

# Lessons Learned: Improving Surgical Antibiotic Prophylaxis Timing

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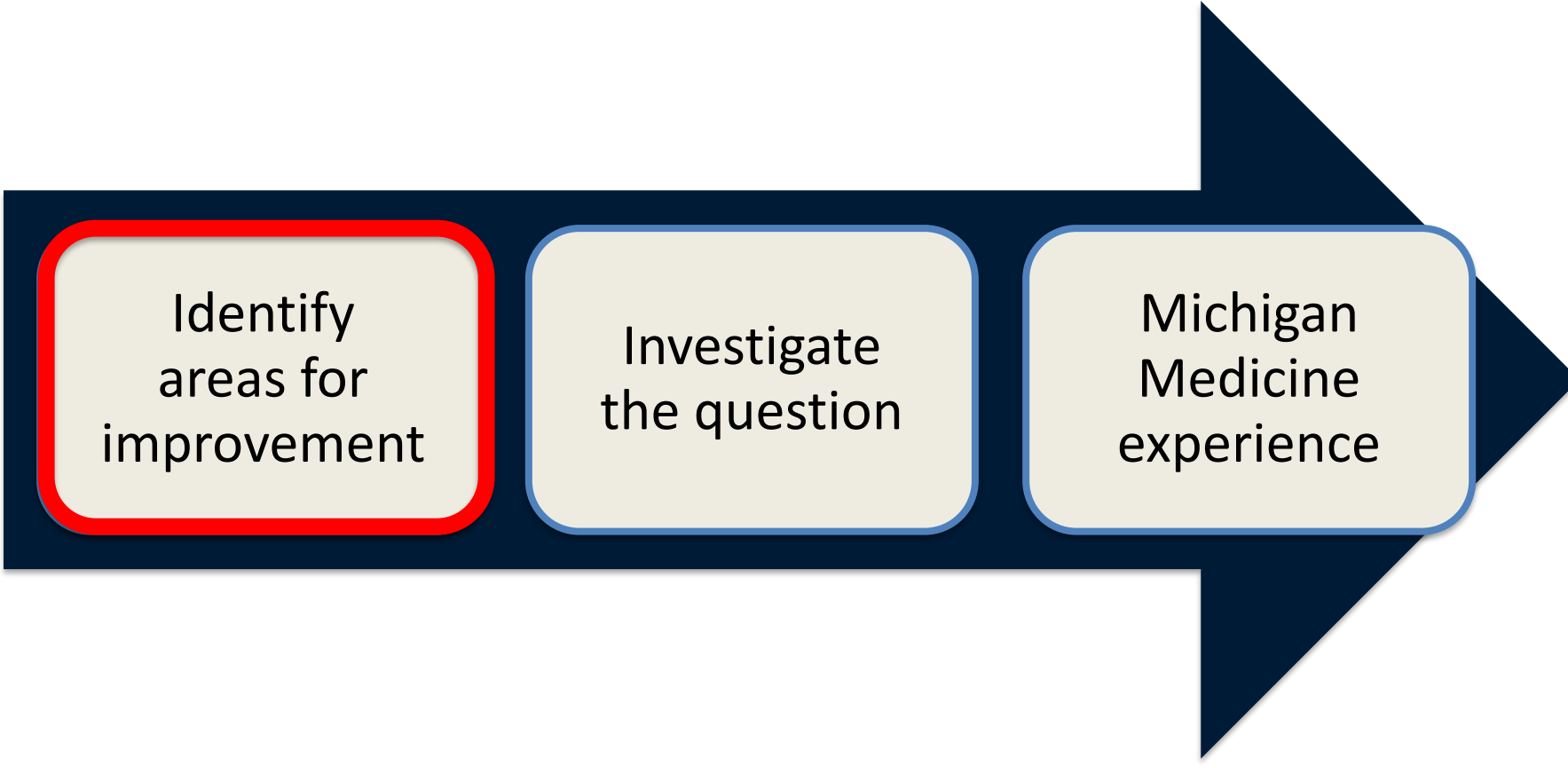
**ASPIRE – 7/21/2017**



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# Overview

A large dark blue arrow pointing to the right, containing three light beige rounded rectangular boxes. The first box on the left has a red border, the middle one has a blue border, and the third one has a blue border. The text inside the boxes is: 'Identify areas for improvement', 'Investigate the question', and 'Michigan Medicine experience'.

Identify  
areas for  
improvement

Investigate  
the question

Michigan  
Medicine  
experience



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# Identifying the Problem

- **Historical Practice:** 2004-2016 institutional guidelines recommended starting beta-lactam antibiotics between 30-60 minutes and vancomycin between 60-120 minutes.
- **Several questions** raised:
  - How much of the antibiotic needs to be infused prior to incision?
  - Is 30 minutes prior to incision better or worse than 60 minutes prior to incision?
  - If administering as an IV push as opposed to infusion, how does that impact timing?
  - Etc...



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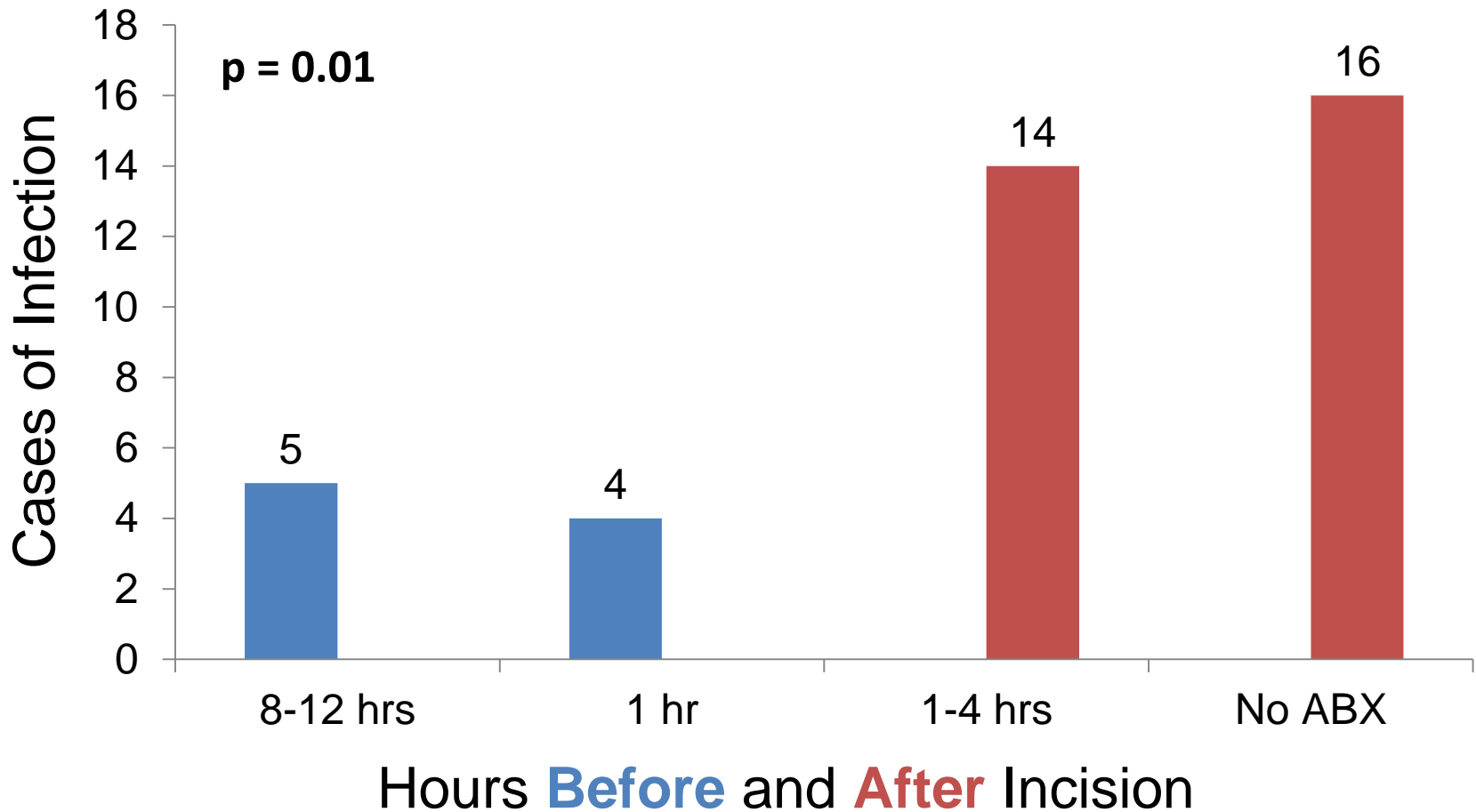


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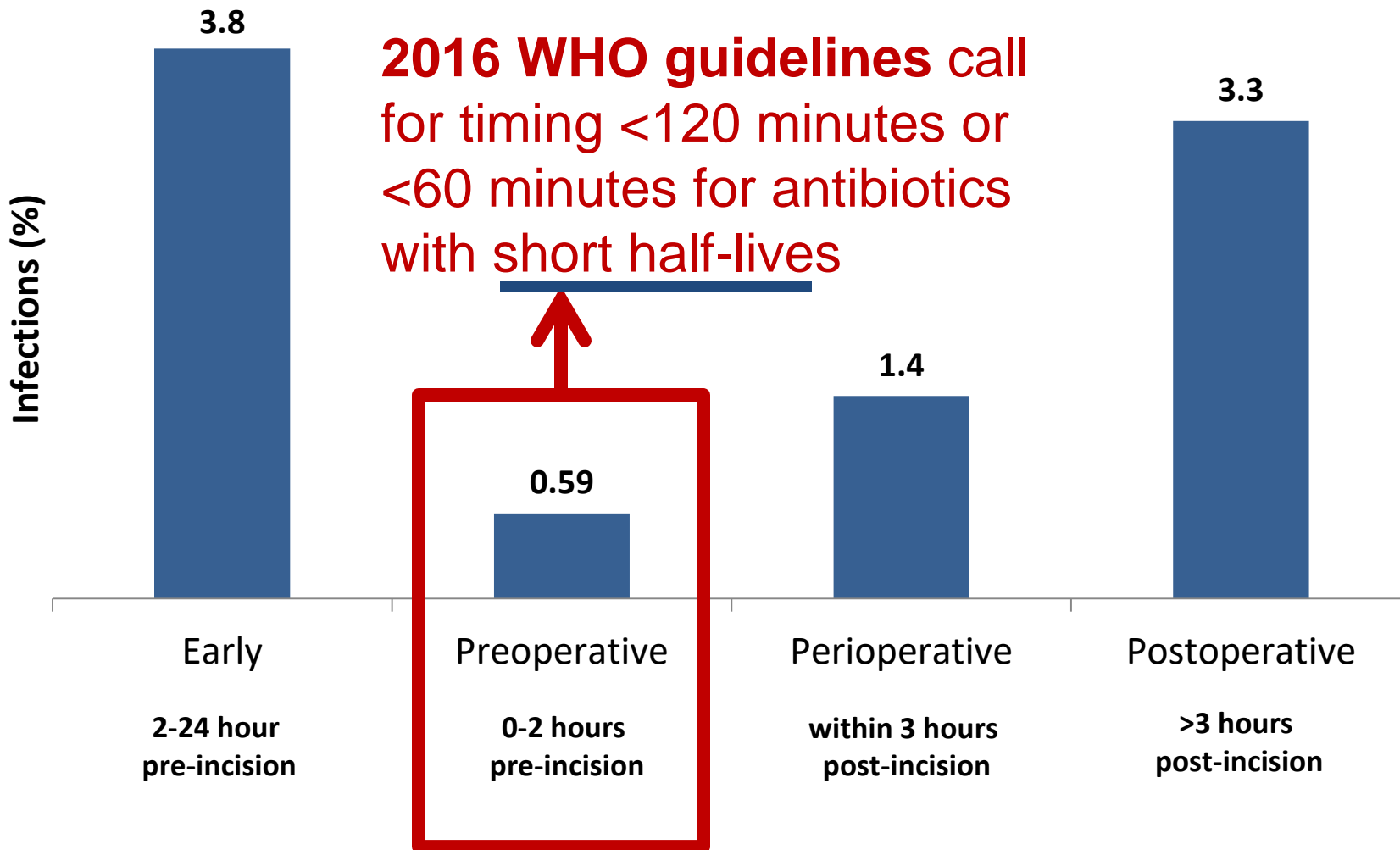
# Does timing even matter?

## Pre-op vs. Post-op





# Landmark Study - 1992





# PK Parameters – Commonly Used Antimicrobials

Antimicrobial	Time to peak, serum	Time to peak, tissue	Distribution	Protein binding	Elimination	t $\frac{1}{2}$
Cefazolin	10-20 min	Up to 1 hr	Widely into most body tissues & fluids	84%	Renal (80-100% unchanged)	1.8 hrs
Cefuroxime	20 min	35 min	Lower in bone & body tissue vs. serum	50%	Renal (89%)	1.3 hrs
Vancomycin	1 hr	Up to 3.5 hr	Lower in fat, sternum & bone vs. tissue/ serum	55%	Renal	4-6 hrs (5-13 hrs)

Cefuroxime for Injection [prescribing information]. Schaumburg, IL: Sagent; 2010  
Metronidazole for Injection [prescribing information]. Deerfield, IL: Baxter; 2015  
Bratzler DW, et al., Am J Health-Syst Pharm 2013;70:195-283  
Cefazolin for Injection [prescribing information]. Schaumburg, IL: Sagent; 2013  
Vancomycin for Injection [prescribing information]. Lake Forest, IL: Akorn-Strides, LLC; 2009

# ASHP Surgical Prophylaxis Guidelines

ASHP REPORT

Clinical

DALE W. BRATZLER, E.  
MAUREEN K. BOLON, D.

**Recommendation**  
**(most antimicrobials):**  
**within 60 minutes of**  
**incision**

Microbial

PAUL G. AUWAERTER,  
YER, DOUGLAS SLAIN,

ASHP

IDSA

SIS

SHEA

**Increasing interest in**  
**narrowing the window!**

- Infectious Diseases Society of America
- Surgical Infection Society
- Society of Healthcare Epidemiology of America

System Pharmacists



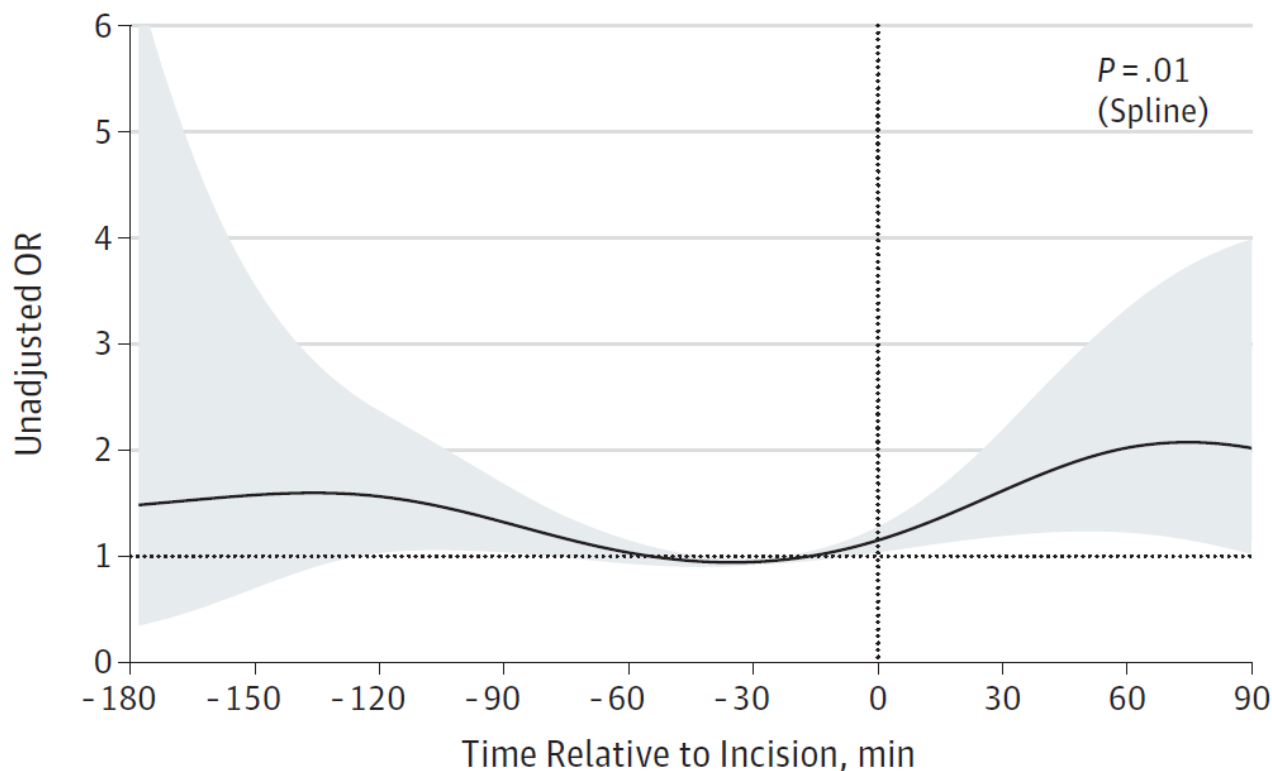


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# Antibiotic Timing and SSI Rates

Odds ratio of SSI from 32,459 patients undergoing hip or knee arthroplasty, colorectal surgical procedures, arterial vascular surgical procedures, and hysterectomy



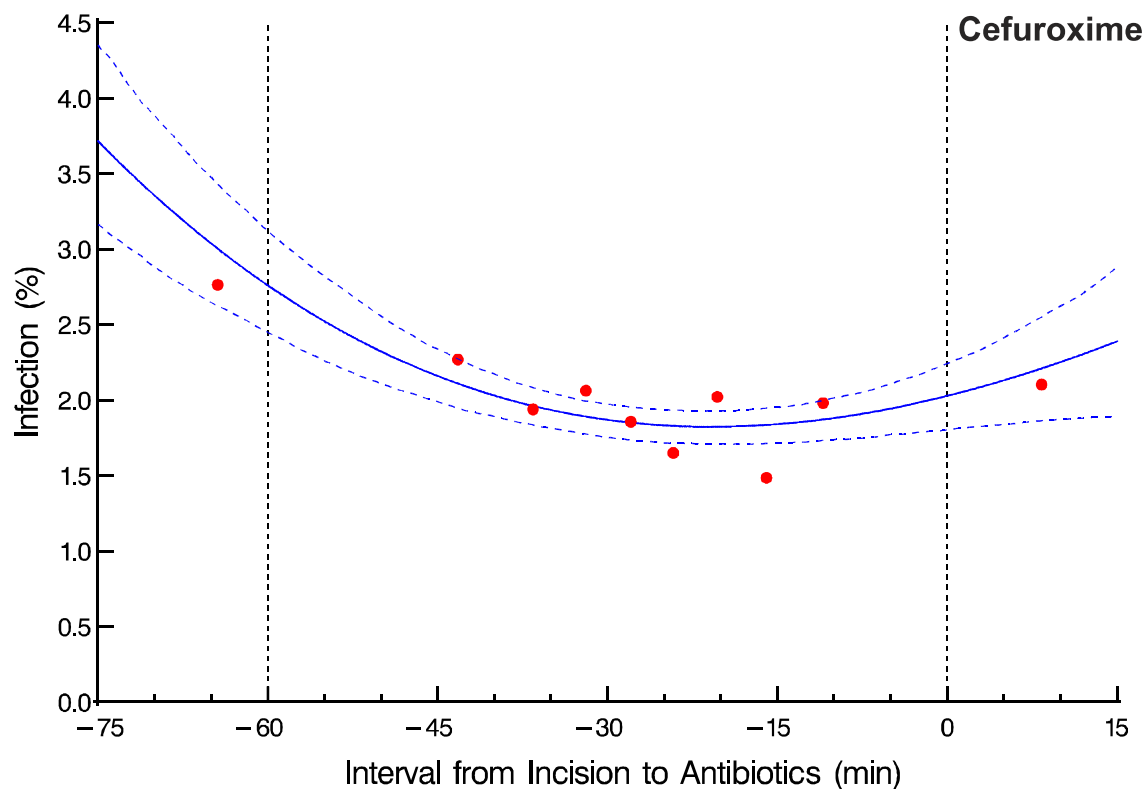


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# Antibiotic Timing and SSI Rates

**Percent of Post-operative SSI by Time of Prophylaxis Administration for 28,250 Patients undergoing Cardiac Surgeries**





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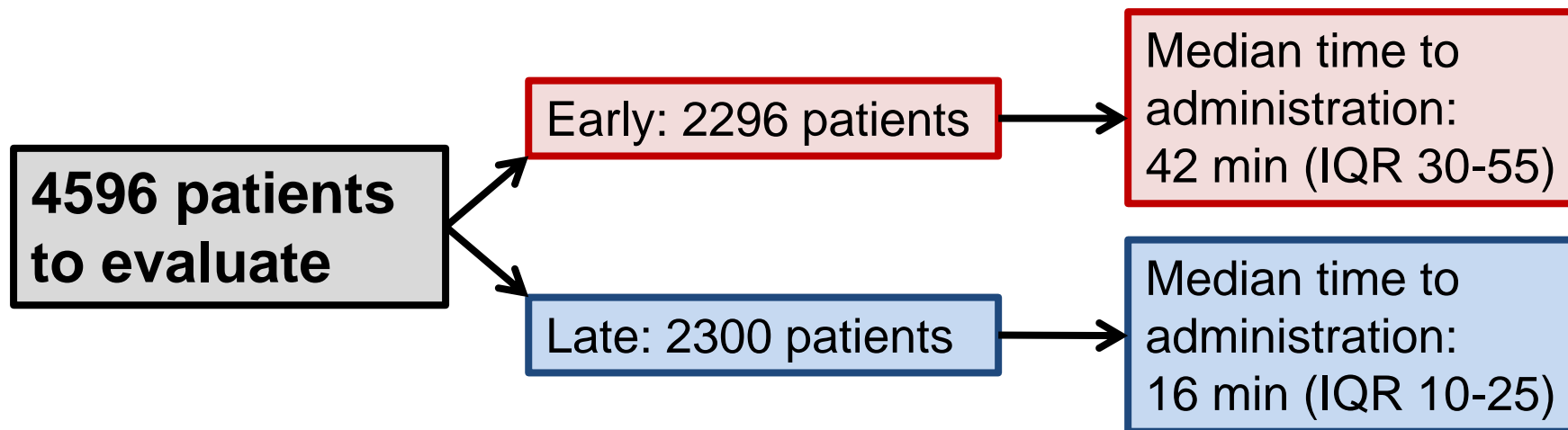
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## Hot Off the Press!

- General surgery adult inpatients
- Swiss hospitals
- Randomized (1:1), controlled trial
  - 1.5 gm IV of cefuroxime **early or late** administration
- Primary endpoint: SSI within 30 days of surgery



# Hot Off the Press!



	Early	Late	Odds Ratio	p value
<b>Primary outcome</b>				
Surgical site infection	113 (5%)	121 (5%)	0.93 (0.72-1.21)	0.601
Superficial incisional infection	48 (2%)	55 (2%)	0.87 (0.59-1.29)	0.491
Deep incisional infection	23 (1%)	20 (1%)	1.15 (0.63-2.11)	0.642
Organ space infection	42 (2%)	46 (2%)	0.91 (0.60-1.39)	0.673
<b>Secondary outcomes</b>				
All-cause 30-day mortality	29 (1%)	24 (1%)	1.21 (0.70-2.09)	0.485
Median length of hospital stay, days	5.1 (3-9)	5.0 (3-10)	NA	0.375



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# New Antibiotic Timing Recommendations as of 2016

- Start antibiotic infusion **15-60 min** prior to incision for beta-lactams
- Start antibiotic infusion **60-120 min** prior to incision for levofloxacin, ciprofloxacin, vancomycin, gentamicin > 5mg/kg, azithromycin, fluconazole



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# Stewardship Website



## CLINICAL HOME PAGE

MiChart | Level One | Outlook | VA

- Search UMHS -

Clinical Home Page

Clinical References

Clinical Resources

Clinical Systems Connection Page

### Pathology

Antibiotic Susceptibility Report  
Blood Bank & Transfusion  
Massive Transfusion  
Lab Handbook

### Radiology

24/7 Reach a Radiologist  
Patient Preps | Steroid Preps  
Study Usage Guide

### Pharmacy

Inpatient Resources / Formulary  
Ambulatory Resources  
Drug Shortages and Recalls  
Medication/Treatment Guidelines  
Chemotherapy Forms  
Ambulatory Infusion Forms  
UM Drug Plan Prior Authorization Forms  
MAPS Info / Sign On

### Nursing

Policies/Guidelines  
Elsevier Clinical Skills  
Clinical Units/Areas  
Professional Development  
Wound & Ostomy  
Clinical Practice Guidelines  
Nursing Governance

### Safety and Professionalism

Office of Clinical Affairs  
PA Services  
Help w/ Aggressive Behavior  
Safety Management Services  
Emergency Operations Plan  
Patient Safety Report Form (Event)  
MLearning/Mandatories  
Find a policy: UM | Mott | Women's  
Privileges: Faculty | House Officers  
Occupational Health Service  
Employee Assistance Program  
Compliance Office  
Quality & Safety Performance

### Directories

Last Name or Pager #

Paging  
M Community Directory  
Dept. Directory  
UM Clinic Locations  
M-LINE | MarketScope MD Lookup  
Michigan Medicine Websites A to Z

### Bed Status

Admissions & Bed Coordination Center  
MIPART  
Visual Hospital

### Clinical Resources

Anticoagulation Service / VTE  
Care Management  
Clinical Organizations  
Consent Forms: Gen Surgical | Others  
Infection Control  
Lean in Daily Work  
MiChart Website | Training Portal  
MVN and Home Care Services  
Nutrition  
Office of Decedent Affairs  
Supply Chain Services  
Web Referral to Emergency Dept.

### Clinical References

**Antimicrobial Stewardship/Guides**  
FGP Guidelines: Ambulatory | Inpatient  
Consult Request Guidelines  
Service Triage Guide (Inpatient)  
Internal Guides and Protocols  
Taubman Health Sciences Library  
Library Contacts (Research Guides)  
MEDSEARCH | PubMed | ClinicalKey  
Cochrane Collection  
DynaMed | Up-to-Date  
R2 Dig Lib | E-journals |  
VisualDx: What's that Rash  
Patient Education  
Pharmacy: Micromedex 2 | Epocrates  
Lexi-Comp (ped dosing)  
Facts & Comparisons | Calculators



One month and counting!

### Other Links

New Provider Restraint Information  
Suggestions  
Request IT Assistance  
Current Outages  
Hospital Cafeteria Menu



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# Stewardship Website

SharePoint

Nagel, Jerod ▾ ?

SHARE FOLLOW

## Antibiograms

- [Link to Antibiogram Page](#)
- [Susceptibility Panels in Use](#)

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## Surgical Antimicrobial Prophylaxis Guidelines

- [Introduction and Guidelines for Surgical Antimicrobial Prophylaxis](#)
- [Adult Dosing and Redosing Guidelines for Surgical Antimicrobial Prophylaxis](#)
- [Pediatric Dosing and Redosing Guidelines for Surgical Antimicrobial Prophylaxis](#)
- [Breast and Axillary Procedures](#)
- [Cardiothoracic](#)
- [Gastrointestinal](#)
- [Genitourinary](#)
- [Gynecological and Obstetrical](#)
- [Head and Neck](#)
- [Neurosurgical](#)
- [Ophthalmic](#)
- [Orthopedic](#)
- [Plastic Surgery](#)
- [Radiology](#)
- [Solid Organ Transplant](#)
- [Thoracic \(non-cardiac\)](#)
- [Vascular](#)

[GO TO TOP](#)

## Antimicrobial Desensitization Protocols

- [Desensitization Policy](#)
- [Desensitization Protocols](#)

[GO TO TOP](#)

## Antibiotic Locks

- [Antibiotic Lock](#)
- [Ethanol-Lock Therapy in C.S. Mott Children's Hospital](#)

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### Michigan Medicine, Department of Pharmacy Services

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HITS Service Desk Phone: 734-936-8000



## ADULT DOSING AND REDOSING GUIDELINES FOR PROPHYLACTIC ANTIMICROBIALS DURING SURGERY<sup>§</sup>

ANTIMICROBIAL	PRE-OPERATIVE DOSE <sup>a</sup> Pre-operative dose does not require adjustment for renal dysfunction	INTRAOPERATIVE RE-DOSING <sup>a</sup> Omit second re-dose in those with CrCL <50 mL/min or on hemodialysis	IV PUSH	INFUSION
Ampicillin	2 g	2 g every 2 hours for 2 re-doses	3-5 min <sup>a</sup>	30 min <sup>b</sup>
Ampicillin/sulbactam	3 g	3 g every 2 hours for 2 re-doses	3-5 min <sup>a</sup>	30 min <sup>b</sup>
Aztreonam	2 g	2 g every 4 hours for 2 re-doses	3-5 min <sup>a</sup>	30 min <sup>b</sup>
Cefazolin	2 g if <120kg, 3g if ≥120 kg	2 g (3g if ≥120 kg) every 4 hours for 2 re-doses	3-5 min <sup>a</sup>	30 min <sup>b</sup>
Cefuroxime	1.5 g	1.5 g every 4 hours for 2 re-doses	3-5 min <sup>a</sup>	30 min <sup>b</sup>

<sup>§</sup>Adapted from *Clinical Infectious Diseases* 2004;38:1706-15 and *Am J Health-Syst Pharm* 2013;70. Last P+T approved Feb, 2017

<sup>a</sup> Reconstituted dose injected directly into vein or via running IV fluids (only if IV piggyback not available). <sup>b</sup> Intermittent IV infusion. <sup>c</sup> Gentamicin dose should be based on ideal body weight unless actual body weight is less than ideal body weight. Consult pharmacy if patient has severe renal dysfunction. <sup>d</sup> Daptomycin should be dosed on actual body weight except in patients with BMI ≥ 35 kg/m<sup>2</sup>, in which case adjusted body weight should be used. <sup>e</sup> Infusions should begin 15-60 minutes prior to incision for all antimicrobial agents EXCEPT levofloxacin, ciprofloxacin, vancomycin, gentamicin, azithromycin, and fluconazole, which should begin 60-120 minutes prior to incision. If incision is delayed more than 60 minutes beyond the maximum dosing window (ie vancomycin and fluoroquinolones are started > 3 hours prior to incision, or all other antibiotics are started >2 hours prior to incision), consider pre-operative re-dosing with 50% of the pre-operative dose (listed above in 2<sup>nd</sup> column) for all antimicrobials except fluoroquinolones, fluconazole and aminoglycosides, only if CrCL >50 ml/min. No pre-operative re-dosing is necessary for fluoroquinolones, fluconazole and aminoglycosides, or for patients with CrCl <50 ml/min. <sup>f</sup> Re-dose every 4 hours for liver transplant recipients. <sup>§</sup> For adult patients weighing <50 kg, use the pediatric dosing recommendations. <sup>f</sup> Re-dose every 4 hours for liver transplant recipients

Metronidazole	500 mg	Not Recommended	Not Recommended	30 min <sup>b</sup>
Ceftriaxone	2 g	Not Recommended	3-5 min <sup>a</sup>	30 min <sup>b</sup>
Gentamicin	5 mg/kg <sup>c</sup> (ideal body weight)	Not Recommended	Not Recommended	30 min - 60 min
Vancomycin	1 g if <80 kg, 1.5 g if ≥80 kg	1 g (1.5 g if ≥80 kg) every 8 hours for 2 doses	Not Recommended	60 - 120 min
Levofloxacin	500 mg	Not Recommended	Not Recommended	60 min <sup>b</sup>
Ciprofloxacin	400 mg	Not Recommended	Not Recommended	60 min <sup>b</sup>
Fluconazole	400 mg	Not Recommended	Not Recommended	120 min <sup>b</sup>

<sup>§</sup>Adapted from *Clinical Infectious Diseases* 2004;38:1706-15 and *Am J Health-Syst Pharm* 2013;70. Last P+T approved Feb, 2017

<sup>a</sup> Reconstituted dose injected directly into vein or via running IV fluids (only if IV piggyback not available). <sup>b</sup> Intermittent IV infusion. <sup>c</sup> Gentamicin dose should be based on ideal body weight



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# Michigan Medicine “Blue Books”

## Guidelines for Antimicrobial Use in Adult Patients Sixth Edition

University of Michigan Health System

 Antimicrobial Stewardship Program



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# MiChart (Epic) Order Sets

Pre-op Antibiotics - RECOMMENDED - Clean contaminated head and neck surgery (incision through oral, pharyngeal or nasal mucosa)

ampicillin/sulbactam

Pre-op Antibiotics - ALTERNATIVE DRUGS - Clean contaminated head and neck surgery (incision through oral, pharyngeal or nasal mucosa)

Cefazolin AND metronidazole **OR** clindamycin

cefazolin AND metronidazole < 120 kg

ceFAZolin (ANCEF) IV Syringe 2,000 mg

2,000 mg (2 g), Intravenous, Start 15-60 minutes prior to incision starting Today at 2025 Until Discontinued  
Sign & Hold

And

Dose:

Administer Dose: **2,000 mg**  $2\text{ g} \times 1,000\text{ mg/g}$   
 $= 2,000\text{ mg} \times 1\text{ mL}/100\text{ mg}$   
 $= 20\text{ mL} \times 100\text{ mg/mL}$   
 $= 2,000\text{ mg}$

Route:

Frequency:

For:   Doses  Hours  Days

Starting:

First Dose:

Starting: **Today 2025** **Until Discontinued**

*i* There are no scheduled times based on the current order parameters.

Priority:



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## Other Strategies

- Education, education, education!
  - Live sessions
  - Email communications
  - Specialized training
- Collaboration is key!



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# Questions?

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