

Healthcare Resource Utilization and Costs Associated with Switching First-line Antiretroviral Therapy Among HIV-1 Infected Patients in the United States

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ABSTRACT

Background: Initial antiretroviral therapy (ART) is modified for non-virologic failure reasons in many patients, and the healthcare resource utilization (HRU) and costs associated with these switches in the real world is not well understood.

Methods: Administrative claims data from the Optum Research and Impact National Benchmark Databases were utilized. Adult patients (≥18 years) with HIV-1 diagnosis code, and claim for an anchor agent of the protease inhibitor (PI) or non-nucleoside reverse transcriptase inhibitor (NNRTI) class in first-line ART between 01/01/2006 and 12/31/2015 were identified (see Fig. 1 for additional criteria). Patients with a claim for an anchor agent (PI or NNRTI) different from that in first-line ART were defined as switchers, with index date being date of first claim for new anchor agent. Switchers were matched to patients who did not switch (non-switchers) at 1:3 ratio using propensity score matching on patient and first-line ART characteristics. For non-switchers, date following corresponding duration of first-line ART in matched switcher was assigned as the index date. Per-patient-per-month (PPPM) all-cause HRU and costs (US dollars) during switch period (±15 days of index date) were compared descriptively.

Results: 11,302 patients met study criteria. Following matching, switcher (1,204) and non-switcher (3,612) groups were comparable on mean age (41.9 vs. 41.7 years), percent male (85.8% vs. 82.6%), percent commercial enrollee (96.0% vs. 95.8%), mean Quan-Charlson comorbidity index score (both 0.4), and mean ART pill burden (both 2.2) with standard difference less than absolute value of 10%. During switch period, switchers had higher mean PPPM ambulatory visits (2.30 vs. 1.26), emergency room visits (0.12 vs. 0.06), inpatient stays (0.04 vs. 0.01), and pharmacy fills (4.52 vs. 3.01) than non-switchers (all $P < 0.001$). Switchers also incurred greater mean PPPM costs during switch than non-switchers, with an additional \$2,261/month total cost, and \$1,031/month pharmacy cost.

Conclusions: The study gives a more complete view of the burden of switching initial ART with pharmacy costs driving this burden. Assuming some patients will switch regardless of the regimen selected, less expensive initial ART could reduce this burden further.

BACKGROUND

- The Department of Health and Human Service Guidelines recommend that the initial antiretroviral regimen should be carefully tailored for each individual to enhance adherence and to support long-term treatment success. However, first-line ART is often modified (switched) for reasons other than virologic failure (VF).
- Healthcare resource use and economic burden associated with first-line ART switch for non-VF reasons are not well understood.

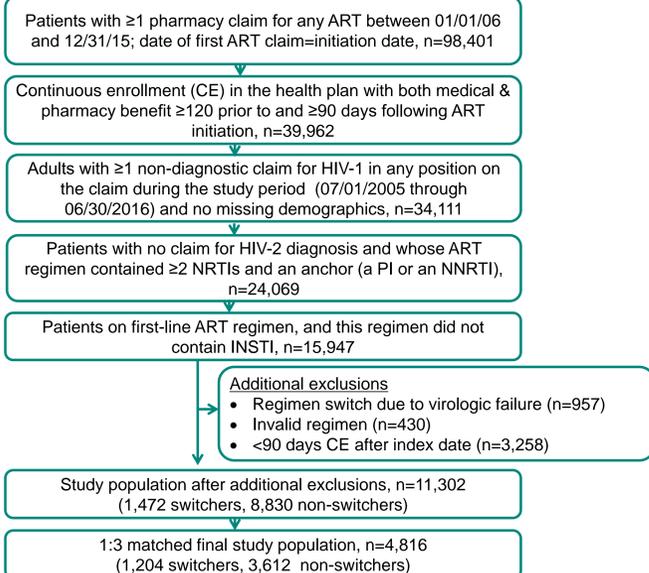
OBJECTIVE

- To compare healthcare resource utilization and costs in HIV-1-infected patients who switched first-line anchor agent for non VF reasons versus patients who did not switch.

METHODS

- Retrospective cohort study using administrative claims data of commercial and Medicare enrollees from the Optum Research Database (ORD) and the Impact National Benchmark Database (Impact).
- Adult patients (≥18 years) with ≥1 claim for HIV-1 infection and ≥1 claim for an anchor PI or NNRTI as first-line ART between 2006-2015 were included. Please see Figure 1 below for additional inclusion/exclusion criteria.

Figure 1. Identification of the Study Population



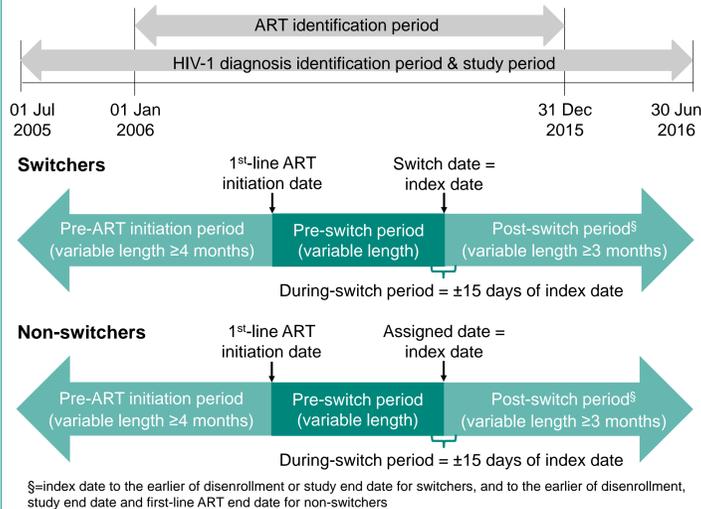
METHODS

- A switch was defined as change of anchor agent in first-line ART that occurred within 60 days of run-out-date (i.e., the last day covered by the last ART fill):
 - Change to and/or addition of anchor from a different ART class.
 - Change to and/or addition of a different anchor agent within the same class.
 - Changes within NRTIs and boosting agents were ignored.

- Patients who switched due to VF were excluded either based on observed HIV RNA viral load or predictive VF based on a published predictive model¹ (among patients with missing laboratory test results).
- Patients who switched (switchers) were matched to patients who did not (non-switchers) at 1:3 ratio using propensity score matching.

- Index date for switchers was date of first claim for a new anchor ART; for non-switchers, the index date was assigned so that the durations from first-line ART initiation to the index date were similar between switchers and non-switchers.
- Four time periods were used (Figure 2), and the outcomes were measured in pre-, during-, and post-switch periods.

Figure 2. Schema of Time Periods Used in the Study



- Costs were adjusted to 2015 U.S. dollars using the annual medical care component of the Consumer Price Index (CPI) to account for inflation.²
- The pre-, during-, and post-switch healthcare resource utilization and costs were compared between switchers and non-switchers using Rao-Scott chi-square statistics for categorical variables and robust variance estimators for continuous variables.
- All-cause total cost after excluding the cost of ART was analyzed with Blough et al.'s formulation of the traditional two-part model.³

RESULTS

Table 1. Patient demographics

	Switcher (N=1,204)	Non-switcher (N=3,612)	Standard Difference* (%)
Age, years, mean (SD)	41.74 (10.52)	41.88 (10.5)	1.31
Age category (years), n (%)			
18-44	728 (60.47)	2,175 (60.22)	-0.51
45-64	450 (37.38)	1,363 (37.74)	0.74
65+	26 (2.16)	74 (2.05)	-0.77
Geographic region, n (%)			
Northeast	283 (23.5)	912 (25.25)	4.06
Midwest	136 (11.3)	442 (12.24)	2.92
South	634 (52.66)	1,823 (50.47)	-4.38
West	151 (12.54)	435 (12.04)	-1.52
Sex, n (%)			
Female	209 (17.36)	514 (14.23)	-8.59
Male	995 (82.64)	3,098 (85.77)	8.59
Insurance type, n(%)			
Commercial	1,153 (95.76)	3,467 (95.99)	1.11
Medicare	51 (4.24)	145 (4.01)	-1.11

* A standardized difference of <10% indicates a good balance between the cohorts

RESULTS

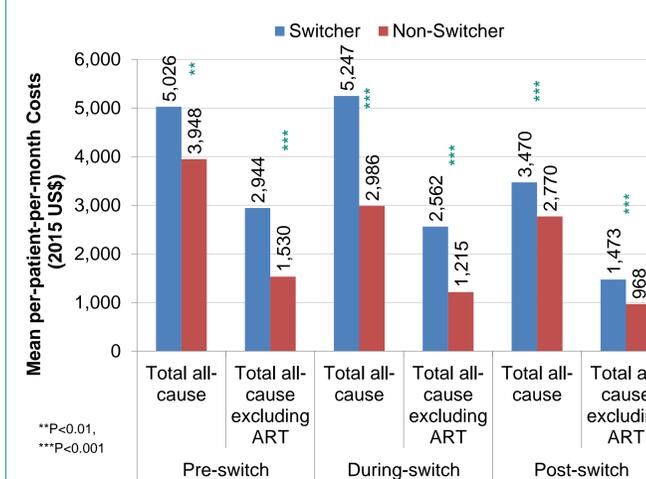
Healthcare Resource Utilization and Costs

Table 2. Per-patient-per-month Healthcare Resource Utilization

	Pre-switch period		During-switch period		Post-switch period	
	Switcher (n=1,204)	Non-switcher (n=3,612)	Switcher (n=1,204)	Non-switcher (n=3,612)	Switcher (n=1,204)	Non-switcher (n=3,612)
Per-patient-per-month count, mean (SD)						
Ambulatory visit	2.15 (2.17)	1.53 (1.88)	2.30 (2.61)	1.26 (1.96)	1.34 (1.39)	1.06 (1.21)
ER visit	0.14 (0.44)	0.07 (0.37)	0.12 (0.47)	0.06 (0.39)	0.08 (0.22)*	0.05 (0.18)*
Inpatient stay	0.05 (0.22)	0.02 (0.13)	0.04 (0.22)	0.01 (0.11)	0.02 (0.06)	0.01 (0.05)
Pharmacy fill	3.95 (3.11)*	3.79 (2.90)*	4.52 (3.18)	3.01 (2.64)	3.48 (2.59)	2.83 (2.15)
Pharmacy fill w/o ART	2.29 (2.74)	1.93 (2.49)	2.29 (2.79)	1.63 (2.30)	1.88 (2.23)	1.50 (1.91)

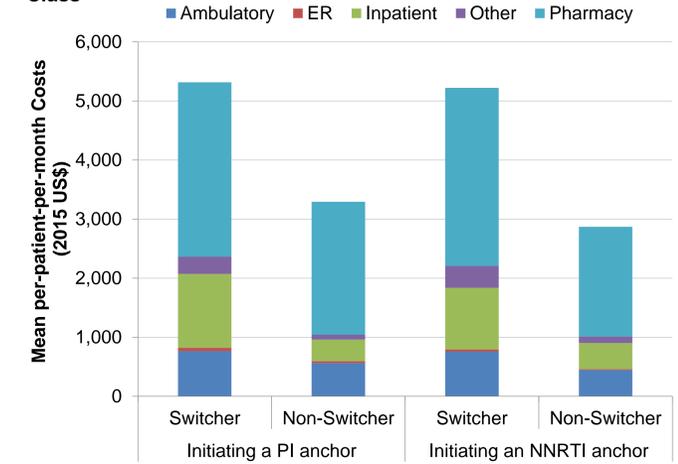
* $P < 0.05$, all others $P < 0.001$; ER=Emergency room; SD=standard deviation

Figure 3. All-cause Cost and All-cause Cost Excluding ART



- The largest difference in average monthly costs between the two cohorts was observed for during-switch period, \$2,261/month for all-cause and \$1,348/month for non-ART total costs (Figure 3).
- Switchers had nearly 4 times the odds of having a non-zero cost compared to non-switchers; among patients with non-zero cost, the average monthly cost for switchers was approximately 60% (cost ratio: 1.60, 95% CI: 1.22-2.10, $P < 0.001$) greater than that for non-switchers (data not shown).
- On average, switchers had greater monthly ambulatory, ER and inpatient visits, and pharmacy fills than non-switchers (Table 2).

Figure 4. During-switch Period: All-cause Cost by Initiating Anchor Class



- Among patients initiating a PI anchor, switchers incurred greater average monthly inpatient cost ($P < 0.05$), other medical cost ($P < 0.05$) and pharmacy cost ($P < 0.001$) than non-switchers.
- Among patients initiating an NNRTI anchor, switchers incurred greater average monthly ambulatory cost, ER cost, and pharmacy cost (all $P > 0.001$) than non-switchers.

LIMITATIONS

- Among patients without available laboratory results, a logistic regression model was used to predict virologic failure. VF defined using logistic model may lead to misclassification and inclusion of patients with VF.
- Patients may have been misclassified if they had ART fills prior to enrollment in the health plan.
- This study only included patients initiating a PI or NNRTI anchor, thus study results may not be applicable to patients initiating an INSTI.
- Due to lack of existing literature defining the length of during switch period, we used ±15 days of index date, but the actual switch period remains unknown.
- The study did not assess the reasons for non-VF switching.

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CONCLUSIONS

- Switchers had significantly greater healthcare resource utilization and incurred greater healthcare costs in the pre-switch, during-switch, and post-switch periods compared to non-switchers.
- It is important to select an optimal first-line ART regimen so that switching can be minimized and postponed.
- Assuming some patients will switch their first-line ART regimen, and ART cost as substantial, reducing the cost of initial ART regimen while improving its safety profile will achieve significant cost savings.

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