VRE on the Oncology Unit:

the thing that wouldn’t leave
In the beginning...

June, 2006:

ICP covering Oncology Unit says, “So, how many is too many VRE infections?”
? ? Your Response ? ?
It’s Friday afternoon...anything under 10 can wait til Monday.

VRE in Oncology?!? Quick, call the Hospital Epidemiologist!

Give it to me in a nutshell.....
4 episodes of enterococcal bacteremia noted over 5 month period

Although all isolates were vancomycin-resistant, antibiotic susceptibility patterns differed

All oncology patients
First Impressions
First Impressions

Time to go home! If the organisms don’t have the same susceptibility pattern, we don’t have an outbreak.

I have no idea if this is a problem.
What next?

Review additional data to help determine if this is a problem....

from Oncology unit

from other units
Some Additional Data:

VRE in Oncology Patients: 2004-2006
A Closer Look....

VRE in Oncology Patients by Specimen Types

![Graph showing VRE cases by specimen types over months]
Now what?
Basic Outbreak Methods....

Define reservoir of disease
Seek additional unrecognized cases

Interrupt chain of transmission
Use of barrier precautions
Education of staff, patients, and families

Epidemiologic investigation
Molecular and traditional epidemiologic links
Defining reservoir of disease

Review of data from other units

no other cases of VRE bacteremia in past 4 months.

Unit-wide “sweep” to determine point prevalence of VRE colonization

~10% of hospitalized oncology patients

Now what?
Active Surveillance for VRE:

Cultures at time of admission and weekly
Evidence of ongoing transmission....

• 12 patients identified as newly colonized during past 6 wks
• 7 patients found to be VRE+ had been documented VRE- at time of hospitalization
• 20% of cultures obtained during past week were positive!!!!

*Now what?!?*
Interrupt Transmission
Does Isolation Prevent VRE Transmission?

YES!

- But must identify reservoir of disease so isolation can be targeted and effective.
Whom to Isolate?

High rate of case capture (91%) with active surveillance*
  • admission and weekly surveillance cultures
  • estimated monthly cost savings >$50,000

Different implementation strategies
  • routine (for all admissions)
  • targeted (for high risk patients and/or admission to high risk units)
  • ongoing (regular intervals after initial contact)

Potential role for point prevalence surveys

*Shadel, ICHE, 2006
Interrupting transmission: inpatient

- Empiric use of high-level contact precautions in inpatient setting
  - VRE screens known to yield false negative results

- Playroom closed and visiting between patient rooms suspended
  - Direct and indirect transmission can propagate outbreaks
Interrupting transmission: outpatient

- Patients known to be VRE+
  - Daily lists of VRE+ patients provided to oncology clinic
  - High-level contact precautions upon arrival
  - Additional exam rooms for isolation

- Patients not known to be VRE+
  - Reduce risk of direct or indirect transmission
  - Eliminated “shared toys”
  - Extensive housekeeping support
Medical and Nursing Directors:

“But why are such draconian measures needed?”
What is “X”?

Hayden M, ICAAC, 2001, Chicago, IL.
Communication and Education

- Weekly meetings with multidisciplinary team to review results, assess interventions, and discuss future plans
- Letters to oncology clinicians and families
- Letter to other members of hospital community who care for oncology patients
Investigation
Initial epidemiologic analysis

• No evidence of single provider (MD or RN)
• No evidence of shared rooms
• Most patients with multiple clinic contacts
Molecular analysis

- 20 strains sent out for PFGE
- Genetically varied (at least 8 unique clones)
- Suggests disease is NOT due to a single source
- Outbreak likely due to transmission of multiple strains over time
Ongoing Active Surveillance for VRE:

Cultures at time of admission and weekly

<table>
<thead>
<tr>
<th>Category Title</th>
<th>Positives</th>
<th>Negatives</th>
<th>Positive blood</th>
</tr>
</thead>
<tbody>
<tr>
<td>September 15th: Initiated enhanced precautions</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sept 15th:
- Initiated enhanced precautions
What Happened!?!?

Cultures at time of admission and weekly

September 15th:
Initiated enhanced precautions
Ongoing transmission despite...

- Ongoing active surveillance
- Continued use of empiric precautions in inpatient units
- Targeted use of high-level precautions in outpatient settings
- Aggressive education

Is this surprising?
Now what?
Possible options.....

- Continue to observe since there are few new cases of invasive VRE infection.

- Close the Oncology unit.

- Environmental cultures.

- Other options????
Case-Control Study

Goal: to identify risk factors for VRE acquisition among CHOP oncology patients

Outcome: VRE acquisition

Exposure: ????
Questions to answer....

Case definition:

Control definition:

What exposures should we examine?

Should we match?
Definitions....

Cases:
any oncology patient who had a documented negative VRE screen followed by a documented positive VRE screen between July and November

Controls:
any oncology patient who had 2 consecutive negative VRE screens between July and November
Exposures and Confounders....

**Exposures:**
characteristics/events that you hypothesize might be associated with acquisition of VRE

**Confounders:**
characteristics/events that you know or suspect might be associated with an exposure
Making sense of exposures and confounders

**Exposure**
visit to Clinic X during exposure window

**Confounder**
underlying diagnosis (Clinic X only sees patients with leukemia...no solid tumors or BMT patients)
What about matching....

Reasons to match:
- limit variation between controls and cases

Problems with matching:
- cannot examine any characteristic that was included in match
- may limit patients eligible to be controls (reduce power)
- more challenging analysis
Would you match?

If so, what would you match on?

**Age and gender?**

- age might make underlying diagnoses more similar

**Date of hospitalization?**

- might control for secular trends in transmission
What about **incidence density matching**?

Incidence density matching attempts to control for **time at risk**.

*time at risk of becoming a case*
What we did...

• Matched on time-interval between 2 cultures

Goal: to make cases and controls more similar in their opportunity of having various exposures, but will not make their specific exposures the same

• Cases

Matched on time between last negative culture and first positive culture

• Controls

Matched on time between two negative cultures
### Initial Findings

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Case (n = 16)</th>
<th>Control (n = 62)</th>
<th>p-value¹</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Outpatient Visits²</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Visit to Clinic 1</td>
<td>8 (50%)</td>
<td>34 (55%)</td>
<td>0.644</td>
</tr>
<tr>
<td>Visit to Clinic 2</td>
<td>0 (0%)</td>
<td>3 (5%)</td>
<td>1.000</td>
</tr>
<tr>
<td>Visit to Clinic 3</td>
<td>3 (19%)</td>
<td>7 (11%)</td>
<td>0.464</td>
</tr>
<tr>
<td>Visit to an Emergency Department</td>
<td>5 (31%)</td>
<td>14 (23%)</td>
<td>0.500</td>
</tr>
<tr>
<td><strong>Presence of Indwelling Devices</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Presence of any device</td>
<td>11 (69%)</td>
<td>19 (31%)</td>
<td>0.013</td>
</tr>
<tr>
<td>Presence of a CVC</td>
<td>15 (94%)</td>
<td>57 (92%)</td>
<td>0.832</td>
</tr>
<tr>
<td>Presence of a GI device</td>
<td>9 (56%)</td>
<td>17 (27%)</td>
<td>0.056</td>
</tr>
<tr>
<td><strong>Procedures/Studies</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Visit to the operating room</td>
<td>4 (25%)</td>
<td>14 (23%)</td>
<td>0.863</td>
</tr>
<tr>
<td>Visit to IR (GI device placement)</td>
<td>6 (38%)</td>
<td>1 (2%)</td>
<td>0.004</td>
</tr>
<tr>
<td><strong>Environmental Status</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Playroom open</td>
<td>13 (82%)</td>
<td>48 (77%)</td>
<td>0.820</td>
</tr>
<tr>
<td>No empiric contact precautions</td>
<td>15 (94%)</td>
<td>39 (63%)</td>
<td>0.032</td>
</tr>
</tbody>
</table>
Results of conditional multivariable analysis....

<table>
<thead>
<tr>
<th>Variable</th>
<th>Unadjusted Odds Ratio</th>
<th>Adjusted Odds Ratio</th>
<th>Confidence Interval$^1$</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presence of a GI device</td>
<td>2.91</td>
<td>4.03</td>
<td>1.04, 15.56</td>
<td>0.04</td>
</tr>
<tr>
<td>No empiric contact precautions during the study period</td>
<td>10.60</td>
<td>17.16</td>
<td>1.49, 198.21</td>
<td>0.02</td>
</tr>
</tbody>
</table>
Over past year, VRE transmission among ONCO inpatients has remained infrequent (4 episodes of presumed transmission over past 12 months) despite the gradual removal of specific enhanced infection control practices.
Now what?

- Instruct Environmental Services to scrub the IR suite
- Obtain hand cultures of IR clinicians
- Observations
Findings from observations

Meticulous technique during procedures within suite

Hand hygiene

Aseptic technique
A smoking gun....

Chaotic waiting room

Patient care assistants unable to access computer system where data on need for IC precautions is stored

Parents asked to report whether their child required precautions.
One last clue....

Interview with Nurse Manager of IR revealed that staffing shortages in Environmental Service had changed cleaning practices.

IR nurses did “between patient” cleaning
Environmental Service Workers did end of the day cleaning
Putting it all together

Our hypotheses....

Poor communication about the need for precautions PLUS environmental cleaning by untrained nurses PLUS vulnerable patients with indwelling medical devices....

Increased risk of VRE acquisition
Thanks!