Solving the Healthcare Equation:
Don’t be Obtuse, Check all the Angles

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Objectives

Understand the multiple factors that can impact Healthcare Associated Infection (HAI) risk

Evaluate if current practices are robust enough to address the risk of HAI transmission

Understand basic and multi-modal practices, to address the risk in the healthcare environment

Create solutions to improve compliance and reduce risk
Ye Olde Algebra

\[ X = f(1) + f(2) + f(3) + \ldots + f(n) \]

Where \( X \) is the problem

Where \( f \) are the components that make up the problem
Healthcare Associated Infections

Multifactorial problem!

Hand Hygiene can reduce infections (WHO 2009, Table 1.22.1)

The Environment plays a role in transmission (Otter 2011)
Healthcare Associated Infections

HAI(p) = PA + HH + ASP + CP + FWM + ED

Where:
HAI(p) = Healthcare Associated Infection Prevention
PA = Patient Acuity
HH = Hand Hygiene
ASP = Antibiotic Stewardship Program
CP = Clinical Practices
FWM = Fecal Waste Management
ED = Environmental Disinfection
Patient Acuity (PA)

The sicker a patient is, the more prone a patient will be to acquiring an HAI.

Each added co-morbidity makes the patient more of a susceptible host.

Non-Critical | Moderately Ill | Complicated Illness

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

0  | 2  | 4  | 6  | 8  | 10
Patient Acuity (PA)
Patient Acuity

Being on a ventilator – increased risk of pneumonia
Portal of entries (Central line, peripheral IV, urinary catheter, surgical incision, open skin areas) all can increase risk of HAI
Elderly (Immune senescence, thinning skin, GI, respiratory and urinary changes, malnutrition, medications)
Antibiotics – change in microbiome
Co-morbidities (CHF, diabetes, immunocompromised etc.) adds pressure on all defense systems
Patient Acuity

On a ventilator (Vent)
Portal of Entry (POE)
Elderly (Old)
Antibiotics (Abtics)
Co-Morbidities (Co-M)
Healthcare Associated Infections

\[ \text{HAI}(p) = PA_{\text{vent}} + PA_{\text{poe}} + PA_{\text{old}} + PA_{\text{abtic}} + PA_{\text{co-m}} \]
Hand Hygiene - Traditional

Get compliance with the moments to be over 70% (still to be defined for ‘ideal’)

Auditing

• Observation, Secret Shopper, Electronic via sensors, ultrasound, etc.
Hand Hygiene - Traditional

Feedback (auditing) of use

- Auditor (Hawthorne effect), Electronic
- Secret shopper
- Staff self reminders
Hand Hygiene Components

Need to have product (ABHR) at point of care

• **Point of Care:** The place where three elements come together: the patient, the HCW, and care or treatment involving contact with the patient or his/her surroundings (within the patient zone). (Sax 2007)
Hand Hygiene Components

Point of care location
- Staff selection, Human factors analysis

Product that staff will use
- Trials, skin care programs with lotions
Hand Hygiene Components

Education to staff on Moments for Use

- Need the ‘why’s’ to go with the moments
- Incorporate moments into any presentation
- Needs the facts and figures on why this is important
- Remind of contact time for alcohol based hand rub

Unit/Site Champions and Support of C-Suite
Hand Hygiene Components

Patient hand hygiene
• Does the patient know that the product is there?
• Does the patient know what the product is?
• Does the patient understand when they need to perform hand hygiene?
• Can the patient perform their own hand hygiene?
  • Assessment on admission
  • Recognition of patients who require assistance
• Empowerment
Hand Hygiene Components

Family and Visitor

- Does the family/visitor know that the product is there?
- Does the family/visitor understand when they need to perform hand hygiene?
- Can the family/visitor assist the patient with hand hygiene?
- Can the family/visitor monitor/audit staff hand hygiene?
Figure 1: Components of a Multifaceted Hand Hygiene Program
<table>
<thead>
<tr>
<th>Component</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product that staff will use</td>
<td>(Prod)</td>
</tr>
<tr>
<td>Point of care location</td>
<td>(Place)</td>
</tr>
<tr>
<td>Feedback (auditing) of use</td>
<td>(Audit)</td>
</tr>
<tr>
<td>Education to staff on Moments for Use</td>
<td>(Mom)</td>
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<tr>
<td>Champions and Support of C-Suite</td>
<td>(Champ)</td>
</tr>
<tr>
<td>Patient Hand Hygiene</td>
<td>(Pat)</td>
</tr>
<tr>
<td>Family and Visitor involvement</td>
<td>(Fam/Vis)</td>
</tr>
</tbody>
</table>
Healthcare Associated Infections

\[ \text{HAI(p)} = \text{PA}_{\text{vent}} + \text{PA}_{\text{poe}} + \text{PA}_{\text{old}} + \text{PA}_{\text{abtic}} + \text{PA}_{\text{co-m}} + \text{HH}_{\text{prod}} + \text{HH}_{\text{place}} + \text{HH}_{\text{audit}} + \text{HH}_{\text{mom}} + \text{HH}_{\text{champ}} + \text{HH}_{\text{pat}} + \text{HH}_{\text{fam/vis}} \]
Antibiotic Stewardship Program

In the community, between 25% and 75% of prescriptions are unnecessary or prescribed inappropriately.

Inappropriate antimicrobial use unnecessarily puts long-term care residents at risk for adverse drug events and increases their vulnerability to colonization and infection with health care associated pathogens, including *Clostridium difficile* and other drug-resistant bacteria (Heath 2016).

Source: CDC
Antibiotic Stewardship Program

In a 5 year study on cardiac surgical infections, an effective program reduced combined infection rates by 66% (Frenette 2016)

By examining organisms isolated from infected hip arthroplasty patients, and modifying pre-surgical antibiotics, infections were reduced from 1.19% to 0.55% (p=0.05) (Bosco 2016)
Antibiotic Stewardship Program

Right drug
Right route (intravenous, oral, inhaled)
Right duration (number of days or doses)
Right dose - Step down to narrow spectrum
  • Important when organism is confirmed and tested
Formulary restrictions on overused or “no brainer” antibiotics
(kills everything!)
  • Fluoroquinolones and other broad spectrum (Talpaert 2011)
Antibiotic Stewardship Program

Right drug
Right route (intravenous, oral, inhaled)
Right duration (number of days or doses)
and De-escalation
Right Dose or step down
Formulary restrictions on overused or “no brainer”
antibiotics (kills everything!)
Healthcare Associated Infections

HAI(p) = PA_{vent} + PA_{poe} + PA_{old} + PA_{abic} + PA_{co-m} + HH_{prod} + HH_{place} + HH_{audit} + HH_{mom} + HH_{champ} + HH_{pat} + HH_{fam/vis} + ASP_{drug} + ASP_{route} + ASP_{duration} + ASP_{dose} + ASP_{restriction}
Clinical Practices

Skin preparation (for lines, surgeries)
• Chlorhexidine vs. iodine (Lee 2010)

Decolonization therapies
• Use of mupirocin, chlorhexicine bathing (Campbell 2014)

Prophylactic antibiotics before procedures (Bosco 2016)
• 30 – 60 minutes before incision
Clinical Practices

Bundles (check lists)

- Central Line Insertion (full barrier, sterile site) (Pronovost 2006)
- Ventilator Care (oral care, head of bed) (Munro 2014)
Clinical Practices

Skin preparation (for lines, surgeries) (Skin Prep)
Decolonization therapies (Decol)
Prophylactic antibiotics before procedures (Prophy)
Bundles (check lists) (Bundles)

- Central Line Insertion (full barrier, sterile site)
- Ventilator Care (oral care, head of bed)
Healthcare Associated Infections

\[ HAI(p) = PA_{\text{vent}} + PA_{\text{po}} + PA_{\text{old}} + PA_{\text{abtic}} + PA_{\text{co-m}} + \]
\[ HH_{\text{prod}} + HH_{\text{place}} + HH_{\text{audit}} + HH_{\text{mom}} + HH_{\text{champ}} + HH_{\text{pat}} + HH_{\text{fam/vis}} + \]
\[ ASP_{\text{drug}} + ASP_{\text{route}} + ASP_{\text{duration}} + ASP_{\text{dose}} + ASP_{\text{restriction}} + \]
\[ CP_{\text{skinprep}} + CP_{\text{decol}} + CP_{\text{prophy}} + CP_{\text{bundle}} \]
Fecal Waste Management

Bedpans/Commode Buckets
• Single use disposable plastic
• Single use macerated
• Thermal disinfection equipment
• Liner bags with absorbent pads

No rinsing in patient room/washroom
Fecal Waste Management

Personal protective equipment (PPE) at point of care for any feces

Brief/diaper change protocol
• When to change gloves
• Where to place soiled articles
• What to disinfect after change
Fecal Waste Management

Bedpans/Commode Buckets (Container)
No rinsing in patient room/washroom (No Rinse)
PPE at point of care for any feces (PPE)
Brief/diaper change protocol (Protocol)
Healthcare Associated Infections

\[ \text{HAI}(p) = \text{PA}_{\text{vent}} + \text{PA}_{\text{poe}} + \text{PA}_{\text{old}} + \text{PA}_{\text{abtic}} + \text{PA}_{\text{co-m}} + \]
\[ \text{HH}_{\text{prod}} + \text{HH}_{\text{place}} + \text{HH}_{\text{audit}} + \text{HH}_{\text{mom}} + \text{HH}_{\text{champ}} + \text{HH}_{\text{pat}} + \text{HH}_{\text{fam/vis}} + \]
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\[ \text{CP}_{\text{skinprep}} + \text{CP}_{\text{decol}} + \text{CP}_{\text{prophy}} + \text{CP}_{\text{bundle}} + \]
\[ \text{FWM}_{\text{container}} + \text{FWM}_{\text{ppe}} + \text{FWM}_{\text{no rinse}} + \text{FWM}_{\text{protocol}} \]
Environmental Disinfection

What does EVS clean and when?
Is there an audit system in place to see if it was cleaned?
• ATP
• Fluorescent
• Visual

What does nursing clean and when?
What does other staff clean and when?
### Who Cleans and When?

<table>
<thead>
<tr>
<th>AREA</th>
<th>EVS</th>
<th>FREQ</th>
<th>NURSING STAFF</th>
<th>FREQ</th>
<th>OTHER (Specify)</th>
<th>FREQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient Room</td>
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<td>Bed rail/controls</td>
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<td>Bedside cabinet and other furniture</td>
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<td>Blood Pressure Cuffs/Sphygmomanometer</td>
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<td>Call box/button and cords</td>
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<td>Computer monitor, mouse, keyboard, and cart (if present)</td>
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<td>Corridor railing</td>
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<td>Data Scope</td>
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<td>Dispensers for towels, soap, sanitizer, etc.</td>
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<td>Door knob/handle and push plates (inside and out) to room</td>
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<td>Glove box and gown holders</td>
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<td>Heart Monitor</td>
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<td>Infusion Pumps and control</td>
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<td>ISO Holder</td>
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<td>IV Poles</td>
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<td>Light Switch</td>
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<td>Multi module monitor Controls</td>
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<td>Multi module monitor touch screens</td>
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<td>Multi module monitor wires and cables</td>
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<tr>
<td>Nurse Server</td>
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Environmental Disinfection

What can family/visitors clean and when?
• Is disinfectant safe for them to use?
• Are they aware that they can use?
Environmental Disinfection

What product can be used in room?
• What product can be used near patient?
• Are staff comfortable using product near patient?
What PPE is required to use product?
Contact time
• TJC and measuring evaporation rate
• TJC and querying staff on contact time
Environmental Disinfection

Dilution control (Boyce 2016)
• Does dilution control system deliver proper concentration?
• Do staff members become a chemist?

Compatibility of chemistry
• Cleaning equipment (Quat Binding) (Boyce 2016)
• Surfaces/fabrics
Environmental Disinfection

Adequate Resources

• Enough money
• Enough staff
Environmental Disinfection

What does EVS clean and when? (EVS)
Did they clean it? (Audit)
What does nursing clean and when? (Nurse)
What does other staff clean and when? (Other)
What can family/visitors clean and when? (Family)
What product can be used near the patient? (Prod)
What PPE is required to use product? (PPE)
Environmental Disinfection

Contact time (Contact)
Dilution control (Dil)
Compatibility of chemistry with cloths (Compat)
Adequate Resources (Resource)
Healthcare Associated Infections

\[ \text{HAI}(p) = \text{PA}_{\text{vent}} + \text{PA}_{\text{poe}} + \text{PA}_{\text{old}} + \text{PA}_{\text{atic}} + \text{PA}_{\text{co-m}} + \]
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\[ \text{ED}_{\text{contact}} + \text{ED}_{\text{dilute}} + \text{ED}_{\text{compat}} + \text{ED}_{\text{resource}} \]
\[ HAI(p) = \sum_{f_n} f_1 f_n = ? \]
HAI(p) = \sum_{f_{36}} f_1
Traditional Focus

$$HAI(p) = HH_{\text{audit}} + ED_{\text{evs}} + ED_{\text{prod}}$$
Modified Focus

\[ \text{HAI}(p) = \text{HH}_{\text{audit}} + \text{ED}_{\text{evs}} + \text{ED}_{\text{prod}} + \]
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\text{ED}_{\text{contact}} + \text{ED}_{\text{dilute}} + \text{ED}_{\text{compat}} + \text{ED}_{\text{resource}}
\]
Discussion

Is this too complicated?
What factors in the equation need to be looked at or considered?
Patient Hand Hygiene

Assessment on admission for capability of performing hand hygiene

- Do you know what this is?
- Show me how to use it
- Signage if not able to do own HH
Fecal Waste Management (FWM)

Strong protocols for feces

- Main source of VRE, ESBL, CRE, *C. difficile* and possibly MRSA (Boyce 2007)
- Rapid spread in facilities, communities
Environmental Disinfection (ED)

Recognize that high touch surfaces are done every 24 hours

• Subsets may be done 2x per day

Point of Care Prevention

• Certain procedures need disinfection of surfaces
Moments to Disinfect Patient’s Environment

1. Before placing a food tray on an over bed table
2. After any procedure involving feces within the patient bed space
3. After any wound dressing change
4. After patient bathing
5. After assistance with productive cough or vomiting
6. Any time surfaces are visibly soiled
Healthcare Associated Infections

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Where:
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FWM = Fecal Waste Management
ED = Environmental Disinfection
Hand Hygiene

Antibiotic Stewardship Program

Environmental Disinfection

Fecal Waste Management

Clinical Practices

HAI
References

Boyce JM, et al. Widespread environmental contamination associated with patients with diarrhea and methicillin-resistant *Staphylococcus aureus* colonization of the gastrointestinal tract. ICHE 2007;28(10):1142-7


References

Frenette C, et al. Influence of a 5-year serial infection control and antibiotic stewardship intervention on cardiac surgical site infections. AJIC April 25, 2016 article in press.


References


References

