The Evolving and Continuing Antimicrobial Stewardship Program

Our experience in a Tertiary Community Hospital
Brookwood Baptist Medical Center
Grandview Medical Center

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Origin:


Timeline leading to Antimicrobial Stewardship
1930s
• Sulfonamides, penicillin and streptomycin became available
• Harnessing of antibacterial agents for clinical use begins
1940s
• Penicillin resistance to *Staph aureus* is detected
1960s
• *Staph aureus* resistance to methicillin emerges
1990s
• MRSA is observed in over 53% of isolates obtained from ICU patients in a US surveillance system
• IDSA/SHEA published "Guidelines for Antimicrobial Resistance in Hospitals"
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Overview:

- Who we are..
- What we did..
- What we do..
- How did we do that..
- Where do we want to be..

- NO DISCLOSURES!!

Brookwood Baptist Medical Center

Location: Birmingham, AL

Licensed Beds: 645

Adult Critical Care Beds: 58

3 ID MD Practice – 1 or 2 ID on a daily basis

Annual antibiotic spend: $1,363,000

Grandview Medical Center

Location: Birmingham, AL

Licensed Beds: 372

Adult Critical Care Beds: 72

3 ID MD Practice – 2 ID on a daily basis

Annual antibiotic spend: $1,107,347

Brookwood Baptist Medical Center

Existing ASP Initiatives (pre-August 2016)

- Pharmacokinetic Dosing by Pharmacy– All vancomycin and aminoglycosides
- Renal dosing adjustments
- IV to PO conversions
- Restricted Antibiotics
- Dose Optimization - Extended Infusions – Pip/Tazo
- Infectious Disease Pathway Order Sets (few)

ASP Must Haves

- Core Team / Champion or Leader
- Administrative Support
- Antibiograms
- Goals
- Program Metrics / Monitoring
- Regulatory Standard Compliance

KEY DRIVERS:
Enthusiasm
Passion
Teamwork

Antibiogram 2016:

Brookwood Medical Center – 2016 Antibiogram

Inpatient, Percent Susceptible

GRAM NEGATIVE	#isolates	Ampicillin	Amoxicillin/ clavulanate	Piperacillin/ tazobactam	Cefazolin	Ceftriaxone	Ceftazidime	Cefepime	Levofloxacin	Ciprofloxacin	Gentamicin	Tobramycin	Amikacin	Tetracycline (doxycycline)	Meropenem	Trimethoprim/ sulfamethoxazol	Oxacillin	Clindamycin	Vancomycin
Enterobacter cloacae	**34**			71		73	67	87	79	73	91	91	100	82	94	91			
Escherichia coli	**289**	35	72	93		88	88	90	60	60	89	90	99	63	99	61			
Klebsiella pneumonia	**117**		96	94	5	89	90	90	93	94	96	96	100	82	100	90			
Proteus mirabilis	**50**	86	95	100	5	94	93	93	74	74	82	87	100	0	100	84			
Pseudomonas aeruginosa	**92**			96			88	86	69	83	93	95	100		91				
GRAM POSITIVE																			
Enterococcus faecalis	**94**	98							69 Urine Only	69 Urine Only				24 Urine Only					98
Staph aureus	**233**																		
MRSA **54%**	**125**													94		96		52	100
MSSA **46%**	**108**													97		99	100	79	100
Staph, coag negative	**108**													78		48	26	50	100

Top 3 pathogens by source: *Urine - Ecoli, Kleb pneumo, Enterococcus faecalis* *Sputum: Staph aureus, Pseudomonas aeruginosa, Kleb pneumo* *Blood –Staph coag neg, Staph aureus, EColi*

Antibiogram - 2017:

Brookwood Baptist Medical Center – 2017 Antibiogram

Inpatient, Percent Susceptible

GRAM NEGATIVE	#isolates	Ampicillin	Amoxicillin/ clavulanate	Piperacillin/ tazobactam	Cefazolin	Ceftriaxone	Ceftazidime	Cefepime	Levofloxacin	Ciprofloxacin	Gentamicin	Tobramycin	Amikacin	Tetracycline (doxycycline)	Meropenem	Trimethoprim/ sulfamethoxazol	Oxacillin	Clindamycin	Vancomycin
Escherichia coli	**309**	37	66	91	6	85	95	100	55	55	86	87	100	68	98	64			
Klebsiella pneumonia	**117**		89	92	15	93	100	100	94	95	98	97	100	69	100	89			
Proteus mirabilis	**41**	77	95	100	10	95	100	100	67	68	78	87	100	0	70	84			
Pseudomonas aeruginosa	**94**			97			84	88	77	84	87	96	100		88				
GRAM POSITIVE																			
Enterococcus faecalis	**80**	96							87 Urine Only					14 Urine Only					96
Staph aureus	**211**																		
MRSA **43%**	**90**													93		91		48	98
MSSA **57%**	**122**													92		100	100	78	100
Staph, coag negative	**126**													83		49	31	48	100

Top 3 pathogens by source: *Urine - Ecoli, Kleb pneumo, Enterococcus faecalis* *Sputum: Staph aureus, Pseudomonas aeruginosa, strep viridans* *Blood –Staph coag neg, Staph aureus, EColi*

ASP – Existing Challenges

- Prolonged use of “empiric therapy”
- No follow-up for duration of therapy
- No de-escalation based on C&S information
- Optimizing Vancomycin
- Evolving Resistance patterns
- Corporate push to decrease pharmacy expense
- Lack of process to address all microbiology data

Re-Building the Team

- **ID physician**
- **Dedicated Antimicrobial Stewardship Pharmacist**
- **Pharmacy Staff / Management**
- **Infection Control**
- **Informatics pharmacist**
- **Administration**
- **Micro Lab**

Pharmacy Structure: Old vs. New

Clinical Pharmacy Specialist

- Scheduling:
  - M-F: CL1 (0700 – 1730) and CL2 (1100 – 2130)
    - 9 pharmacists rotated through these shifts
  - Sat, Sun: CL1 (0700 – 1730)
    - 3 rotating pharmacists

Antimicrobial Stewardship Pharmacist

- Scheduling:
  - ASP (0700 – 1730)
    - 3 rotating pharmacists who work M-Th or F - Su
  - M-F: CL2 (1100 – 2130)
    - 5 pharmacists rotate to cover

Consistency and Communication are KEY

Education

- Weekly Rounds: Q&A with ID physician
- Surgery PI In-service for pre-op antibiotics
- Vancomycin In-service for nursing units
- ASP module with post test for all nurses and pharmacists

MAD-ID Training – May 2017

- Basic training completed by 11 pharmacists
- Advanced training in process for 4 pharmacists

ASP Pharmacist Responsibilities

- Weekly meeting/rounding with ID physician
- Monthly Antimicrobial Stewardship Committee (ASP, pharmacy management, infection control, informatics, administration)
- Vancomycin and aminoglycoside dosing for critical care
- Restricted Antibiotics
- Day of Therapy (DOT) notifications
- Inappropriate therapy interventions (Drug – Bug mismatch, etc)
- De escalation of broad therapy
- Prospective Audit and Feedback to Prescribers

Low Hanging Fruit

- DOT Notifications
- Expand restricted antibiotics and re-work criteria
  - Meropenem, micafungin
- Drug – Bug mismatch
- Development of criteria for pharmacy to consult ID
- Automatic stop date for certain antibiotics (oral vancomycin, fidaxomicin)

Day of Therapy Notifications

ASP pharmacist will communicate with prescriber (chart reminder, phone call or face-to-face interaction) about day of antibiotic therapy

Day of Antibiotic Therapy	Disease State	Action
7	Empiric antibiotic use, uncomplicated cellulitis or UTI	Contact prescriber
12	HAP, CAP that failed OP treatment, complicated cellulitis or complicated UTI	Contact prescriber
14	All except exclusions* (*osteomyelitis, endocarditis)	ID Consult by pharmacy

Restricted Antibiotics

Restricted to ID Approval / Consultation

- Colistin (colistimethate)
- Cubicin (daptomycin)
- Noxafil (posaconazole)
- Teflaro (ceftaroline)
- Tygacil (tigecycline)
- Ambisome (Lip Amp B)

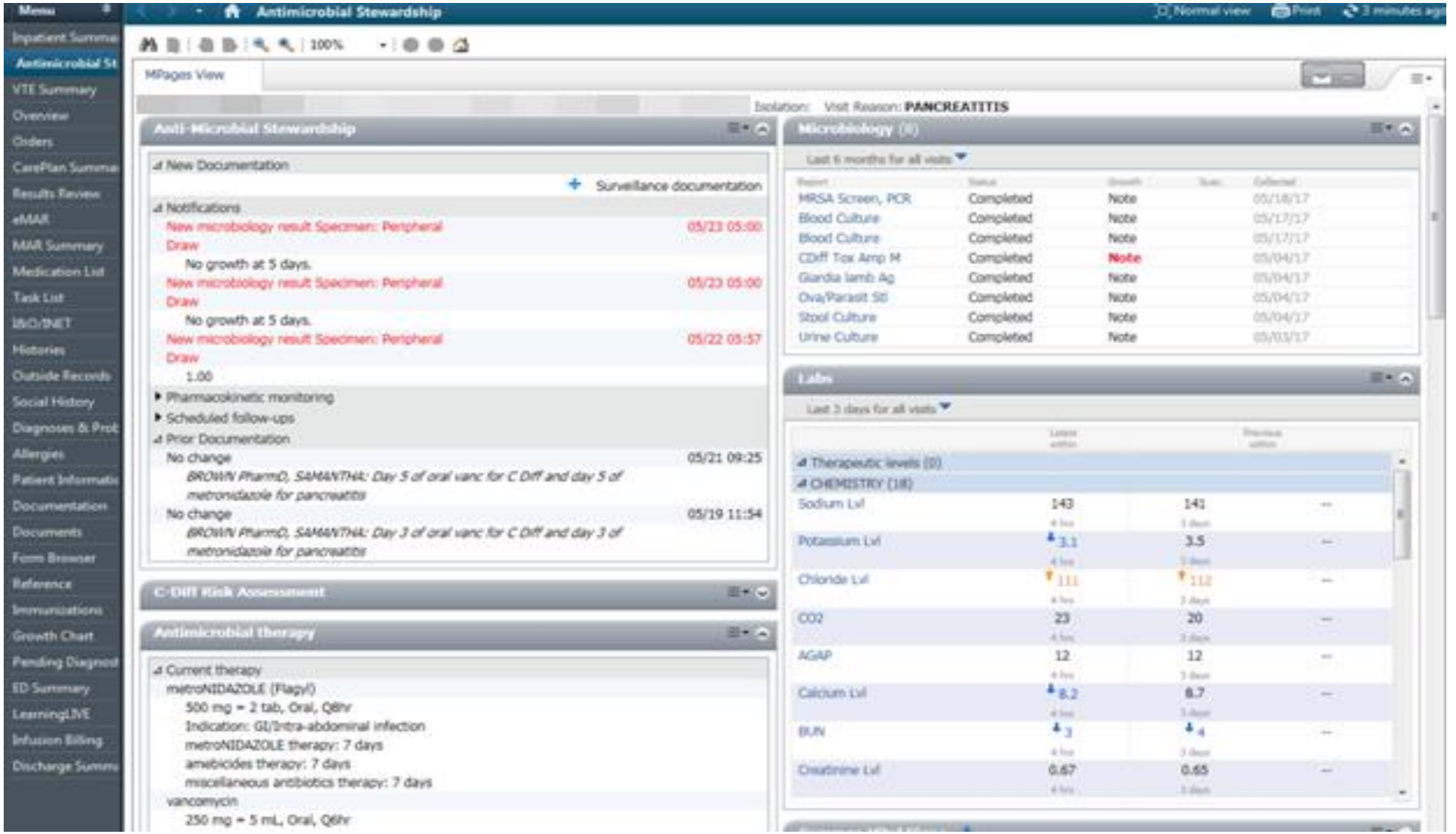
Restricted by Criteria - Pharmacy Review

- Merrem (meropenem)
- Mycamine (micafungin)
- Vfend (voriconazole)
- Zyvox (linezolid)

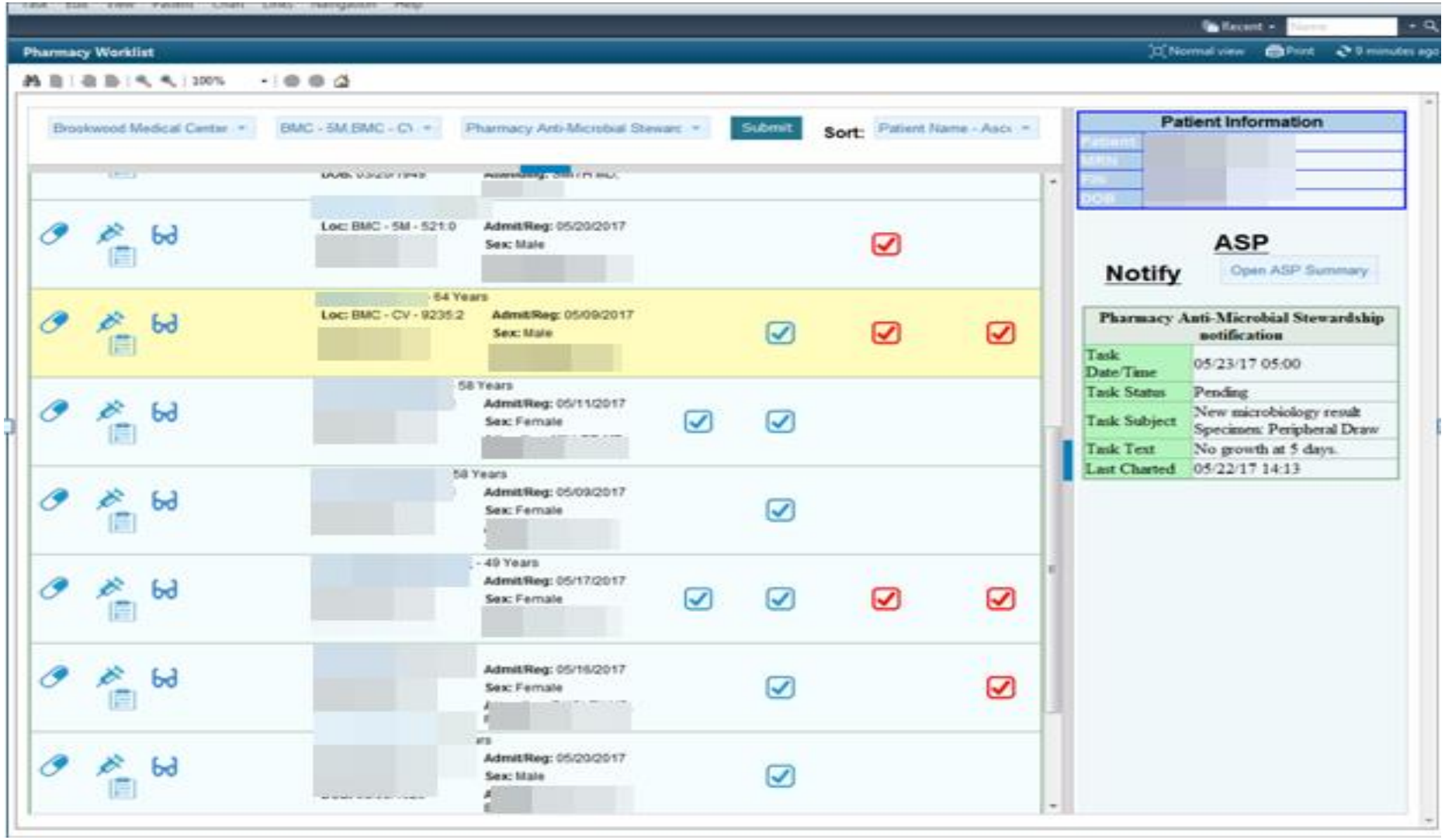
Technology

- EMR = Cerner Millennium
  - Indication Required for all antimicrobial prescribing
  - ASP work page – consolidated page that displays micro, antibiotic duration of therapy, labs, vital signs, *C.diff* risk assessment, prior ASP documentations
  - ASP Pharmacist Alerts
    - DAILY task for each patient on antibiotics 48 hours or longer
    - IV to PO candidate
    - Renal Dosing candidate
    - Drug – Bug Mismatch, Positive Culture No Therapy

Cerner ASP Workpage



Cerner ASP Pharmacist Alerts



Technology (cont)

MedMined

- Infection control
- Antibiogram
- Antibiotic Days of Therapy Tracking
- Annual Antibiotic Use Assessment And Benchmarking

Technology (cont)

Excel Daily Reports

- Day of Therapy Notifications
- Restricted Drugs
- IV to PO
- Dose Optimization
- Interventions (Drug/Bug Mismatch, + Culture/No Abx, Escalation, De-escalation)
- Problems or Questions
- Focused reviews (meropenem)

Day of Therapy Tracking

1	DAY OF THERAPY NOTIFICATIONS - APRIL 2017									
2	Date DOT placed on chart	FIN	Pt (Last, First)	Drug	DOT	Prescriber	Comments	Recommendations to DC abx accepted within 72 hrs	DOT when antibiotics DC'ed	Pt Discharged within 72 hrs of placing 1st DOT
3	4/3			Zosyn	10d			N	11d	Y
4	4/3			Fluconazole	7d			N	9d	Y
5	4/3			Vancomycin	7d			Y	9d	N
6	4/3			Vancomycin	8d			Y	9d	N
7	4/3			Zosyn	8d			Y	9d	N
8	4/3			Azithromycin	8d			N	14d	N
9	4/3			Levaquin	7d			N	14d	N
10	4/4			Levaquin	13d			Y	14d	N
11	4/4			Metronidazole	18d			Y	20d	N
12	4/5			Ceftriaxone	8d			Y	9d	N
13	4/5			Levaquin	8d			Y	9d	N
14	4/6			Cipro	6d			N	12d	N
15	4/6		[illegible]	Zosyn	13d		ID consult	N	15d	N

Interventions

NON-PHARMACOKINETIC INTERVENTIONS - APRIL 2017			
Date	**FIN**	**Patient Name**	**Intervention**
4/3			MD note stated to discontinue vancomycin/merrem - still active called MD and abx discontinued
4/10			Patient on ceftriaxone and pip/tazo for E.coli UTI (sensitve to both) left note on chart to de-escalate to one abx; ceftriaxone d/c'ed
4/18			Spoke with [redacted] about ESBL e coli UTI. He gave me a verbal order to switch from cefepime to nitrofurantoin.
4/20			Spoke with [redacted] up on the floor. I asked him about de-escalating vancomycin for MSSA. He said he would de-escalate to oral clindamycin and send the patient home.
4/24			Ancef as surgical prophylaxis with no stop date/duration and order comment stated not to continue past 24h after surgery. Confirmed with RN patient had received 24h of Ancef after surgery. Discontinued Ancef.
4/24			Blood cx - Streptococcus Grp A on vancomycin report on chart - changed to Ceftriaxone
4/25			Urine cx- > 100,000 cfu/ml E coli - no note - patient in process of being discharged spoke with RN he said patient did not have S&S of UTI but would give results to daughter if had symptoms take to MD
4/28			Called Dr Mitchell and made him aware that patient is C Diff positive. He said he will add flagyl.

NON-PHARMACOKINETIC INTERVENTIONS - MAY 2017			
Date			**Intervention**
5/1			Patient on vancomycin for cellulitis and doxycycline also started for cellulitis. Contacted doctor and vancomycin d/c'ed
5/1			Note in chart stated to d/c vancomycin but was not d/c'ed in Cerner. Contacted doctor and gave verbal order to discotinue vancomycin
5/2			Post-op Ancef with no stop date/duration with order comments not to exceed 24h past surgery. Called RN to confirm 24h since surgery and d/c'ed Ancef.
5/2			Read pt's progress notes and it said to start vancomycin and Levaquin but no orders entered; they had been entered under incorrect pt. Called doctor and vancomycin and Levaquin started on right patient and d/c'ed on incorrect pt.
5/2			Patient on Levaquin for UTI; urine cx - VRE. C/S left on chart --> changed to Zyvox

Metrics

Decide what to measure?
Decide how to measure?
Decide who to tell?

BBMC developed a concise scorecard reported at the monthly Antimicrobial Stewardship Committee meeting

2017 BBMC ANTIMICROBIAL STEWARDSHIP SCORECARD

	GOAL	JAN	FEB	MAR
Antimicrobial Spend		$107,264.79	$107,015.60	$135,912.57
Antimicrobial Spend per Adjusted Patient Day (APD)	< $10	$5.79	$6.10	$6.94
Pharmacy-Monitored Vancomycin Patients		188	158	173
Pharmacy-Monitored Aminoglycoside Patients		11	11	8
Pharmacokinetic Monitoring, Total Intervention Count		1109	844	925
Pharmacokinetic Monitoring and Intervention, Time Spent		286 h 30 m	228 h	251 h 40 m
Days of Therapy (DOT) Notification Acceptance		66% (43/65)	87% (55/63)	89% (41/46)
DOT Intervention Count		69	65	50
Patients Discharged		4	63	4
Antimicrobial IV to PO Intervention Count		28	28	38
Antimicrobial Dose Optimization - EIPT		40	54	54
Stewardship Interventions (Drug-Bug Mismatch, Positive Culture/No Abx, Abx Escalation/De-escalation)		22	21	29
Restricted Drugs		36	41	51
Anti-Infective Renal Dosing Intervention Count		41	59	78
All Antimicrobial Monitoring, Total Intervention Count		1135	1377	1829
Total Monitoring Time		138 h	166 h 30 min	220 h 5 m

What's Next?
Higher Hanging Fruit

- Infectious Disease Treatment Pathways
- Accelerated Days of Therapy Notification
- Additional Restricted Antibiotics and Criteria
- Peri-Operative Antimicrobial Use
- Antifungal Stewardship
- *Clostridium difficile* Risk Reduction Strategies
- Rapid Diagnostics

The Battle is on….