Predictors of type II diabetes treatment modification within 10-days post-acute discharge from an unplanned admission among Medicare Advantage members

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Background

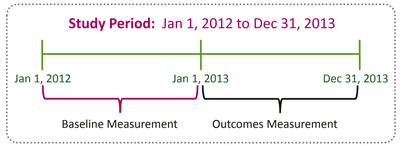
- Hospitalization may provide an opportunity to assess type II diabetes (T2DM) treatment regimen and intensify treatment if warranted. Factors that influence diabetes drug treatment modification (TM) after an inpatient hospitalization have not been examined in detail.

Objective

- Identify factors that predict TM within 10-days post hospitalization among T2DM patients.

Methods

- A retrospective cohort study using claims data from Medicare Advantage Prescription Drug Plan members with T2DM. Members aged 18-89 with an unplanned admission during calendar year 2013 were included. TM was defined as addition of any new antidiabetic medication(s) within 10-days of discharge. Multivariate logistic regression was used to predict the likelihood of TM post-hospitalization. Candidate variables included provider and patient demographics, baseline (12 months pre-index hospitalization) clinical conditions, baseline antidiabetic medication(s), and health care utilization metrics. Baseline clinical conditions were classified using the healthcare cost and utilization project (H-CUP) clinical classification system (CCS) for ICD9CM.H-CUP) clinical classification system (CCS) for ICD-9-CM.



Results

- Of 45,401 members included, 5,108 (11.25%) had evidence of TM within 10 days of discharge. Older age was associated with lower TM likelihood, while blacks had a higher likelihood of TM compared with whites. Members with more frequent outpatient physician encounters or prescribed a greater number of unique antidiabetic medications pre-hospitalization were less likely to have TM. Baseline uses of sulfonylureas, insulin sensitizers, dipeptidyl peptidase-4 inhibitors, and oral antidiabetics in combination were associated with higher TM likelihood. Insulin was associated with lower likelihood. Greater frequency of HbA1c monitoring during the inpatient stay and longer length of stay was associated with higher likelihood of TM. Trauma-related disorders, hyperlipidemia, and GI disorders before the unplanned hospital admission were associated with less likelihood of TM. Of ~300 variables, 17 were predictors of TM within 10-days of discharge and demonstrated good discriminant ability (c-statistic = 0.70).

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Results

Figure 1. Patient Selection

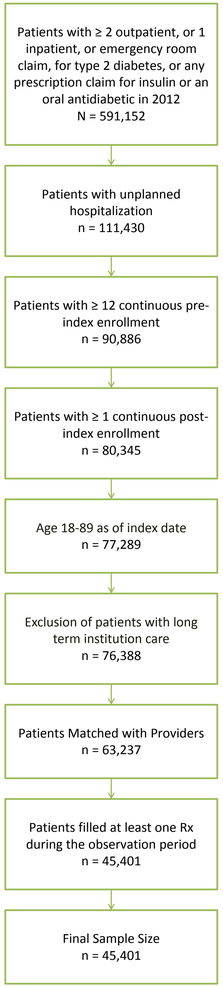


Table 1. Patient Demographics and Provider Characteristics

Measure	No Readmission n = 40,293	Readmitted n = 5,108	*P* value [a]
Demographic characteristics			
Age, mean [SD]	71.4 [9.7]	70.7 [9.7]	<.0001
Gender (Male), n (%)	19,228 (47.7)	2,599 (50.9)	<.0001
Geographic region, n (%)			
Northeast	869 (2.2)	118 (2.3)	0.4788
Midwest	9,100 (22.6)	1,193 (23.4)	0.2151
South	27,195 (67.5)	3,404 (66.6)	0.2207
West	3,129 (7.8)	393 (7.7)	0.8566
Race/ethnicity, n (%)			
White	31,898 (79.2)	3,914 (76.6)	<.0001
Black	6,499 (16.1)	922 (18.1)	0.0005
Hispanic	829 (2.1)	112 (2.2)	0.5228
Other/missing	1,067 (2.6)	160 (3.1)	0.0508
Health plan type, n (%)			
HMO	18,989 (47.1)	2,296 (44.9)	0.0033
FFS	4,292 (10.7)	548 (10.7)	0.8678
POS	870 (2.2)	115 (2.3)	0.6701
PPO	16,142 (40.1)	2,149 (42.1)	0.0058
Low income subsidy, n (%)	13,842 (34.4)	1,626 (31.8)	0.0003
Dual eligibility status, n (%)	9,275 (23.0)	1,081 (21.2)	0.0029
Urbanity, n (%)			
Rural	4,956 (12.3)	686 (13.4)	0.0194
Urban	24,857 (61.7)	3,131 (61.3)	0.5795
Suburban	10,231 (25.4)	1,250 (24.5)	0.1541
Region Unknown	249 (0.6)	41 (0.8)	0.1186
Prior use of medical services, mean [SD]			
Hospitalization	1.6 (1.2)	1.5 (1.0)	<.0001
ER visits	2.7 (3.4)	2.5 (2.9)	<.0001
Outpatient visits	12.9 (8.7)	11. (8.1)	<.0001
Pre-index Deyo-Charlson score	4.7 [2.6]	4.3 [2.5]	<.0001
Diabetes Complications Severity Index Score	3.4 [2.4]	3.1 [2.2]	<.0001
Provider Characteristics			
Specialty, n (%)			
Endocrinology	2,181 (5.4)	198 (3.9)	<.0001
Cardiology	409 (1.0)	59 (1.2)	0.3507
PCP	647 (1.6)	80 (1.6)	0.8319
Internal Medicine	33,091 (82.1)	4,182 (81.9)	0.6551
Others	3,965 (9.8)	589 (11.5)	0.0002
Type of Practice, n (%)			
Solo Practice	8,016 (19.9)	1,036 (20.3)	0.5136
Group Practice	30,311 (75.2)	3,778 (74.0)	0.0491
Unknown	1,966 (4.9)	294 (5.8)	0.0067

SD = Standard deviation; HMO = Health management organization; FFS = Fee-for-service; POS = Point of service; PPO = Preferred provider organization; PCP = Primary care provider; ER = Emergency room

[a] P values were calculated based on Chi-square, Wilcoxon Rank tests and t-test

Table 2. Predictors of Diabetes Treatment Modification (addition) within 10-days Post Discharge

Measure	Odds Ratio	95% Confidence Interval Lower limit	Upper limit	*P* Value [a]
Patients' Age	0.986	0.981	0.99	<.0001
Race (White is the reference group)				
Black	1.06	0.819	1.372	0.7981
Hispanic	1.176	1.051	1.315	0.2256
Other races	1.128	0.835	1.524	0.7653
Health Resources Utilization in the Baseline Period				
Number of physician encounters	0.982	0.977	0.988	<.0001
Health Resources Use at the Indexed Hospitalization				
Length of Stay	1.019	1.013	1.026	<.0001
Number of A1C tests	1.446	1.264	1.655	<.0001
Baseline Comorbidities				
Trauma related disorders	0.845	0.769	0.928	0.0004
Hyperlipidemia	0.875	0.79	0.97	0.0109
Other GI Disorder [b]	0.875	0.794	0.964	0.0071
Admitting diagnosis at the Indexed Hospitalization				
Other Stomach and Intestinal disorders [c]	0.53	0.391	0.718	<.0001
Complication of surgery	0.637	0.503	0.808	0.0002
COPD and asthma	1.225	1.06	1.415	0.0058
Baseline Diabetic Drug Regimen				
Drug count in the baseline	0.896	0.887	0.906	<.0001
Insulin	0.687	0.619	0.761	<.0001
Sulfonylureas	1.327	1.207	1.459	<.0001
DM oral combination	1.395	1.165	1.671	0.0003
Dipeptidyl peptidase-4 inhibitor (DPP4)	1.635	1.396	1.916	<.0001
Insulin Sensitizers	1.495	1.213	1.842	0.0002

[a] P values were calculated based on Chi-square, Wilcoxon Rank tests and t-test

[b] Regional enteritis and ulcerative colitis, Intestinal obstruction without hernia, Diverticulosis and diverticulitis, Anal and rectal conditions and Peritonitis and intestinal abscess [CCS-DX 144-148]

[c] Gastrointestinal hemorrhage, Noninfectious gastroenteritis and Other gastrointestinal disorders [CCS DX 153 - 155]

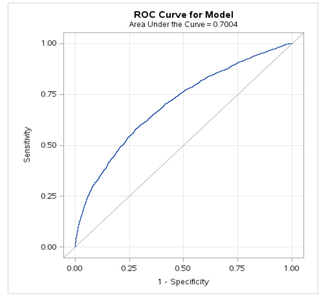
Discussion

- Members who had more frequent encounters with their treating physicians before their hospitalization event were less likely to have the addition of an oral antidiabetic upon discharge, potentially suggesting their diabetic conditions may have been better managed or there was a perceived confidence that there will be continued timely follow-up. Patients who had sulfonylureas, DPP4 and insulin sensitizers during baseline had a higher likelihood of having medications added post discharge, while having insulin was associated with less likelihood of receiving a new diabetic medication upon discharge. Insulin dose adjustment could have also occurred. However, assessment of insulin dose adjustment was beyond the current study scope and design.

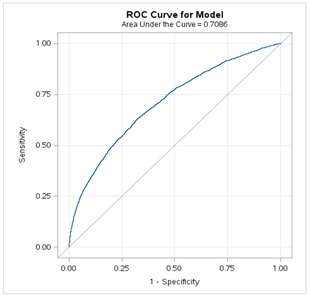
Table 3. Predictive Model Performance

Measure	In-Sample Diagnostic Measure (test dataset)	Out-of-sample Diagnostic Measures (training dataset)
C-statistic	0.70	0.71
Sensitivity	67.9	70.9
Specificity	59.9	56.8
False Positive Rate	82.9	82.3
False Negative Rate	6.2	6.3

In Sample Receiver Operator Curve (ROC)



Out of Sample Receiver Operator Curve (ROC)



Limitations

- Limitations include lack of certain information in the database and error in claims coding. This study used data from Humana members only, thus the results may not be generalizable to populations outside of Humana.

Conclusions

- In this study, more than 10% of patients experienced TM within 10-days of discharge. Characteristics of both pre-admission medical utilization (e.g., oral baseline antidiabetic medication regimen) and inpatient course of care (e.g., higher frequency of HbA1c monitoring) were associated with TM post discharge. The predictive model may be useful for identifying profiles of patients for targeted monitoring and/or intervention.

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