The Impact of Censoring Drug Switching in Medication Adherence Measures and Classifications of Chronic Non-combinational Oral Drugs

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ABSTRACT

Background: Estimates of the rate of drug switching may occur between different drugs, ingredients, or therapeutic classes range from 10-20% based on different definitions and diseases. However, drug switching has never been incorporated into medication adherence measures. We developed a medication adherence measure with censoring drug switching and studied the impact of drug switching on adherence measures and classifications in patients taking common chronic non-combinational oral medications.

Methods: Drug switching between ingredients having the same indication was detected within a 30-day grace period. A 365-day Proportion of days covered (PDC) for each ingredient was calculated and compared with or without censoring drug switching for each patient. PDC was classified as adherent (≥0.8) or non-adherent (<0.8). Paired T-test and Chi-square tests were applied to test the whether incorporating drug switching changed the population PDC or adherence status.

Results: In the Optum ClinFormatics database (Optum), 942,233 (17.2%) patients switched to different ingredient within one year among 5,365,644 eligible patients. When censoring switching, the mean PDC was slightly higher (0.84 vs. 0.82) and 279,355 (29.6%) patients changed adherence status. In the MarketScan Multi-state Medicaid database (MDCD), 158,258 (23.1%) patients switched to a different ingredient within one year among 684,102 eligible patients. When censoring switching, the mean PDC was slightly higher (0.82 vs. 0.80) and 60,124 (37.9%) patients changed adherence status.

Conclusions: Drug switching significantly affects medication adherence measures and classifications status.

BACKGROUND

- Drug switching is estimated at 10-12% based on different definitions and diseases
- Drug switching has never been incorporated into medication adherence measures

OBJECTIVES

- To incorporate drug switching into medication adherence measure
- To explore how drug switching impacts medication adherence measures and classifications in patients taking chronic non-combinational oral medications

METHODS

Data sources and setting

- Databases
  - the Optum ClinFormatics database (Optum)
  - the MarketScan Multi-state Medicaid database (MDCD)
- Database format
  - Observational Medical Outcomes Partnership Common Data Model (OMOP CDM)
- Data retrieve coding system: OMOP vocabulary

Studied ingredients and targeted diseases

- sulfonylurea
- biguanides
- thiazolinedione (TZD)

} hyperglycemia

- statin — hyperlipidemia
- beta-blocker (BB)
- angiotensin-converting-enzyme (ACE) inhibitor
- angiotensin II-receptor antagonist (ARB)
- calcium-channel blocker

} hypertension

Patient selection

- Patients who were dispensed any included chronic oral medications are eligible for this study
- Patients who took combinational drug were excluded
- Followed up 365 days from the index event of each ingredient for each patient

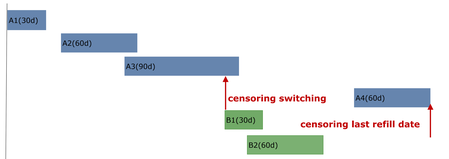
Ingredient switching definition

- A replacement ingredient initiated within 30 days of a previous ingredient terminated
- The previous ingredient has to be terminated within 30 days after the new therapy started
- Distinguish from drug augmentation: the existing ingredient NOT terminated within 30 days after the new therapy started
- Switching between ingredients having same indication
- Only count the first switching for each ingredient

Measurements

- Proportion of days covered (PDC) following up 365 days for each patient per ingredient
- $$PDC = \frac{\text{\# of total days of supply (without overlapped days)}}{\text{\# of days of the observation time period}}$$
- Censoring observation time period:
  - by the last date of last prescription, or
  - by the switching date
- Medication adherence classification
  - Adherent: PDC ≥ 0.8
  - Non-adherent PDC<0.8

PDC example



PDC without censoring switching= (30+60+(90-15) +60)/360=0.62

PDC with censoring switching= (30+60+(90-15)-15)/(30+15+60+(90-15-15)=0.91

Analysis

- Paired t-test was used to test the difference of patient PDC with/without censoring switching
- Chi-square test was performed to detect the difference of adherence classification with/without censoring switching

RESULTS

- 60 ingredients: 41 for antihypertensive, 11 for antihyperglycemic, and 8 for cholesterol lowering medication (Table 1)
- Eligible patients
  - Optum: 5,365,644
  - MDCD: 684,102
- Number of patients who had at least one switching (Table 2 & Figure 1)
  - Optum: 942,233 (17.6%)
  - MDCD: 158,258 (23.1%)
- Switching change adherence measure and classification (Table 2)
- PDC may either increase or decrease when censoring switching (Figure 2)
- Adherence status changed when censoring switching
  - Optum: 279,355 (29.6%)
  - MDCD: 60,124 (37.9%)

CONCLUSIONS

- Drug (ingredient) switching is frequently observed in patients who were dispensed common chronic non-combinational oral medications
- Censoring drug switching significantly affects medication adherence measures and classifications

Table 1. Top five commonly used ingredients for hypertension, hyperlipidemia, or hyperglycemia

	Optum (N, %)			MDCD (N, %)	
Antihypertensive	3,846,879	71.70%		547,057	79.97%
Lisinopril	1,280,275	23.86%	Lisinopril	198,296	28.99%
Metoprolol	949,974	17.71%	Metoprolol	130,529	19.08%
Amlodipine	709,582	13.23%	Amlodipine	110,746	16.19%
Atenolol	522,690	9.74%	Atenolol	76,850	11.23%
Valsartan	244,453	4.56%	Propranolol	43,607	6.37%
Cholesterol lowering	2,804,909	52.28%		262,099	38.31%
Simvastatin	1,182,717	22.04%	Simvastatin	134,099	19.60%
Atorvastatin	1,082,041	20.17%	Atorvastatin	66,683	9.75%
Rosuvastatin	473,426	8.82%	Lovastatin	45,020	6.58%
Pravastatin	329,511	6.14%	Pravastatin	33,238	4.86%
Lovastatin	221,381	4.13%	Rosuvastatin	27,316	3.99%
Antihyperglycemic	1,143,236	21.31%		205,448	30.03%
Metformin	929,112	17.32%	Metformin	158,366	23.15%
Pioglitazone	215,189	4.01%	Glipizide	46,127	6.74%
Glipizide	204,887	3.82%	Pioglitazone	40,858	5.97%
Glimepiride	148,719	2.77%	Glyburide	32,961	4.82%
Glyburide	121,959	2.27%	Rosiglitazone	19,351	2.83%

Table 2. Switching and medication adherence

	Optum (n=5,365,644)	MDCD (n=684,102)
Ingredient switching		
# of patents had at lease one switching	942,233 (17.6%)	158,258 (23.1%)
# of switching	1,350,523	255,226
# of switchings before existing drug ended	742,081 (54.9%)	142,746 (55.9%)
# of switchings after existing drug ended	608.422 (45.1%)	112,480 (45.1%)
Medication adherence		
PDC without censoring switching (mean, SD)	0.82 [0.19]	0.80 [0.21]
PDC with censoring switching (mean, SD)	0.84 [0.17]	0.82 [0.19]
# of patients who changed adherence status	279,355 (29.6%)	60,124 (37.9%)
adherent to non-adherent	117,260 (42.0%)	24,041 (40.0%)
non_adherent to adherent	162,075(58.0%)	36,083 (60.0%)

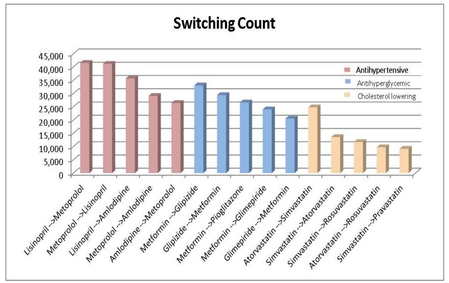
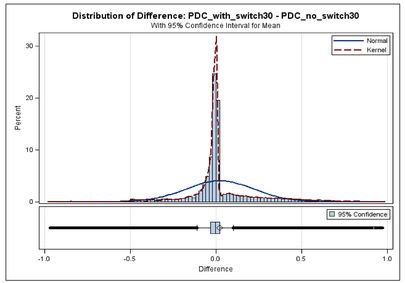


Figure 1. Top five common switching patterns for hypertension, hyperglycemia, or hyperlipidemia in Optum



* min=-0.96, max=0.98, mean=-0.01, Median=0, Q1=-0.03 Q3=0.003
* T(1,350,392)=104.45, P<0.0001

Figure 2. Distribution of difference of medication adherence by patient per Ingredient with or without censoring Switching in Optum

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This study was conducted by Janssen Research & Development, LLC.