Prevention of Healthcare-Associated Infections

Lisa Winston, MD
University of California, San Francisco / San Francisco General Hospital

Outline

Two parts
- Big picture
  - Data
  - Regulation
- Nitty gritty
  - Review a few common issues that arise

Preventability Is the Key

Healthcare-associated infections (HAI) are predictable complications

Middle Ground

Healthcare-associated infections result from provider lapses

How to Prioritize Prevention?

- HAI that have high mortality and/or morbidity and/or cost
- HAI that are common
- HAI for which we have good evidence regarding effective prevention
- HAI that can be reproducibly and accurately defined

Organizations

Regulatory function:
The Joint Commission (TJC)
Centers for Medicare and Medicaid Services (CMS) State

Public agencies:
Under U.S. Department of Health and Human Services
Centers for Disease Control and Prevention (CDC)
Agency for Healthcare Research and Quality (AHRQ)

Professional organizations:
Society for Healthcare Epidemiology of America (SHEA)
Association of Professional in Infection Control and Epidemiology (APIC)

Organizations

Public/private collaborations:
Hospital Quality Alliance (HQA) – Hospital Compare website
National Quality Forum (NQF)
Quality Improvement Organizations (QIOs) – private contractor, extensions working under CMS [1 per state]
Other:
Institute for Healthcare Improvement (IHI): 5 million lives Campaign has “bundles” which target, in part, HAI

Initiatives also have acronyms:
e.g. Surgical Care Improvement Project = SCIP (several elements pertain to infection prevention)
CMS Non-Payment of Hospital-Acquired Conditions

- Four items which pertain directly to infection prevention
  - Catheter-associated urinary tract infection
  - Vascular catheter-associated infection
  - Mediastinitis after coronary artery bypass grafting
  - Surgical site infections following certain orthopedic procedures and bariatric surgery

Joint Commission National Patient Safety Goals

- Follow hand hygiene guidelines according to World Health Organization (WHO) and CDC
- Manage as sentinel events unanticipated death or major permanent loss of function associated with HAI
- New for 2009
  - Preventing multidrug resistant organism infections
  - Preventing central line-associated bloodstream infections
  - Preventing surgical site infections

What Are the Targets?

Infections:
- Central-line-associated bloodstream infections (CLABSI)
- Catheter-associated urinary tract infection (CA-UTI)
- Surgical site infections (SSI)
- Ventilator-associated pneumonia (VAP)
- Stand alone process:
  - Hand hygiene

Vaccinations:
- Influenza vaccination of healthcare personnel
- (Influenza and pneumococcal vaccine for patients)

Organisms:
- Methicillin-resistant Staphylococcus aureus (MRSA)
- Clostridium difficile
- Other multidrug resistant organisms (MDRO), e.g. vancomycin-resistant enterococci (VRE)

Targets to Be Discussed

- Hand hygiene
- Influenza vaccination of healthcare personnel (HCP)
- Central-line-associated bloodstream infection
- Catheter-associated urinary tract infection
- Surgical site infection
- Ventilator-associated pneumonia
- Methicillin-resistant Staphylococcus aureus

Hand Hygiene

Data summary:

Recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force
Hand Hygiene

- Many studies (mostly small, mostly non-randomized) showing association between hand hygiene and decreased rates of HAI
  - Interventions often multi-factorial, some during outbreaks
- Well demonstrated that HCP have pathogenic organisms on hands, usually transiently
- Overall, compelling aggregate data that hand washing and hand hygiene products reduce organism burden on hands

Example: Clinical Impact of Hand Hygiene

- Following introduction of alcohol hand rub in a Swiss hospital:
  - Sustained increase in hand hygiene compliance: 48% to 66%
  - 20,000 observations over 3 years
- Decrease in all healthcare associated infections
  - 16.9% to 9.9%


Example: Clinical Impact of Hand Hygiene

- Eight month cross over trial observing nearly 1900 adult patients in 3 ICUs
- Comparison of two hand washing systems
  - Chlorhexidine vs. isopropyl alcohol with optional soap
- Hand washing frequency was improved when chlorhexidine was available
- 152 infections during chlorhexidine period vs. 202 during alcohol/soap period (adjusted incidence 0.73, 95% CI 0.59 – 0.90)


Hand Hygiene

- Alcohol based products more effectively reduce bacterial counts on hands than hand washing with soap (including antimicrobial soap) or detergents and are generally preferred
  - Alcohol based products are more convenient and may increase compliance
    - Hand washing preferred when hands are visibly soiled
    - Hand washing preferred for some organisms, e.g. *Clostridium difficile*, *norovirus*, *anthrax*
When you know what to do, how do you get people to do it?

- Data are limited with respect to healthcare-associated infections and hand hygiene
- Most studies are of low quality
  - Simple before-and-after design predominates

Ranji et al. AHRQ Publication No. 04(07)-0051-6;2007

Influenza Vaccination of HCP

- Influenza is a common disease that causes substantial morbidity and mortality, particularly in the elderly
- Many elderly persons do not have a robust immune response to the vaccine
- Influenza is transmitted in healthcare facilities
  - HCP both transmit and acquire influenza
  - HCP frequently work when they are ill
  - Influenza is shed before symptoms develop; some infections are asymptomatic

Does Influenza Vaccination of HCP Help?

Based on results of double blind, RCTs:
- Vaccination can decrease some manifestations of influenza infection and absenteeism in working adults
  - Bridges et al, JAMA 2000;284:1655-63
  - Nichol et al, JAMA 1999;281:137-44
- Vaccination decreases influenza infection in HCP and may decrease absenteeism
  - Wilde et al, JAMA 1999;281:908-13

Bridges et al, JAMA 2000;284:1655-63
Nichol et al, JAMA 1999;281:137-44
Wilde et al, JAMA 1999;281:908-13

Data summary:
MMWR Recomm Rep, Influenza Vaccination of Health-Care Personnel. 2006(55):1-16

Does Influenza Vaccination of HCP Help?

- HCP influenza vaccination is associated with decreased patient mortality in long-term care
  - Potter et al, J Infect Dis 1997;175:1-6
- Note that efficacy of vaccination varies from year-to-year and is influenced by vaccine match

Data summary:
MMWR Recomm Rep, Influenza Vaccination of Health-Care Personnel. 2006(55):1-16

Central Line-Associated Bloodstream Infection

- Hand hygiene
- Maximal sterile barrier precautions during insertion (cap, mask, sterile gown, sterile gloves, large sterile drape)
- 2% chlorhexidine preparation for skin antisepsis
- Avoid routine placement / remove when not needed
- Use of antiseptic / antibiotic impregnated catheters when rates are high despite adherence to other measures
- Preferential use of subclavian site (except for dialysis)

Central Line-Associated Bloodstream Infection
Keystone ICU Project

- All ICUs in Michigan invited to participate
- 108 ICUs (mostly in Michigan) agreed; 103 reported data
- 18-month study period
- Required at least one physician and one nurse team leader

Keystone ICU Project

- Focused on 5 interventions:
  - Hand washing
  - Full barrier precautions during insertion
  - Cleaning the skin with chlorhexidine
  - Avoiding the femoral site, if possible
  - Removing unnecessary catheters

Keystone ICU Project

- Showed continuous and sustained improvement throughout study period
- Median baseline rate 2.7 infections per 1000 catheter days decreased to 0 infections per 1000 catheter days after implementation
- Mean rate of 7.7 infections per 1000 catheter days decreased to 1.4 per 1000 catheter days at study completion

Central Line-Associated Bloodstream Infection

- One of the HAIs most amenable to intervention
- Many ICUs have already made substantial progress
- Specifically targeted by both CMS and TJC
- Early target of state regulation
  - Public reporting

Catheter-Associated Urinary Tract Infection

- Cited as the most common HAI
  - Expensive in aggregate
  - Less attributable morbidity and mortality than other HAIs
- CDC guidelines updated 2009
  - Few substantive differences from previous guidelines in 1981
- UTIs are frequently overcalled
- Asymptomatic bacteriuria seldom needs treatment
  - Exceptions – pregnancy, GU surgery

Catheter-Associated Urinary Tract Infection

- Bacteriuria develops at a rate of about 5% per day
- Recommendations
  - Hand hygiene
  - Aseptic technique and sterile equipment
  - Secure catheter properly
  - Maintain closed, sterile drainage
Catheter-Associated Urinary Tract Infection

- CDC recommendations continued:
  - Catheterize only when necessary
  - Urinary obstruction, urinary retention, urologic or contiguous surgery, measure urine output when needed in critically ill patients
  - Remove unneeded catheters

Surgical Site Infection


- Significant regulatory input
  - CMS, including QIOs
  - TJC
  - States
- Early target of public reporting – process and outcome

Ventilator-Associated Pneumonia

Chlorhexidine-Alcohol versus Povidone-Iodine for Surgical-Site Antisepsis

January 7, 2010
Ventilator-Associated Pneumonia

- High mortality
- Expensive
- Some evidence regarding effective prevention
- Significant challenges with definition
  - Fewer regulatory interventions at this point


IHI Ventilator-Associated Pneumonia initiative: the ventilator bundle

- Elevation of the head of the bed One study – 86 pts
- “Sedation vacation” and assessment of readiness to extubate One study – 128 patients
- Peptic ulcer disease prophylaxis
- Deep venous thrombosis prophylaxis No study

Ventilator-Associated Pneumonia

March 2008

Update to guidelines published by Ann Intern Med, 2004

Methicillin-Resistant Staphylococcus aureus

- Significant controversy
  - Active surveillance
  - Contact isolation
- Subject of legislation in many states

Methicillin-Resistant Staphylococcus aureus

March 2008: Surveillance decreases MRSA disease

Potential Harms of Contact Isolation

- Patient loneliness, depression, feelings of stigmatization
- Fewer nursing and physician visits
- Less complete documentation
  - Nursing and physician notes
  - Vital signs
- Less education
- Increased risk for preventable adverse events, such as falls and pressure ulcers

Common calls in the hospital

A quick potpourri...

The best call is the one you don’t have to take....

Know the phone number for your Infection Control Practitioner – now often called Infection Preventionist

Overview

Patient-to-Patient (staff often conduit)
- Isolation strategies
  - Examples: MRSA, VRE, resistant Gram negatives, C. difficile

Staff-to-Patient
- Vaccines as condition of employment, TB screening, rules for staying home
  - Examples: rubella, varicella, TB, influenza

Patient-to-Staff
- Barrier protections
  - Examples: bloodborne pathogens, TB, scabies, SARS

Infection Prevention

Standard Precautions: based on the principal that ALL blood and body fluids may contain an infectious pathogen
- Hand hygiene before and after all patient encounters (and after removing gloves)
- Gloves for potential hand contact with blood, fluid, mucous membranes, and non-intact skin
- Gown, mask, eye protection/face shield for potential contact with secretions, blood, or fluid
- Respiratory hygiene/cough etiquette – for all patients and visitors who may have respiratory infections

Standard Precautions are a key safety measure for patients and healthcare workers

Transmission Based Precautions

Contact
- Prevent spread of organisms by direct or indirect contact
  - Private room, gowns, gloves, dedicated patient equipment
  - Used e.g. for certain drug-resistant organisms, C. difficile

Droplet
- Prevent spread of organisms through respiratory secretions
  - Large particle droplets generated by coughing, sneezing, suctioning
  - Private room (physical separation), mask for healthcare worker
  - Used e.g. for N. meningitidis, influenza

Airborne
- Prevent spread of organisms in small particles (< 5 μ) suspended in air
  - Negative pressure, private room, N95 respirator for healthcare worker
  - Used e.g. for tuberculosis, smallpox

Infection Control

<table>
<thead>
<tr>
<th>Type of Precaution</th>
<th>Conditions</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact</td>
<td>Diarrhea</td>
<td>C. difficile, group A strep</td>
</tr>
<tr>
<td></td>
<td>Wound infections</td>
<td>(some), chickenpox,</td>
</tr>
<tr>
<td></td>
<td>Vesicular rashes</td>
<td>smallpox</td>
</tr>
<tr>
<td></td>
<td>Some respiratory infections</td>
<td>RSV (some), SARS</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>scabies, lice, viral</td>
</tr>
<tr>
<td></td>
<td></td>
<td>conjunctivitis</td>
</tr>
<tr>
<td>Droplet</td>
<td>Meningitis</td>
<td>Meningococcus, H. influenzae</td>
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<tr>
<td></td>
<td>Some respiratory infections</td>
<td>pertussis</td>
</tr>
<tr>
<td>Airborne</td>
<td>Some respiratory infections</td>
<td>TB, chickenpox, measles,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>smallpox, SARS</td>
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</tbody>
</table>
Tuberculosis – Hospital Control

- Identify suspect patients – most effective
  - Demographics
  - Signs and symptoms
  - CXR
- Engineering controls
  - Ventilation: 10 – 12 air exchanges/hr. (min. 6)
  - Negative pressure with respect to corridor
  - HEPA filtration
- Personal protective equipment
  - Disposable respirators (N-95 masks)
- Surveillance for healthcare personnel
  - PPD (or Quantiferon) and symptom checks

What the Patient Wears for TB Control

What HCP Wear for TB Control

What celebrities do???

Heidi Montag and Spencer Pratt honeymooning in Mexico

When to Think of TB

**History**
- Close contact with active case
- Homeless, substance use, HIV risk factors, ETOH, recent incarceration, elderly, foreign born

**Symptoms** for > 2 weeks
- New productive cough – most helpful
- Fever, night sweats, weight loss

**Low threshold** for initial isolation

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**TB Case Rates by Age Group and Race/Ethnicity,**
**United States, 2008**

- Asian
- Black or African-American
- Hispanic or Latino
- Native Hawaiian/Pacific Islander
- White

*All cases are non-Hispanic. Percentages reporting two or more races accounted for less than 1% of all cases.*
Tuberculosis in San Francisco
Demographics - 2008

- 118 new cases in 2008 (down from 143 in 2007)
- Incidence = 14.6/100,000
- US average = 4.4/100,000
- CA average = 7.0/100,000
- Health People 2010 goal = 1/100,000

Other factors
- Foreign born: 76% (41% born in China)
- Homeless: 12%
- HIV: 11% (slight increase)
- Alcohol abuse: 7.6%
- Injection drug use: 3.4%

PPD interpretation

- Positive:
  - > 5mm: HIV, recent contact, fibrotic changes on CXR, other significant immunosuppression
  - > 10mm: recent immigrants, injection drug use, medical conditions (e.g. diabetes, chronic kidney disease), < 4 years old, healthcare worker
  - > 15mm: all others, i.e. no risk factors
  - Conversion: >10mm change within 2 years

Targeted testing: A decision to test is a decision to treat

Tuberculosis in the Hospital

- Acid fast bacilli (AFB) smear positive: minimum 14 days of therapy and 3 follow up negative smears
  - Not generally required to go home but needed if going to jail, SNF, etc.
- AFB smear negative, suspicion high and started on therapy: minimum 4-5 days of therapy
- AFB smear negative, not on therapy: discontinue isolation after 3 negative smears
- Persons with TB or suspect for TB should be referred to public health

Meningococcal Disease

- Post-exposure prophylaxis only with disease
- Notify hospital infection control and public health
- HCP need prophylaxis only if close/prolonged contact: e.g. intubation, resuscitation
  - Rifampin 600 mg P.O. q 12 hrs. x 4 doses
  - Ciprofloxacin 500 mg P.O. x 1 dose
- Patient in droplet isolation for 24h after ceftriaxone

Needle Sticks

- Local decontamination
  - Soap and water
  - Flush mucosal splashes with water
  - Irrigate eyes with water or saline
- Report to Needle Stick hotline 24/7
- Resource: National Clinician’s Post-Exposure Prophylaxis Hotline (PEPline): 888-448-4911

Risk of seroconversion from a needle stick or splash

“Rule of 3’s”

- HBV, e-antigen+: ~30%
- HCV+: ~3% (1.8%+)
- HIV+: ~0.3% (0.2-0.5%)
- HIV+ splash: <0.1%
HIV

- Is it a real exposure?
- Risk stratify source patient and exposure
  - Hollow bore needle in vascular space
  - Deep injury (> 3mm)
  - Visible blood on device
  - Advanced disease in source patient
- AZT does appear to decrease seroconversion risk
  - Other data extrapolated and from animal studies
- Initiate PEP within 1 hr. and continue for 28 days
- HCP serologies usually at baseline, 6, 12, 24 weeks

HIV Post Exposure Prophylaxis: MMWR 2005

- Basic regimen: Zidovudine or tenofovir plus lamivudine or entecavir
- Expanded regimen: Preferred: add lopinavir/ritonavir
  - Also consider atazanavir or fosamprenavir +/- ritonavir
  - Efavirenz another possible third drug
  - Older protease inhibitors can be considered
- Avoid nevirapine, delavirdine, (abacavir)

HIV Post Exposure Prophylaxis: MMWR 2005

<table>
<thead>
<tr>
<th>Time</th>
<th>Regimen</th>
</tr>
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<tbody>
<tr>
<td>1 hr</td>
<td>Zidovudine or tenofovir plus lamivudine or entecavir</td>
</tr>
<tr>
<td>1 hr and 4 hrs</td>
<td>Lopinavir/ritonavir or atazanavir or fosamprenavir + ritonavir</td>
</tr>
<tr>
<td>12 hrs</td>
<td>Efavirenz</td>
</tr>
<tr>
<td>1 day</td>
<td>Nevirapine, delavirdine, (abacavir)</td>
</tr>
</tbody>
</table>

Hepatitis B

- Staff screened for proof of vaccination, not necessarily for immunity
- Check immunity in context of BBP exposure, if not known; HBIG + 1 dose vaccine if not immune and source positive (or ? unknown)
- No revaccination guidelines
  - ? Check immunity at 7-10 yrs (not done in U.S.)
- Non-responders (3-6%)
  - Pre-exposure: booster, second course, different product, double dose
  - Post-exposure: HBIG X 2 (0, 1 month)

Hepatitis C

- Pre-exposure prophylaxis: none
- Post-exposure prophylaxis: none
- Consider interferon for acute infection
  - Probably no need for ribavirin in this setting

Source Patient BBP Status
San Francisco General Hospital
2008 Exposures

<table>
<thead>
<tr>
<th>Source Patients (98 / 105 tested)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIV+</td>
</tr>
<tr>
<td>HCV+</td>
</tr>
<tr>
<td>HBsAg+</td>
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</tbody>
</table>
Public Health Reporting

Remember to do it....

Your Infection Preventionists can help