

Implementation of a Pharmacist-led Antiretroviral Stewardship Program at an Academic Medical Center

Aja Badgeley, PharmD, Amanda Binkley, PharmD AAHIVP, Jessica Wallauer, PharmD, William R. Short, MD, MPH
Penn Medicine, Penn Presbyterian Medical Center, Philadelphia, PA

Background

People living with human immunodeficiency virus (PLWH) are on multiple medications and management of their medications is complex

- As PLWH age, they are at an increased risk for comorbidities¹
- 24.4% of PLWH take at least 5 non-antiretroviral (ARV) medications²
- ARV medications have a high potential for drug interactions¹

Inpatient ARV medication error rates have been identified to be as high as 86%^{1,3-4}

- Transitions of care
- Alert fatigue
- Provider unfamiliarity with human immunodeficiency virus (HIV)
- Rapidly evolving guidelines and recommendations

Objectives

Primary endpoint

- Optimize patient medication regimens to ensure appropriate ARV drug delivery

Secondary endpoints

- Decrease the time to resolution of ARV and medication optimization
- Identify risk factors for ARV medication optimization
- Determine the number of patients with ARV prescriptions filled by the hospitals outpatient pharmacy

Study Design

	Retrospective Cohort	Prospective Cohort
Dates	October 1, 2019 to February 28, 2020	October 1, 2020 to February 28, 2021
Inclusion	Patients at least 18 years of age Admitted to Penn Presbyterian Medical Center during study dates HIV-positive on ARV therapy	
Exclusion	Not on ARV therapy	
Interventions	Standard of care	Standard of care PLUS Pharmacist verification resources Pharmacy staff education Daily prospective chart review Discharge counseling Referral to outpatient pharmacy

Pharmacist Verification Checklist

PHARMACIST ARV VERIFICATION CHECKLIST	
ART Regimen	
☐ Ensure the accurate home regimen has been ordered	
☐ Check dispense report	
☐ Check if patient is followed by a Penn Medicine provider outpatient	
☐ For protease inhibitors (“-navir”)	
☐ Verify that they are co-administered with a booster (ritonavir, cobicistat)	
☐ If no information available on Epic, confirm accuracy of regimen with patient or provider	
Dosing	
☐ Check renal function and verified accurate dosing	
☐ Clinical pearl: lamivudine has been found to be well-tolerated across various degrees of renal impairment and is often administered at doses higher than those listed in the package insert	
Administration	
☐ Verify appropriate route of administration	
☐ If the medication needs to be crushed, check “ART Do Not Crush List”	
☐ Verify appropriate timing with regards to meals	
Drug Interactions	
☐ Consult a drug interaction database (Liverpool HIV Drug Interaction Checker, Lexicomp®, Micromedex®, etc.)	
☐ Clinical pearls	
☐ Inhalers: ritonavir and cobicistat interact via CYP3A4 with inhaled corticosteroids and increase the risks associated with inhaled corticosteroids; consider beclomethasone as an alternative	
☐ Cations: integrase inhibitors (“-gravir”) must be separated from positive cations as concomitant administration can decreased integrase inhibitor concentration by as much as 80%	

Baseline Characteristics

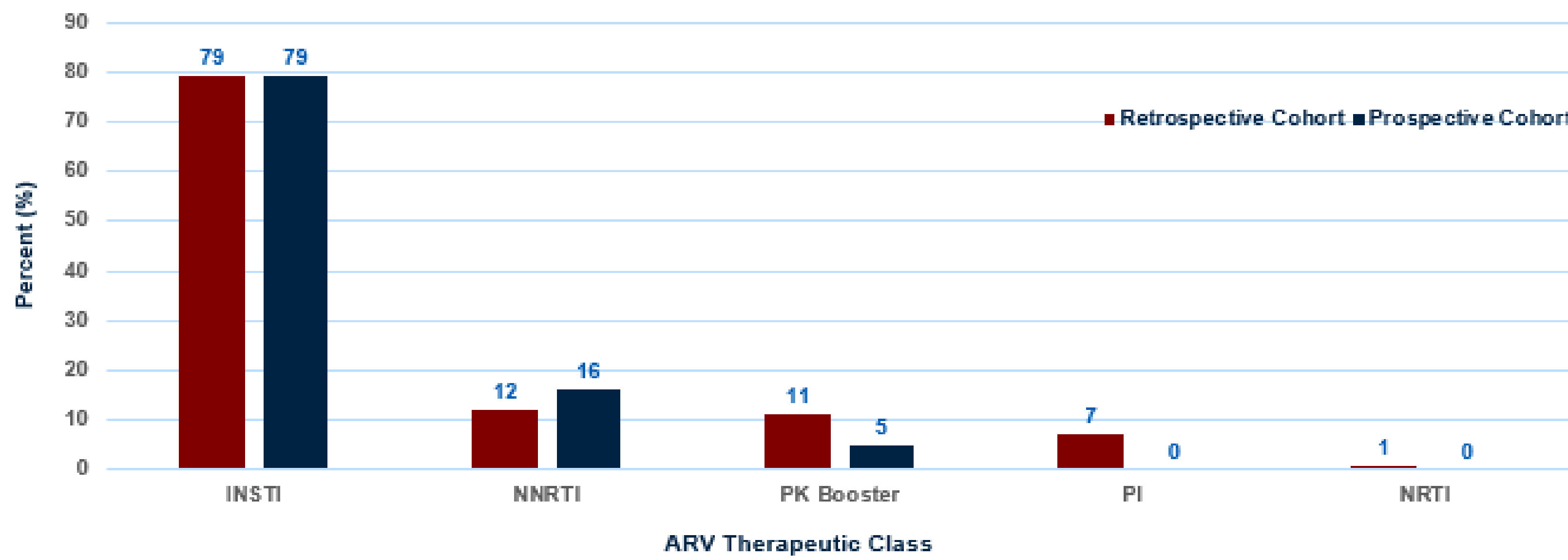
	Retrospective Cohort (n = 126)	Prospective Cohort (n = 150)
Total admissions– n	160	176
Median length of stay– days (IQR)	5 (3 – 8)	6 (3 – 10)
Median age– years (IQR)	57 (52 – 68)	54 (48 – 63)
Sex– n (%)		
Male	79 (63)	95 (63)
Female	47 (37)	55 (37)
Race– n (%)		
Black	105 (83)	127 (85)
White	12 (10)	17 (11)
Asian	4 (3)	0 (0)
Hispanic Latino	2 (2)	2 (1)
Unknown	3 (2)	3 (2)

	Retrospective Cohort (n = 160)	Prospective Cohort (n = 176)
Median CD4 count– cells/mm ³ (IQR)	478 (285 – 667)	367 (209 – 665)
Median CD4%– % (IQR)	30 (22 – 39)	26 (15 – 35)
Undetectable viral load (< 30 copies/mm ³)– n (%)	79 (50)	64 (36)
ARV class– n (%)		
NRTI	137 (86)	165 (94)
INSTI	128 (80)	145 (82)
NNRTI	46 (29)	24 (14)
PI	45 (28)	40 (23)
PK Booster	44 (28)	56 (32)
CCR5 Antagonist	2 (1)	2 (1)

INSTI – integrase inhibitor, NRTI – nucleoside/nucleotide reverse transcriptase inhibitors, NNRTI – non-nucleoside reverse transcriptase inhibitors, PI – protease inhibitor, PK Booster – pharmacokinetic booster

Results

Drug Interactions by Therapeutic Class



Drug interactions by therapeutic class=
$$\frac{\text{Total number of drug interactions involving a class}}{\text{Total number of drug interactions for all classes}} \times 100$$

INSTI – integrase inhibitor, NRTI – nucleoside/nucleotide reverse transcriptase inhibitors, NNRTI – non-nucleoside reverse transcriptase inhibitors, PI – protease inhibitor, PK Booster – pharmacokinetic booster

	Retrospective Cohort (n = 105)	Prospective Cohort (n = 19)
Drug interactions– n (%)		
Cations, H2RAs, PPIs, or sucralfate	91 (87)	18 (95)
Inhaled steroids	4 (4)	1 (5)
High-dose statins	3 (3)	0 (0)
Other	7 (7)	0 (0)

H2RAs – H2 receptor antagonists

PPIs – proton pump inhibitors

Discussion

Conclusions

- The majority of medication errors were drug interactions, primarily with cation medications, H2RAs, PPIs, and sucralfate
- INSTIs were the most common ARV class associated with drug interactions

Future Directions

- Daily prospective review by pharmacists initiated with standardized documentation
- Evaluation for optimization of Electronic Medical Record (EMR)
- Enhanced Education for all Providers of care

References

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