The importance of infection control in the era of multidrug resistance
Nosocomial infections

- In Australian acute hospitals – 200,000 HAIs / year
- In US hospitals – 1.7 milion HAIs with 99,000 deaths / year
- Most common complication in hospital
Nosocomial infections and mortality

- 16 tertiary care hospitals in Northern France (14,222 beds)
- Medical records of patients dying 48hrs after admission
- 26.6% of 1945 had nosocomial infections
- 14.6% - nosocomial infections contributed to the death
- 4th most common cause of death

Bugs are not what they used to be
MRSA is getting too thick skinned

Electron microscopy of cell wall of the MRSA

MIC 0.5 µg/ml

MIC 2 µg/ml

A Norazah et al. MJM, 2009 64; 166-67
Carbapenems have been beaten in their own backyard

Acinetobacter
Cost of antimicrobial resistance

Attributable mean total cost of patients infected with MDR organism vs non-MDR organism

- Carbapenam resistance nonfermenters
  - US$ 58,457 and US$85,229
- ESBL Enterobacteriaceae
  - US$ 1584 - US$30,093
- MRSA
  - US$1014 – US$40,090

In US – cost of MDR pathogens – US$3.5 billion is excess health care costs annually

Common belief in medical field

Nosocomial infection is an unpredictable complication

But is actually......
Potentially preventable adverse events
How is it handled in other industry?
How is it handled in other industry?

- Faulty floormats; accelerator pedal gets stuck
- Between 2007-10 – Toyota recalls 5.7 million vehicles
- Settles ~ 1 billion claims for economic loss
- 89 deaths (as of 2010) – potentially linked to this problem
Evidence for infection control

Role of infection control

PFGE results
- Isolates from 64 of 73 patients belonged to a single clone

Infection control has to be made integral part of clinical care
Public disclosure of health care-associated infections in Australia: quality improvement or parody?

Leon J Worth, Karin A Thursky and Monica A Slavin

Effect of Nonpayment for Preventable Infections

Incidence Rates of Infections Reported by Hospital Units between January 2006 and March 2011.

Success with MRSA

Trend of MRSA Incidence Rate

Malaysian National Surveillance of Antibiotic Resistance
Decline in MRSA
Univ. hospitals of Paris area (n=39) 1993-2007

Jarlier V et al. Arch Intern Med 2010; 170: 552-559
Hand hygiene and MRSA - Australia

4 National monthly incidence rates of methicillin-resistant *Staphylococcus aureus* bacteremia (MRSAB), July 2007 – December 2010*

* Dashed line indicates National Hand Hygiene Initiative (NHHI) implementation. MRSAB rates were statistically stable before implementation (P = 0.366) but significantly declined after (P = 0.008).
What happened when Semmelweis tried to improve hand hygiene?

- Colleagues dismissed his observations
- His contract in Vienna was not renewed
- Returned to his home country – Hungary
  Made the same observations
  Got the same response
- Admitted to a insane asylum
  Died there miserably
Challenge with gram negatives

- Higher bacterial burden in the gut
- Fecal excretion
- Transferable resistance genes
- No effective decolonisation regimes
- Substantial role of antibiotic selection pressures
Where do these bugs come from?

Sources of pathogens causing HAI in ICUs

- 40 – 60% - patients’ endogenous flora
- 20-40% - cross infections via HCWs hands
- 20-25% - antibiotic driven changes in flora
- 20% - others including environmental contamination

Weisnstein RA, Am J Med 1991; 91; 179S-184S
Contact precaution adherence

- **On room entry**
  - Hand hygiene – 19.4%
  - Gloves – 67.5%
  - Gowns – 67.9%

- **On room exit**
  - Hand hygiene – 48.4%
  - Gloves – 63.5%
  - Gowns – 77.1%

Clock SA. et al., AJIC 2010;38:105-111
Equipment associated adherence

- **Signages**
  - Gloving on entry
    - 67.5% vs 22.7%
  - Gowning on entry
    - 67.9% vs 2.2%

- **Gloves of all sizes**
  - 49.4 – 72.1% had all glove sizes
  - In rooms with all glove sizes
    - Adherence to gloving on entry higher
      - 72% vs 63.4%; p=0.032

Clock SA. et al., AJIC 2010;38:105-111
Steps to isolation

1. identifying an at-risk patient;
2. obtaining a specimen for culture or PCR;
3. testing the specimen for multi-resistance;
4. providing the nurse or physician with the result
5. placing the patient in a private room or cohorting the patient with other carriers;
6. posting signs indicating that the patient is in isolation
7. stocking the patient’s room with isolation supplies;
8. requiring visitors and HCWs who care for the patient to wear gloves and gowns;
9. enforcing strict hand hygiene;
10. providing for adequate environmental hygiene, including waste removal
Landing procedure checklist for a Boeing 737-800 aircraft. Adapted from the Atlantic Sun Airways CAT B pilot procedures and checklists series [52]. KIAS, knots indicated airspeed.
Catheter-related Blood Stream Infection
Care Team Checklist

Purpose: To work as a team to decrease patient harm from catheter-related blood stream infections
When: During all central venous or central arterial line insertions or re-wires
By whom: Bedside nurse

1. Today’s date
   [ ] month [ ] day [ ] year

2. Procedure:
   [ ] New line  [ ] Rewire

3. Is the procedure:
   [ ] Elective  [ ] Emergent

4. Before the procedure, did the housestaff:
   Wash hands (chlorhexidine or soap) immediately prior
   Sterilize procedure site
   Drape entire patient in a sterile fashion
   [ ] Yes  [ ] No  [ ] Don’t know

During the procedure, did the housestaff:
   Use sterile gloves
   Use hat, mask and sterile gown
   Maintain a sterile field
   Did all personnel assisting with procedure follow the above precautions
   [ ] Yes  [ ] No  [ ] Don’t know

After the procedure:
   Was a sterile dressing applied to the site
   [ ] Yes  [ ] No  [ ] Don’t know

Please return completed form to the designated location in your ICU.
Where do these bugs come from?

- Sources of pathogens causing HAI in ICUs
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Weisnstein RA, Am J Med 1991; 91; 179S-184S
Role of environment

Independently predictive of healthcare worker contamination with multidrug-resistant bacteria

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Odds Ratio (95% Confidence Interval)</th>
<th>( p^a )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive multidrug-resistant bacteria environmental culture</td>
<td>4.15 (2.66–6.47)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Duration in room &gt;5 mins</td>
<td>1.99 (1.15–3.43)</td>
<td>.014</td>
</tr>
<tr>
<td>Performing physical examination</td>
<td>1.74 (1.10–2.77)</td>
<td>.019</td>
</tr>
<tr>
<td>Contact with ventilator</td>
<td>1.78 (1.12–2.82)</td>
<td>.014</td>
</tr>
</tbody>
</table>

Acinetobacter in the environment

Role of environmental cleaning in controlling an outbreak of Acinetobacter baumannii on a neurosurgical intensive care unit

M. Denton\textsuperscript{a,*}, M.H. Wilcox\textsuperscript{a,b}, P. Parnell\textsuperscript{c}, D. Green\textsuperscript{c}, V. Keer\textsuperscript{a}, P.M. Hawkey\textsuperscript{a,b,1}, I. Evans\textsuperscript{d}, P. Murphy\textsuperscript{d}


‘Healthcare planners need to be aware that hospital cleaning is invaluable in controlling outbreaks…..’
Prevent Pressure Ulcers
Reduce Methicillin-Resistant *Staphylococcus aureus* (MRSA) Infection
Prevent Harm from High-Alert Medications
Reduce Surgical Complications
Deliver Reliable, Evidence-Based Care for Congestive Heart Failure
Get Boards on Board
Deploy Rapid Response Teams
Prevent Adverse Drug Events (Medication Reconciliation)
Improve Care for Acute Myocardial Infarction
Prevent Surgical Site Infections
Prevent Central Line-Associated Bloodstream Infections
Prevent Ventilator-Associated Pneumonia
Care bundles in infection control

Timing of bundle compliance measurement

- Bundle compliance
- Normothermia
- Antibiotic prophylaxis
- Hair removal
- Door openings

Suresh

Jasper van der Slegt et al., Plos 2013
Care bundles in infection control

Jasper van der Slegt et al., Plos 2013
Sequence of Behaviour Change

- Knowledge
- Attitudes
- Behaviour

Lack of agreement
Lack of outcome expectancy
Lack of self-efficacy
Lack of motivation
Inertia of previous practice

Why Don’t Physicians Follow Clinical Practice Guidelines?
JAMA. 1999;282:1458-65
Hospital practice to introduce new policies vs predicted staff compliance

Suresh

Summary

- We need to be more serious about nosocomial infection prevention
- How to create local ownership?
- Hand hygiene is alone not enough
- Identify and isolate patients with MDR pathogens
  - Checklists
- Emphasis is required on environmental cleanliness
- Use bundles for infection prevention
- Use behavioral tools to increase compliance
“We'll be remembered more for what we destroy than what we create.”

Thank you