
  - APRONS/ GOWNS
- Handwashing
- Safe sharps handling and disposal
WEAR GLOVES FOR:

- Contact With Mucous Membranes
- Contact with non-intact skin including rashes
- Contact with moist body substances

FOR ALL PATIENTS surfaces soiled with them

GOWN

“when it is likely that clothing will be soiled”

For All Patients
EYE AND FACE PROTECTION

“WHEN IT IS LIKELY THAT EYES OR MUCOUS MEMBRANES WILL BE SPLASHED BY BODY FLUIDS”

For All Patients

Standard Precautions

■ HAND HYGIENE/HANDWASHING
  ■ Alcohol-based hand rubs are now considered the primary mode of hand hygiene by the CDC and WHO because of their broad spectrum activity and increased compliance due to less time, less irritation and availability close to the patient when hands are not visibly soiled or when caring for patients with diarrhea.
  OR
  ■ 15 - 30 second friction rub with soap & water under warm water anytime hands are soiled
Standard Precautions

- **HAND HYGIENE**
  - Before touching a patient, even if gloves will be worn.
  - Before exiting the patient's care area after touching the patient or immediate environment.
  - After contact with blood, body fluids or excretions, or wound dressing.
  - Prior to performing an aseptic task.
  - Moving from a contaminated body site to a clean body site during patient care.
  - After glove removal.

For All Patients

Injection Safety

- The CDC “One & Only” Campaign
  - The One & Only Campaign is a public health campaign, led by the Centers for Disease Control and Prevention (CDC) and the Safe Injection Practices Coalition (SIPC), to raise awareness among patients and healthcare providers about safe injection practices. The campaign aims to eradicate outbreaks resulting from unsafe injection practices.
Injection Safety

- Use aseptic technique when preparing and administering medications
- Cleanse the access diaphragms of medication vials with 70% alcohol before inserting a device into the vial.
- NEVER administer medications from the same syringe to multiple patients even if the needle is changed or the injection is administered through intravenous tubing.

Injection Safety (Cont.)

- **Do not** reuse a syringe to enter a medication vial or solution.
- **Do not** administer meds from a single use or single dose vials etc. to more than one patient.
- **Do not** use fluid infusion or administration sets (e.g. IV tubing) for more than one patient.
- **Dedicate** multi-dose vials to single patient when ever possible. If used for more than one patient, restrict their use to a central medication area & should not enter the patient treatment area.
ADVANTAGES OF STANDARD PRECAUTIONS

- Applies principles of “common-sense”
- Does not need a diagnosis
- Becomes part of routine HCW behavior
- Consistent and defendable
- Eliminates the Factor

TRANSMISSION-BASED ISOLATION

- 3 Types – Contact, Droplet, Airborne
- Used when routes of transmission is (are) not completely interrupted using Standard precautions alone.
- Always used in addition to Standard Precautions
- Efforts must be made to counteract possible adverse events in these residents.
TRANSMISSION-BASED ISOLATION

- Regarding patient placement in NH/SNFs, make decisions on a case by case basis, balancing the risks of other patients in the room, the presence of risk factors that increase the likelihood of transmission, and the potential adverse psychological impact.


TRANSMISSION-BASED PRECAUTIONS

- CONTACT ISOLATION
  - Used for diseases that are known and transmitted through contact. Examples include Multi-drug resistant organisms such as MRSA, VRE, and CRE’s.
  - Precautions include:
    - Appropriate Hand Hygiene
    - Put on gloves and gown before entering the room,
    - Remove before exiting
    - Appropriate Hand Hygiene
Droplet Precautions

- (Although Droplet is a category of Contact Transmission an additional form of transmission-based precautions called Droplet Precautions have been added by CDC and is used to prevent transmission of pathogens spread through close respiratory or mucous membrane contact with respiratory secretions.)

Droplet Precautions

- Use for Pertussis, Influenza, Adenovirus, Rhinovirus, N. meningitidis
  - Priv. room or cohort (separate by at least 3 feet).
  - Wear regular isolation mask for close contact.
  - Patient wear mask if transported, if tolerated & follow resp. hygiene/cough etiquette.
AIRBORNE TRANSMISSION - for diseases transmitted through droplet-nuclei

AIRBORNE DISEASES
- Chickenpox**
- Varicella Zoster**
- Tuberculosis*
- Measles**

- Use N-95 Respirator
- For diseases with ** must be properly immunized to enter room.
- Need Private Room with Negative air pressure.
  - Unless NH/ SNF is properly equipped with neg. pressure room patients with these diseases should be transferred

STOP
CHECK WITH NURSE BEFORE ENTERING
AIRBORNE INFECTIONS IN LTC FACILITIES

- If a Long Term Care Facility is not properly equipped with Negative Pressure Isolation rooms it is important that protocols are in place to safely hold the patient prior to transporting to an appropriate facility that is equipped to care for the airborne infection.

(Example: Tuberculosis symptomatic patients should wear a surgical or procedure mask, if possible, and should be instructed to observe strict respiratory hygiene and cough etiquette procedures.*)

*http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5417a1.htm?s_cid=rr5417a1_e

Other Control Techniques

- Clinical Practices - P &P, use and care of devices (foley catheters, IVs, respirators, transducers, etc., isolation procedures)

- Employee health practices
  - Health screening immunizations
  - Post exposure management
  - Policies for not working with specific conditions
Other Control Techniques

- Environmental cleanliness
  - P&P for cleaning, disinfection, sterilization and maintenance, Infectious Waste Disposal
  - Daily room cleaning
  - Pay close attention to “High Touch” surfaces such as bedside tables, bed rails, IV poles, bathroom surfaces.

Other Control Techniques

- Environmental cleanliness (Cont.)
  - Use EPA approved disinfectant in proper dilution and for proper contact time.
  - Always remember cleaning is a prerequisite to disinfection or sterilization.
Urinary Tract Infections

The most commonly reported and treated infection in NH/SNF residents

- Avg. indwelling catheter use is approx. 5% therefore majority of UTIs not catheter associated!
- Many develop weakened pelvic muscles, urinary retention, incomplete emptying, and bacterial colonization.

Urinary Tract Infections (Cont.)

- If you don’t differentiate between Asym. Bacteruria from Symptomatic UTI = antibiotic overuse!
- Ab overuse increases adverse events, & complications such as CDI, & the emergence, & transmission of MDROs.
Risk Factors for Catheter-associated UTIs (CAUTIs)

1. Length of time of catheterization
2. Colonization of the drainage bag
3. Host factors: (i.e. Female gender, Diabetes mellitus, uremia)
4. Improper catheter care

Prevention

- Eliminate or restrict catheterization
- Other methods - condom catheters, intermittent catheterization, supra-pubic catheterization and urinary diversion.
- Limit length of catheterization
- Keep system closed

http://www.cdc.gov/HAI/ca_utl/uti.html
Lower Respiratory Tract Infections (LRTI)

- Risk factors for LRI
  1. Previous use of Antibiotics.
  2. Surgery
  3. COPD
  4. Advanced age
  5. Immunosuppression
  6. Unvaccinated


LOWER RESPIRATORY TRACT INFECTIONS (LRTI s)

- Declining oral hygiene, difficulty swallowing, and diminished cough reflex especially in those with neurologic conditions increases the risk of aspirating. Also underlying conditions such as COPD & Asthma increase the risk of pneumonia.

- LRTI attack rate in NH/SNF residents
  - 33/1000 residents vs 1.4/1000 residents in community
LOWER RESPIRATORY TRACT INFECTIONS (LRTIs)

- Pneumonia -5th leading cause of death in people >65
  - S. pneumo. Is most frequent cause of pneumonia.

LOWER RESPIRATORY TRACT INFECTIONS (LRTIs)

- Difficult to diagnosis
  - Presentation atypical - only evidence might be malaise, anorexia, non-specific muscle weakness, behavioral changes, Wt. loss.
  - May have little cough, no fever, & few changes in the bedside exam.
  - Altered mental state may be the most common presenting symptom in 40% of those with bacterial pneumonia.
Lower Respiratory Tract Infections

- The most dangerous HAI with a high case fatality rate
- Endotracheal intubation and tracheostomy are the major risk factors for healthcare-associated LRI. (both dry the lower respiratory tract mucous and provide entry for microbes.)
- Ventilators and nebulizers also increase the risk

Pneumococcal Disease

- Most common form of community-acquired bacterial pneumonia in the elderly
  - 60% of all cases
  - 20% of HAI pneumonias
  - Elderly have highest pneumococcal bacteremia rates of any population group
    - 50 per 100,000 persons>65 (3X greater than rates for younger persons)
    - Death rates range from 20-80%, increasing with age & complications
Pneumococcal Disease

- Streptococcus pneumonia
  - Over 90 serotypes
  - Causes pneumonia, bronchitis, bacteremia and meningitis
  - Very costly in elderly - require hospitalizations and complications

Pneumococcal Disease

- Antibiotics are helpful - sometimes!
- Death & complications often occur despite prompt use.
- Only preventative measure available - vaccine.
- Shown to be >70% effective in the elderly
- Follow *current medical guidance as to the most appropriate vaccine and vaccine schedule.
- Give to anyone over 50 (Medicare part B will pay for it.)

*http://www.vaccines.gov/diseases/pneumonia/index.html
Influenza in the Elderly

- Influenza leads all other disease categories in terms of restricted activity & bed delays
- Elderly consistently have the highest hospitalization & death rates of any population group

Influenza in the Elderly (Cont.)

- Even in mild years there are > 20,000 excess deaths from flu in U.S. - 80-90% occur in the elderly
- Flu complications - pneumonia (viral & bacterial) and cardiac respiratory failure
- Long recovery time in those who do get well
Influenza in the Elderly

- Largely unnecessary - vaccines available since the 1960’s
- Reduces risk or decreases severity
- Very cost-effective
- Some anti-virals available for Influenza A viruses


Prevention (examples)

- Handwashing
- Aseptic technique
- Good oral hygiene
- Decontamination of respiratory equipment
- Bed elevation
**Skin and Soft-Tissue Infections**

- Decubitus Ulcers – Occurs in 20% of LTCF residents and are associated with increased mortality. (osteomyelitis, bacteremia = 50% mortality)
- Risk factors – immobility, pressure, friction, shear, moisture, malnutrition, steroids, infection, reduced nursing time.
- Prevention = nutrition, preventing fecal incontinence, plan for turning, eliminating focal pressure, keeping skin dry.

**Gastro-Intestinal Infections**

- Viral gastroenteritis (rotavirus, enterovirus or norovirus) Bacterial gastroenteritis (B.cereus, E.coli, Campylobacter, Salmonella, Shigella)
- Clostridium difficile is becoming the #1 cause of diarrhea in NH/SNF residents accounting for more than 50% of all GI illness reported in Penn. NHs in 2009.
  - It is estimated that more than half of all HAI CDI cases will manifest in NHs: reported rates are between 1.7- 2.9/10,000 resident days.
**Clostridium difficile Infection (CDI)**

- Antibiotic induced diarrhea
- May cause approximately 50% of all cases of healthcare associated diarrhea in LTC.
- Disease may be mild or cause life threatening pseudomembranous colitis
- Increasing numbers of cases
  - Cases tripled in US hospitals from 2000 until 2005
  - Increasing disease severity and mortality

**Clostridium difficile Colonization vs Infection**

- Colonization: presence of microorganisms without tissue invasion or damage, therefore no signs or symptoms
- Colonization rate of *C. difficile*
  - About 10-25% of hospitalized patients
  - About 4-20% of long term care residents
  - Antibiotic therapy may disrupt normal colonic flora in colonized patients and *C. difficile* proliferates, producing toxins and symptomatic disease
- Infection: presence of microorganisms with tissue invasion and damage, therefore signs or symptoms
Rapid Rise in Antibiotic Resistance

- MRSA
  - HAMRSA
  - CAMRSA
- Vancomycin Resistant Enterococci (VRE)
- Carbapenemase Resistant Enterobacteriaceae (CRE)
  - NDM 1
  - KPCs

Rapid Rise in Antibiotic Resistance - Reasons

- Overuse/Misuse (Human and animal)
  - Used when not needed
  - Wrong drug for the bug
  - Wrong dose
  - Improper duration
  - Public perceptions

Antibiotics and Deaths

After the introduction of a mild dose of antibiotics, some mutated forms of bacteria may survive.
Antibiotics in NH/SNFs

- 40% of systemic drugs prescribed in LTCFs.
- Odds that a resident will receive a systemic course of antibiotics during one yr. period is 50-70%.
- Studies suggest that 25-75% of systemic Ab use may be inappropriate in LTCFs.

What Can Be Done?

- Can not stop microorganisms from becoming resistant!
- BUT - can slow the process down through:
  - Antibiotic stewardship - need for the Ab, right drug for the bug, right dose, right duration, and right route of administration.
  - Education of the health care community and the public