Published in final edited form as:

J Pharm Health Serv Res. 2018 December ; 9(4): 393–401. doi:10.1111/jphs.12266.

Predictive Value Positive of MTM Eligibility Criteria under MMA and ACA in Identifying Individuals with Medication Utilization Issues

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Abstract

Objectives.—To compare the predictive value positives (PVP) of medication therapy management eligibility criteria under the Medicare Modernization Act (MMA) and Affordable Care Act (ACA) in identifying individuals with medication utilization issues (MUI).

Methods.—This is a retrospective analysis of Medicare database (2012–2013). MUI were determined based on medication utilization measures related to Medicare Part D Star Ratings. PVP or proportions of individuals with MUI were compared between individuals eligible for MTM under MMA and ACA. Need-based and demand-based logistic regression was used to adjust for patient characteristics. MTM eligibility thresholds in 2009 and 2013 and proposed 2015 MTM eligibility thresholds under MMA were examined. Main/sensitivity/disease-specific analyses were conducted to cover the range of eligibility thresholds and combinations.

Key Findings.—MMA has higher PVP in identifying patients with MUI than ACA. Proportions of individuals with MUI were higher based on MMA than ACA (e.g., 74.96% for 2009 MMA, 73.51% for 2013 MMA, and 62.46% for proposed 2015 MMA vs. 52.17% for ACA in main analysis; $P < 0.05$). Adjusted findings were similar. For example, based on the demand-based model in the main analysis, the odds ratios were 2.474 (95% CI: 2.454–2.494) for 2013 MMA in comparison to ACA. These numbers indicate that the MMA MTM eligibility criteria for 2013 had 147.4% higher PVP in identifying patients with MUI than ACA. Similar patterns were found in most sensitivity and disease-specific analyses.

Conclusions.—MMA has higher PVP than ACA in identifying patients with MUI. This study may inform the government on future MTM policy.

Keywords

Predictive value positive; medication therapy management services; eligibility criteria; Medicare Prescription Drug, Improvement, and Modernization Act; Patient Protection & Affordable Care Act; medication utilization issues; performance; efficiency

Introduction

Inappropriate drug use in the elderly, including non-adherence, delayed evidence-based prescribing, and suboptimal use of generic drugs, accounted for an estimated \$170 billion (80%) of unnecessary medical expenses in 2013.¹ Medicare seniors are especially vulnerable to these problems because they typically use multiple prescription drugs, contributing to significantly higher risk of drug-related morbidity and mortality.² Because of these risks, Medicare Part D providers have been required, since 2006, to offer medication

therapy management (MTM) services to eligible beneficiaries in accordance with the Medicare Prescription Drug, Improvement, and Modernization Act (MMA).³

MTM services typically include a comprehensive medication review (CMR) by a pharmacist or other qualified provider who identifies and addresses medication utilization issues (MUI), medication treatment plan formulation, and the incorporation of the medication treatment plan into all health services being provided to a patient.^{4,5} MTM services have been shown to improve patients' health outcomes, reduce emergency room visits and hospitalizations, and reduce total health care costs.^{6–10} These services are particularly beneficial for patients with multiple chronic conditions, those who use several medications, take medications that require close monitoring, and have been hospitalized, especially the elderly for whom management of pharmacotherapy plays a major role.^{6–10}

Centers for Medicare & Medicaid Services (CMS) require Part D plans to target patients with the following characteristics in their offering of MTM programs: (1) having multiple chronic conditions, (2) taking multiple Part D drugs, *and* (3) incurring annual drug costs exceeding a pre-specified threshold.³ Initially, Medicare Part D plans were afforded flexibility in designing their own MTM enrollment criteria for enrollees within the legislative framework of MMA. Aiming to increase MTM enrollment, CMS later set minimum eligibility thresholds for 2010 and after, mandating that plans open enrollment to patients with at least 3 chronic diseases, 8 covered drugs, and \$3,000 annual Part D drug costs.¹¹ However, the participation rate in MTM services has remained at approximately 10%, falling far short of expectations: CMS set a goal of 25% of enrollees receiving MTM services.¹¹ For the year 2015, CMS proposed to further lower MTM eligibility thresholds to increase MTM participation, but the new thresholds were not implemented due to stakeholders' concerns over other Part D reforms proposed concurrently.¹¹

Previous studies have documented the shortcomings of the MMA MTM eligibility criteria and emphasized the importance of modifying the design of MTM programs to increase accessibility and benefit individuals who most need MTM services.^{12–19} Wang et al. reported a series of findings on racial and ethnic disparity implications of the MMA MTM eligibility criteria.^{12–17} Stuart et al. indicated that current MMA MTM eligibility criteria are not optimally targeted to capture patients in greatest need of MTM – those with underuse of or poor adherence to medications for chronic conditions.¹⁸ Lee et al. found that increasing the threshold number of Part D drugs while decreasing the threshold of annual drug costs in the 2013 MMA MTM eligibility criteria would result in better performance of these criteria in identifying patients who had drug therapy problems and were in greatest need of MTM services.¹⁹

The 2010 Patient Protection and Affordable Care Act (ACA) laid out the following criteria for eligible entities to target patients for MTM services in MTM demonstration programs: “(1) take 4 or more prescribed medications (including over-the-counter medications and dietary supplements); (2) take any ‘high risk’ medications; (3) have 2 or more chronic diseases... or (4) have undergone a transition of care, or other factors... that are likely to create a high risk of medication-related problems”.²⁰ Although the timeline for implementation of these provisions has not yet been determined, ACA MTM eligibility

criteria represent a potential alternative to the MMA MTM eligibility criteria. However, their utility in identifying patients with MUI, particularly in comparison to the MMA criteria, has not been explored extensively in the literature. Predictive value positive (PVP) is a statistical measure for lab tests and it has also been increasingly used in policy analysis.^{19,21–23} It measures the proportions of true positives among all patients who test positive for a given test. In the setting of this policy analysis, it reflects the policy performance of MTM eligibility criteria in identifying patients with MUI from the perspective of potential efficiency. Efficiency is an important aspect of policy analysis given the ever-increasing budget pressure for health care in the United States and in other nations. The objective of this study was to compare the PVP of MTM eligibility criteria under MMA and ACA in identifying individuals with MUI based on an analysis of policy scenarios.

Methods

Study Design, Population, and Data Sources

This study is a retrospective analysis of Medicare beneficiary claims data (2012–2013) linked to Area Health Resource File.^{24,25} In the Medicare database, Medicare Prescription Drug Event file (PDE), Master Beneficiary Summary File (MBSF), and Medicare Parts A/B claims were used.²⁴ The AHRF was linked with the Medicare database to provide characteristics of Medicare beneficiaries' residence at the county level. To be included, Medicare beneficiaries had to be: (1) 65 years or older at any time during the enrollment to reduce heterogeneity; (2) alive at the end of 2013; (3) had continuous Parts A, B, and D coverage but not Medicaid coverage in 2012–2013 to have complete claims.

Conceptual Framework

Andersen's Behavioral Model of Health Services Utilization was used in this study as the conceptual framework because medication utilization is the study outcome.²⁶ According to this model, determinants of health services utilization can be classified as predisposing factors, enabling factors, and need factors. Predisposing factors predispose individuals to utilization of health services, enabling factors enable individuals' access to health services, and need factors reflect individuals' need for health services.

Predisposing factors included in this study were age, gender, race/ethnicity, and the county-level information of percentage of non-white population, percentage of married-couple families, per capita income, percentage of population living in poverty, percentage of population with various educational achievements among 25 years or older, percentage of population eligible for Medicaid, percentage of population unemployed, and percentage of population without health insurance. Enabling factors included in this study were metropolitan statistical area (MSA), census regions and whole/part of county as a health professional shortage area (HPSA) for primary care. Need factors included in this table were Deyo-adapted Charlson Comorbidity Index (CCI) and a risk adjustment summary score developed by CMS to adjust payment to Medicare Advantage Plans.^{27,28}

Independent and Outcome Variables

MMA MTM Eligibility Criteria—The study examined the 2009, 2013, and proposed 2015 MTM eligibility criteria. Of the three sets of criteria, the 2009 thresholds represent the most recent MTM eligibility thresholds before 2010.^{11,29,30} The 2013 criteria represent the most current thresholds employed by CMS at the time of the analysis. The proposed 2015 criteria have the least restrictive criteria of the three sets of MTM eligibility thresholds under study.

¹¹ Employing three sets of criteria in the analysis allowed comprehensive assessment of the efficiency of MMA eligibility thresholds.

The wide variation in eligibility thresholds were accounted for by considering the minimum, median, mode, and maximum of these thresholds as representative values. For example, the MTM eligibility thresholds for Part D drugs in 2009 under MMA ranged from 2 to 15, meaning there are 4 unique representative thresholds for this criterion (minimum=2, median=6, mode=8, and maximum=15). The thresholds for number of chronic conditions ranged from 2 to 5, meaning there were 3 unique representative thresholds for this criterion (minimum=2, both median and mode=3, and maximum=5). As the drug cost threshold was \$4,000, with no range given, there was only one representative threshold for this criterion.²⁹ Because an individual must meet all three eligibility criteria to be eligible for MTM under MMA, a total of $12=4*3*1$ different combinations of representative thresholds were examined, where 4, 3, and 1 are the number of unique representative thresholds for each eligibility criterion. The combination of modal values was examined in a main analysis and the remaining 11 combinations were examined in sensitivity analyses. There was only one combination of 2015 eligibility criteria: 2 chronic conditions, 2 Part D-covered drugs, and \$620 in annual drug costs.¹¹ The drug cost thresholds were adjusted to dollars in study years based on consumer price index for medical care.³¹ Number of Part D drugs and Part D drug costs were calculated based on information in PDE. To determine number of chronic conditions, a list of chronic conditions applicable to the Medicare population assembled by Daniel and Malone was applied.³² These conditions include all chronic conditions targeted by MTM programs as required by CMS.^{11,29,30}

ACA MTM Eligibility Criteria—When determining ACA MTM eligibility based on the criterion of (1) “take 4 or more prescribed medications (including over-the-counter medications and dietary supplements),” the number of medications was calculated based on the PDE File.²⁰ The use of over the counter medications and dietary supplements was not examined because PDE file does not have such information. For criterion (2) “take any ‘high-risk’ medication,” patient eligibility was determined based on the list of high-risk medications compiled by the Pharmacy Quality Alliance (PQA) which is widely used by health plans and payers including CMS.³³ Criterion (3) “have 2 or more chronic diseases” was determined using the aforementioned list devised by Daniel and Malone.³² The fourth criterion is based on a transition of care or “other factors.” Because “other factors” were not explicitly defined in the regulatory document, the study focused on “transition of care,” which was determined based on patients’ health services records.²⁰ For a community-dwelling individual, any record of a hospitalization or admission to other facilities including nursing homes was considered a transition of care.³⁴ For a facility-dwelling individual (considered as claims for nursing homes, assisted living and related facilities, long-term

hospitals, mental health centers, and various other long-term care settings), any record of services in another setting, excluding physician visits and outpatient visits, was considered a transition of care.³⁵ Fifteen combinations were possible when including one or more of these four eligibility criteria. A main analysis was conducted for the combination of all four eligibility criteria, and fourteen sensitivity analyses were conducted for the other possible combinations.

Medication Utilization Issues—The outcome measure for this study is MUI defined based on the most current existing medication safety and adherence measures developed by PQA at the time when this study was conducted.³³ These measures are the basis for the measures of medication utilization in Medicare Part D Star Ratings system, a quality assessment program for Medicare Part D program.^{33,36–38} Patients were considered to have MUI if they had any of the following 9 medication utilization issues: (1) High risk medication use in the elderly; (2) inappropriate treatment of hypertension in persons with diabetes; (3) proportion of days covered (PDC) <80% for three drug classes: renin-angiotensin system antagonists, cholesterol medications among adults with coronary artery disease, and oral diabetes medications (including biguanides, sulfonylureas, thiazolidinediones, and dipeptidyl peptidase-IV inhibitors); (4) drug-drug interactions; (5) excessive doses of oral diabetes medications; (6) PDC <90% for HIV antiretroviral medications; (7) chronic use of atypical antipsychotics by elderly beneficiaries in nursing home; (8) PDC <80% for beta-blockers, calcium-channel blockers, and non-warfarin oral anticoagulants; and (9) antipsychotic use in persons with dementia.

Statistical analysis—Both descriptive and multivariate analyses were performed. When conducting descriptive analysis, the PVPs of MTM eligibility criteria under MMA and ACA were compared based on probability of individuals having MUI among individuals eligible for the relevant MTM eligibility criteria. Chi-square tests were used to determine significance of the differences between groups. In the multivariate analysis, a logistic regression model was used to control for patient and community characteristics when comparing the likelihood of having MUI between individuals eligible for MMA and ACA. Specifically, the likelihood of having MUI between the following four categories of individuals was compared:

- 1= Not meeting MTM eligibility criteria under either ACA or MMA;
- 2= Meeting MTM eligibility criteria under ACA but not under MMA;
- 3= Meeting MTM eligibility criteria under MMA but not under ACA;
- 4= Meeting MTM eligibility criteria under both ACA and MMA.

Category 2 was used as the reference group to determine the efficiency of catching MUI under ACA relative to under MMA. However, as no patients were found in Category 3 because criteria under ACA are less restrictive than criteria under MMA, only Categories 4 and 2 were compared. An odds ratio greater than one for Category 4 would suggest the criteria under MMA are associated with higher PVP than the criteria under ACA.

The strategy of need-based and demand-based analyses was applied.³⁹ When conducting need-based analysis, the variables affecting individuals' need for health care, such as age, gender, race and ethnicity, Deyo-adapted Charlson Comorbidity Index, and risk adjustment summary score, were included. When conducting demand-based analysis, all covariates were included.²⁶ Due to the importance of MTM services for chronic disease management, disease-specific analyses for each of the top ten MTM-targeted chronic conditions were conducted to produce policy recommendations applicable to patients with specific conditions.^{11,29,30} Data analysis was conducted using SAS[®] 9.4 (SAS Institute Inc., Cary, NC) and STATA[®] 13.1 (STATA Corporation, College Stations, TX). This study was deemed exempt by the Institutional Review Board at the corresponding author's institution (approval number: 13-02788-XM).

Results

The study sample included 2,265,721 Medicare beneficiaries. Characteristics of the sample were analyzed (Table 1). Non-Hispanic Whites accounted for 90.61% of the sample, non-Hispanic Blacks 4.28%, Hispanics 2.81%, and the rest were Asian, American Indian, and other races and ethnicities (2.29%). Mean age was 76.67 years (Standard Deviation [SD]=7.25), 60.45% were female (n=1,369,689). The mean Deyo-adapted Charlson comorbidity score was 1.83 (SD: 2.20), and the mean risk adjustment summary score was 0.80 (SD=0.65).

According to descriptive analysis (Table 2), proportions of MTM eligibility would be lower based on MMA than ACA. Specifically, based on the main analysis for 2009 MMA MTM eligibility thresholds, this proportion would be 9.91% (ranges 4.81%–11.11%). According to the main analysis for 2013 MTM eligibility thresholds and the thresholds proposed for 2015, these proportions would be 17.22% (ranges 17.22%–20.40%), and 62.91%, respectively. Proportions of MTM eligibility based on the main analysis for ACA would be 96.19% (ranges 24.84%–96.19%).

Patients had higher probabilities of having MUI if they were eligible for MTM under MMA than ACA. For example, in main analysis, based on 2009 and 2013 MMA MTM eligibility thresholds, proposed 2015 MMA MTM eligibility thresholds, and ACA, probabilities of having MUI would be 74.96%, 73.51%, 62.46%, and 52.17%, respectively. This indicates that the stricter MMA MTM eligibility criteria have higher PVP in capturing individuals with MUI than ACA ($P<0.05$).

According to the multivariate analysis, there would be significant differences between MMA and ACA in the PVP of identifying individuals with MUI (Table 3). Both unadjusted and adjusted odds ratios (ORs) for the likelihood of having MUI were greater than one for Category 4 (meeting MTM eligibility criteria under both the ACA and MMA) compared to the reference group, Category 2 (meeting MTM eligibility criteria under ACA but not MMA). For example, based on the demand-based model in main analysis for 2013 MMA MTM eligibility thresholds versus ACA the OR would be 2.474 (95% CI: 2.454–2.494). These numbers indicate that the MMA MTM eligibility criteria were 147.4% more efficient in identifying patients with MUI than ACA (Table 3). Similar patterns were found in both

unadjusted and adjusted models for the 2009 and proposed 2015 MMA eligibility thresholds.

Some independent variables are associated with MUI. For example, according to the need-based model in the main analysis comparing 2013 MMA MTM eligibility thresholds and ACA (Table 4), MMA was 146.3% more efficient in identifying MUI than ACA (OR: 2.463; 95% CI: 2.443–2.483). Individuals one year older were 0.8% (OR: 1.008; 95% CI: 1.008–1.009) more likely to have MUI. Females compared to males were 8.4% (OR: 1.084; 95% CI: 1.078–1.091) more likely to have MUI. Compared to non-Hispanic Whites, minorities were more likely to have MUI. Specifically, non-Hispanic Blacks, Hispanics, Asian/Pacific Islanders, American Indian/Alaska Natives, and others were 69.5%, 25.4%, 8.5%, 28.2%, and 8.7%, respectively, more likely to have MUI. The study also found that patients with CCI one unit higher were 25.7% (OR: 1.257; 95% CI: 1.255–1.260) more likely to have MUI. Patients with a risk adjustment summary score one unit higher were 20.4% less likely to have MUI.

In the disease-specific analysis for each of the 10 chronic conditions examined, MMA had higher PVP in identifying patients' MUI than the ACA (Table 5). For example, for 2013 MMA MTM eligibility threshold, the OR for Category 4 from the demand-based adjusted regression model were 2.513 for diabetes (95% CI=2.480–2.546). This indicates that, among patients with diabetes, MMA has 151.3% higher PVP in identifying patients with MUI than ACA criteria. Diabetes seems to have the highest ORs among all chronic conditions.

Discussion

This study compared the predictive value positive of MMA and ACA MTM eligibility criteria in identifying patients with MUI. In general, MMA MTM eligibility criteria had higher PVP in identifying patients with MUI than ACA. MTM plays a critical role in improving health outcomes among older patients with chronic diseases and this study could provide evidence to assist policy makers in improving efficiency of these services. Such analysis is not only applicable to policy making in the United States but also in other nations facing budget pressure in health care.

Such a finding is not surprising since patients who use a higher number of medications are more likely to meet utilization-based eligibility criteria, and are more likely to have MUI. Likewise, Lee et al. found that the ability by MMA MTM eligibility criteria to identify patients with drug therapy problems may improve when drug count thresholds were increased.¹⁹ Lee et al. also further pointed out that 1% increase in the probability of patients having MUI among those identified for MTM services could potentially translate to considerable cost savings for health plans due to the large target population size and substantial CMR costs.¹⁹ Improving efficiency of MTM eligibility criteria could ultimately help to achieve the maximum number of patients benefiting from MTM services.

This study found that older patients, minorities, females, and patients with higher Charlson comorbidity scores were more likely to have MUI. These individuals constitute the groups that MTM programs should strategically target. Older patients and those with higher

Charlson comorbidity scores tend to have more complex comorbidities and thus are more likely to have MUI. Previous literature has documented that minorities are more likely to have lower medication adherence rates due to their sociodemographic status.^{40,41} Gellad and colleagues found racial and ethnic disparities in medication nonadherence related to cost concerns among seniors.⁴⁰ Gerber et al. reported that elderly African Americans had lower medication adherence than elderly whites, even after adjusting for differences in demographic characteristics, health literacy, depression, and social support.⁴¹

In the disease-specific analysis, MMA MTM eligibility criteria were found to have higher PVP in identifying patients with MUI than those under ACA for patients with common chronic conditions. The largest OR of the likelihood of identifying MUI was among patients with diabetes. This may be because patients with this disease use more prescription medications than patients with other conditions and may be more easily identified according to MMA MTM eligibility criteria which are predominantly based on medication utilization. Patients with diabetes may be prescribed multiple medications and also have comorbidities such as dyslipidemia, hypertension, and depression, which may also require the use of prescription medications. In fact, prescribers may sometimes have to “under-prescribe” some medications to avoid drug interactions and encourage adherence with essential medications to address individual diseases.⁴² Prioritizing treatment of serious health problems over less urgent issues may be a way to achieve maximum benefits of MTM for patients with diabetes.⁴³

This study did not focus on the comparison of PVP of ACA and MMA MTM eligibility criteria in identifying MUI across races and ethnicities. This should be explored in future studies. Prior studies reported issues associated with MMA and ACA MTM eligibility criteria. For example, Wang et al. reported lower likelihood of MTM eligibility criteria among minorities than Whites under the MMA and ACA MTM eligibility criteria.^{12–16} Future research may need to consider other alternative MTM eligibility criteria. Rather than basing MTM eligibility on criteria used in MMA and ACA such as drug counts, costs and, number of chronic conditions, policymakers may consider selecting MTM-eligible individuals by directly identifying patients who have MUI based on medication safety and adherence measures in Medicare Part D Star Ratings.^{33,36–38} Plan sponsors are familiar with such Star Ratings and may be ready to deploy the medication utilization measures in Star Ratings as MTM eligibility criteria.

Strengths & Limitations

The main strength of the study is that it provides crucial and time-sensitive information by comparing the efficiency of ACA and MMA in identifying patients with MUI based on policy-scenario analysis. This can assist policymakers by identifying the strengths and weaknesses of policies before they are implemented. However, the study findings should be considered with a few caveats. This is not an analysis of actual MTM claims data, as MTM enrollment status under MMA and ACA was not available. A limitation related to this is that the effects of ignoring “other factors” when determining MTM eligibility based on ACA MTM eligibility criteria could not be evaluated by comparing with the actual MTM enrollment under ACA. Additionally, this study included nine measures of MUI based on

existing medication safety and adherence measures related to CMS' Star Ratings. Although these measures represent the state of the art, they may not include all types of MUI. Another limitation is that due to the application of multiple inclusion criteria, racial and ethnic composition of this study sample is not typical of Medicare beneficiaries. Although there is a significant number of minorities in the study sample, the proportion of non-Hispanic Whites was over 90%.

Conclusions

MTM eligibility criteria under MMA have higher PVP and are more efficient in identifying patients with MUI than those under ACA. This study addresses a time-sensitive topic and provides useful information for policymakers when modifying MTM patient eligibility criteria in order to improve the efficiency of MTM system. Future studies should compare the PVP of ACA and MMA MTM eligibility criteria in identifying MUI across races and ethnicities and explore alternative MTM eligibility criteria.

Acknowledgments and Funding

This project was funded by grant R01AG049696 from the National Institute On Aging. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institute on Aging or the National Institutes of Health. The authors would like to acknowledge the research assistance of Alexandra Dewitt, Joseph Michael Pittman, and Mimi Nguyen, all PharmD students at the corresponding author's institution.

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Table 1.

Characteristics of patients in the Study Sample (N=2,265,721)

Variables	Number/Mean	Percentage/SD
Predisposing Factors		
Race and ethnicity		
Non-Hispanic White	2,052,997	90.61%
Non-Hispanic Black	96,941	4.28%
Hispanic	63,656	2.81%
Asian/Pacific Islander	33,371	1.47%
American Indian/Alaska Native	5,050	0.22%
Other	13,706	0.60%
Age (Mean and SD)	76.67	7.25
Gender		
Female	1,369,689	60.45%
County-Level Predisposing Factors		
Percentage of non-white population (Mean and SD)	23.48%	15.83%
Percentage of married-couple families (Mean and SD)	77.32%	6.32%
Per capita income (Mean and SD)	\$44,623.19	\$12,320.71
Percentage of all people in poverty (Mean and SD)	15.50%	5.36%
Percentage of education for 25+ (Mean and SD)		
< high school diploma	13.57%	5.50%
high school diploma	86.44%	5.49%
4+ years college diploma	27.63%	10.63%
Percentage eligible for Medicaid (Mean and SD)	19.63%	7.83%
Percentage unemployed (Mean and SD)	7.47%	2.11%
Percentage without health insurance (Mean and SD)	13.54%	4.19%
Enabling Factors		
Metropolitan statistical area	1,729,698	76.34%
Census regions		
Northeast	427,639	18.87%
Midwest	591,669	26.11%
South	857,770	37.86%
West	380,242	16.78%
Other	8,401	0.37%
County-Level Enabling Factors		
Health provider shortage area *	1,998,387	88.20%
Need Factors		
Charlson Comorbidity Index (Mean and SD)	1.83	2.20
Risk adjustment summary score (Mean and SD)	0.80	0.65

*Health provider shortage area: whole county or part of the county being a health professional shortage area (HPSA) for primary care.

SD: Standard Deviation.

Table 2.

Predictive Value Positive of Identifying Patients with Medication Utilization Issues (MUI) for All Medication Therapy Management (MTM) Eligibility Criteria

Analyses	Drug Count	Disease Count	Annual Drug Spending (\$)	Proportions of MTM Eligibility	Proportion of Having MUI among the MTM Eligible(%)
2009 MTM Eligibility Thresholds under MMA					
Main analysis	8	3	4,000	9.91	74.96
Sensitivity 1	2	2	4,000	11.11	71.87
Sensitivity 2	2	3	4,000	11.09	72.27
Sensitivity 3	2	5	4,000	9.84	73.60
Sensitivity 4	6	2	4,000	10.74	73.18
Sensitivity 5	6	3	4,000	10.62	73.42
Sensitivity 6	6	5	4,000	9.65	74.33
Sensitivity 7	8	2	4,000	10.00	74.82
Sensitivity 8	8	5	4,000	9.16	75.55
Sensitivity 9	15	2	4,000	4.93	81.60
Sensitivity 10	15	3	4,000	4.92	81.63
Sensitivity 11	15	5	4,000	4.81	81.75
2013 MTM Eligibility Thresholds under MMA					
Main analysis	8	3	3,144.25	17.22	73.51
Sensitivity 1	2	2	3,144.25	20.40	69.48
Sensitivity 2	2	3	3,144.25	20.01	69.95
Sensitivity 3	8	2	3,144.25	17.39	73.36
Proposed MTM Eligibility Thresholds for 2015 under MMA					
Main analysis	2	2	620	62.91	62.46
Analyses	Combinations			Proportions of MTM Eligibility (%)	Proportions of Having MUIs among the MTM Eligible (%)
MTM Eligibility Criteria in Patient Protection and Affordable Care Act					
Main analysis*	Criterion 1, 2, 3, or 4			96.19	52.17
Sensitivity 1	Criterion 1			81.94	58.28
Sensitivity 2	Criterion 2			24.84	76.55
Sensitivity 3	Criterion 3			92.65	53.22
Sensitivity 4	Criterion 4			82.30	53.72
Sensitivity 5	Criterion 1 or 2			82.71	58.25
Sensitivity 6	Criterion 1 or 3			94.50	52.89
Sensitivity 7	Criterion 1 or 4			92.56	53.44
Sensitivity 8	Criterion 2 or 3			93.21	53.29
Sensitivity 9	Criterion 2 or 4			84.82	54.28
Sensitivity 10	Criterion 3 or 4			95.26	52.27
Sensitivity 11	Criterion 1, 2, or 3			94.66	52.90
Sensitivity 12	Criterion 1, 2, or 4			92.80	53.45
Sensitivity 13	Criterion 1, 3, or 4			96.11	52.16
Sensitivity 14	Criterion 2, 3, or 4			95.51	52.31

MMA: Medicare Prescription Drug, Improvement, and Modernization Act

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Table 3.

Predictive Value Positive of Identifying Medication Utilization Issues between Medicare Prescription Drug, Improvement, and Modernization Act (MMA) and Patient Protection and Affordable Care Act (ACA) in the Main Analysis Based on Logistic Regression

Comparison Groups	Unadjusted model			Need-Based model			Demand-Based Model		
	Odds Ratio	95% Confidence Interval	Interval	Odds Ratio	95% Confidence Interval	Interval	Odds Ratio	95% Confidence Interval	Interval
ACA and 2009 MMA MTM Eligibility Criteria									
Category 2 [†]	-	-	-	-	-	-	-	-	-
Category 4 [†]	3.049	3.018–3.079		2.359	2.335–2.384		2.378	2.353–2.403	
Category 1 [†]	0.044	0.043–0.046		0.060	0.058–0.062		0.060	0.058–0.062	
ACA and 2013 MMA MTM Eligibility Criteria									
Category 2	-	-	-	-	-	-	-	-	-
Category 4	3.065	3.042–3.089		2.463	2.443–2.483		2.474	2.454–2.494	
Category 1	0.048	0.046–0.050		0.063	0.061–0.065		0.063	0.060–0.065	
ACA and Proposed 2015 MMA MTM Eligibility Criteria									
Category 2	-	-	-	-	-	-	-	-	-
Category 4	3.422	3.402–3.442		2.948	2.930–2.966		2.953	2.934–2.971	
Category 1	0.089	0.086–0.092		0.105	0.102–1.109		0.105	0.102–0.109	

Table 4. Likelihood of Having Medication Utilization Issues for Individuals Meeting Eligibility Criteria for Medication Therapy Management Services according to 2013 MMA and ACA in Main Analysis Based on Need-Based Logistic Regression

Parameter	Estimate	Standard Error	Wald Chi-Square	P	Odds Ratio (OR)	95% Confidence Interval for OR
Intercept	-1.078	0.016	4571.806	<.0001	-	-
Category 2 [†]	-	-	-	-	-	-
Category 4 [†]	0.901	0.004	48558.422	<.0001	2.463	2.443–2.483
Category 1 [†]	-2.774	0.017	25960.993	<.0001	0.063	0.061–0.065
Age	0.008	0.0002	1482.899	<.0001	1.008	1.008–1.009
Gender						
Male	-	-	-	-	-	-
Female	0.081	0.003	768.520	<.0001	1.084	1.078–1.091
Race						
Non-Hispanic White	-	-	-	-	-	-
Non-Hispanic Black	0.528	0.007	5224.175	<.0001	1.695	1.671–1.720
Hispanic	0.219	0.009	621.850	<.0001	1.254	1.226–1.266
Asian/Pacific Islander	0.082	0.012	47.682	<.0001	1.085	1.060–1.111
American Indian/Alaska Native	0.248	0.030	67.081	<.0001	1.282	1.208–1.360
Other	0.083	0.018	20.857	<.0001	1.087	1.049–1.126
Charlson comorbidity index	0.229	0.001	53578.857	<.0001	1.257	1.255–1.260
Risk adjustment summary score	-0.228	0.003	4825.199	<.0001	0.796	0.791–0.801

MMA: Medicare Prescription Drug, Improvement, and Modernization Act; ACA: Patient Protection and Affordable Care Act.

Table 5.

Disease-Specific Analysis for Comparison in Predictive Value Positive of MMA and ACA in Main Analysis Based on Demand-Based Logistic Regression (to be continued)

Comparison Groups [¶]	2009 MMA & ACA		2013 MMA & ACA		2015 MMA & ACA	
	Odds Ratio	95% Confidence Interval	Odds Ratio	95% Confidence Interval	Odds Ratio	95% Confidence Interval
Diabetes						
Category 2	-	-	-	-	-	-
Category 4	2.406	2.366–2.446	2.513	2.480–2.546	3.076	3.042–3.111
Category 1	0.122	0.095–0.157	0.130	0.101–0.167	0.234	0.182–0.300
Chronic Heart Failure						
Category 2	-	-	-	-	-	-
Category 4	2.047	0.022–2.073	2.110	2.090–2.131	2.699	2.674–2.723
Category 1	0.166	0.135–0.205	0.175	0.142–0.216	0.307	0.249–0.380
Dyslipidemia						
Category 2	-	-	-	-	-	-
Category 4	2.236	2.209–2.262	2.310	2.288–2.331	2.672	2.653–2.692
Category 1	0.146	0.129–0.164	0.152	0.134–0.172	0.254	0.224–0.286
Hypertension						
Category 2	-	-	-	-	-	-
Category 4	2.134	2.110–2.158	2.188	2.168–2.207	2.550	2.532–2.568
Category 1	0.274	0.252–0.297	0.286	0.263–0.310	0.469	0.432–0.510
Chronic Obstructive Pulmonary Disease						
Category 2	-	-	-	-	-	-
Category 4	1.896	1.861–1.931	1.983	1.953–2.014	2.948	2.896–3.001
Category 1	0.029	0.014–0.059	0.031	0.016–0.063	0.061	0.030–0.122
Osteoporosis						
Category 2	-	-	-	-	-	-
Category 4	2.181	2.152–2.211	2.271	2.247–2.295	2.972	2.944–3.000
Category 1	0.053	0.041–0.070	0.056	0.043–0.074	0.102	0.077–0.134
Asthma						
Category 2	-	-	-	-	-	-

Comparison Groups ^j	2009 MMA & ACA			2013 MMA & ACA			2015 MMA & ACA		
	Odds Ratio	95% Confidence Interval		Odds Ratio	95% Confidence Interval		Odds Ratio	95% Confidence Interval	
Category 4	1.982	1.931–2.033		2.036	1.992–2.080		3.017	2.928–3.108	
Category 1	0.013	0.003–0.054		0.015	0.004–0.059		0.030	0.008–0.120	
Depression									
Category 2	-	-	-	-	-	-	-	-	-
Category 4	2.055	2.023–2.087		2.141	2.114–2.168		2.926	2.890–2.963	
Category 1	0.030	0.019–0.047		0.032	0.020–0.050		0.058	0.036–0.093	
Rheumatoid Arthritis									
Category 2	-	-	-	-	-	-	-	-	-
Category 4	1.967	1.888–2.050		2.060	1.991–2.131		2.940	2.822–3.064	
Category 1	-	-	-	-	-	-	-	-	-
End-Stage Renal Disease									
Category 2	-	-	-	-	-	-	-	-	-
Category 4	1.927	1.882–1.972		2.028	1.990–2.068		2.870	2.811–2.930	
Category 1	0.027	0.004–0.202		0.029	0.004–0.215		0.055	0.007–0.403	

ACA: Patient Protection and Affordable Care Act; MMA: Medicare Prescription Drug, Improvement, and Modernization Act