Patient and provider factors predicting adherence to oral antidiabetic medication

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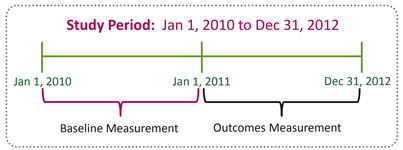
Background

The Centers for Medicare and Medicaid Services rate health plans on Healthcare Effectiveness Data and Information Set (HEDIS) quality measures related to type 2 diabetes (T2DM), including adherence to oral antidiabetic medications (OAD).

Methods

To develop a model that discriminates between OAD adherent and non-adherent individuals, a retrospective cohort study was performed. The study included Medicare Advantage Prescription Drug Plan members with T2DM from 1/1/2010-12/31/2011, and excluded members in long-term care with a stay >30 days. Adherence was determined using proportions of days covered (PDC ≥0.8) for the following: biguanides, sulfonylureas, thiazolidinediones, or dipeptidyl peptidase-4 inhibitors (DPP4). Multivariate logistic regression predicted determinants of adherence in 2011. The analytic file was randomly split into training and test datasets to build and validate the model. Candidate variables included patient and provider demographics, pre-index clinical conditions, and health care utilization metrics. Conditions, medical services, and procedures were classified using the Healthcare Cost and Utilization Project Clinical Classification System (CCS) for ICD9CM and CCS for Services and Procedures.



Results

Of nearly 300 variables explored, 23 were significant predictors of adherence. Of 99,349 individuals, 77,981 (78%) were adherent. Older age, Charlson Comorbidity score, essential hypertension, and prescriptions for DPP4 and sulfonylureas were positively associated with adherence. Emergency room utilization (baseline), nutritional deficiencies, nonspecific chest pain, mood disorders, T2DM without complication, and prescriptions for insulin or thiazolidinediones were negatively associated with adherence

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Figure 1. Patient Selection

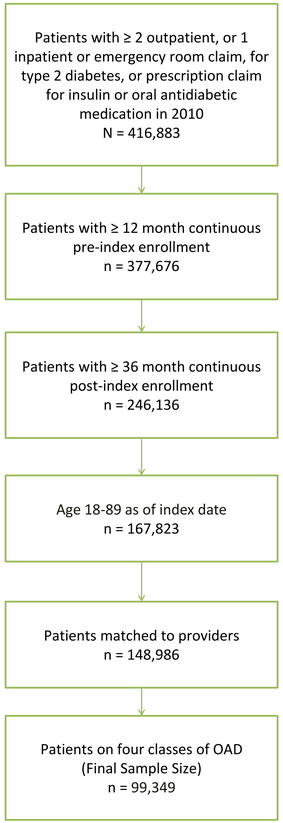


Table 1. Predictors of Adherence to Oral Antidiabetic Medications

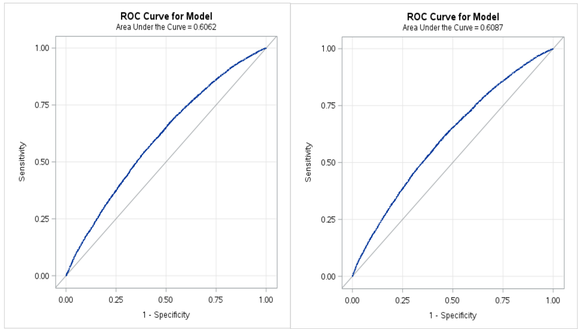
Variables	Odds Ratio	95% Confidence Interval		P Value
Patient Demographics				
Patient age	1.01	1.01	1.02	<.001
Gender (male is the reference group)	0.85	0.81	0.89	<.001
Race (White is the Reference Group)				
Black	0.58	0.54	0.61	<.001
Hispanic	0.71	0.61	0.83	<.001
Others	0.84	0.74	0.94	0.004
Region (Northwest is the Reference Group)				
Midwest	1.13	1.02	1.25	0.017
Northeast	1.10	0.91	1.34	0.327
South	0.92	0.85	1.01	0.087
Plan Type (HMO is the Reference Group)				
FFS	1.01	0.95	1.08	0.738
POS	1.02	0.83	1.26	0.848
PPO	1.05	1.00	1.11	0.067
Other plans	0.82	0.73	0.92	0.001
Comorbidities at Baseline Period				
Charlson score	1.03	1.02	1.05	<.001
Diabetes mellitus with complications	0.87	0.83	0.92	<.001
Nutritional deficiencies	0.91	0.83	0.99	0.026
Essential hypertension	1.10	1.05	1.16	<.001
Nonspecific chest pain	0.89	0.83	0.96	0.002
Chronic obstructive pulmonary disease and bronchiectasis	0.88	0.82	0.94	<.001
Mood disorders	0.88	0.82	0.95	0.001
Health resources utilization at baseline period				
Number of ER visits	0.95	0.94	0.97	<.001
Medical Procedures in the Baseline Period				
Destruction of lesion of retina and choroid	0.70	0.58	0.85	<.001
Excision of skin lesion	1.15	1.07	1.24	<.001
Mammography	1.26	1.19	1.34	<.001
Ophthalmologic and otologic diagnosis and treatment	1.21	1.15	1.26	<.001
Prophylactic vaccinations and inoculations	1.15	1.10	1.20	<.001
Antidiabetic Medications Regimen in the Baseline Period				
Diabetes Combination Products	0.84	0.79	0.90	<.001
DPP4	1.27	1.09	1.47	0.002
Insulin sensitizers	0.91	0.85	0.96	0.001
Insulin	0.93	0.87	0.98	0.008
Sulfonylureas	1.12	1.07	1.17	<.001

DPP4 = dipeptidyl peptidase 4; FFS = Fee-for-service; POS = Point of service; PPO = Preferred provider organization.

Table 2. Predictive Model Performance

Measure	In-Sample Diagnostic Measure (test dataset)	Out-of-Sample Diagnostic Measures (training dataset)
C-statistic	0.606	0.609
Sensitivity	65.2	63.5
Specificity	49.8	51.8
False Positive Rate	17.3	17.3
False Negative Rate	72.0	71.8

In Sample ROC **Out of Sample ROC**



Limitations

Limitations common to studies using administrative claims data apply to this study. These include lack of certain information in the database and error in claims coding. As this study utilized only retrospective claims data, additional clinical factors not routinely captured within these administrative databases was not considered. This study utilized data from Humana members only, thus the results may not be generalizable to populations outside of Humana.

Discussion

The objective of this study was to develop a model to discriminate between OAD adherent and nonadherent individuals. This study did not elicit any provider characteristics associated with improved patient adherence to the four classes of oral antidiabetic medications explored. The study identified patient characteristics and clinical conditions which could be used to identify potential sub groups for targeted adherence interventions. From a health plan perspective, targeted interventions could be designed to specifically address the adherence related to disparities. The study also suggests that the identified comorbidities may negatively influence adherence except for essential hypertension and Charlson score where the perceived higher risk and highly correlated relationship with diabetes might incentivize members to be more adherent. The majority of medical services and procedures identified through the model tended to be positively associated with higher likelihood of adherence. This model has identified important variables that could be used by health plans to devise interventions to improve adherence to oral antidiabetic medications. However, the complexity of psychosocial and behavioral factors that are associated with medication adherence may be difficult to elicit from administrative claims data.

Conclusion

Medication adherence is a complex behavior that is difficult to assess using claims data. This model identified tangible predictors of adherence and nonadherence that may inform intervention strategies to improve OAD adherence.

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