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# Incidence of hospital-acquired *Clostridium difficile* infection in patients at risk

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## Background

In 2013, the CDC published “Antibiotic Resistance Threats in the United States” in which Clostridium difficile was recognized as an urgent threat. As a result, a 50% decrease in Clostridium difficile infection (CDI) incidence and a 20% decrease in the use of inpatient antibiotics has been mandated by 2020. CDI carries many implications ranging from increased morbidity and mortality to longer length of hospital stay.

Typical risk factors associated with CDI include elderly age (> 64y), increased length of stay, and debilitation. Certain medications, such as chemotherapy, antibiotics and proton pump inhibitors (PPI), may also predispose patients to CDI. Of these risk factors, antibiotics have been recognized as the most important risk factor for CDI. Although all classes have been associated with CDI, clindamycin, third-generation cephalosporins and fluoroquinolones pose the highest risk. As a result, pharmacists are at an ideal position to address the multiple medication centered risk factors.

## Objectives

- Primary objectives: identify prescribing patterns of antibiotics and PPI in order to perform pharmacist led interventions targeting modifiable risk factors
- Secondary objective: promote antimicrobial stewardship practices (ASP) and appropriate PPI use in patients at risk for HA-CDI

## Methods

- This study was institutional review board (IRB) approved
- Biphasic study, including patients ≥18 years old
  - Phase I: retrospective chart review of HA-CDI patients from 01/14 – 06/15
  - Phase II: prospective review of interventions targeting HA-CDI prevention from 11/15 – 03/16

## References

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**Table 1: Clinical Characteristics of HA-CDI Patients**

Characteristic	n = 151
Age - average (range)	70 yrs (18 – 105)
Female gender - n (%)	82 (54)
Days between symptom onset - average (range)	12 (3 – 185)
Tube feeds - n (%)	38 (25)
Chemotherapy - n (%)	41 (27)
Gastric acid suppression - n (%)	
PPI	100 (66)
H2B	15 (10)
Antimicrobials - n (%)	129 (85)
Piperacillin/tazobactam	55 (43)
Vancomycin	30 (23)
Levofloxacin	32 (25)
Ceftriaxone	29 (22)
Ciprofloxacin	1 (1)
Clindamycin	2 (2)
Gastric acid suppression <u>and</u> antibiotics – n (%)	96 (64)

**Table 2: Subgroup Population Analysis: PPI interventions**

	Control (n=51)	Intervention (n=51)
Age ≥ 65 - (%)	59	75
Female gender-(%)	59	55
Tube feed - (%)	14	8
LOS - average (range)	8 (2-49)	9 (2-54)
On antibiotics - (%)	61	59
HA-CDI-tested- (%)	8	10
HA-CDI - (%)	2	0

**Table 3: Subgroup Population Analysis: ASP Interventions**

	Ceftriaxone (n=39)		Levofloxacin (n=17)		Vancomycin (n=56)	
	Control	Intervention	Control	Intervention	Control	Intervention
Age ≥ 65 - (%)	67	67	35*	63*	54	63
Female gender-(%)	59	64	59	59	45	59
Tube feed - (%)	10*	0*	6	18	11	14
LOS - average (range)	10 (2-46)	11 (2-107)	10 (2-48)	14 (2-39)	12 (2-45)	12 (2-53)
Concomitant antibiotics - (%)	54	44	35	59	80	88
PPI - (%)	51	39	47	59	52	38
HA-CDI-tested-(%)	26	10	24	6	23	13
HA-CDI - (%)	3	0	0	0	2	0

## Results


- Retrospective data collection demonstrated that risk factors present in the 151 patients diagnosed with HA-CDI were consistent with those outlined in the literature (Table 1)
  - The majority of patients were female, with average age of 70 years
  - One-third of patients were either on tube feeds or chemotherapy
  - 85 % of patients were on antibiotics
  - 66 % of patients were on a PPI
  - 64 % of patients were on antibiotics and gastric acid suppression
- During the prospective phase of the study, 183 interventions were made
  - The majority of patients were female, ≥ 65 years with an average length of stay (LOS) of 11 days
  - None of the patients in the pharmacist led intervention group vs 7 patients in the control group developed HA-CDI
- 51 PPI interventions were made, of these 37 were discontinuations, and 17 were de-escalations to a histamine-2 blocker
  - There was no significant difference between intervention or control groups
  - Nobody in the intervention group developed HA-CDI versus 2 patients in the control group
- 132 ASP interventions were made (Tables 3), of these the majority were ceftriaxone, levaquin and vancomycin interventions
  - The ceftriaxone intervention population had a statistically significantly lower amount of patients on tube feeds versus the control population
  - The levofloxacin intervention population had a statistically higher amount of elderly patients versus the control population
  - There was no significant differences in the levaquin
- Interventions performed were associated with an approximate cost savings of \$19,780.88.

## Conclusion

Antimicrobials and PPIs are the most common predisposing factors for CDI, and as a result, pharmacists are in an ideal position in order to target medication related risk factors. By implementing practices, such ASP and PPI de-escalation, into daily responsibilities not only are we able to prevent HA - CDI and other medication related side effects, but also contribute to significant cost savings.

## Disclosures

All authors of this presentation have nothing to disclose concerning possible financial or personal relationships with commercial entities that may have direct or indirect interest in the subject matter of this presentation


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**Incidence of hospital-acquired *Clostridium difficile* infection in patients at risk**

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## Disclosures

None of the authors have any financial or nonfinancial relationships to disclose

## Definitions

- **CDI:** *Clostridium difficile* infection
- **CDC:** Centers for Disease Control and Prevention
- **HA-CDI:** Hospital acquired - *Clostridium difficile* infection
- **BHM:** Baptist Hospital of Miami
- **ASP:** Antimicrobial stewardship program
- **PPI:** Proton-pump inhibitor
- **H2B:** Histamine 2 blocker
- **LOS:** Length of stay

## Presentation Objectives

- Recognize CDI as a CDC national threat
- Identify risk factors for HA - CDI at BHM
- Review pharmacy driven interventions to ↓ CDI
- Assess pharmacy interventions cost savings

## Background

2013

'Antibiotic Resistance Threats in the U.S.' released by CDC

2015

'National Action Plan to Combat Antibiotic-Resistant Bacteria' released by White House

2020

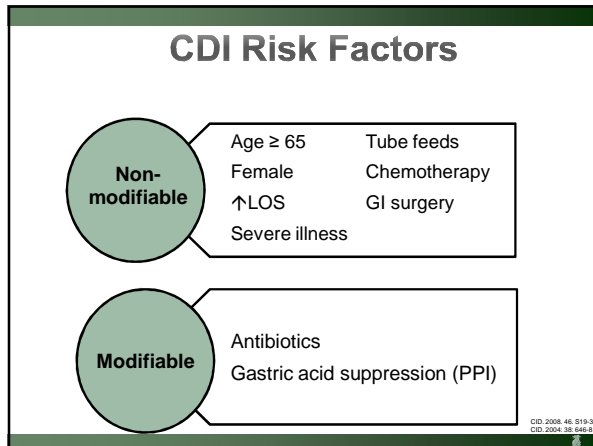
Goals: 20 % ↓ antibiotics, 50% ↓ CDI

CDC 2013

## HA - CDI

- Clinically significant diarrhea or toxic megacolon without other etiology that meets one or both of the following criteria
  - Positive stool sample
  - Pseudomembranous colitis
- Symptom onset > 3 days after admission
- National average: 2.8 - 9.3 per 10,000 patient days

Infection Control and Hospital Epidemiology, 2010, 31 (1): 439-454



### HA - CDI Patients

Characteristic	n = 151
Age - average (range)	70 yrs (18 – 105)
Female gender - n (%)	82 (54)
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Clindamycin	2 (2)
Gastric acid suppression and antibiotics – n (%)	96 (64)

- ### Study Purpose
- Identify prescribing patterns of antimicrobials and PPIs among patients
  - Implement pharmacist led initiative
    - Target high risk meds
    - Promote ASP practices
    - Discontinue unwarranted PPIs
    - Document Pharmacist interventions

- ### Methodology
- IRB approved
  - Single center prospective cohort study
    - November 2015 to March 2016
  - Inclusion
    - Adults (≥ 18 yrs)
    - Pharmacist - led interventions

- ### Study Objectives
- Asses pharmacist-led interventions
  - Evaluate the pharmacist’s impact in targeting modifiable risk factors to prevent HA-CDI
  - Identify cost savings associated with interventions utilizing Theradoc®

### Intervention Population

Characteristic	n = 183
Age ≥ 65 - n (%)	127 (69)
Female gender - n (%)	116 (63)
LOS - average (range)	11 days (2 - 107)
Tube feed - n (%)	21 (11)
Concomitant antibiotic use - n (%)	87 (48)
Interventions - n	
PPI	51
Vancomycin	56
Ceftriaxone	39
Levofloxacin	17
Piperacillin/tazobactam	10
Unasyn/Augmentin	3
Carbapenems	3
Clindamycin	2
Aztreonam	2
HA - CDI incidence	<b>0</b>

### Incidence of HA-CDI

	PPI (n=51)	
	Control	Intervention
Age ≥ 65 - (%)	59	75
Female gender- (%)	59	55
Tube feed - (%)	14	8
LOS - average (range)	8 (2-49)	9 (2-54)
On antibiotics - (%)	61	59
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\*p ≤ 0.05

### Incidence of HA-CDI

	Ceftriaxone (n=39)		Levofloxacin (n=17)		Vancomycin (n=56)	
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### Associated Cost Savings

ASP Interventions (n=132)		
Intervention type	Number of interventions	Associated cost-savings
Bug-drug mismatch	7	\$525.00
De-escalation	71	\$6,390.00
Duplication of coverage	4	\$360.00
Discontinue antibiotics	40	\$3,000.00
Antibiotics not indicated	10	\$750.00
Total savings - antibiotic interventions = \$11,025.00		

PPI Interventions (n=51)		
Intervention type	Number of interventions	Associated cost-savings
Discontinuation of PPI	34	\$7,480.88
De-escalation of PPI	17	\$1,275.00
Total savings - PPI interventions = \$8,755.88		

**Estimated savings: \$19,780.88**

- ### Discussion
- Strengths
    - Study design: prospective, control matched
    - Proactive approach utilizing different interventions
  - Limitations
    - Small sample size → multiple confounding factors
    - Constraints: time, formulary
    - Bias: attrition, selection, information
  - Future direction
    - Expansion of BHM ASP practices
    - Stress ulcer prophylaxis protocol

- ### Conclusion
- Antimicrobials and PPIs are the most common predisposing factors for CDI
  - Pharmacists play a vital role in CDI prevention
  - ASP reduces the incidence of CDI
  - Preventative CDI interventions ↑ cost savings

- ### Acknowledgements
- Co-investigators
    - Jenny Martinez, Pharm. D., BCPS-AQ ID
    - Heidi Clarke, BCCCP
  - Infection Control Department
    - Barbara Russell, RN, MPH, CIC
    - Carol Covington, RN

## Self-Assessment Question

Which three antibiotics or antibiotic classes are associated with the highest risk for CDI ?

- Fluoroquinolones
- Clindamycin
- 3<sup>rd</sup> generation cephalosporins



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