Waging the War against C. difficile – Radical Multidisciplinary Approaches
From a Community Hospital

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Type: Acute Care Hospital
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IDENTIFICATION:

Through routine Infection Control monitoring of C. diff rates, it was identified that the number of monthly cases had increased compared to previous time periods. An in-depth evaluation of each patient further discovered an increased severity of C. difficile infection, leading to the concern that we were potentially dealing with a more virulent strain. Not only was this trend identified by Infection Control monitoring, but physicians were also noting an increase in the number of patients they were treating for C. diff. Furthermore, patients infected with C. diff appeared to have minimal response to traditional treatment measures such as metronidazole. It became critically important that action be taken to decrease the bioburden of C. diff at SJMC through multiple mechanisms.

PROCESS:

The following points help describe methods/processes taken to ensure a consistent and quick resolution.

- Multidisciplinary taskforce created with representatives including but not limited to Infection Control, Senior Leadership, Patient Safety, Environmental Services, Pharmacy, Infectious Disease, and Nursing. This team was instrumental in ensuring a meticulous review of contributing factors. Multiple solutions were developed through influence of our C. diff Taskforce. In an ideal setting, a single approach would be initiated at a time in order to review the implications of each and to determine which approach yielded the best results. It was decided that due to the severity of our C. diff outbreak, we could not afford to delay any approach which may be successful.
- Evidence based literature-helped identify the potential solution of an antibiotic restriction
- Consulted experts- requested assistance from The State Health Department and The Centers for Disease Control and Prevention.
- Implemented immediate infection control measures-including epidemiologically tracking patients, creating an isolation ward etc.
- Examined our internal practices to identify opportunities for improvement- including environmental cleaning and hand hygiene.
**SOLUTION:**

**Automatic 3-day Stop for Antibiotics**

- Anticipated immediate and long-term benefits.
  - Decrease patient’s exposure to multiple antibiotics
  - Decrease risk associated with developing C. diff infection.
- Hospital pilots a three-day stop in MSICU. The pilot lasted for roughly one month prior to being adapted house-wide.
- Due to the success of this implementation, we continue to institute an automatic three-day stop on antibiotics ordered without duration. Antibiotic usage continues to be lower in the post-outbreak period as shown by reviewing monthly-defined daily dose (DDD) values.

**Fluoroquinolone (FQ) restriction**

- Review of a study performed in Norway in which restriction of ciprofloxacin resulted in a decrease of C. diff cases, lead the Taskforce to consider restricting the FQ class at SJMC.
- Pharmacy formulary included levofloxacin, ciprofloxacin, and moxifloxacin. FQ associated with toxigenic strain.
- Indeed, a review of our defined daily dose (DDD) usage of the three formulary quinolones, found that usage was the highest in the pre-outbreak period of January 2005 through May 2005. At the start of the FQ restriction, the Taskforce set a timeline of three months and was enforced for inpatients only.
- Physicians and nurses were notified of the restriction through multiple outlets including letters, emails, and grand rounds announcement(s).
- Automatic substitution with an alternative agent would be most appropriate. The advantage of this approach was one hundred percent compliance as well as patients receiving their antibiotic in a timely fashion. In working with our Infectious Disease physicians, piperacillin/tazobactam was chosen as the alternative agent in light of its FDA approved indications and organism spectrum of coverage. Nursing and pharmacy were required to determine patient’s allergy status and if allergic to penicillin, determination of allergy severity was necessary.
- Algorithm tool helped guide pharmacists with question prompts when making phone calls to prescribers.
- Review of overall antibiotic usage demonstrated a decrease during the restriction period compared to pre-outbreak numbers. After the six month restriction, the Taskforce reconvened and based on the number of C. diff cases, decided to reintroduce the quinolones in a staggered fashion, while removing Moxifloxacin from formulary.
OUTCOMES:

- The hospital-wide mean defined daily doses (DDD) of antimicrobials decreased 22% after restricting FQ use, primarily because of a 66% decrease in the use of FQs. The restriction of FQ use may be useful as an adjunct control measure in a healthcare facility during outbreaks of epidemic-strain of Clostridium difficile.
- Ongoing review of FQ usage continues to demonstrate significantly lower DDD values to date.
- The interventions were also associated with a decrease of 22% in Hospital Onset of Clostridium Difficile Infection cases caused by the epidemic strain (from 66% before the intervention period to 44% during and after the intervention period; p=.02).
- To date there has been a 57% reduction in Hospital Associated Clostridium difficile infection.
- Continue to sustain greater than 90% compliance with Hand Hygiene Compliance.

<table>
<thead>
<tr>
<th></th>
<th>MEAN</th>
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<tbody>
<tr>
<td>Pre-Outbreak</td>
<td>2062.2</td>
</tr>
<tr>
<td>Outbreak</td>
<td>1563.8</td>
</tr>
<tr>
<td>Post-FQ restriction (12/06 - 12/07)</td>
<td>1194.4</td>
</tr>
</tbody>
</table>
Automatic Substitution of Piperacillin/Tazobactam for Fluoroquinolone(s)
(No physician is allowed to override this automatic substitution – please forward any procedure issues to Dr. Boehler)

Physician orders IV levoﬂoxacin or moxifloxacin

Check patient proﬁle for penicillin allergy

PCN allergy on ﬁle

No PCN allergy

IV Zosyn already ordered?

Yes

Contact MD for alternative agent to be given in addition i.e. double-coverage for Pseudomonas - aminoglycoside

GI intolerance (diarrhea, stomach upset)

Substitute with IV Zosyn 1st dose of 3.375 grams then dose per renal function

Hives, edema bronchospasms anaphylaxis

Put order on hold, contact MD for alternative agent

Alternatives based on diagnosis

No

Substitute with IV Zosyn 1st dose of 3.375 grams then dose per renal function

Alternatives based on diagnosis

Doxycycline + azithromycin

CAP

Tobramycin +/- aztreonam plus

HAP

TMP SMX or doxycycline or tobramycin

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St. Joseph Medical Center

Automatic Therapeutic Interchange of IV Piperacillin/tazobactam

As of May 30th 2006, there will be a mandated restriction of the fluoroquinolone class at SJMC in an effort to take action against *Clostridium difficile*. All written orders for a fluoroquinolone (ciprofloxacin, moxifloxacin, levofloxacin) will be automatically substituted by Pharmacy with IV piperacillin/tazobactam. Physicians are encouraged to tailor therapy as appropriate for their patients as soon as possible.

<table>
<thead>
<tr>
<th>CLINICAL SETTING</th>
<th>ALTERNATIVE</th>
<th>PENICILLIN-ALLERGIC</th>
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<tbody>
<tr>
<td>Community-acquired pneumonia</td>
<td>Ceftriaxone** + azithromycin</td>
<td>Doxycycline + azithromycin</td>
</tr>
<tr>
<td>(Empiric)*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hospital-acquired pneumonia</td>
<td>Piperacillin/tazobactam +</td>
<td>Tobramycin or aztreonam +</td>
</tr>
<tr>
<td></td>
<td>Vancomycin</td>
<td>Vancomycin</td>
</tr>
<tr>
<td>(Ventilator-associated)</td>
<td>+ Tobramycin</td>
<td>Tobramycin + aztreonam</td>
</tr>
<tr>
<td>Urinary tract infection</td>
<td>Piperacillin/tazobactam</td>
<td>TMP SMX or tobramycin or doxycycline</td>
</tr>
<tr>
<td>IV (initially for pyelonephritis)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oral</td>
<td>TMP SMX or nitrofurantoin or</td>
<td>Same</td>
</tr>
<tr>
<td></td>
<td>doxycycline</td>
<td></td>
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</table>

**KEY POINTS**

1. It is important to document medication allergies in the patient profile, particularly the type of allergic reaction. In penicillin-allergic patients, pharmacy will notify and if possible, discuss with the attending physician.

2. Antibiotics ordered without a duration of therapy will be given a 3-day automatic stop per MEC policy.

* Use azithromycin as a quinolone substitute when treating community-acquired pneumonia (see above)

** Oral alternatives to IV ceftriaxone include cefpodoxime or cefuroxime

S:\Abixworkgrp\2006\Therapeutic Interchange w piperacillin/tazobactam