



# Pharmacist-led Interventions for Inpatient HIV-related Medication Errors

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## Background

- Inpatient HIV-related medication errors have been reported in rates between 5.8-86%
- Several studies have shown a decrease in HIV-related medication errors through a variety of interventions targeting the most common errors
  - Interventions reported in the literature include providing education; having ID-trained individuals performing medication reconciliations; providing prospective audit-with-feedback for ART; and updating the computerized physician order enter (CPOE) system and formulary
- The landscape of HIV-medication errors may be changing with first-line regimens having fewer pills, less drug interactions, and less frequent administration; therefore, evaluating current HIV-related medication errors is crucial in providing sustained decreases in ART and OI errors in the inpatient setting

## Methods

**Study Design and Objectives**  
Single center, quasi-experimental study with a pretest-posttest design. Institutional Review Board approval waived.

- Intervention**
- Basic ART- and OI-related education provided to pharmacists and internal medicine residents
  - A quick-reference sheet and electronic booklet provided following the presentation
    - Included ART dosing, dosing adjustments, drug interactions, and enteral administration recommendations
  - Prospective audit with feedback on weekdays

**Primary outcome:**

- ART-related medication errors pre- and post-intervention

**Secondary outcomes:**

- OI-related medication errors pre- and post-intervention
- Time to resolution of ART- and OI-related medication errors
- Types of errors

**Subjects**  
Patients admitted to the University of Mississippi Medical Center from December 1, 2014 to February 28, 2017 or December 1, 2017 to February 28, 2018.

Inclusion criteria	Exclusion Criteria
<ul style="list-style-type: none"> <li>≥18 years old</li> <li>HIV-positive inpatients</li> <li>First admission per patient during the study period</li> <li>Receiving either OI prophylaxis, ART, or both</li> </ul>	<ul style="list-style-type: none"> <li>Patients receiving antiretroviral agents for hepatitis B alone, such as lamivudine or tenofovir</li> <li>Patients enrolled in a study for investigational ARV medication</li> </ul>

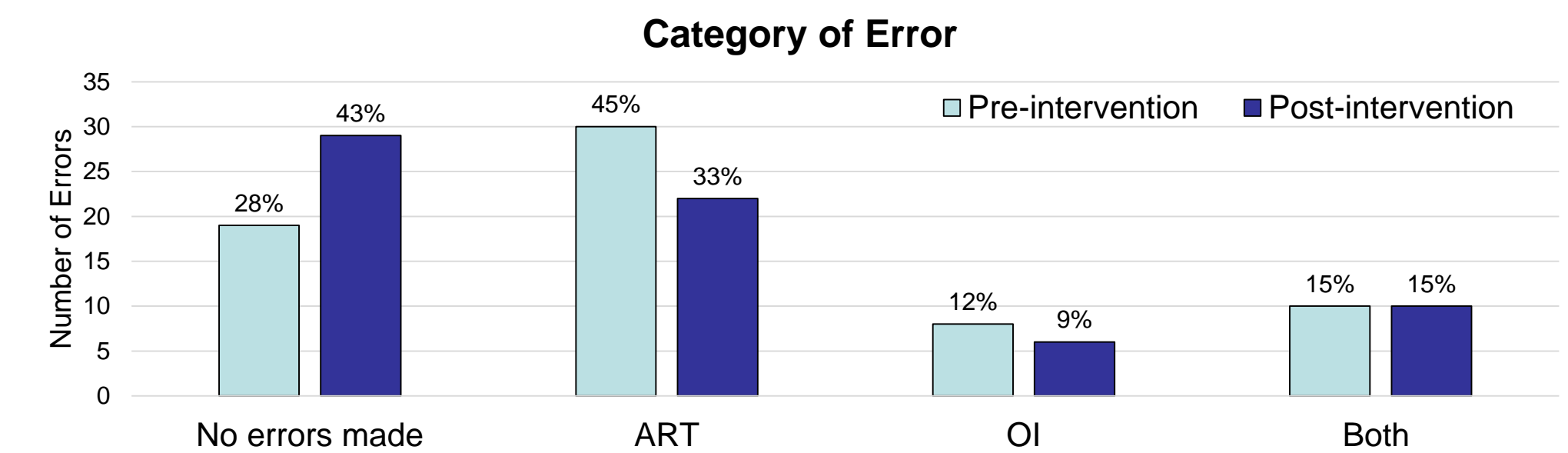
- Error Classification**
- Errors were classified by timing, source and type of error
    - Timing: admission, during hospitalization, discharge
    - Source: prescribing, dispensing, administering
    - Types: drug interactions, dosing errors, administration timing errors, drug omission, wrong drug, purposeful delay in therapy, incidental delay in therapy

**Analysis**  
Results were reported as proportions or medians [interquartile range (IQR)]. Comparisons between the pre-intervention and post-intervention group were performed using the Mann-Whitney U test for continuous variables and X<sup>2</sup> test or Fisher's Exact test for categorical variables. A p-value of < 0.05 was considered statistically significant. Statistical analyses were performed using SPSS (v. 24).

## Baseline Demographic Results

Variable	Total (n=134)	Pre (n=67)	Post (n=67)	P-value
Age in years, median (IQR)	46.5 (35-58)	40 (31-57)	50 (41-59)	0.002
Male, n (%)	78 (58.2)	34 (50.7)	44 (65.7)	0.080
Black, n (%)	110 (82.1)	57 (85.1)	53 (79.1)	0.367
Mild-moderate CKD, n (%)	19 (14.2)	6 (9)	13 (19.4)	0.083
Charlson comorbidity score, median (IQR)	6 (1-7)	6 (2-7)	6 (1-8)	0.971
ID consult, n (%)	54 (40.3)	32 (47.8)	22 (32.8)	0.078
CD4 count, median (IQR)	191 (48-394)	114 (30-376)	215.5 (77-399)	0.094
HIV viral load, median (IQR)	68 (0-46928)	242 (0-54077)	21.5 (0-12461)	0.040
ART-base, n (%)				
Not applicable	16 (11.9)	9 (13.4)	7 (10.5)	0.790
NNRTI	26 (19.4)	13 (19.4)	13 (19.4)	1.000
PI	21 (15.6)	13 (19.4)	8 (11.9)	0.342
INSTI	48 (35.8)	20 (29.9)	28 (41.8)	0.207
Other	23 (17.2)	12 (17.9)	11 (16.4)	0.819
OI Prophylaxis, n (%)				
Not applicable	65 (48.5)	28 (41.8)	37 (55.2)	0.120
PCP	66 (49.3)	36 (53.7)	30 (44.8)	0.300
<i>Toxoplasma gondii</i>	41 (30.6)	24 (35.8)	17 (25.4)	0.189
MAC	34 (25.4)	26 (38.8)	8 (11.9)	< 0.001

## Error Characteristics



Variable	Total (n=134)	Pre (n=67)	Post (n=67)	P-value
Error timing, n (%)				
Admission	64 (47.8)	34 (50.7)	30 (44.8)	0.489
During hospitalization	36 (26.9)	22 (32.8)	14 (20.9)	0.119
Source of error, n (%)				
Prescribing	69 (51.5)	37 (55.2)	32 (47.8)	0.387
Dispensing	9 (6.7)	3 (4.5)	6 (9)	0.492
Administration	24 (17.9)	14 (20.9)	10 (14.9)	0.367

- For both the pre- and post-intervention groups, errors occurred most often with the PI (23.1%) and NRTI (29.9%) classes
- Drug interactions were not common but occurred most frequently with PIs (4.5%)
- OI errors were less common than ART errors and occurred most frequently with PCP prophylaxis (21.6%)

## ART-Related Outcomes

Variable	Total (n=134)	Pre (n=67)	Post (n=67)	P-value
Rate of ART-related medication errors, n (%)	52 (38.8)	30 (44.8)	22 (32.8)	0.156
Time to resolution of ART- and OI-related medication errors in hours, median (IQR)	60 (28-120)	72 (43.5-156)	48 (25-96)	0.123
Rate of ART-related medication errors, n (%)	52 (38.8)	30 (44.8)	22 (32.8)	0.156

## OI Prophylaxis-Related Outcomes

Variable	Total (n=134)	Pre (n=67)	Post (n=67)	P-value
Rate of OI-related medication errors, n (%)	14 (10.4)	8 (11.9)	6 (9)	0.572

## Clinical Outcomes

Variable	Total (n=134)	Pre (n=67)	Post (n=67)	P-value
Error Type, n (%)				
DDI	10 (7.5)	5 (7.5)	5 (7.5)	1.000
Dosing	15 (11.2)	11 (16.4)	4 (6)	0.055
Administration	13 (9.7)	8 (11.9)	5 (7.5)	0.381
Incidental delay	20 (14.9)	7 (10.4)	13 (19.4)	0.146
Omissions	29 (21.6)	21 (31.3)	8 (11.9)	0.006
Wrong drug	23 (17.2)	14 (20.9)	9 (13.4)	0.252
Purposeful delay	26 (19.4)	10 (14.9)	16 (23.9)	0.190
Communication by provider type, n (%)		N=16	N=34	
Primary Teams	3 (7.3)	1 (6.3)	2 (5.9)	1.000
Consult Teams	28 (68.3)	14 (87.5)	14 (41.2)	0.002
Pharmacists	19 (46.3)	1 (6.3)	18 (52.9)	0.001
Error resolution, n (%)		N=48	N=38	
Error resolved during admission	57 (66.3)	24 (50)	33 (86.8)	< 0.001
Error not resolved during admission; resolved upon discharge	16 (18.6)	13 (27.1)	3 (7.9)	0.023
Error not resolved during admission; not resolved upon discharge	13 (15.1)	11 (22.9)	2 (5.3)	0.023
Hospital LOS in days, median (IQR)	4 (3-11)	4 (3-11)	4 (2-8)	0.168

## Conclusions

- No significant difference found in number of ART- or OI-related medication errors with basic education and prospective audit-with-feedback
- Significantly more errors were resolved during admission and were resolved 1 day faster
- Errors targeted during pharmacist-based education all numerically decreased except DDI (i.e. dosing, administration timing, and identifying incorrectly entered regimens)
- Number of pharmacist-based interventions significantly increased; acceptance was high
- Additional interventions are needed to further decrease inpatient HIV-related prescribing errors