Impact of Value-Based Insurance Design on Medication Adherence in Patients with Asthma and/or COPD in an Employee Health Plan: An Interrupted Time Series Analysis

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BACKGROUND

- Value-based insurance design (VBID) is intended to incentivize the use of services that are the most cost-effective for patient care. One strategy to improve care is to reduce patient cost-sharing of high-cost, brand-only medication classes that are crucial for the management of chronic disease.
- Previous studies in employee-group plans have found that reductions in patient copays for chronic medications (including those for asthma) were associated with significant increases in adherence to those medications, however other outcomes have mixed evidence or are unexplored.[1,2]
- In 2016, Baylor Scott & White Health (BSWH) began to implement a series of VBID benefits for employees and their dependents. In total, these included:
  - ✓ Implementing a chronic & preventive list (CPL) of medications with capped copays, which included antidiabetic agents and inhaled respiratory agents
  - ✓ Eliminating deductible requirements for CPL medications
  - ✓ Subsidizing health plan premiums based on employee hourly pay rate
- This study seeks to determine the impact of VBID on BSWH employee-group patients who use maintenance inhalers for asthma and/or chronic obstructive pulmonary disease (COPD).

PURPOSE / OBJECTIVES

Purpose:
- To determine how a series of VBID strategies utilized in the BSWH employee group affect medication adherence in enrolled patients

Objective:
- To evaluate the effect of each VBID strategy on patient adherence rates for maintenance inhalers

SETTING

Baylor Scott & White Health (BSWH) is an integrated health system in Texas that includes 52 hospitals and over 800 patient care sites. It is the largest not-for-profit health care system in Texas.

DISCLOSURES

- This study was approved by the BSWH Institutional Review Board (IRB).
- The authors have no financial disclosures to report.

STUDY DESIGN / METHODS

Methods:
- This study is a segmented regression analysis of retrospective time series data.
- Adherence was measured and assessed monthly by using proportion of days covered (PDC) and was evaluated independently for each maintenance inhaler class (**ICS, inhaled corticosteroid; LABA, long-acting beta agonist; LAMA, long-acting muscarinic antagonist**), including combination inhalers.

CPL – Respiratory Drug Classes
- Short-acting beta agonists (**SABA**)
- Short-acting muscarinic antagonists (**SAMA**)
- Inhaled corticosteroids (**ICS**) ▼
- Long-acting beta agonists (**LABA**) ▼
- Long-acting muscarinic antagonists (**LAMA**) ▼
- Combination inhalers:
  - SABA+SAMA
  - ICS+LABA ▼
  - LABA+LAMA ▼
  - ICS+LABA+LAMA ▼

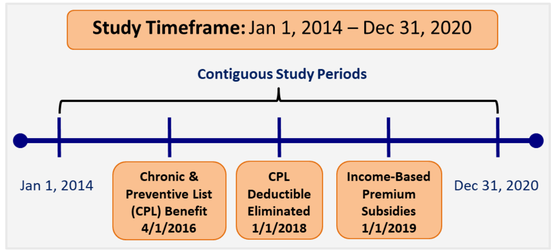
▼ **Maintenance Inhalers**

- Data was obtained from:
  - BSWH electronic health records (EHR)
  - BSWH employee-group plan pharmacy claims
  - BSWH employee-group plan enrollment records

Inclusion criteria:
- Patients had at least one paid claim under the employee benefit for a maintenance inhaler used in asthma and/or COPD, **and**
- Had a concurrent or previous diagnosis of asthma and/or COPD

Statistical analysis:
- To estimate the effect of each sequential VBID benefit, a segmented regression analysis with three intervention points was used.
- The general segmented regression model was fitted manually with guidance from an automated backward selection fitting process using predicted residual sum of squares (PRESS) criteria on all measured variables.

Study timeline:



MODEL

Sample size:
- After applying inclusion and exclusion criteria, the following total and monthly patient counts were obtained:

Inhaler Class	ICS	LABA	LAMA
Unique patients with an eligible PDC	469	339	42
Patients assessed per month, median (IQR)	137 (124-147)	104 (97-112)	7.5 (6-11)

IQR, 25th-75th interquartile range

- Due to insufficient monthly count, the LAMA model was not considered further.

Missing data:
- Fill data was incomplete for month 24 (**period 0**, pre-intervention 1) and month 80 (**period 3**, post-intervention 3).
- Three indicator variables were assigned to the months with missing fill data (*missingmonth0*) and the 1st and 2nd months immediately following (*missingmonth1* and *missingmonth2*, respectively).

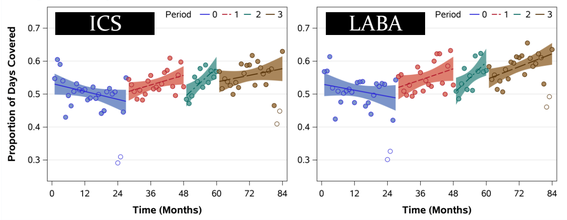
Seasonality:
- Seasonality terms for month and quarter were both considered.

Final model:

$$PDC = \beta_0 + (\beta_1 * \text{time}) + (\beta_2 * \text{intervention 1}) + (\beta_3 * \text{time after intervention 1}) + (\beta_4 * \text{intervention 2}) + (\beta_5 * \text{time after intervention 2}) + (\beta_6 * \text{intervention 3}) + (\beta_7 * \text{time after intervention 3}) + (\beta_8 * missingmonth0) + (\beta_9 * missingmonth1) + (\beta_{10} * \text{quarter2}) + (\beta_{11} * \text{quarter3}) + (\beta_{12} * \text{quarter4}) + \varepsilon$$

Model Variable	Interpretation
PDC	Predicted PDC (adherence)
time	Elapsed time (in months)
intervention 1	Binary indicator - CPL is in effect
time after intervention 1	Elapsed time after CPL is in effect (in months)
intervention 2	Binary indicator - CPL deductible is eliminated
time after intervention 2	Elapsed time after CPL deductible eliminated (in months)
intervention 3	Binary indicator - Premium subsidies in effect
time after intervention 3	Elapsed time after premium subsidies in effect (in months)
missingmonth0	Binary indicator for months with missing fill data
missingmonth1	Binary indicator for 1st month after month with missing fill data
quarter2	Binary indicator for month in 2nd quarter (Apr – Jun)
quarter3	Binary indicator for month in 3rd quarter (Jul – Aug)
quarter4	Binary indicator for month in 4th quarter (Sep – Dec)

Regression plots of time series data:



RESULTS

- Fitted model results are listed in the table below, with significant findings highlighted (and *P*-values < 0.05 bolded):

Variable	Parameter	ICS			LABA		
		Estimate	Std. Error	*P*-value	Estimate	Std. Error	*P*-value
intercept	β_0	0.19095	0.04610	**<.0001**	0.20227	0.04996	**0.0001**
time	β_1	-0.00227	0.00092	**0.0161**	-0.00189	0.00099640	0.0618
intervention 1	β_2	0.03688	0.02180	0.0951	0.04252	0.02362	0.0761
time after int. 1	β_3	0.00437	0.00158	**0.0074**	0.00420	0.00172	**0.0171**
intervention 2	β_4	-0.06552	0.02873	**0.0256**	-0.07337	0.03114	**0.0212**
time after int. 2	β_5	0.00542	0.00341	0.1170	0.00582	0.00370	0.1198
intervention 3	β_6	-0.04589	0.02681	0.0913	-0.05775	0.02905	0.0507
time after int. 3	β_7	-0.00535	0.00332	0.1110	-0.00432	0.00360	0.2336
missingmonth0	β_8	0.19023	0.02772	**<.0001**	0.18463	0.03004	**<.0001**
missingmonth1	β_9	0.15968	0.02743	**<.0001**	0.15826	0.02973	**<.0001**
quarter2	β_{10}	-0.01102	0.01135	0.3346	-0.02414	0.01230	0.0536
quarter3	β_{11}	-0.01862	0.01175	0.1175	-0.02167	0.01274	0.0932
quarter4	β_{12}	0.00397	0.01268	0.7553	-0.00190	0.01374	0.8904

- There was little evidence for autocorrelation of residuals (Durbin-Watson statistics: 1.754 for ICS and 1.804 for LABA).

Significant parameter estimates:
- At baseline, adherence for both inhaler classes was similar (ICS PDC, 0.541; LABA PDC, 0.545), but PDC for ICS inhalers was **significantly decreasing** at 0.00227 per month.
- After the introduction of the CPL list, adherence for both classes began to **significantly increase** monthly (ICS PDC, +0.0021; LABA PDC, +0.0042).
- Lastly, the removal of the deductible for CPL drugs was associated with an instantaneous **significant decrease** in PDC for both classes (ICS PDC, -0.0655; LABA PDC, -0.0734).

DISCUSSION

- Introduction of the CPL drug list was associated with a durable increase in PDC each month. This likely was the single biggest impact on PDC, as the remaining two interventions did not show any additive durable effects.
- Interestingly, deductible elimination appeared to cause an instantaneous worsening in PDC. However, visual inspection of the time series data indicates that this may be something to expect at the beginning of each calendar year. Without a control, it is challenging to differentiate the instantaneous effect of a new policy from this anticipated new year PDC decrease.

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