

ORIGINAL RESEARCH

Effects of Medicare Part D on Disparity Implications of Medication Therapy Management Eligibility Criteria

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BACKGROUND: Previous studies have shown that there were greater racial and ethnic disparities among individuals who were ineligible for medication therapy management (MTM) services than among MTM-eligible individuals before the implementation of Medicare Part D in 2006.

OBJECTIVE: To determine whether the implementation of Medicare Part D in 2006 correlates to changes in racial and ethnic disparities among MTM-ineligible and MTM-eligible beneficiaries.

METHODS: Data from the Medicare Current Beneficiary Survey were analyzed in this retrospective observational analysis. To examine potential racial and ethnic disparities, non-Hispanic whites were compared with non-Hispanic blacks and Hispanics. Three aspects of disparities were analyzed, including health status, health services utilization and costs, and medication utilization patterns. A generalized difference-in-differences analysis was used to examine the changes in difference in disparities between MTM-ineligible and MTM-eligible individuals from 2004-2005 to 2007-2008 relative to changes from 2001-2002 and 2004-2005. Various multivariate regressions were used based on the types of dependent variables. A main analysis and several sensitivity analyses were conducted to represent the ranges of MTM eligibility thresholds used by Medicare Part D plans in 2010.

RESULTS: The main analysis showed that Part D implementation was not associated with reductions in greater racial and ethnic disparities among MTM-ineligible than MTM-eligible Medicare beneficiaries. The main analysis suggests that after Part D implementation, Medicare MTM eligibility criteria may not consistently improve the existing racial and ethnic disparities in health status, health services utilization and costs, and medication utilization. By contrast, several sensitivity analyses showed that Part D implementation did correlate with a significant reduction in greater racial disparities among the MTM-ineligible group than the MTM-eligible group in activities of daily living and in instrumental activities of daily living. Part D implementation may be also associated with a reduction in greater ethnic disparities among the MTM-ineligible group than the MTM-eligible groups in the costs of physician visits.

CONCLUSION: Part D implementation was not associated with consistent reductions in the disparity implications of the Medicare MTM eligibility criteria. The main analysis showed that Part D implementation was not associated with a reduction in disparities associated with MTM eligibility, although several sensitivity analyses did show reductions in disparities in specific aspects. Future research should explore alternative Medicare MTM eligibility criteria to eliminate racial and ethnic disparities among the Medicare population.

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The Medicare Part D program was implemented in 2006 according to the Medicare Prescription Drug, Improvement, and Modernization Act (MMA).¹ Medication therapy management (MTM) services were established by the Centers for Medicare & Medicaid Services (CMS) as part of the Part D benefit. MTM services may be furnished by a pharmacist or by other healthcare providers to “ensure that covered Part D drugs prescribed to targeted beneficiaries...are appropriately used to optimize therapeutic outcomes.”¹ The core components of MTM are the formulation of a medication treatment plan and integration of the plan with all health services provided to patients.²

In consideration of limited resources, the MMA restricted MTM services to Medicare beneficiaries meeting all 3 criteria, including (1) having multiple chronic conditions, (2) using multiple Part D drugs, and (3) being likely to exceed a drug cost threshold of \$4000.^{1,3} For the year 2010 and onward, CMS required the eligibility thresholds to be lowered to no more than 3 chronic conditions, 8 drugs, and \$3000 in annual drug costs.³

Of note, 2 of the 3 eligibility criteria depend significantly on the utilization of medications by the beneficiary, whereas multiple studies on medication use patterns have shown that racial and ethnic minorities use fewer medications and incur lower drug costs compared with nonminorities.⁴⁻⁹ Therefore, as Wang and colleagues have found, minorities may be less likely to meet the Medicare MTM eligibility criteria.¹⁰

Furthermore, in a recent study, Wang and colleagues found that non-Hispanic blacks and Hispanics were less likely than non-Hispanic whites to report self-perceived good health status, and that there were greater racial and ethnic disparities among the MTM-ineligible than MTM-eligible beneficiary population before the implementation of Part D based on the 2006 and 2010 MTM eligibility criteria.¹¹ This suggests that MTM eligibility criteria perpetuate the existing racial and ethnic disparities in health status.

The purpose of this present study was to determine the effects of Part D implementation on the health implications of Medicare MTM eligibility across racial and ethnic groups. If this study found that Part D implementation was not associated with reductions in greater racial and ethnic disparities in the MTM-ineligible than the MTM-eligible individuals, the urgency for modifying MTM eligibility criteria would be even greater than established by the previous studies by Wang and colleagues.^{10,11}

Methods

We conducted a retrospective observational analysis using data from the Medicare Current Beneficiary Survey (MCBS; study periods 2001-2002, 2004-2005, and 2007-

KEY POINTS

- The implementation of Medicare Part D established criteria for medication therapy management (MTM) services eligibility to improve beneficiaries' health outcomes.
- Previous researchers found that racial and ethnic minorities may be less likely to meet the MTM eligibility criteria than non-Hispanic whites.
- Previous studies reported greater racial and ethnic disparities in self-perceived health status among MTM-ineligible than MTM-eligible populations.
- This suggests that the MTM eligibility criteria may perpetuate existing racial and ethnic disparities in health status of Medicare beneficiaries.
- This study investigated the effects of Part D implementation on the health implications of Medicare MTM eligibility across racial and ethnic groups.
- The main analysis found that Part D implementation was not associated with reductions in greater racial and ethnic disparities among MTM-ineligible than MTM-eligible beneficiaries.
- However, several sensitivity analyses showed a significant reduction in greater racial disparities among the MTM-ineligible group than the MTM-eligible group in activities of daily living and in instrumental activities of daily living.
- Eliminating racial and ethnic disparities in healthcare has become an essential step to improving the healthcare system.
- Future research should explore alternative MTM eligibility criteria that would be value-based.

2008).¹² The MCBS, which is sponsored by CMS, includes a nationwide sample of Medicare beneficiaries linked to patients' Medicare claims.¹² This continuous, multipurpose survey provides information on Medicare beneficiaries' health status, healthcare utilizations, health insurance coverage, and socioeconomic and demographic characteristics.¹² The Electronic Orange Book Query data files (Orange Book) from the US Food and Drug Administration (FDA) were used to determine characteristics specific to prescription medications.¹³ These files provide comprehensive information for both brand-name and generic medications.

To examine racial and ethnic disparities, 3 major groups were included—non-Hispanic whites, non-Hispanic blacks, and Hispanics. Racial disparities were examined by comparing whites and blacks, and ethnic disparities were examined by comparing whites and Hispanics. To reduce the heterogeneity of the study pop-

ulation, the sample included only home-dwelling Medicare beneficiaries who were eligible for Medicare based on their age. Beneficiaries in a health maintenance organization with a closed network were excluded from the analysis, because not all claims for these individuals were included in the databases.

Theoretical Framework

Andersen's Behavioral Model for Health Services Utilization and Iezzoni's Risk Adjustment Model were applied in this study.^{14,15} According to Andersen's model, independent variables that govern prescription and health services utilization and costs were categorized into 3 groups: predisposing factors (race, ethnicity, age, sex, and marital status), enabling factors (socioeconomic status, education, health insurance, and region of residence), and need factors (self-perceived health status and a risk adjustment summary score).¹⁴ Iezzoni's Risk Adjustment Model was used to analyze health status by categorizing risk dimensions into sociodemographic variables and health status measures.¹⁵

Disparity Measures

The 3 aspects of disparities that were analyzed include health status, health services utilization and costs, and medication utilization patterns. To identify disparities in health status, the following measures were used: self-perceived good health status (classified as good [excellent, very good, or good] or poor [fair or poor]), number of chronic conditions, number of activities of daily living (ADLs), and number of instrumental ADLs (IADLs). To identify chronic conditions, a raw count among a list of 25 chronic conditions was obtained using the Clinical Classifications Software (Rockville, MD).¹⁶ This list was devised by Daniel and Malone and includes all major conditions that were specifically targeted by Medicare Part D.¹⁷

Disparities in health services utilization and costs were measured by number and cost of emergency department visits, physician visits, hospitalizations, and total healthcare costs. Medication utilization patterns were based on the generic-dispensing ratio.^{11,18}

The generic-dispensing ratio was defined as the proportion of generic prescriptions among total prescriptions.^{11,18} The MCBS was linked to the FDA's Orange Book to determine if the medications prescribed were generic or brand-name agents. A pharmacist manually determined if any unmatched medications were generic agents.

Determining MTM Eligibility

To determine MTM eligibility, the 2010 CMS criteria were applied.¹⁹ MTM eligibility thresholds used by Part D plans in 2010 included 2 to 8 Part D drugs (median, 5), 2 to 3 chronic conditions (median, 3), and at least

\$3000 in drug costs. Upper, median, and lower limits were used as representative values for the eligibility thresholds used by Part D plans based on the number of Part D drugs and chronic conditions for each beneficiary.¹⁹ The median and upper limits were the same for chronic conditions, thus 1 main analysis and 5 sensitivity analyses were conducted (3*2*1, representing the number of representative values for the thresholds based on the number of Part D drugs, number of chronic conditions, and the only drug cost threshold; 6 in total).

The main analysis examined the combination of median threshold values for the number of chronic conditions (3 conditions), the number of Part D drugs (5 drugs), and the \$3000 drug cost thresholds, whereas the other 5 of the 6 combinations of those thresholds were calculated as sensitivity analyses. The drug cost was converted to the study year dollars using the Consumer Price Index for medical care.²⁰

Statistical Analysis

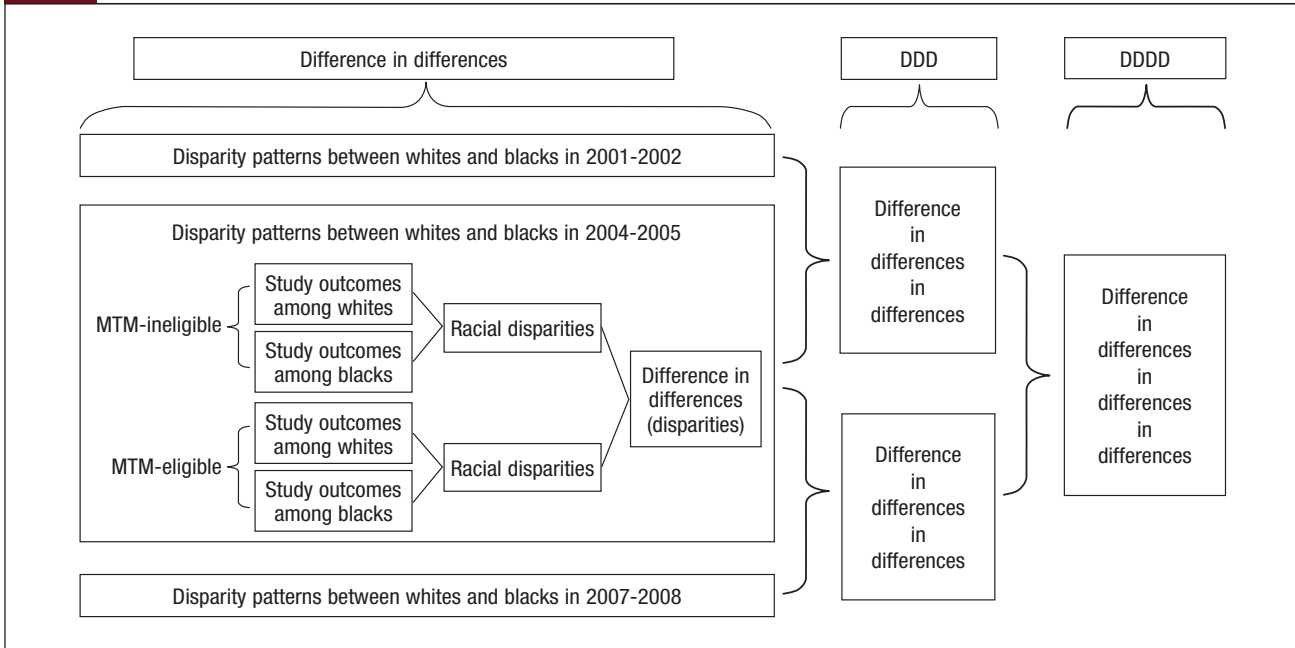
A generalized difference-in-differences (DD) model, a difference-in-differences-in-differences-in-differences (DDDD) model was used. Specifically, differences in patterns of racial and ethnic disparities between MTM-ineligible and MTM-eligible beneficiaries between 2004-2005 and 2007-2008, relative to the changes from 2001-2002 and 2004-2005, were compared and are described in the **Figure**.

(For example, when examining racial disparities, disparities between non-Hispanic whites and blacks were referred to as "difference," whereas DD represented difference in disparities between the MTM-ineligible and MTM-eligible populations. There were 3 DDs in this study, one for each of the time periods—2007-2008, 2004-2005, and 2001-2002. Difference in differences in differences [DDD] in this study refers to changes in racial disparities from one period to the next. Specifically, there were 2 DDDs, one representing changes in DD from 2004-2005 to 2007-2008, the other for changes in DD from 2001-2002 to 2004-2005. DDDD in this study represents the difference in these 2 DDDs.)

Racial and ethnic disparities were analyzed separately in regression models (see **Appendix** at www.AHDBonline.com). The functional forms of the regression models varied according to the types of dependent variables. For example, a logistic regression was used when analyzing self-perceived good health status and high-risk medication use.

A negative binomial model was used for count variables, including ADLs, IADLs, number of emergency department visits, number of physician visits, and number of hospitalizations. A Poisson regression was used for the number of chronic diseases, because a negative bino-

Figure Research Design



NOTE: This figure used the 2004-2005 period to illustrate difference in differences (disparities) between individuals eligible for MTM services and those ineligible for MTM.

DDD indicates difference in differences in differences; DDDD, difference in differences in differences in differences; MTM, medication therapy management.

mial model would not converge. A generalized linear model was analyzed using log link and gamma distribution on all cost variables. An ordinary least squares regression was used for the generic-dispensing ratio.

The highest levels of differences (ie, DDDD) calculated in this study were carried out with a creative programming method using STATA (StataCorp LP, College Station, TX) that is based on the interpretative method on the additive term (also called marginal effect). This method takes into account only the baseline effect among the reference group.²¹

The complex sampling structure of MCBS, including primary sampling units, strata, and cross-sectional full sample weights, was accounted for in all data analyses using SAS 9.3 (SAS Institute Inc, Cary, NC) and STATA 12.0. This study was deemed exempt from further Institutional Review Board review at the lead author's institution.

Results

The 2001-2002 study sample included a total of 15,787 (weighted to 54,259,004) Medicare beneficiaries. The sample included 13,299 whites (weighted to 45,997,416 or 84.77%), 1408 non-Hispanic blacks (weighted to 4,489,293 or 8.27%), and 1080 Hispanics (weighted to 3,772,315 or 6.95%).

Significant differences were noted between whites and minorities on several demographic characteristics (Table 1). In comparison to whites, minorities were less likely to be married, and were more likely to have lower levels of education, belong to poorer income categories, have Medicaid, and have reported poorer health status ($P < .05$). The 2004-2005 and 2007-2008 samples had similar characteristics.

Based on unadjusted and adjusted multivariate regression models in the DDDD part of the analyses, the main analysis (representing the combination of 5 Part D drugs, 3 chronic conditions, and \$3000 in drug costs) did not find any significant DDDD (Table 2, Panel 1).

However, significant findings were seen in other levels of differences and in some variables' sensitivity analyses. For example, the marginal effects were higher among whites than among blacks in the model (Table 3, Panel 1). In the DD part of the analysis, the difference was calculated for the differences between whites and blacks among the MTM-ineligible and the MTM-eligible beneficiaries.

This study found significant differences for every individual time period in the unadjusted model for the self-perceived good health status, including 2001-2002 (difference in odds, 2.49; $P < .001$; 95% confidence interval [CI], 1.96-3.02); 2004-2005 (difference in odds, 2.51;

Table 1 Sociodemographic Characteristics across Racial and Ethnic Groups in the Medicare Population, 2001-2002

Variables	Groups	Non-Hispanic whites, N (%)	Non-Hispanic blacks, N (%)	Hispanics, N (%)
Age, yrs ^a	65-74	5787 (51.52)	635 (53.93)	536 (57.46)
	75-84	5361 (37.00)	512 (33.45)	368 (31.17)
	≥85	2151 (11.47)	261 (12.62)	176 (11.37)
Sex	Female	7563 (56.80)	867 (60.71)	634 (59.51)
	Male	5736 (43.20)	541 (39.29)	446 (40.49)
Marital status ^{a,b}	Not married	5931 (42.06)	945 (65.11)	547 (47.48)
	Married	7362 (57.94)	461 (34.89)	530 (52.52)
Education ^{a,b}	Lower than high school	3657 (30.91)	895 (64.78)	666 (66.04)
	High school	4086 (38.12)	266 (22.31)	183 (19.91)
	Higher than high school	3293 (30.97)	141 (12.91)	129 (14.05)
Poverty status ^{a,b}	100% FPL	1272 (11.36)	528 (37.71)	367 (35.13)
	100%-149% FPL	1949 (17.61)	328 (24.98)	253 (24.92)
	150%-199% FPL	1621 (14.73)	175 (13.70)	134 (13.90)
	200%-300% FPL	3045 (29.12)	184 (14.83)	161 (16.70)
	>300% FPL	2704 (27.18)	89 (8.79)	84 (9.36)
Medicaid ^{a,b}	No	12,291 (92.95)	885 (66.09)	654 (62.55)
	Yes	1008 (7.05)	523 (33.91)	426 (37.45)
US Census region ^{a,b}	Northeast	2607 (20.51)	216 (18.21)	119 (16.32)
	Midwest	3519 (26.44)	203 (15.51)	86 (10.42)
	South	4876 (36.70)	896 (58.47)	338 (40.81)
	West	2282 (16.34)	90 (7.81)	245 (32.45)
Metropolitan statistical area ^b	No	4395 (27.98)	405 (21.88)	154 (11.66)
	Yes	8899 (72.02)	1002 (78.12)	926 (88.34)
Self-perceived health status ^{a,b}	Excellent	2189 (17.48)	142 (10.88)	137 (14.02)
	Very good	3961 (30.58)	293 (22.91)	227 (21.80)
	Good	4234 (31.68)	477 (33.38)	352 (33.25)
	Fair	2095 (14.79)	372 (25.37)	280 (24.44)
	Poor	750 (5.47)	120 (7.46)	79 (6.50)

^a*P* <.05 for the difference between non-Hispanic whites and Hispanics.
^b*P* <.05 for the difference between non-Hispanic whites and non-Hispanic blacks.
FPL indicates federal poverty level.

P <.001; 95% CI, 1.77-3.25); and 2007-2008 (difference in odds, 2.24; *P* <.001; 95% CI, 1.17-3.3). These results suggest that racial disparities may be greater among MTM-ineligible beneficiaries than among MTM-eligible beneficiaries. Similar patterns were found in the adjusted model (Table 2, Panel 1).

Nonetheless, neither the difference-in-differences-in-differences (DDD) nor the DDDD part of the analyses revealed significant findings, which indicates that Part D was not associated with significant changes in pat-

terns of disparities (DDDD in the unadjusted model = -0.30; *P* = .72; 95% CI, -1.97 to 1.37; DDDD in the adjusted model = -0.56; *P* = .63; 95% CI, -2.82 to 1.71). The sensitivity analyses for self-perceived good health status had similar findings.

For a few variables, however, when examining racial disparities, some sensitivity analyses did produce significant findings for the DDDD part of the analysis, suggesting that Part D may be associated with significant changes in disparities in some situations. Specifically, in the

Table 2, Panel 1

Unadjusted and Adjusted Estimates of Part D Effect on Health Implications of MTM Eligibility Criteria across Groups, based on 2010 Eligibility Criteria: Main Analysis^a

Outcomes		2001-2002 (DD) ^b	2004-2005 (DD) ^b	2007-2008 (DD) ^b	2001-2002 vs 2004-2005 (DDD) ^c	2007-2008 vs 2004-2005 (DDD) ^c	Part D effect (DDDD) ^d
Health status							
Self-perceived good health status	Unadjusted	2.49 ^e	2.51 ^e	2.24 ^e	-0.02	-0.28	-0.30
	Adjusted	2.26 ^e	2.37 ^e	1.92 ^e	-0.10	-0.45	-0.56
Chronic diseases, N	Unadjusted	-0.26	-0.19	-0.14	-0.07	0.05	-0.02
	Adjusted	-0.25	-0.17	-0.22	-0.08	-0.05	-0.12
Activities of daily living, N	Unadjusted	-0.14	-0.05	0.22	-0.09	0.27	0.18
	Adjusted	-0.14	-0.14	0.63 ^e	-0.001	0.77 ^e	0.76
Instrumental activities of daily living, N	Unadjusted	-0.15	-0.04	0.27	-0.10	0.31	0.21
	Adjusted	-0.17	-0.06	0.58 ^e	-0.11	0.64	0.53
Health services utilization/costs							
Emergency department visits, N	Unadjusted	-0.04	0.14 ^e	0.07	-0.18	-0.07	-0.25
	Adjusted	-0.03	0.09	0.13 ^e	-0.12	0.04	-0.08
Emergency department cost, \$	Unadjusted	-13.95	31.61	21.11	-45.56	-10.50	-56.06
	Adjusted	-35.77	-25.53	93.77	-10.24	119.31	109.06
Physician visits, N	Unadjusted	-4.28	-1.90	0.04	-2.38	1.95	-0.43
	Adjusted	-6.27 ^e	-0.83	-3.82	-5.44	-2.99	-8.43
Cost of physician visits, \$	Unadjusted	-48.08	-725.43	510.70	677.35	1236.13	1913.47
	Adjusted	-125.77	-738.56	-736.69	612.80	1.87	614.67
Hospitalizations, N	Unadjusted	-0.08	-0.09	-0.003	0.002	0.08	0.09
	Adjusted	-0.07	-0.11	-0.05	0.03	0.06	0.09
Hospitalization cost, \$	Unadjusted	-901.71	-918.14	-792.26	16.43	125.89	142.32
	Adjusted	-891.81	-598.73	-975.07	-293.08	-376.34	-669.42
Total cost, \$	Unadjusted	-1462.66	-2793.35	164.90	1330.69	2958.25	4288.93
	Adjusted	-1485.44	-2190.91	-905.71	705.47	1285.20	1990.67
Medication utilization							
Generic-dispensing ratio	Unadjusted	-0.01	0.02	0.03	-0.03	0.01	-0.01
	Adjusted	-0.01	0.02	0.05	-0.04	0.02	-0.01

^aEligibility thresholds examined 5 Part D drugs, 3 chronic conditions, and \$3000 in drug costs.
^bDD (Difference in differences [disparities]) = (MTM-ineligible whites – MTM-ineligible blacks) – (MTM-eligible whites – MTM-eligible blacks).
^cDDD (Difference in differences in differences [disparities]) = DD for (2007-2008) – DD for (2004-2005) or DD for (2004-2005) – DD for (2004-2005) – DD for (2001-2002).
^dDDDD (Difference in differences in differences in differences [disparities]) = DDD for ([2007-2008] vs [2004-2005]) – DDD for ([2004-2005] vs [2001-2002]).
^eP < .05.
 DD indicates difference in differences; DDD, difference in differences in differences; DDDD, difference in differences in differences in differences; MTM, medication therapy management.

analysis of ADLs, only sensitivity analysis 5 (thresholds of ≥8 drugs, ≥2 chronic conditions, and >\$3000 in drug costs) produced a significant DDDD estimate of 1.13 in the adjusted model (P = .03; 95% CI, 0.09-2.17).

The interpretation of this estimate requires an examination of all levels of differences involved. The marginal effects were typically lower among whites than blacks (Table 3, Panel 1). The same patterns predominantly

Table 3, Panel 1 Differences between Non-Hispanic Whites and Non-Hispanic Blacks, Measured by Marginal Effects for Select Variables and Analyses

Time period	MTM eligibility	Group	Marginal effect	Standard error	95% confidence interval	Differences between non-Hispanic whites & blacks
Self-perceived health status (unadjusted main analysis)						
2001-2002	Ineligible	Whites	5.12	0.19	4.76-5.49	2.84
		Blacks	2.28	0.18	1.92-2.64	
	Eligible	Whites	1.53	0.07	1.39-1.66	0.36
		Blacks	1.17	0.19	0.80-1.54	
2004-2005	Ineligible	Whites	5.86	0.22	5.43-6.28	3.24
		Blacks	2.61	0.25	2.11-3.11	
	Eligible	Whites	1.81	0.08	1.66-1.97	0.73
		Blacks	1.08	0.16	0.77-1.39	
2007-2008	Ineligible	Whites	6.47	0.27	5.94-7.01	2.94
		Blacks	3.53	0.43	2.69-4.38	
	Eligible	Whites	1.71	0.08	1.56-1.87	0.71
		Blacks	1.01	0.18	0.66-1.36	
Activities of daily living (adjusted sensitivity analysis 5)						
2001-2002	Ineligible	Whites	0.56	0.02	0.52-0.59	-0.32
		Blacks	0.88	0.07	0.73-1.02	
	Eligible	Whites	1.44	0.07	1.30-1.58	-0.30
		Blacks	1.74	0.22	1.30-2.18	
2004-2005	Ineligible	Whites	0.48	0.02	0.44-0.51	-0.28
		Blacks	0.76	0.06	0.64-0.88	
	Eligible	Whites	1.32	0.06	1.21-1.43	0.02
		Blacks	1.29	0.18	0.93-1.65	
2007-2008	Ineligible	Whites	0.44	0.02	0.40-0.49	-0.16
		Blacks	0.61	0.05	0.51-0.71	
	Eligible	Whites	1.16	0.06	1.04-1.27	-0.70
		Blacks	1.85	0.30	1.26-2.45	
Instrumental activities of daily living (adjusted sensitivity analysis 4)						
2001-2002	Ineligible	Whites	0.48	0.01	0.45-0.50	-0.23
		Blacks	0.71	0.05	0.60-0.81	
	Eligible	Whites	0.94	0.04	0.86-1.02	-0.11
		Blacks	1.05	0.14	0.78-1.32	
2004-2005	Ineligible	Whites	0.63	0.02	0.60-0.67	-0.37
		Blacks	1.00	0.07	0.87-1.13	
	Eligible	Whites	1.64	0.06	1.53-1.76	-0.02
		Blacks	1.66	0.18	1.30-2.02	
2007-2008	Ineligible	Whites	0.61	0.02	0.57-0.64	-0.23
		Blacks	0.84	0.07	0.70-0.97	
	Eligible	Whites	1.40	0.06	1.27-1.52	-0.60
		Blacks	1.99	0.25	1.51-2.47	

MTM indicates medication therapy management.

Table 2, Panel 2		Unadjusted and Adjusted Estimates of Part D Effect on Health Implications of MTM-Eligibility Criteria across Ethnic Groups, based on 2010 Eligibility Criteria (Main Analysis)^a					
Outcomes		2001-2002 (DD) ^b	2004-2005 (DD) ^b	2007-2008 (DD) ^b	2001-2002 vs 2004-2005 (DDD) ^c	2004-2005 vs 2007-2008 (DDD) ^c	Part D effect (DDDD) ^d
Health status							
Self-perceived good health status	Unadjusted	2.06 ^e	1.95 ^e	3.13 ^e	0.10	1.18	1.29
	Adjusted	1.85 ^e	1.77 ^e	2.83 ^e	0.08	1.06	1.14
Chronic diseases, N	Unadjusted	0.26	0.07	0.29	0.19	0.22	0.40
	Adjusted	0.24	0.03	0.26	0.21	0.23	0.44
Activities of daily living	Unadjusted	0.26	-0.04	-0.02	0.30	0.02	0.31
	Adjusted	0.30	-0.21	-0.08	0.51	-0.13	0.64
Instrumental activities of daily living	Unadjusted	0.34 ^e	0.08	0.05	0.26	-0.03	0.23
	Adjusted	0.28	-0.06	0.07	0.34	0.13	0.47
Health services utilization/costs							
Emergency department visits, N	Unadjusted	-0.002	0.06	0.01	-0.07	-0.05	-0.12
	Adjusted	-0.05	0.04	0.02	-0.09	-0.02	0.10
Emergency department cost, \$	Unadjusted	-22.48	-11.79	-15.07	-10.69	-3.28	-13.97
	Adjusted	-65.23	-61.86	-32.59	-3.37	29.27	25.89
Physician visits, N	Unadjusted	-3.85	4.57	9.70 ^e	-8.43	5.13	-3.30
	Adjusted	-1.04	5.97	4.43	-7.01	-1.54	-8.54
Cost of physician visits, \$	Unadjusted	-946.22	1793.64	-136.80	-2739.87	-1930.45	-4670.31
	Adjusted	-834.08	2311.65	320.71	-3145.73 ^e	-1990.94	-5136.67
Hospitalizations, N	Unadjusted	-0.16	0.03	0.02	-0.19	-0.01	-0.20
	Adjusted	-0.23	-0.003	0.01	-0.22	0.01	-0.21
Hospitalization cost, \$	Unadjusted	-498.20	453.10	762.66	-951.31	309.55	-641.76
	Adjusted	-1756.59	-135.06	-445.20	-1621.53	-310.14	-1931.67
Total costs, \$	Unadjusted	-1309.96	2369.43	3150.54	-3679.38	781.11	-2898.27
	Adjusted	-2198.01	2821.89	2172.83	-5019.90	-649.06	-5658.95
Medication utilization							
Generic dispensing ratio	Unadjusted	-0.001	-0.002	0.02	0.001	0.03	0.03
	Adjusted	0.001	0.0003	0.03	0.0003	0.03	0.03

^aEligibility thresholds examined 5 Part D drugs, 3 chronic conditions, and \$3000 in drug costs.
^bDD (Difference in differences) = (MTM-ineligible whites – MTM-ineligible blacks) – (MTM-eligible whites – MTM-eligible blacks).
^cDDD (Difference in differences in differences) = DD for (2007-2008) – DD for (2004-2005) or DD for (2004-2005) – DD for (2004-2005) – DD for (2001-2002).
^dDDDD (Difference in differences in differences in differences) = DDD for ([2007-2008] vs [2004-2005]) – DDD for ([2004-2005] vs [2001-2002]).
^eP < .05.
 DD indicates difference in differences; DDD, difference in differences in differences; DDDD, difference in differences in differences in differences; MTM, medication therapy management.

held for 2004-2005 and 2007-2008 (Table 3, Panel 1). The DD between the MTM-ineligible group and the MTM-eligible group was -0.02 (P = .94) for 2001-2002; -0.31 for 2004-2005 (P = .09); and 0.54 (P = .09) for 2007-2008, suggesting there may not be significant difference in the abovementioned disparity patterns be-

tween the MTM-ineligible and MTM-eligible groups for any time periods examined.

Furthermore, the DDD was found to be -0.29 (P = .36) for 2004-2005 versus 2001-2002 and 0.84 (P = .01) for 2007-2008 versus 2004-2005, indicating that there may be a decrease in the greater racial disparity among the

Table 3, Panel 2 Differences between Non-Hispanic Whites and Hispanics, Measured by Marginal Effects on Non-Hispanic Whites and Hispanics for Select Variables and Analyses

Time period	MTM eligibility	Group	Marginal effect	Standard error	95% confidence interval	Differences between non-Hispanic whites & Hispanics
Self-perceived good health status (unadjusted main analysis)						
2001-2002	Ineligible	Whites	5.12	0.19	4.76-5.49	2.60
		Hispanics	2.53	0.21	2.11-2.95	
	Eligible	Whites	1.53	0.07	1.39-1.66	0.54
		Hispanics	0.99	0.17	0.65-1.32	
2004-2005	Ineligible	Whites	5.86	0.22	5.43-6.28	2.74
		Hispanics	3.12	0.37	2.39-3.85	
	Eligible	Whites	1.81	0.08	1.66-1.97	0.79
		Hispanics	1.02	0.18	0.67-1.38	
2007-2008	Ineligible	Whites	6.47	0.27	5.94-7.01	3.63
		Hispanics	2.84	0.37	2.13-3.56	
	Eligible	Whites	1.71	0.08	1.56-1.87	0.50
		Hispanics	1.22	0.24	0.74-1.70	
Costs of physician visits (adjusted sensitivity analysis 1)						
2001-2002	Ineligible	Whites	2177.49	60.36	2059.19-2295.79	-376.28
		Hispanics	2553.77	611.89	1354.49-3753.05	
	Eligible	Whites	4747.57	183.95	4387.02-5108.11	688.58
		Hispanics	4058.99	415.98	3243.69-4874.29	
2004-2005	Ineligible	Whites	2716.63	81.63	2556.65-2876.62	503.10
		Hispanics	2213.53	128.99	1960.71-2466.35	
	Eligible	Whites	5507.98	283.04	4953.24-6062.72	-1406.17
		Hispanics	6914.15	983.19	4987.14-8841.16	
2007-2008	Ineligible	Whites	2985.01	137.39	2715.73-3254.29	1087.59
		Hispanics	1897.42	195.87	1513.52-2281.32	
	Eligible	Whites	6184.31	236.85	5720.10-6648.52	817.90
		Hispanics	5366.42	452.90	4478.75-6254.08	
MTM indicates medication therapy management.						

MTM-ineligible than in the MTM-eligible populations when comparing 2007-2008 and 2004-2005, but there may not be significant changes when comparing 2001-2002 and 2004-2005.

These findings, combined with the significant DDDD value of 1.13, suggest that Part D implementation may be associated with a decrease in any racial disparities in ADLs among the MTM-ineligible group versus the MTM-eligible group using the combinations of eligibility thresholds for sensitivity analysis 5. For the variable IADLs, the same patterns as ADLs were found in sensi-

tivity analysis 4 (for thresholds of ≥ 8 drugs, ≥ 3 chronic conditions, and $> \$3000$ in drug costs) and sensitivity analysis 5. This suggests that Part D implementation may be also associated with a greater decrease in any racial disparities in IADLs among the MTM-ineligible group than among the MTM-eligible group.

With regard to racial disparities, no other variables were found to be associated with significant results in the DDDD part of the analysis.

Concerning the comparison between whites and Hispanics, the main analysis did not find significant DDDD

for any variable (Table 2, Panel 2). However, the analysis of costs of physician visits did show significant findings for some sensitivity analyses. For costs of physician visits, the DDDD was found to be significant in the adjusted models for sensitivity analysis 1 (thresholds of ≥ 2 drugs, ≥ 2 chronic conditions, and $> \$3000$ in drug costs) and analysis 3 (thresholds of ≥ 5 drugs, ≥ 2 chronic conditions, and $> \$3000$ in drug costs). The DDDD estimate was -4613.71 ($P = .04$; 95% CI, -8907.29 to -320.13) for sensitivity analysis 1.

The marginal effects were quantitatively higher among whites than among Hispanics under most situations, although the CIs did not overlap for the MTM-ineligible groups in 2004-2005 and in 2007-2008 (Table 3, Panel 2). The DD estimates were -1064.86 ($P = .17$) for 2001-2002; 1909.27 ($P = .06$) for 2004-2005; and 269.69 ($P = .63$) for 2007-2008, suggesting that disparities between whites and Hispanics were similar between MTM-ineligible and MTM-eligible populations for all time periods.

The DDD values were 2974.13 ($P = .02$) when comparing 2004-2005 and 2001-2002, and -1639.58 when comparing 2007-2008 and 2004-2005 ($P = .15$). When combined with the DDDD value of -4613.71 ($P = .04$), these findings suggest that Part D implementation was associated with a reduction in greater ethnic disparities in the costs of physician visits for the MTM-ineligible than for the MTM-eligible groups.

Sensitivity analysis 3 had similar results, showing a DDDD estimate of -5094.36 ($P = .03$). No other variables were found to be associated with significant findings in the DDDD part of the analysis.

Discussion

This study sought to determine the effects of Part D implementation, based on the 2010 MTM eligibility criteria, on differences in racial and ethnic disparities in health status, health services utilization and costs, and medication utilization between the MTM-ineligible group and the MTM-eligible group. Although several sensitivity analyses for a few variables showed significant association between Part D implementation and MTM disparities, the results of the main analysis did not show a significant association between Part D implementation and MTM disparities. This suggests that after Part D implementation, the Medicare MTM eligibility criteria did not mitigate the majority of variables related to existing racial and ethnic disparities in health status, health services utilization and costs, and medication utilization.

However, it is important to note that in some situations, Part D did correlate with a significant reduction in racial disparities, specifically among the MTM-ineligible

group versus the MTM-eligible groups in relation to ADLs (sensitivity analysis 5) and IADLs (sensitivity analyses 4 and 5).

Furthermore, Part D implementation also may be associated with a greater reduction in ethnic disparities, if any, among the MTM-ineligible group versus the MTM-eligible groups in the costs of physician visits (sensitivity analyses 1 and 3). However, these findings are not comforting, because the combinations of the thresholds in the sensitivity analyses were used by Part D plans less frequently than the combination of the thresholds in the main analysis.

This suggests that after Part D implementation, the Medicare MTM eligibility criteria did not mitigate the majority of variables related to existing racial and ethnic disparities in health status, health services utilization and costs, and medication utilization.

These findings are not surprising. Previous literature has reported that Part D implementation led to higher medication utilization, but also had mixed effects on patient health status and the use of healthcare resources other than prescription medications.²²⁻²⁴ In addition, Part D has been found to have mixed effects on racial and ethnic disparities in prescription utilization.^{25,26}

This present study did reveal significant differences in several variables. For example, the self-perceived health status measured by marginal effects was higher among non-Hispanic whites than among non-Hispanic blacks and Hispanics. In addition, this study found that there were greater disparities in self-perceived good health status in MTM-ineligible than in the MTM-eligible population. Both results are consistent with previous research.¹¹

The reasons for the absence of consistent and significant effects of Part D implementation on racial and ethnic disparities may be complex. For example, various barriers hinder appropriate medication utilization among minorities, including patients' lack of accurate knowledge about medications. Omojasola and colleagues found that blacks and Hispanics were 10 times as likely as whites to believe that generic drugs had more side effects.²⁷

Blacks and Hispanics were also 4 times as likely to agree that generic drugs were inferior to brand-name drugs when compared with their white counterparts. However, respondents who found generic drugs comparable with brand-name drugs were 3 times more likely to

use generic drug discount programs.²⁷ The negative perceptions regarding generic drugs among minority patients likely prevent these patients from enjoying the benefits of generic prescriptions, such as decreased total out-of-pocket expenses and a reduction of cost-related barriers to medication adherence.

One additional cause for the limited effects of Part D may be that blacks and Hispanics are more likely to have lower income and education levels and poorer health status, which are associated with problems related to healthcare coverage and access.^{28,29} Socioeconomic status is a particularly serious challenge to reducing racial and ethnic disparities in health outcomes and can also hinder the potential benefits of MTM services.

For example, Cook and colleagues assessed patient behaviors after MTM services and found that poverty status was associated with participants taking less action after a medication review, even after adjusting for factors such as insurance.³⁰ Therefore, even if MTM services are available to eligible minorities, socioeconomic factors have a substantial impact on whether health disparity patterns improve as a result of these services. Reducing disparity implications of MTM services, therefore, may have to take a multipronged approach.

Prioritization of value-based healthcare (where costs and benefits are balanced) rather than cost-based healthcare represents a key strategy in combating racial and ethnic disparities.

This study is important also because eliminating racial and ethnic disparities in healthcare has become an essential step to improving the healthcare system. Since the first report about racial and ethnic disparities was issued in the 1980s,³¹ bridging the gap between minorities and nonminorities has become a primary goal of government agencies, such as the US Department of Health and Human Services (HHS).³²

The HHS initiative Healthy People 2010/2020 set the elimination of disparities as one of its goals.³³ In addition, the National Institute on Minority Health and Health Disparities pursues the mission “to lead scientific research to improve minority health and eliminate health disparities.”³⁴ Its research aims for an “America in which all populations will have an equal opportunity to live long, healthy, and productive lives.”³⁴

Prioritization of value-based healthcare (where costs and benefits are balanced) rather than cost-based healthcare represents a key strategy in combating racial and ethnic disparities. Given the same health status, minori-

ties tend to use fewer prescription medications and incur lower drug costs than do whites, and thus are less likely to be eligible for MTM services.¹⁰

According to Porter, within a value-based system, good health is ultimately less costly than poor health, so the best way to contain cost may be to improve the health of the population.³⁵ Future research should explore alternative MTM eligibility criteria that would be value-based.

Limitations

This study has limitations. Because of the unavailability to the research community of MTM claims databases suitable for this study, the analyses conducted were based on policy scenarios rather than on actual beneficiary enrollment data for MTM services. Similarly, disparities in MTM eligibility were examined rather than actual receipt of services. However, it is necessary to examine eligibility criteria to ensure that awareness is raised among policymakers regarding the disparity effects of these criteria.

In addition, the main analysis did not show significant differences; however, several scenarios in the sensitivity analyses did find that the Part D implementation was associated with significant reduction in greater racial and ethnic disparities among the MTM-ineligible population compared with the MTM-eligible population in measures of health status, health services utilization and services, and medication utilization patterns.

Furthermore, the categorization of the study sample into 3 racial and ethnic groups may not accurately reflect variation in biology, culture, or preferences, although data from the MCBS have been considered authoritative for the reported information on race and ethnicity when compared with other databases.^{4,36,37}

Conclusion

The results of this study indicate that the greater racial and ethnic disparities seen among the Medicare MTM-ineligible population than the MTM-eligible population in measures related to health status, health services utilization and services, and medication utilization patterns may not have been significantly reduced after the implementation of Medicare Part D. These results highlight a need for the US healthcare system to develop strategies to address these health inequalities and/or gaps between nonminority and minority Medicare beneficiaries to improve the health of the population. Future studies should explore strategies to eliminate the disparity implications related to the MTM eligibility as reflected in health status, health services utilizations and costs, and medication utilization patterns. ■

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STAKEHOLDER PERSPECTIVE

Medication Therapy Management, Medicare, and Disparities in Population Health

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Racial and ethnic disparities in health and healthcare among older adults, including Medicare beneficiaries, have been long-standing public health concerns in the United States. The study by Wang and colleagues in this issue of the journal is yet another reminder that the current Medicare program, specifically Medicare Part D, needs to better prioritize the unmet healthcare needs of minority populations.

PATIENTS: The findings in the study by Wang and colleagues have important health implications for minority patients, particularly black and Hispanic Medicare beneficiaries with Part D coverage. Black and Hispanic patients are more likely than nonminority patients to underuse prescription medications, which are often critical for improving their health. Consequently, they are also less likely to qualify for or to meet the eligibility criteria for medication therapy management (MTM), which is largely based on the number, types, and costs of medications prescribed. MTM programs have important health benefits and are often associated with improved medication adherence and health outcomes.

Therefore, as the results of this study suggest, current Medicare Part D MTM programs may be perpetuating existing disparities in health status, considering that nonminority patients are more likely to be eligible for and to benefit from these programs. The current Medicare Part D MTM program requirements ignore the problem of the persistent underuse of prescription medications among chronically ill minority patients with Medicare coverage.

POLICYMAKERS: This study has important implications for Medicare policy and reiterates that Medicare programs, such as MTM, should focus more on improving population health. Programs such as Medicare Part D

need to target the unmet health and healthcare needs of the minority Medicare population. The current MTM program structure is poorly designed, because it disproportionately excludes the patients who are most at risk for poor health outcomes—low-income minority Medicare beneficiaries with multiple chronic conditions who are prescribed multiple medications but are often not using them. These are the patients who are less likely to adhere to prescription medications and the most likely to benefit from an MTM program.

Alongside health reform efforts to improve population health and reduce health disparities through the provision of population-based healthcare, Medicare Part D should also adopt a similar mechanism in identifying MTM-eligible Medicare enrollees. Such an alternative strategy should be designed to target patients and not numbers; the number of prescription medications (from a predetermined list of eligible medications) is currently a criterion for MTM eligibility. For example, all Medicare beneficiaries with specific chronic conditions for which medications are critical in improving health outcomes should be eligible.

Targeting patients with conditions that are major contributors to health disparities (eg, hypertension, diabetes, and cardiovascular disease) should also be prioritized. This population-based approach may not only improve health outcomes for minority patients but may also get us closer to reducing the gap in health outcomes between minority and nonminority older adults.

Ultimately, efforts to reduce disparities in population health, whether through the implementation of MTM or the reduction of the costs of prescription medications, will result in considerable cost-savings to the US healthcare system. ■

APPENDIX

Effects of Medicare Part D on Disparity Implications of Medication Therapy Management Eligibility Criteria

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When examining the effect of Medicare Part D on racial disparities, the expected value of y (ie, dependent variable) can be analyzed using the following difference-in-differences-in-differences (DDD) model:

$$E [y|Black, Eligible, Period] = F [b_0 + b_1Black + b_2 Eligible + b_3PostPeriod + b_4 ComparisonPeriod + b_5Black * Eligible + b_6Black * PostPeriod + b_7 Black * ComparisonPeriod + b_8Eligible * PostPeriod + b_9Eligible * ComparisonPeriod + b_{10} Black * Eligible * PostPeriod + b_{11}Black * Eligible * ComparisonPeriod + e]$$

In this equation, the function “F” depends on the nature of the dependent variable:
-“Black” denotes a dummy variable (1 for blacks, 0 for whites)
-“Eligible” denotes a dummy variable for individuals’ medication therapy management (MTM) eligibility (1 for eligible, 0 for ineligible)
-“Period” denotes a vector of categorical variables and represents 3 different time periods, including 2004-2005 as the reference period and dummy variables for the “PostPeriod” (1 for 2007-2008) and “ComparisonPeriod” (1 for 2001-2002).

The coefficient estimate for “Black*Eligible*PostPeriod” (b_{10}) is a 3-way interaction term representing changes in differences in disparity patterns between MTM-ineligible and MTM-eligible individuals between 2007-2008 (PostPeriod) and 2004-2005 (ReferencePeriod).

Similarly, the coefficient estimate for “Black*Eligible*ComparisonPeriod” (b_{11}) is an interaction term representing changes from 2001-2002 (ComparisonPeriod) to 2004-2005 (ReferencePeriod). The “e” is an error term. Because 2004-2005 is an earlier period than 2007-

2008, the models were linear, so the net effect of Part D could be directly estimated by calculating the difference between b_{10} and negative b_{11} .

Thus, another level of difference was calculated based on results from the DDD model, resulting in a difference-in-differences-in-differences-in-differences (DDDD) model (see **Figure** in the body of the article).

The interpretation of the results depends on the direction of disparities. If whites had lower values for a variable than minorities, and if the confidence interval of DDDD included only positive values, then that would suggest that the difference in racial disparities was reduced after implementing Part D. Similarly, the same conclusion would be true if whites had higher values for a variable, and if the confidence interval included only negative values.