Residency Project Pearls 2015

Evaluation of Opportunities for Pharmacist Integration into the Discharge Process

Thomas Yu, Pharm.D.
Outpatient Pharmacy Manager
Sinai Health System
ICHP Annual Meeting 2015
September 12, 2015

The speaker has no actual or potential conflict of interest in relation to this presentation

Learning Objectives

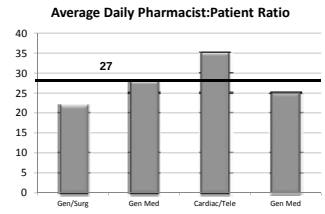
- Identify the transition of care where most medication discrepancies typically occur.
- Recognize the amount of time required to complete medication reconciliation at discharge.

Mount Sinai Hospital

- Part of Sinai Health System
- 319-bed urban teaching hospital on Chicago's west side
- Level I Trauma Center
- Safety Net Hospital
  - Emergency visits: 56,236
  - Outpatient visits: 207,728
  - > 700 health professionals trained annually

Mount Sinai Pharmacy Department

- Decentralized/centralized
  - 3 general medicine units
  - 1 general surgery units
  - ~1 APPE student/unit



Med History vs. Med Reconciliation

- Medication history (MH)
  - ***Initial list*** of medications obtained from the patient and other sources
- Medication reconciliation (MR)
  - ***Comparison*** of MH vs inpatient medications and ***error correction***

- An accurate MR cannot be obtained without an accurate MH

Br J Clin Pharmacol. 2009;67:671–675

Interpretation of the Medication Use Process

Admission
- Medication history
- Medication reconciliation

Inpatient
- Inpatient hospitalization (orders, transfers)

Discharge
- Medication reconciliation

Current Process at MSH

Current Medication Reconciliation Policy

Nurse or Physician

Admission
- Medication history
- Medication reconciliation

Inpatient
- Inpatient hospitalization (orders, transfers)

Physician

Physician

Discharge
- Medication reconciliation

Current Medication Reconciliation Policy

Nurse or Physician

Admission
- Medication history

Current Limitations

- **Documentation not standardized**
- **Med history quality variable**
- **Pharmacist involvement is suboptimal**

Physician

- Medication reconciliation

Audience Participation

What transition of care do most medication discrepancies typically occur?

A. Admission
B. ICU → Floor
C. ED → Floor
D. Discharge

Quality Improvement Project

Pharmacist Medication Reconciliation

Objectives of the Study

- Primary
  - Delineate role for pharmacists in the discharge process by identification of safety benefits derived from transition services
- Secondary
  - Identify drug classes and chronic disease states associated with medication discrepancies

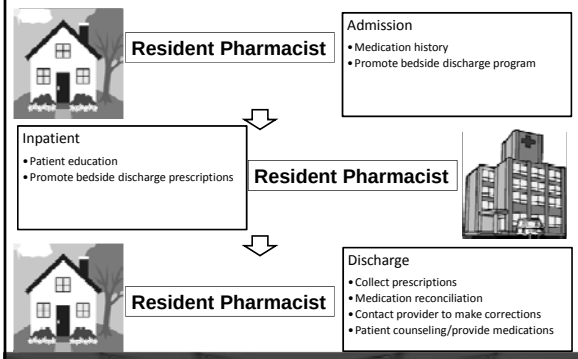
Methods

- Services provided during resident rotation on 3 adult medical units
  - December 8, 2014 to February 5, 2015
- Admission
  - Obtained complete medication history
  - Promoted bedside discharge services

Methods

- Discharge
  - Collected discharge prescriptions
  - Reviewed medication reconciliation performed by discharging physician
  - Contacted physician to correct any discrepancies on prescriptions prior to discharge
  - Counseled patients on new medication regimen

Methods



Methods

- Discrepancy definitions
  - Intended – Correct medication change due to disease/lab
  - Unintended – Incorrect medication change resulting in potential for ADR

Institute For Safe Medication Practices Arch Intern Med. 2005;165(16):1842-7

Methods

- Discrepancy classified by type
  - Omission (missing medication)
  - No indication for an ordered medication
  - Wrong dose and/or frequency
  - Wrong medication
  - Duplication (same drug or class)

Institute For Safe Medication Practices Arch Intern Med. 2005;165(16):1842-7

Methods

- Severity scale adapted from ISMP severity categories
  - No harm – No patient harm
  - Mild harm - Increased monitoring but no change in homeostasis
  - Moderate harm – Need for treatment/intervention or temporary harm
  - Critical harm – Prolonged hospitalization, near death or death

Institute For Safe Medication Practices Arch Intern Med. 2005;165(16):1842-7
ISMP = Institute of Safe Medication Practice

Methods

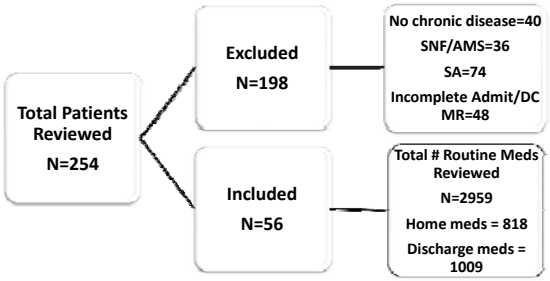
Inclusion

- Admitted to general medical unit
- History/new diagnosis ≥1 of the following chronic diseases
  - Chronic obstructive pulmonary disease (COPD)
  - Chronic heart failure (CHF)
  - Diabetes mellitus (DM)
  - Coronary artery disease (CAD)
  - Cerebrovascular accident (CVA)
  - Thromboembolism (VTE) requiring long term anticoagulation

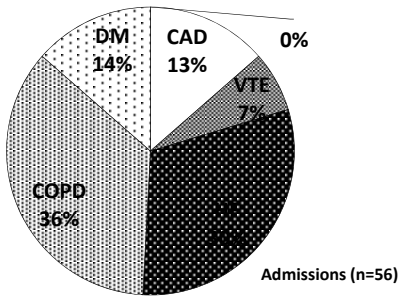
Exclusion

- Documented substance abuse (SA)
- Non-English speaking
- Admission from or discharge to skilled nursing facility (SNF)
- Diagnosis of dementia/altered mental status (AMS)
- Diagnosis of major schizoaffective disorder

Results



Baseline Demographics



Baseline Demographics

	Study (n=56)
Gender (F)	34 (61%)
Average Age	54.4 years
Length of Stay	4.6 days
Average # of Meds	11.2
Average # of Routine Meds	8.6
Number of Comorbidities	1: 9 (16%) 2: 13 (23%) 3: 23 (41%) 4: 8 (14%) 5: 3 (6%)
Insurance Status	**Medicaid 41 (75%)** Medicare 8 (14%) Self Pay 5 (8%) Insured 2 (3%)

Baseline Demographics

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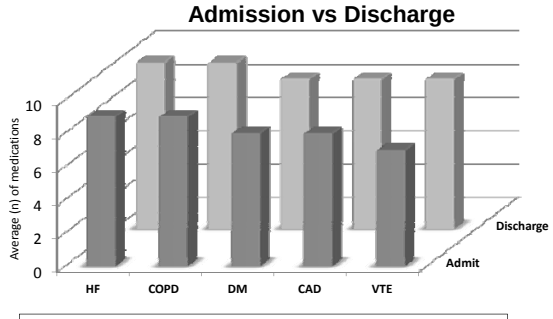
Average Number of Medications

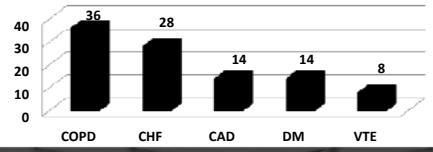


Average Number of Medications Increased at Discharge ~2.1

Discrepancies by Disease State

	COPD	CHF	DM	CAD	VTE	Sum
Total by Disease State	20	16	8	8	4	**56**
Average Per Patient	1.2	1.2	0.7	1	1	**1**
Percent of Total Discrepancies (%)	**36**	**28**	14	14	8	**100**

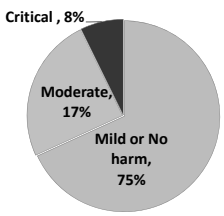
Percentage of Discrepancies



Discrepancies at Discharge by Type

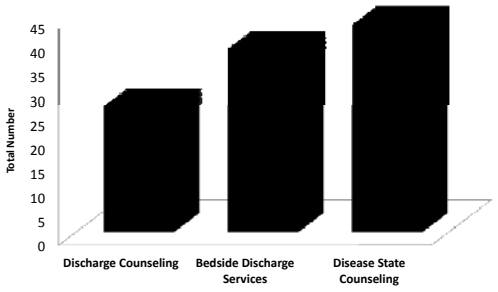
Type	Percent (%)	Example
Omission	57	Beta blocker for CHF Rescue inhaler for COPD
Wrong Dose	21	Insulin for DM
Duplication	11	2 statins for CAD
No Indication	8	PPI
Drug/Disease	3	Ibuprofen in CHF

Discrepancies at Discharge by Severity

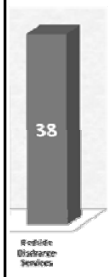


Severity	Type	Example	Disease State
Critical Harm	Wrong Dose Omission	Insulin Enoxaparin	DM VTE
Moderate harm	Omission Duplication	Beta blocker 2 statins	CHF COPD CAD

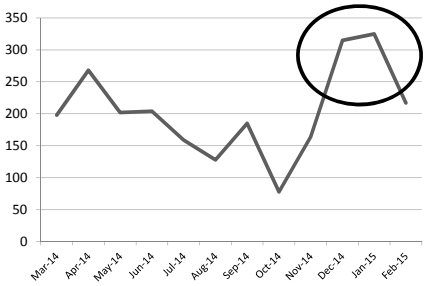
Resident Discharge Interventions Beyond Medication Reconciliation



Increase in Discharge Services



Bedside Discharge Rx Program



Result Highlights

- Safety benefits
  - Approximately 1 discrepancy per patient prevented
    - 25% of discrepancies critical or moderate
  - Prevented potential ADE

Result Highlights

- High Risk Disease States
  - CHF, COPD
    - Highest average number discharge medications (10)
    - Highest readmission rates
  - DM, VTE
    - Medications associated with highest potential for critical harm

Observations

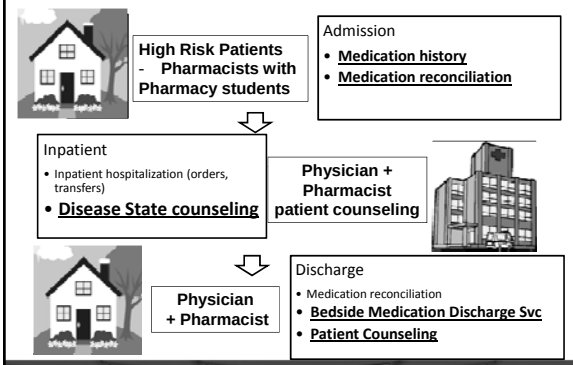
- Observed reduction in 30 day readmissions
- Analysis
  - Identified subset patients with readmissions (n=32)
  - ↓ 39%

Prior Admission	Resident Project 12/6/14 – 2/6/15	Post-Discharge

Limitations

- Small, retrospective, single center study limited to 2 months duration
- Unable to complete numerous Med Rec due to inadequate communication to pharmacist of discharge
- Resident categorized discrepancies by type and severity

Integration of Pharmacist in Discharge Process



Lessons Learned

- Need to start with admission med history
  - Cannot prevent discharge discrepancies without full knowledge of baseline medications
- More time spent with patient affects positive outcomes
- Bundled approach
  - A multiple layered approach has more significant impact than one dimensioned approach

Audience Participation

What patient populations would benefit from a pharmacist assisted medication reconciliation at discharge?

a. Patients with CHF
b. Patients with COPD
c. Patients on insulin
d. A and B only
e. All of the above

Acknowledgements

- Diane Cluxton, Pharm.D.
- Karen Trenkler, Pharm.D., BCPS
- Sameer Shah, Pharm.D., MHA
- Tejal Patel, Pharm.D., BCPS
- Mount Sinai Hospital General Medicine Pharmacists

Evaluation of Opportunities for Pharmacist Integration into the Discharge Process

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September 12, 2015

Illinois Council of Health-System Pharmacists 2015 Annual Meeting

Evaluation of the Safety and Efficacy of Valganciclovir Twice Weekly Dosing in Kidney Transplant Patients with Impaired Graft Function

Great Lakes Resident Research
Presented by: Rachel Ralph, PharmD

The speaker has no actual or potential conflict of interest in relation to this presentation

Background

- Cytomegalovirus (CMV) is an opportunistic infection associated with significant morbidity and mortality in transplant recipients
- Incidence:
  - ~60% will have active infection (replicating virus)
  - >20% will have symptomatic disease
- Treatment options for CMV prevention in the post-transplant period include:
  - Intravenous (IV) ganciclovir
  - Valganciclovir (prodrug)

Cochrane AB. 2006;63:S17-21.
Cordero E, et al. 2012;44:694-700.

Valganciclovir

Adverse Effects

- Leukopenia/neutropenia [Black Box Warning (BBW)]
- Thrombocytopenia (BBW)
- Anemia (BBW)
- Renal insufficiency
- Liver function test (LFT) changes

Valcyte® [package insert].

Valganciclovir

Maintenance Dosing Recommendations

- CrCl ≥60 mL/min: 900 mg daily
- CrCl 40-59 mL/min: 450 mg daily
- CrCl 25-39 mL/min: 450 mg q2 days
- CrCl 10-24 mL/min: 450 mg twice weekly
- CrCl <10 mL/min or hemodialysis (HD): NOT RECOMMENDED

Valcyte® [package insert].

Valganciclovir vs. Ganciclovir

Maintenance Dosing Recommendations

Valganciclovir	Ganciclovir
• CrCl ≥60 mL/min: 900 mg daily	• CrCl ≥70 mL/min: 5 mg/kg/d
• CrCl 40-59 mL/min: 450 mg daily	• CrCl 50-69 mL/min: 2.5 mg/kg/d
• CrCl 25-39 mL/min: 450 mg q2 days	• CrCl 25-49 mL/min: 1.25 mg/kg/d
• CrCl 10-24 mL/min: 450 mg twice weekly	• CrCl 10-24 mL/min: 0.625 mg/kg/d
• CrCl <10 mL/min or HD: NOT RECOMMENDED	• CrCl <10 mL/min or HD: 0.625 mg/kg TIW

Valcyte® [package insert].
Ganciclovir. Lexicomp®.

Pharmacokinetic Studies

- Single dose 900 mg valganciclovir demonstrated:
  - 4-fold increase drug concentration in CrCl <10mL/min vs. 21-50 mL/min
- Similar systemic exposure between:
  - Valganciclovir 900 mg/day
  - IV ganciclovir 5 mg/kg/day
- Low-dose valganciclovir effective and relatively safe
  - Further dose decreases and discontinuation rate of ~20%

Czock D. 2002; 72:142-50.
Wiltshire H, et al. 2005;44:495-507.
Gabardi S, et al. 2004;24:1323-30.

Research Question

Is valganciclovir dosed 450 mg twice weekly both safe and effective in kidney transplant patients with slow graft function on HD or with CrCl <10 mL/min?

Outcome Measures

Primary Outcome

- Bone Marrow Suppression
  - Neutropenia
    - Composite: absolute neutrophil count (ANC) <1500 cells/ul
    - 500 < ANC < 1500 cells/ul
    - ANC <500 cells/ul (severe)
  - Thrombocytopenia
    - Platelet count <100 k/ul
  - Composite neutropenia and thrombocytopenia

Outcome Measures

Secondary Outcomes

- Use of growth colony stimulating factor (GCSF)
- CMV viremia: viral load >600 IU/mL

Study Design

- Retrospective case-control study
  - Matched 1:2 (study to control)
  - Matching criteria:
    - Transplant date within 1 calendar year
    - CMV serostatus
- This study was approved by the Northwestern University Institutional Review Board

Study Population

- Inclusion Criteria
  - Kidney transplant recipients
  - Alemtuzumab induction
  - Study: slow graft function (SGF) with CrCl <10 mL/min or necessitating HD
  - Control: CrCl >40 mL/min
- Exclusion Criteria
  - Simultaneous receipt of another organ
  - Rituximab desensitization
  - Antithymocyte globulin use
  - D-/R- CMV serostatus
  - HIV

Northwestern Memorial Hospital - Chicago, Illinois

Feinberg and Galter Pavilions

Prentice Women's Hospital

- 894-bed Academic Medical Center
- Primary teaching affiliate of Northwestern University Feinberg School of Medicine
- Fiscal Year 2014
  - 47,139 Inpatient Admissions
- Kovler Organ Transplantation Center
  - 220 kidney transplants annually
  - 122 living donor kidney transplants annually

My Role

- Designed study
- Obtained IRB approval
- Collected data
- Analyzed data

Data Analysis

- Continuous variables were analyzed with Student's t-test and Wilcoxan Rank-Sum test
- Categorical variables were analyzed with Chi-square and Fisher's Exact
- All data were analyzed with Epi-Info 7.1.3; Atlanta, GA

Study Population

SGF Patients

78 SGF Patients Identified

Excluded

- Basiliximab induction
- Receipt of
  - Rituximab
  - Antithymocyte globulin
- D-/R-
- No BIW dosing
- HIV
- Unable to find in medical record
- Duplicate entry

31 SGF Patients Included

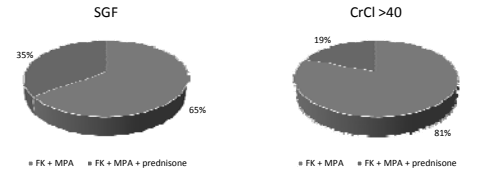
Baseline Demographics

	SGF (n=31)	CrCl >40 (n=62)	p-value
Age, yrs (mean, SD)	53.7 (11.6)	49.6 (14.7)	0.18
Gender, male (n,%)	25 (80.7%)	30 (48.4%)	<0.01
Race (n,%)			
White	9 (29%)	26 (41.9%)	0.23
Black	14 (45.2%)	10 (16.1%)	<0.01
Hispanic	4 (12.9%)	21 (33.9%)	0.05
Asian	3 (9.7%)	5 (8%)	0.99
Other	1 (3.2%)	0 (0%)	0.33

SGF patients:

- Median time BIW dosing: 55 days (IQR 24 to 167)
- Median time SGF: 14 days (IQR 6 to 17)

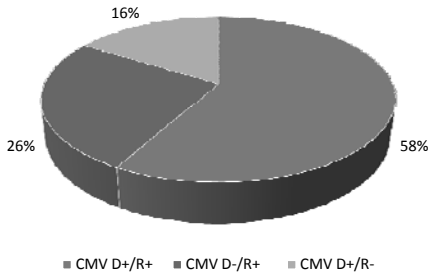
Immunosuppression



p=0.09

FK= tacrolimus; MPA= mycophenolic acid

CMV Serostatus



Primary Outcomes

Neutropenia			
	SGF (n=31)	CrCl >40 (n=62)	p-value
Neutropenia (Composite)	19 (61.3%)	32 (51.6%)	0.38
Neutropenia (500 < ANC < 1500)	14 (45.2%)	19 (30.7%)	0.17
Severe Neutropenia (ANC < 500)	5 (16.1%)	13 (21%)	0.58
Thrombocytopenia			
Thrombocytopenia (plts < 100)	12 (38.7%)	6 (9.7%)	<0.01
Composite Neutropenia and Thrombocytopenia			
ANC <1500 and/or plts <100	23 (74.2%)	33 (53.2%)	0.05

Secondary Outcomes

Use of GCSF			
	SGF (n=31)	CrCl >40 (n=62)	p-value
GCSF Use	10 (32.3%)	13 (21%)	0.24
CMV Viremia			
CMV Viremia	2 (6.9%)	0 (0%)	0.1

Subgroup Analysis

Impact of GCSF on ANC

GCSF Patients			
	SGF (n=10)	CrCl >40 (n=13)	p-value
Neutropenia (500 < ANC < 1500)	6 (60%)	1 (8%)	0.02
Severe Neutropenia (ANC < 500)	4 (40%)	12 (92%)	

Subgroup Analysis

Impact of HD versus reduced CrCl

SGF patients			
	HD (n=23)	Non HD (n=8)	p-value
Neutropenia (ANC <1500)	13 (56.5%)	6 (75%)	0.43
Thrombocytopenia (plts <100)	10 (43.5%)	2 (25%)	0.43
ANC <1500 and/or plts <100	16 (69.6%)	7 (87.5%)	0.64

Limitations

- Retrospective study design
- Sample size limited to patients during the protocol period
  - May not have been powered to detect significant differences
- Difficult to categorize time on HD
- Did not compare average MPA doses between groups

Summary and Conclusions

- Valganciclovir is renally eliminated necessitating dose adjustments
- Per labeling, valganciclovir is not recommended in CrCl <10 mL/min or HD
- Extrapolated valganciclovir dosing appears to be effective, however, was shown to lead to increased incidences of thrombocytopenia
  - Trend towards more neutropenia and GCSF use in the SGF group
- Prospective study may be warranted to further substantiate these findings and look for clinical significance

Future Directions

- Present results to P&T Committee
- Share data with the department of solid organ transplantation
- Submit abstract to American Transplant Congress (ATC) annual meeting for 2016
- Submit for publication

Question #1

Which of the following are adverse effects of valganciclovir?

A. Neutropenia
B. Eosinophilia
C. Thrombocytopenia
D. A & C only

Question #2

What is the lowest creatinine clearance (CrCl) for which valganciclovir has dosing recommendations?

A. CrCl 75 mL/min
B. CrCl 50 mL/min
C. CrCl 30 mL/min
D. CrCl 10 mL/min

Acknowledgements

Thank you to the following:

Chad Richardson, PharmD
Michael Postelnick, BS Pharm, BCPS AQ ID
Noelle RM Chapman, PharmD, BCPS, FASHP
Milena McLaughlin, PharmD, MSc, BCPS, AAHIVP
Michael Ison, MD

Evaluation of the Safety and Efficacy of Valganciclovir Twice Weekly Dosing in Kidney Transplant Patients with Impaired Graft Function

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The speaker has no actual or potential conflict of interest in relation to this presentation

2015 Residency Project Pearls:
Accuracy and impact of a penicillin allergy label on hospitalized patient outcomes

Sara Vu, PharmD
September 12, 2015

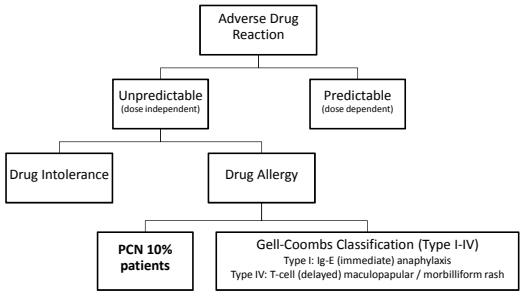
Conflict of Interest:

The speaker has no actual or potential conflict of interest in relation to this presentation.

Swedish Covenant Hospital
Chicago, IL
Community teaching hospital: 312 beds
Average daily census: 230

How often has a penicillin (PCN) allergy prevented you from using the drug of choice in a patient?

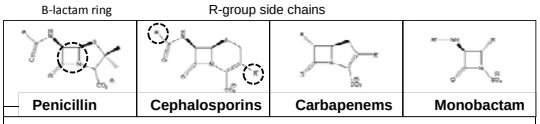
Most Common Allergy: Penicillin



Ann Allergy Asthma Immunol. 2010 Oct;105(4):259-273, e78.

Mechanism and Risk of Cross Reactivity

B-lactam ring R-group side chains



Penicillin	Cephalosporins	Carbapenems	Monobactam

Cross Reactivity between PCN and other B-lactams			
0.5% to 2.5% First & second generation cephalosporins	Less then 1% Third & fourth generation cephalosporins	0.3% to 4.3% carbapenems	0% monobactam

Amino-PCNs that Share Identical R_1-Group Side Chains with Cephalosporins	
Amoxicillin Cefadroxil Cefprozil	**Ampicillin** Cefaclor Cephalexin

Adapted from: J Allergy Clin Immunol 2010;125(Suppl):S126–S137.
Clin Infect Dis. 2014;59(8):1113.
J Emerg Med 2012; 42:612–20.
Ann Pharmacother. 2009 Feb;43(2):304-15.

Implications of PCN Allergy Label

- Electronic Health Record (EHR) Incentive Program
  - Stage 3 Meaningful Use Standards, 2016
    - Define drug allergy
    - Define intolerance
    - Define condition
- "PCN allergy" label associated with
  - Antibiotics
    - Broad spectrum: vancomycin, fluoroquinolones
    - *C. difficile* associated: clindamycin, fluoroquinolones
  - Increased rates of VRE, MRSA, *C. difficile*
  - Longer hospital days and greater admissions to the ICU

EHR Incentive Programs. Centers for Medicare and Medicaid Services.
J Allergy Clin Immunol 2014 Mar; 133(3):790-6.
J Allergy Clin Immunol Pract. 2013 May-Jun;1(3):252-7.
Pharmacotherapy. 2011 Aug;31(8):742-7.
Arch Intern Med. 2000 Oct 9;160(18):2819-22.

Research:

Accuracy and impact of a penicillin allergy label on hospitalized patient outcomes

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Objectives

The objectives of this study were to:

1) Assess the accuracy of penicillin allergy documentation
2) Assess the impact a PCN allergy label has on patient outcomes

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Study Design

- Retrospective, case-control study
  - Matched PCN allergic (case) to non-PCN (control)
    - ICD-9 discharge diagnosis
    - Age group
    - Sex
- EHR System
  - Query all patients who received antibiotic
    - Patient medical record number & visit number
    - Patient age
    - Drug allergies
    - Antibiotics prescribed

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Study Design

Inclusion Criteria

- Age ≥ 18
- Received IV or PO antibiotic
- Admitted January 1, 2013 – March 31, 2013

Exclusion Criteria

- Ophthalmic and topical antibiotics
- Only received one antibiotic dose in ED
- Admitted to same day surgery or obstetrics units

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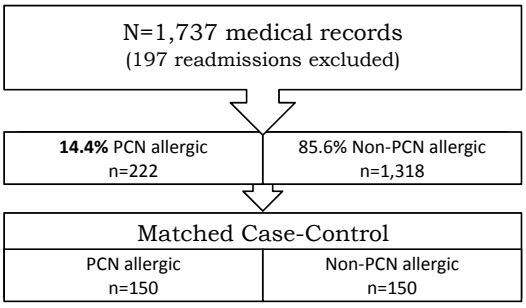
Study Design



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Study Design

Part one: 222 EHRs assessed for accuracy of PCN allergy documentation

Part two: PCN allergic vs. Non-PCN

Primary Endpoint: Hospital LOS

Secondary Endpoints: ICU LOS; MRSA; *C. difficile*

Statistical Analysis

- Dichotomous or binary variables were analyzed via chi-squared tests.
- Continuous variables were analyzed via two-tailed t-tests.
- A result was considered to be statistically significant if the p-value was < 0.05.

PCN Allergy Documentation

14.4% with Documented Penicillin Allergy (n=222)	
Allergic description – absent 60.3%	
Allergic description – present 39.2%	
"Anaphylaxis"	29 (13.0%)
"Skin rash" or "hives"	24 (10.8%)
"Itchiness" or "swelling"	15 (6.8%)
"Childhood allergy"	9 (4.1%)
"Nausea / vomiting" or "diarrhea"	6 (2.7%)
"Fast heart rate" or "I pass out"	4 (1.8%)
Adverse reaction – present 0.5%	
"Diarrhea"	1 (0.5%)
Severity of reaction – absent 48.6%	
Severity of reaction – present 51.4%	
Mild	41 (18.5%)
Intermediate	32 (14.4%)
Severe	41 (18.5%)

Patient Characteristics

	PCN Allergic n = 150	Non-PCN n = 150
Female, # (%)	136 (61.2%)	136 (61.2%)
Age, avg. (Range)	70.3 (21-103)	69.8 (20-103)

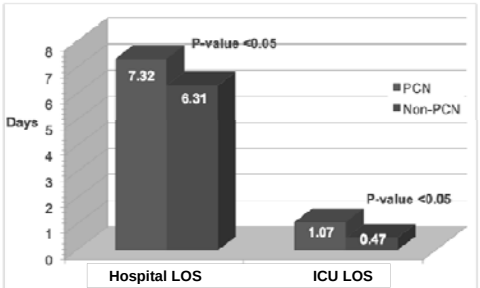
Matched Discharge Diagnosis

# Pts	ICD-9 Discharge Diagnosis	
30	590-595:	Pyelonephritis, Cystitis
24	480-486:	Pneumonia, NOS
21	038.9:	Septicemia, NOS
18	681-682:	Cellulitis/abscess
12	288.6:	Leukocytosis
12	490,493,496:	Bronchitis, Asthma, COPD
9	995.9:	SIRS, Sepsis
5	428.0:	Congestive heart failure
4	562,574:	Diverticulitis, cholelithiasis
15	Various:	Malignancy, OA, etc.

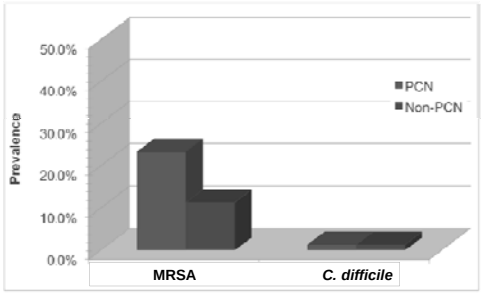
Antibiotic Exposure

	PCN Allergic n=150	Non-PCN n=150	P-value
Avg. # antibiotics (range)	1.99 (1-7)	2.15 (1-8)	0.48
Vancomycin, linezolid	**70**	**67**	**0.73**
Clindamycin	**15**	**4**	**<0.01**
Fluoroquinolone	**95**	**73**	**0.015**
Aztreonam	31	0	<0.0001
Penicillin	10	37	<0.0001
Cephalosporin	25	85	<0.0001
Carbapenem	10	14	0.39
Metronidazole	9	8	0.80
Azithromycin	11	16	0.31
Other (aminoglycosides, daptomycin, doxycycline, micafungin)	14	6	0.06

Primary & Secondary Endpoint



Secondary Endpoints



Primary & Secondary Endpoints

	PCN Allergic n=150	Non-PCN n=150	P-value
Hospital LOS, avg. (SD)	7.32 (5.67)	6.31 (4.26)	<0.05
ICU LOS, avg. (SD)	1.07 (3.23)	0.47 (1.69)	<0.05
# Patients admitted to ICU	26 (17.3%)	15 (10%)	0.06
MRSA prevalence	35 (23.3%)	17 (11.3%)	<0.01
C. difficile prevalence	2 (1.3%)	2 (1.3%)	No diff.

Limitations

- Small sample size, limited by match and time spent on data collection
- Confounding variables (comorbidities and severity of illness)

Study Conclusions

- Need for improving penicillin allergy documentation was identified.
- PCN allergy associated with longer hospital and ICU LOS
- PCN allergy associated with increase prevalence of MRSA but not *C. difficile*

Next Steps

- Guideline for the Use of Cephalosporins and Carbapenems in Patients with Reported Penicillin Allergy
  - PCN Allergy Questionnaire
  - Treatment Algorithm
- February 2015: Antimicrobial Stewardship Committee
- March 2015: P&T and the Medical Executive Committee
- March 2015: Nurse Counsel Meeting

Patient Case

March 10, 2015

A 72 yo **PCN allergic** male was admitted with infected **RLE calf wound**. The patient's wound began in November and since then he has been hospitalized two times in the past two months for surgical debridement & IV antibiotics. Pt was empirically started on:

Vancomycin
Aztreonam

Patient Case

March 13, 2015

Wound culture:

	PS AERUG		E COLI	
	M.I.C.	RX	M.I.C.	RX
AMIKACIN	<=16	S	<=16	S
AMP/SULBAC			>16/8	R
AZTREONAM	16	I		
CEFAZOLIN			<=8	S
CEFEPIME	8	S	<=4	S
CEFTAZIDIN	8	S	<=1	S
CEFTRIAXON			<=1	S
CEFUROXIME			<=4	S
GENTAMYCIN	<=4	S	>8	R
IMIPENEM	2	S	<=1	S
LEVOFLOXACIN	>4	R	>4	R
MEROPENEM	<=1	S	<=1	S
PIPERACILLIN/TAZ	>64	R	<=16	S
* TOBRAMYCIN	<=4	S		
TRIME/SULF			>2/38	R

Guideline for the Use of Cephalosporins and Carbapenems in Patients with PCN Allergy:
Questionnaire

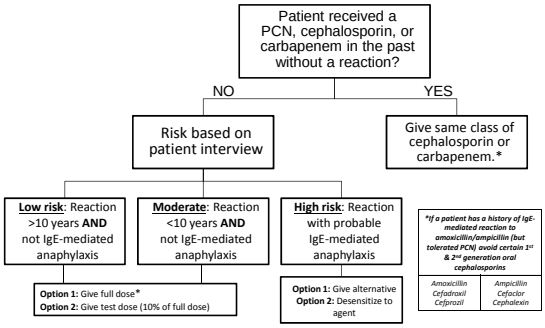
1. How long ago did you have the allergic reaction to PCN?
2. What allergic symptoms did you experience?
3. Has the patient received a PCN, cephalosporin, or carbapenem in the past without a reaction?
4. How was the PCN administered? (Oral vs. IV?)
5. How long after beginning PCN did your reaction occur? *(Immediate vs. delayed?)*
6. If a rash occurred, where was it located and what did it look like? *(Rash on face/mouth, blistering or exfoliative?)*
7. Did you take any other medications at the same time?
8. Did you receive treatment for the PCN allergic reaction?
9. What happened when the PCN was stopped?
10. Have you ever received a PCN skin test?

Patient Case

Patient interview:

- Occurred in college (> 40 years ago)
- Diffuse rash located on body
- Unsure of exposure to amoxicillin, cephalexin, or other B-lactam antibiotics
- Denies previous PCN skin test

Guideline for the Use of Cephalosporins and Carbapenems in Patients with PCN Allergy:
Treatment Algorithm



Self-Assessment Question #1

A 29 yo female patient with history of rash from amoxicillin returns to the ED with UTI after failing treatment with nitrofurantoin. The physician would like to discharge the patient and asks for your recommendation.

Urine cx - *E. coli*
- (R) Ciprofloxacin
- (I) TMP-SMX
- (S) Ampicillin
- (S) Cefazolin

Which antibiotic would be the best option for this patient?

a. Nitrofurantoin PO
b. Cefpodoxime PO
c. Levofloxacin IV
d. Imipenem/cilastatin IV

Self-Assessment Question #2

What is the risk of cross-reactivity between penicillin and third & fourth generation cephalosporins?

a. >10 %
b. 3 – 4 %
c. 1 – 2 %
d. < 1 %

References

1. Solensky R, Khan DA, Bernstein IL, et al. Drug allergy: An updated practice parameter. Ann Allergy Asthma Immunol. 2010 Oct;105(4):259-273, e78.
2. Khan DA, Solensky R. Drug allergy. J Allergy Clin Immunol 2010;125(Suppl):S126–S137.
3. Pichichero ME, Casey JR. Safe use of selected cephalosporins in penicillin-allergic patients: a meta-analysis. Otolaryngol Head Neck Surg 2007;136:340–7.
4. Campagna JD, Bond MC, Schabelman E, Hayes BD. The use of cephalosporins in penicillin-allergic patients: A literature review. J Emerg Med 2012; 42:612–20.
5. Kula B, Djordjevic G, Robinson JL. A systematic review: can one prescribe carbapenems to patients with IgE-mediated allergy to penicillins or cephalosporins? Clin Infect Dis 2014; 59:1113.
6. Frumin J, Gallagher JC. Allergic cross-sensitivity between penicillin, carbapenem, and monobactam antibiotics: what are the chances? Ann. Pharmacother. 2009;43:304–315.

References

7. EHR Incentive Programs. Centers for Medicare and Medicaid Services. http://www.cms.gov/Regulations-and-Guidance/Legislation/EHRIncentivePrograms/index.html?redirect=/EHRIncentivePrograms/01_Overview.asp (Accessed on November 6, 2014)
8. Macy E, Contreras R. Health care use and serious infection prevalence associated with penicillin "allergy" in hospitalized patients: A cohort study. J Allergy Clin Immunol 2014 Mar; 133(3):790-6.
9. Picard M, Bégin P, Bouchard H et al. Treatment of patients with a history of penicillin allergy in a large tertiary-care academic hospital. J Allergy Clin Immunol Pract. 2013 May-Jun;1(3):252-7.
10. Charneski L, Deshpande G, Smith SW. Impact of an antimicrobial allergy label in the medical record on clinical outcomes in hospitalized patients. Pharmacotherapy. 2011;31:742–747.
11. Lee CE, Zembower TR, Fotis MA, et al. The incidence of antimicrobial allergies in hospitalized patients: implications regarding prescribing patterns and emerging bacterial resistance. Arch Intern Med 2000;160:2819-22.

Questions?

Medication errors in hospitalized patients with HIV: Impact of prospective review by an on-call pharmacy resident

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Speaker has no conflicts of interest to dislose

Background

- Antiretroviral therapy (ART) has transformed HIV into a chronic, manageable condition
- 26 antiretroviral agents belonging to six different drug classes
- Maintaining a high level of adherence to ART is critical for virologic suppression and preservation of the immune system
  - A medication adherence rate of 95% is recommended

Ann Pharmacother.2014;48(8):998-1010
DHHS guidelines. 2014
J Antimicrob Chemother.2005;55:413-416

ART Error Rates

- Hospitalized patients with HIV: **5.8% to 86%**
  - Most errors occur **on admission**
- Incorrect inpatient ART therapy may be unintentionally continued at discharge
- Outpatient medication lists within the electronic medical record may not accurately reflect a patient's current ART regimen
  - **Accurate medication reconciliation on admission is critical in preventing medication errors** as patients move through care transitions

Ann Pharmacother.2014;48(8):998-1010

Review of Literature

Source No. pts	Description of study	Duration	No. pts with medication errors in the control group
Eginger et al, 2013 N= 86	Pharmacy resident reviewed admission orders of HIV-positive patients and intervened on ART and opportunistic infection (OI) prophylaxis prescribing errors	6 months	47/86 (55%)
Daniels et al, 2012 N = 68/78	Evaluation of rate of ART and OI prophylaxis errors, pre and post implementation of targeted intervention and daily review by clinical pharmacist trained in HIV care (admission to discharge)	4 months	49/68 (72%)
Corrigan et al, 2010 N= 21/20	A clinical ID pharmacist assessed medication errors 48 hours after admission, before and after a pharmacist-led medication reconciliation process	6 months	11/21 (52.4%)

Purpose

- To evaluate the impact of prospective medication reconciliation by an on-call pharmacy resident (ROC) on ART medication errors

Study Setting

- Rush University Medical Center (Chicago, IL)
- 677 beds
- An average of 40 HIV + patients admitted each month
- Most ART agents on formulary, with policies allowing patients to use their own supply if needed

RUMC Pharmacy ROC Program

Residents

- 8 PGY1s
- 6 PGY2s
  - 3 Critical Care
  - 1 Infectious Disease
  - 1 Heme/Onc
  - 1 Transplant

Responsibilities

- 24-hour code blue & rapid response coverage
- Overnight acute stroke/tPA evaluation pager coverage
- Overnight approval of restricted anti-infective agents
- Overnight kinetics follow-up and evaluation of all new orders for aminoglycosides and vancomycin for ICU and Heme/Onc patients
- Weekend INR follow-up for ortho patients

Current Practice

- Evaluation of ART orders is done by the pharmacist assigned to verify orders for that unit
- Medication histories are performed as time permits by both pharmacists and pharmacy students
- If discrepancies are identified, the pharmacist covering the unit will reach out to the primary medical team via phone/page or in person to discuss recommendations

Limitations and Consequences

- Limitations
  - Not all patients have a medication history obtained by a pharmacist/ pharmacy student
  - Hospitalized patients with HIV may not be seen by an infectious disease specialist
- Consequences
  - Incorrect ART regimen continued throughout the patients stay→ Incorrect discharge prescriptions
    - Increased viral load→ Increased risk of transmission
    - Decreased CD4 cell count→ Development of OIs
    - Development of resistance to drug(s)/drug class(s)
      - Limitation of future treatment options
    - Decreased overall health and survival

Self Assessment - Question 1

Which of the following events may occur if an incomplete ART regimen is administered to a patient during their hospital stay?

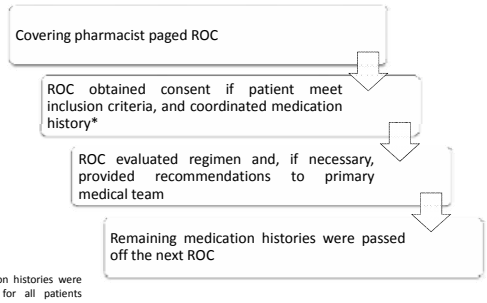
a) Increase in CD4 cell count
b) Increase in viral load
c) Prevention of opportunistic infections
d) Decreased development of resistance

Methods

- Study design
  - Two phase study

Phase 1: Pre-intervention phase (09/10/2014 – 11/30/2014)	Phase 2: Intervention phase (12/1/2014 – 02/28/2015)
• Retrospective cohort study in order to establish the incidence of ART and OI prophylaxis medication errors prior to implementation of ROC participation in ART-focused medication reconciliation	• The pharmacy ROC coordinates completion of a medication history with subsequent medication reconciliation for ART and OI prophylaxis agents ordered for hospitalized patients with HIV

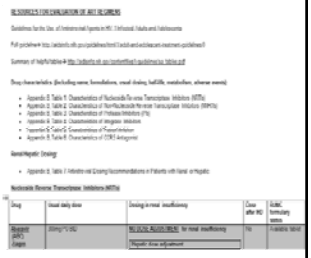
Intervention Phase



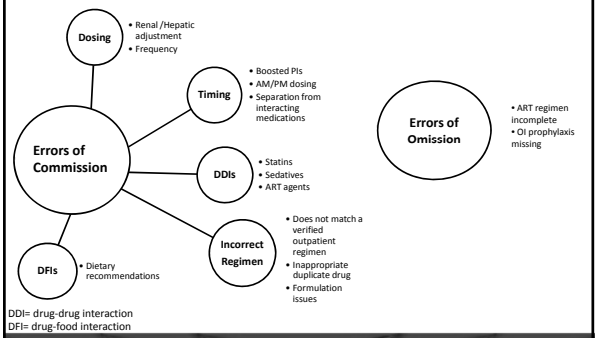
* Medication histories were preformed for all patients regardless of consent status

Training

- Live teaching session
- Orientation to DHHS guidelines and other resources
- Distribution of materials



Regimen Evaluation



DDI= drug-drug interaction
DFI= drug-food interaction

Study Population

- Hospitalized adult patients with HIV who have orders for ART with or without OI prophylaxis agents

Inclusion	• Adults ≥ 18 years of age • Patients administering ART for the treatment of HIV/AIDS prior to admission
Exclusion	• Patients seen in the emergency department but not admitted • Unable to take oral meds • Pregnant or breastfeeding • Admitted for a psychiatric related diagnosis • No consent provided (interventional phase)

Study Endpoints

- Primary: Proportion of resolved ART medication errors in hospitalized patients with HIV prior to and after implementation of prospective review by a pharmacy ROC
- Secondary: Specific types of ART and OI prophylaxis errors and time to error correction

Statistics

- Statistical analysis performed using SPSS statistical software (version 22)
- Continuous data
  - Normally distributed: Student's t-test
  - Non-normally distributed: Mann-Whitney U
- Nominal and ordinal data
  - Fisher's exact test
  - Chi-square

Baseline Characteristics

Demographics	Preintervention phase (n=40)	Intervention phase (n=40)
Age, years, mean(SD)	47.6 (13.5)	51.0 (10.0)
Sex, male, n(%)	25 (62.5)	32 (80.0)
Race, n(%)		
African American	33 (82.5)	27 (67.5)
Caucasian	4 (10.0)	11 (27.5)
Hispanic/Latino	3 (7.5)	2 (5.0)
Estimated CrCl ml/min, mean (SD)	76.4 (39.9)	74.7 (35.1)
Hemodialysis, n(%)	5 (12.5)	3 (7.5)
CD4+ cell counts ,cells/mm³, mean(SD)	347 (273)	438 (333)
CD4+ cell %, mean(SD)	23.9 (15.0)	27.7 (16.0)
Mean (SD) HIV-1 RNA conc, log10 copies/mL	2.44 (1.5)	2.67 (1.5)
No. (%) patients with undetectable HIV RNA conc.	26 (65.0)	23 (57.5)
Length of Stay, days, mean(SD)	5.9 (5.1)	5.6 (4.0)
Hospital location, n(%)		
General medicine floor	26 (65.0)	24 (60.0)
Surgery	5 (12.5)	3 (7.5)
Intensive Care Unit	8 (20.0)	9 (22.5)
Hematology/oncology	1 (2.5)	4 (10.0)
ID consult with in 48 hours of admission, n(%)	13 (32.5)	14 (35.0)

Results: Error Resolution

ART Error Evaluation				
	Pre-intervention (n=40)	Intervention (n=40)	Mean difference, % (95% CI)	p-value
Patients with ART error(s), n (%)	18 (45.0)	20 (50.0)	n/a	0.654
Total number of ART errors	30	40	n/a	0.348
ART proportion resolved errors, %	46.7	82.5	-53.4 (-79.77 to -26.96)	<0.001
OI Prophylaxis Error Evaluation				
Patients with OI error(s), n (%)	8 (20.0)	8 (20.0)	n/a	1.000
Total number of OI prophylaxis errors	11	10	n/a	0.506
OI ppx proportion resolved errors, %	54.5	70.0	12.5 (-51.75 to 26.75)	0.506

Results: ART Error Type

	Preintervention (n=40)	Intervention (n=40)	Total (n=80)	p-value
Type of ART error, n (%)				
Omitted drug	6 (15.0)	6 (15.0)	12 (16.3)	0.625
Regimen does not match outpatient therapy	10 (25.0)	8 (20.0)	18 (22.5)	0.592
Dosing error	3 (7.5)	6 (15.0)	9 (11.3)	0.481
Renal dosing error	0 (0.0)	4 (10.0)	4 (5.0)	0.116
Hepatic dosing error	1(2.5)	0 (0.0)	1(1.3)	1.000
Frequency error	6 (15.0)	4 (10.0)	10 (12.5)	0.499
Timing error	9 (22.5)	8 (20.0)	17 (21.3)	0.785
Duplication error	1 (2.5)	0 (0.0)	1 (1.3)	1.000
Drug-drug Interaction	4 (10.0)	8 (20.0)	12 (15.0)	0.210
Drug-food interaction	0 (0.0)	0 (0.0)	0 (0.0)	n/a
Formulation Error	0 (0.0)	1 (2.5)	1 (1.3)	1.000

Results: OI Prophylaxis Error Type

	Pre-intervention (n=40)	Intervention (n=40)	Total (n=80)	p-value
Type of OI prophylaxis error, n (%)				
Omitted drug	3 (7.5)	2 (5.0)	5 (6.3)	0.473
Dosing error	4 (10.0)	7 (17.5)	11 (13.8)	0.505
Renal dosing error	0 (0.0)	0 (0.0)	0 (0.0)	n/a
Hepatic dosing error	0 (0.0)	0 (0.0)	0 (0.0)	n/a
Frequency error	2 (5.0)	5 (12.5)	7 (8.8)	0.432
Duplication error	1 (2.5)	1 (2.5)	2 (2.5)	1.000
Drug-drug interaction	0 (0.0)	0 (0.0)	0 (0.0)	n/a
Drug-food interaction	0 (0.0)	0 (0.0)	0 (0.0)	n/a
Formulation Error	0 (0.0)	0 (0.0)	0 (0.0)	n/a

Results: Time to Resolution

ART regimen	Preintervention (n*=18)	Intervention (n*=20)	P-value
Time to resolution of errors, n (%)			
<24 hours	3 (16.7)	10 (50.0)	0.031
< 48	6 (33.3)	17 (85.0)	0.001
Never	10 (55.6)	2 (10.0)	0.003

OI regimen	Preintervention (n*=16)	Intervention (n*=9)	P-value
Time to resolution of errors, n (%)			
<24 hours	12 (75.0)	5 (55.6)	0.394
< 48	12 (75.0)	6 (66.7)	0.673
Never	1 (6.3)	2 (22.2)	0.530

*n= patients with ≥ 1 medication error

Study Limitations

- Single center
- Patients may have been missed due to pharmacist not notifying the ROC
- Errors of omission may have been underestimated
- Time to evaluate regimens was not captured
- Possible inconsistencies in the knowledge, skills and interventions of the residents
- Differences in errors based on regimen type were not evaluated
- Pre intervention group was a retrospective cohort study

Conclusion

- ART prescriber errors are common and a pharmacist focused on managing these errors can have a major impact on both decreasing error rates and time to resolution of errors
- ROC participation in ART focused prospective medication reconciliation significantly increased the proportion of resolved ART errors in the interventional group vs. the pre-intervention group [33/40 (82.5%) vs. 14/33 (46.7%), respectively]
- A significantly greater proportion of patients with ART errors had a resolution of errors within 48 hours in the interventional group vs. the pre-intervention group [17/20 (85.0%) vs. 6/18 (33.3%), respectively]
- Implementation into a pharmacy residency program provides benefit to patients, providers, and residents

Next Steps

- Continuation of medication histories targeted towards HIV patients admitted on ART therapy
  - Workflow and ROC involvement to be determined
- Changes to electronic physician order entry to minimize common preventable errors
  - Timing of PIs to coincide with ritonavir
  - Darunavir 600mg dosing to default to BID dosing
  - Drug interaction alert to fire when rilpivirine ordered with H2RAs or PPIs
- Incorporation of ART and OI prophylaxis dosing tables into an anti-infective stewardship handbook that is currently in progress

Self Assessment - Question 2

During which of the following time points of a patients hospital stay do most ART medication errors occur?

a) Admission
b) Unit transfer
c) Room change
d) Discharge

Acknowledgements

- Amy Hanson, PharmD, BCPS
- Paul O'Donnell, PharmD, BCPS
- 2014-2015 RUMC Pharmacy Residency Class

PGY1s	PGY2s
Rachel Dobersztyn, PharmD	Abeer Ammar, PharmD, BCPS
Sabrina Grandi, PharmD	Timothy Cober, PharmD, BCPS
Ian Karall, PharmD	Srijana Jonchhe, PharmD, BCPS
Ken Kurek, PharmD	Heather LaRue, PharmD, BCPS
Elizabeth Messana, PharmD	Tristan O'Driscoll, PharmD, MPH, BCPS
Zachary Schlei, PharmD	Eris Tollkuci, PharmD
Lana Wong, PharmD	

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