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Potential Health Implications of Racial and Ethnic Disparities in Meeting MTM Eligibility Criteria

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Abstract

Background—Previous studies have found that racial and ethnic minorities would be less likely to meet the Medicare eligibility criteria for medication therapy management (MTM) services than their non-Hispanic White counterparts.

Objectives—To examine whether racial and ethnic disparities in health status, health services utilization and costs, and medication utilization patterns among MTM-ineligible individuals differed from MTM-eligible individuals.

Methods—This study analyzed Medicare beneficiaries in 2004–2005 Medicare Current Beneficiary Survey. Various multivariate regressions were employed depending on the nature of dependent variables. Interaction terms between the dummy variables for Blacks (and Hispanics) and MTM eligibility were included to test whether disparity patterns varied between MTM-ineligible and MTM-eligible individuals. Main and sensitivity analyses were conducted for MTM eligibility thresholds for 2006 and 2010.

Results—Based on the main analysis for 2006 MTM eligibility criteria, the proportions for self-reported good health status for Whites and Blacks were 82.82% vs. 70.75%, respectively (difference=12.07%; $P < .001$), among MTM-ineligible population; and 56.98% vs. 52.14%, respectively (difference=4.84%; $P = .31$), among MTM-eligible population. The difference between these differences was 7.23% ($P < .001$). In the adjusted logistic regression, the interaction effect for Blacks and MTM eligibility had an OR of 1.57 (95% Confidence Interval, or CI=0.98–2.52) on multiplicative term and difference in odds of 2.38 (95% CI=1.54–3.22) on additive term. Analyses for disparities between Whites and Hispanics found similar disparity patterns. All analyses for 2006 and 2010 eligibility criteria generally reported similar patterns. Analyses of other measures did not find greater racial or ethnic disparities among the MTM-ineligible than MTM-eligible individuals.

Conclusions—Disparities in MTM eligibility may aggravate existing racial and ethnic disparities in health outcomes. However, disparities in MTM eligibility may not aggravate existing disparities in health services utilization and costs and medication utilization patterns. Future studies should examine the effects of Medicare Part D on these disparities.

Keywords

Health disparities; race; ethnicity; medication therapy management services; eligibility criteria

INTRODUCTION

The Medicare Prescription Drug, Improvement, and Modernization Act (MMA) was implemented by the Centers for Medicare and Medicaid Services (CMS) in 2006.¹ This federal law established the outpatient prescription drug (Part D) benefits for Medicare beneficiaries. Also according to this federal law, CMS required Part D plans to establish medication therapy management (MTM) programs for targeted beneficiaries.¹ The purpose for establishing MTM programs was to “optimize therapeutic outcomes... by improving medication use and reducing adverse events.”¹ MTM services consist of a distinct group of services whose core components are the formulation of a medication treatment plan and the integration of the plan within the context of all health services provided to patients.^{2,3} These services can be provided by pharmacists or other qualified health care providers.¹ In 2011, over 90% of MTM services were provided by pharmacists in various practice settings.⁴

MTM programs are important because of the increased use of prescription drugs and inappropriate drug use among older adults compared to their younger counterparts. The rate of inappropriate drug use among ambulatory older adults was estimated to be as high as 17–48%.⁵ Inappropriate drug use is associated with adverse drug reactions, which lead to increased physician visits and hospital admissions and declines in functional status among the elderly.⁵ The increase in drug use among the elderly also leads to a greater possibility for clinically significant drug interactions. Furthermore, the incidence of adverse drug events (ADEs) that result from adverse drug reactions was estimated to be 27% per year among older adults in the ambulatory setting, and over one third of these ADEs were deemed ameliorable or preventable.⁵ It was reported that ADEs among ambulatory older adults were associated with an increase of over \$1,000 in medical costs in the 6 weeks post-ADE onset.⁵

The value of MTM services has been increasingly evidenced because of the positive effects of these services on patient outcomes achieved in a cost-effective fashion. For example, in a study of patients in Veterans Affairs medical centers, pharmacist interventions resolved 90% of the medication utilization issues,^{6,7} improved lipid measurements among patients with dyslipidemia, and increased patient quality of life.^{6,7} For another example, in the American Pharmacists’ Association Foundation’s Diabetes Ten City Challenge, community

pharmacists' intervention at 10 geographical sites over an average 14.8 months resulted in clinical and economic benefits among patients.⁸

Due to limited resources, the MMA required Part D plans to offer MTM services to individuals meeting the following three MTM eligibility criteria: (1) having multiple chronic conditions; (2) taking multiple Part D drugs; (3) being likely to exceed an annual drug cost threshold.¹ The legislative language allowed Part D plans great flexibility in determining the thresholds for these eligibility criteria except a fixed \$4,000 cost threshold in the original years of the programs.⁵ For instance, the MTM eligibility thresholds used by Part D plans based on the number of chronic conditions ranged from 2 to 5 and those based on the number of Part D drugs ranged from 2 to 23 in 2006.⁹ From 2010, CMS provided more stringent guidelines for Part D plans by lowering the maximum allowable thresholds based on chronic conditions and Part D drugs to 3 and 8, respectively, and lowering the drug cost threshold to \$3,000.¹⁰

The MTM provisions in MMA present a unique opportunity for reducing racial and ethnic disparities in chronic disease outcomes. This is because MTM services are particularly beneficial for some chronic diseases such as hypertension and diabetes for whose management pharmacotherapy plays an important role, and some chronic conditions targeted by MTM programs, such as diabetes and hypertension, are more prevalent among minorities than their non-Hispanic White counterparts.^{11,12} However, previous research has reported that Blacks and Hispanics would be less likely to meet the Medicare eligibility criteria for MTM services.^{9,13,14} For example, a study by Wang et al. using historical data reported that the adjusted odds ratios for meeting MTM eligibility criteria for Blacks and Hispanics to Whites ranged from 0.36 to 0.60 ($P < .05$) and 0.13 to 0.46 ($P < .05$), respectively, according to 2006 eligibility criteria.⁹ Similar results were found using the 2010 eligibility thresholds.⁹ Such results can be expected because the Medicare MTM eligibility criteria are primarily based on prescription drug cost and utilization but minorities historically use fewer prescription drugs and incur lower drug costs than Whites.¹⁵⁻¹⁹

The objective of this study was to examine whether the racial and ethnic disparities in health status, health services utilization and costs, and medication utilization patterns among MTM-eligible individuals are equivalent or different than the disparities among MTM-ineligible individuals (Figure 1; racial disparities, as an example). The situation before Part D implementation was analyzed to determine the potential implications of MTM eligibility criteria based on the historical situation. This is an important question because greater disparities among MTM-ineligible individuals than MTM-eligible individuals would suggest that the MTM eligibility criteria have the potential to aggravate racial and ethnic disparities. It is important to include as study outcomes health status, health services utilization and costs, and medication utilization patterns because MTM could improve patient health outcomes, reduce health services utilization and costs, and improve patient medication utilization patterns.^{6-8,20-26} Additionally, the 2010 Patient Protection and Affordability Care Act also identified improvements of these aspects as outcomes to achieve through providing MTM services.²⁷ Racial and ethnic disparities in all these aspects have also been reported.²⁸⁻³¹

METHODS

Conceptual Framework

This study employed the use two conceptual frameworks to guide its design and execution, Andersen's Behavioral Model for Health Services Utilization and Iezzoni's risk adjustment model.^{32,33} When analyzing health services utilization and costs and medication utilization patterns, Andersen's Behavioral Model for Health Services Utilization was used. According

to this model, 3 groups of independent variables were included: predisposing factors (race, ethnicity, age, gender, and marital status), enabling factors (education, poverty status, U.S. census regions, and metropolitan statistical area), and need factors (self-perceived health status and a risk adjustment summary score). When analyzing health status, Iezzoni's risk adjustment model was used. This model categorized dimensions of risk into sociodemographic variables and health status measures when predicting health outcomes.³³ The regression models for health status included same independent variables as above according to the Andersen's Behavioral Model except the self-perceived health status when analyzing self-perceived health status.

Data Source

This was a retrospective analysis of the Medicare Current Beneficiaries Survey (MCBS; 2004–2005).³⁴ MCBS is a continuous, multipurpose survey of a nationally representative sample of Medicare beneficiaries and has been linked to patients' Medicare claims. Sponsored by CMS and started in 1991, MCBS is the most comprehensive data source for studying the Medicare population. The Cost and Use Files of MCBS contain information on a variety of topics, including beneficiaries' health status; health care use and financing; and social, economic, and demographic characteristics. MCBS data Cost and Use files were purchased through the Research Data Assistance Center at the University of Minnesota.

Besides MCBS, the Electronic Orange Book Query data files (Orange Book) from the Food and Drug Administration (FDA) were also used to determine characteristics of medications that patients were on.³⁵ The Orange Book database is an authoritative data source for medication approvals maintained by FDA. This database includes rich information including but not limited to medication name, medication approval date, and type of new drug application for both brand name and generic medications. When drug utilization information in MCBS is linked to the Orange Book database, it could be determined whether a medication is generic or brand name.

Disparity Measurements

The following 3 aspects of disparities were analyzed: disparities in health status, disparities in health services utilization and costs, and disparities in medication utilization patterns. Health status was measured using self-perceived good health status (categorized as good or poor, including excellent, very good, or good and fair or poor, respectively), self-perceived health status (excellent, very good, good, fair, poor), number of chronic conditions, number of activities of daily living (ADLs), and number of instrumental activities of daily living (IADLs). The number of chronic conditions was determined using a raw count of chronic conditions among a list of 25 chronic conditions. This list of chronic conditions was compiled by Daniel and Malone as chronic conditions applicable to Medicare beneficiaries.⁵ These conditions included all major conditions that Part D plans targeted.^{4,10} To identify chronic conditions, an existing free software, Clinical Classification Software (CCS), was used.^{36,37*}

Health services utilization and costs were measured using number of and cost of physician visits, number of and cost of emergency room visits, number of and cost of hospitalizations, and total health care costs. Medication utilization patterns were measured based on the use of high-risk medications and a generic dispensing ratio. The use of high risk medications

*Developed by the Agency for Healthcare Research and Quality, CCS aggregates medical conditions and illnesses into 285 mutually exclusive categories.^{36,37} For examples of CCS, category 49 is diabetes mellitus without complications and category 50 is diabetes mellitus with complications. The most current version of CCS is valid for the period from January 1980 to September 2009. CCS has been used by federal surveys and by health services researchers including those using MCBS.^{36,37}

was measured as whether a patient took 2 or more high risk medications based on a MTM performance measure developed by Pharmacy Quality Alliance (PQA).³⁸ Beers criteria, a list of potentially inappropriate medications in adults 65 years and older was used to determine high risk medications by PQA.³⁹ Beers criteria was most recently updated in 2012, however its 2003 version was used in this study because this edition was applicable for the study years of 2004 and 2005.⁴⁰ The 2003 edition of the Beers criteria contain 49 individual medications or classes of medication according to the likelihood and clinical significance of potential adverse outcomes for the older adults. In this study, drugs with Beers criteria based on daily dosage and dosage form were excluded from the list due to the lack of such information in MCBS. Overall, 39 out of 49 Beers criteria could be operationalized and a total of 1,808 drugs, drug classes and combinations were included in the analysis.

Generic dispensing ratio was defined as the proportion of generic prescriptions among all prescriptions. Due to the lack of types of medications (brand name versus generic) in MCBS, the MCBS was linked to the Orange Book. When a medication in MCBS was associated with a type of drug application “N” in the Orange Book, it was considered brand name medication. Otherwise it was considered generic medication. Approximately 50% of the medications in MCBS did not have an exact match within Orange Book due to drug name abbreviations, misspellings, etc. A pharmacist manually determined the type of medications in those situations.

Determining MTM Eligibility

When analyzing MTM eligibility criteria, the MTM eligibility thresholds used by Part D plans in 2006 and 2010 were examined. The 2010 thresholds were the latest ones at the time of this analysis, and the 2006 eligibility thresholds were the earliest ones. Therefore, analyzing all these eligibility criteria would provide a comprehensive picture of the MTM eligibility criteria. When determining the implications of the eligibility criteria, because Part D plans used ranges of eligibility thresholds, it was necessary to represent these ranges. This study examined the upper limits, median, and lower limits as representative values for both the criteria based on the number of Part D drugs and the number of medical conditions. This was not necessary for the drug cost threshold because there was only one threshold for each time period of 2006 (\$4,000) and 2010 (\$3,000). According to a CMS report, MTM eligibility thresholds used by Part D plans had the following patterns in 2006–2007: the thresholds based on the number of Part D drugs ranged from 2 to 23 (median=6); the thresholds based on number of chronic conditions ranged from 2 to 5 (median=3); the threshold based on Part D drug costs was constant at \$4,000.⁹

When analyzing 2006–2007 criteria, because an individual must meet all 3 criteria to be eligible for MTM, the investigators just need to determine the disparity implications of $3*3*1=9$ different combinations of the thresholds, where the “3s” represent the number of representative values for the eligibility criteria based on the number of Part D drugs and the number of chronic conditions, and the “1” represents the drug cost threshold. Therefore, one primary analysis was conducted to examine the combination of MTM eligibility criteria represented by the median values of the 2006 thresholds used by Part D plans; that is, 6 Part D drugs, 3 chronic conditions, and \$4,000 in drug costs; other eight combinations of eligibility thresholds were included in sensitivity analyses. The cost threshold of \$4,000 in 2006 dollars was converted to 2004 and 2005 dollars by using the consumer price index for medical care.⁴¹

According to a CMS report, MTM eligibility thresholds used by Part D plans in 2010 had the following patterns: the thresholds based on the number of Part D drugs ranged from 2 to 8 (median=5); the thresholds based on number of chronic conditions ranged from 2 to 3

(median=3); the threshold based on Part D drug costs was constant at \$3,000. Therefore, when testing the eligibility thresholds for 2010, only 6 combinations (3*2*1) were analyzed. The cost threshold of \$3,000 was also converted from 2010 dollars to 2004 and 2005 dollars.

Disparity Implications

Three major racial and ethnic groups were included in this study: Non-Hispanic Whites (Whites), Non-Hispanic Blacks (Blacks), and Hispanics. Racial disparities were examined by comparing Whites and Blacks, and ethnic disparities were examined by comparing Whites and Hispanics. Other minority groups were excluded from the analysis because their small sample sizes would not provide adequate statistical power to detect the differences between them and other racial and ethnic groups. The study sample included home dwelling Medicare beneficiaries who are 65 or over that were not in a Health Maintenance Organization (HMO). Individuals eligible for Medicare not for age but due to disability or end stage renal disease were excluded from the main analysis to reduce the heterogeneity of the study population.

This study examined whether racial and ethnic disparities in study outcomes including health status, health services utilization and costs, and medication utilization patterns, were greater among the MTM-ineligible individuals than among MTM-eligible individuals. To achieve this objective, a difference-in-difference model was used. For instance, when examining racial disparities, let “y” denote the dependent variable, “Black” denote a dummy variable for Blacks (1 for Blacks, 0 for Whites), “Eligible” denote a dummy variable for individuals’ eligible for MTM (1 for individuals eligible for MTM services, 0 for individuals ineligible for MTM services), and “Black*Eligible” is an interaction term representing the difference in disparity patterns between MTM-eligible and MTM-ineligible individuals. The expected value of y is:

$$E [y|Black, Eligible]=F [b_0+b_1Black+b_2Eligible+b_3Black*Eligible+e]$$

The “e” in the model is an error term. The “b₃” provides an estimate on the implications of MTM eligibility criteria on racial and ethnic disparities in health outcomes. This is equivalent to first calculating the difference between Blacks and Whites among the MTM-ineligible individuals, and among MTM-eligible individuals, respectively, and then subtracting the differences. The functional form of the regression model varies according to the types of dependent variables. For example, for self-perceived health status with a Likert-type scale, an ordinal logistic regression was first used. One important assumption of the ordinal logistic regression is proportional odds assumption or the parallel regression assumption, which requires that the relationship between each pair of outcome groups is the same. A Brant test was used to test this assumption. Because this assumption was found violated, a multinomial logistic regression was used instead of the ordinal logistic regression. For ease of interpretation, self-perceived health status was also coded as a dummy/dichotomous variable (1 for excellent, very good, or good; 0 for fair or poor) and a logistic regression was used. The measure for the use of high-risk medication was also a dichotomous variable so a logistic regression was also used for that variable. For some dependent variables that were count variables, including number of chronic conditions and number of physician visits, a negative binomial model was used. For other dependent variables that were count variables, including ADLs and IADLs, number of emergency room visits, and number of hospitalizations, a zero-inflated Poisson regression was used. This is because these variables have excessive number of zeros and their variances were approximately equal to their means. For all cost variables including costs of physician visits, costs of emergency room visits, costs of hospitalization, and total health care costs, a

generalized linear model was analyzed using log link and Gamma distribution. For generic dispensing ratio, an ordinary least-squares regression was used.

Concerning the estimate on the effect of the interaction between “Black” and “Eligible,” when the function form of the regression models were nonlinear, the interpretation on the multiplicative term and the interpretation on the additive term were both estimated. The difference between these 2 types of interpretations lies in the calculation of the quantity of the effect: interpretation on the multiplicative term takes into account the baseline effect among each group compared (both Whites and Blacks, for example); interpretation on the additive term only takes into account the baseline effect among the reference group, Whites in this study.⁴² The interaction effect according on the additive term is also called “marginal effect.” While both interpretations are deemed acceptable interpretations of the interaction effects, the latter is more preferred in some quarters of the research community.

All data analyses above took into account the complex survey design of MCBS, including primary sampling units, strata, and personal weights, by using the survey data analysis procedures in SAS 9.3 (SAS Institute Inc., Cary, NC) and STATA 12.0 (StataCorp LP, College Station, TX). The statistical significance level was set *a priori* at 0.05. This study was approved by the IRB Office at the leading author’s institution.

RESULTS

Demographic Characteristics

The study sample included 14,729 (weighted to 55,398,957) Medicare beneficiaries in MCBS in 2004 and 2005. Within the study sample, 12,576 (weighted to 47,231,211 or 85.26%) were white, 1,173 (weighted to 4,478,602 or 8.08%) were Black, and 980 (weighted to 3,689,143 or 6.66%) were Hispanics. The differences between Whites and minorities were significant for most characteristics examined (Table 1). Minorities were more likely to belong to the younger age groups than were Whites ($P < .05$); compared to Whites, minorities were less likely to be married, more likely to belong to lower educational and poverty categories, more likely to have Medicaid, more likely to reside in metropolitan statistical areas, and less likely to have reported better health categories. For gender, neither the comparison between Whites and Blacks nor that between Whites and Hispanics was significant. Minorities and Whites also had different geographic distributions across census regions; more than half of the Blacks lived in the South, more Whites lived in Midwest and South than other regions, and the majority of Hispanics lived in West and South. The comparison between Whites and Hispanics was significant for geographical distributions ($P < .05$), but the difference between Whites and Blacks was not significant ($P > .05$).

Disparities in MTM Eligibility

This study examined whether higher proportions of Whites would meet the MTM eligibility criteria than would Blacks and Hispanics among the Medicare population in 2004–2005. This study found that quantitatively both Blacks and Hispanic would be less likely to be eligible for MTM services according to both 2006 and 2010 eligibility criteria. However, the differences between Whites and the 2 minority populations were not always significant according to the bivariate analyses (Table 2). For example, according to the main analysis of 2006 eligibility criteria, the proportions of eligible individuals would be 9.76 percent among Whites, 9.19 percent among Blacks and 8.86 percent among Hispanics. Neither the difference between Whites and Blacks nor the difference between Whites and Hispanics was significant ($P > .05$). According to the multivariate analyses on MTM eligibility, the differences between Blacks and Whites were always significant but the differences between Whites and Hispanics were significant only in some situations. For example, the odds ratio

(OR) for Blacks to Whites was 0.74 according to the main analysis for 2006 ($P = .04$; 95% confidence interval or CI=0.55–0.99); the OR for Hispanics to Whites was 0.80 according to the same analysis ($P = .10$; 95% CI=0.61–1.05) (Table 3). Sensitivity analyses for 2006 had similar findings (Tables 5–12 in Appendix).

Disparity Implications/Health Status

Disparities in Self-Perceived Good Health Status between Whites and Blacks

—This study found that racial disparity in self-reported good health status was greater among MTM-ineligible individuals than among MTM-eligible individuals (Table 4). For example, based on the main analysis for 2006 MTM eligibility criteria, the proportions for self-reported good health status for Whites and Blacks among MTM-ineligible population were 82.82% vs. 70.75%, with a difference of 12.07% ($P < .001$); these proportions were 56.98% vs. 52.14%, respectively, for Whites and Blacks among the MTM-eligible individuals with a difference of 4.84% ($P = .31$). The difference between the MTM-ineligible and MTM-eligible individuals was 7.23% ($P < .001$). In the logistic regression, the interaction term between Blacks and the MTM eligibility criteria in 2006 was significant based on the main analysis before adjusting for confounding factors (OR=1.62; $P = .03$; 95% CI=1.04–2.53); after adjusting for confounding factors, this interaction term was not significant (OR=1.57; $P = .06$; 95% CI=0.98–2.52). These ORs were interpretations on the multiplicative term. However, interpretations on additive term showed that in the unadjusted model, marginal effects for racial groups differed across MTM eligibility categories with the marginal effects higher among MTM-ineligible individuals than MTM-eligible individuals (difference in odds=2.45; $P < .001$; 95% CI=1.79–3.12); in the adjusted model, marginal effects for racial groups differed across MTM eligibility categories with the marginal effects higher among MTM-ineligible individuals than MTM-eligible individuals (difference in odds=2.38; $P < .001$; 95% CI=1.54–3.22). Sensitivity analyses for 2006 eligibility criteria and all analyses for 2010 eligibility criteria found similar patterns.

Disparities in Self-Perceived Good Health Status between Whites and

Hispanics—Concerning the comparison between Whites and Hispanics, a similar pattern was found. For example, based on the main analysis for 2006 MTM eligibility criteria, the proportions for self-reported good health status for Whites and Hispanics among MTM-ineligible population were 82.82% vs. 72.24%, respectively, with a difference of 10.58% ($P < .001$); these proportions were 56.98% vs. 43.43%, for Whites and Hispanics, respectively, among the MTM-eligible individuals with a difference of 13.55% ($P = .009$). The difference between the differences among the MTM-ineligible and MTM-eligible individuals was -2.97% ($P < .001$). According to the logistic regression before adjusting for confounding factors, interaction term between Hispanics and the MTM eligibility criteria in 2006 was not significant (OR=0.98; $P = .94$; 95% CI=0.56–1.71); after adjusting for confounding factors, this interaction term was still not significant (OR=0.99; $P = .98$; 95% CI=0.54–1.84). Interpretations on additive term showed that in the unadjusted model, marginal effects for ethnic groups were similar across MTM eligibility categories (difference in odds=1.71; $P < .001$; 95% CI=0.95–2.46); in the adjusted model, marginal effects for ethnic groups differed across MTM eligibility categories with the marginal effects higher among MTM-ineligible individuals than MTM-eligible individuals (difference in odds=1.48; $P = .003$; 95% CI=0.52–2.44). Sensitivity analyses for 2006 eligibility criteria and all analyses for 2010 eligibility criteria found similar patterns.

The Disparities in Self-Perceived Health Status among Whites, Blacks and

Hispanics—When analyzing self-perceived health status, a multinomial logistic regression was used to obtain relative risk ratios. The results were less easy to interpret than using self-perceived good health status but similar patterns were reported as when analyzing self-

perceived good health status. For example, when conducting the main analysis for 2006 eligibility criteria with poor health status as the reference group, the coefficient for the interaction term between Blacks and the MTM eligibility criteria was 1.54 ($P = .02$) for the comparison between excellent and poor health status. Most coefficients for the interaction terms between Hispanics and the MTM eligibility criteria were not significant for the comparison between poor health status and other health status categories.

Disparities in Other Health Status Measures—When analyzing the number of chronic conditions and ADLs and IADLs, a negative binomial model and a zero-inflated Poisson regression were used. No significant interaction effects were identified.

Disparity Implications/Health Services Utilization and Costs and Medication Utilization Patterns

For all other outcome measures including the number and costs of physician visits, emergency room visits, hospitalizations, and total health care costs, the use of high risk medication and generic dispensing ratio, a negative binomial model, a zero-inflated Poisson regression, a generalized linear model with log link and Gamma distribution, a logistic regression and an ordinary least-squares regression were used. No statistical significance was found for the interaction effects between the MTM eligibility criteria and dummy variables for Blacks or Hispanics.

DISCUSSION

Using the most comprehensive database nationally representative for the Medicare beneficiaries, this study found that Blacks and Hispanics would be less likely to report good health status than Whites. This disparity pattern was found to be greater among MTM-ineligible individuals than the MTM-eligible individuals. This study also compared between the MTM-ineligible individuals and MTM-eligible individuals on other measures on health status, health services utilization and costs, and medication utilization patterns. The disparity patterns did not statistically significantly differ between MTM-ineligible individuals and MTM-eligible individuals. These results are consistent when examining both the MTM eligibility criteria in 2006 and 2010. These findings suggest that the MTM eligibility criteria may have the potential to aggravate existing racial and ethnic disparities in health outcomes according to some measures.

The establishment of MTM programs for Medicare beneficiaries is a quality improvement initiative because of the increasingly validated benefit of MTM programs in improving patient therapeutic outcomes.¹ This study provides additional evidence that quality improvement efforts may not reduce racial and ethnic disparities. For example, according to the Healthy People 2010 final review, the US made significant progress on quality improvement but much less progress toward disparity reduction.⁴³ Healthy People 2010 has 2 overarching goals: increase quality and years of healthy life; and eliminate health disparities. For Goal 1, 71% of the 733 objectives with tracking data exhibited progress; for Goal 2, only 16% of the 169 objectives on racial and ethnic disparities showed reduction in disparities. For additional examples of the situations where quality improvement strategies may not reduce disparities, mailed patient reminder cards may not be effective among patient populations with limited English proficiency; while public reporting may empower patients to switch from providers with lower performance measures, if minorities have fewer providers to choose from, larger disparities may ensue.⁴⁴

Quality-improvement efforts may not necessarily lead to greater disparities when designed carefully. One example of this was provided by Ryan when evaluating the impact of a hospital-based pay-for-performance demonstration.⁴⁵ In that demonstration, hospitals

performing in the top decile of a composite quality measure was paid a 2% bonus on Medicare reimbursement rates. Ryan's study mainly examined whether hospitals avoided minority patients who were considered to be likely to reduce their performance measures. Ryan's study found that the hospital-based pay-for-performance program had little impact on access to care among racial and ethnic minorities. While these findings are reassuring, they also suggest additional directions of inquiry. For the medical conditions examined in Ryan's study, racial and ethnic minorities may have lower inpatient mortality rates than Whites; informed hospitals may engage in patient selection favoring minority over Whites. Regardless, Ryan's study serves as an example that well-crafted pay-for-performance programs may not lead to greater disparities.

Strategies may exist for the research communities and decision-makers to explore in order to eliminate the potential for MTM eligibility criteria in leading to greater racial and ethnic disparities in health. Future research efforts are called for to concentrate on this important issue. Additionally, the findings from this study are based on historical data before Part D implementation, it would also be important to study the effects of Part D on the impact of MTM eligibility criteria on racial and ethnic disparities in health status.

The study findings also suggest that the examined MTM eligibility criteria may not aggravate existing racial and ethnic disparities in health services utilization and costs and medication utilization patterns according to historical data. The effect of Medicare Part D on racial and ethnic disparities on health services utilizations and costs and medication utilization patterns have been evaluated to a certain degree. The findings have been mixed. According to Kaiser Family Foundation's 2012 Medicare Data Spotlight, a wide variety of stand-alone prescription drug plans are available for Medicare beneficiaries.⁴⁶ While the variety of options can provide beneficiaries the chance to choose a plan according to personal needs, when too many choices are available, improper selection among minority beneficiaries can possibly adversely affect utilization patterns and contribute to health disparities. The study by Chen et al. was one of the first to examine racial and ethnic disparities in out-of-pocket expenses and access following Part D implementation.⁴⁷ They used MEPS data between 2004 and 2007 and included Medicare beneficiaries who were classified as non-Latino White (White), Latino, or Black. They found that all racial and ethnic groups experienced decreases in total out-of-pocket expenses. For example, they found that among Medicare-only beneficiaries, out-of-pocket expenses decreased 34% for Whites, 31% for Latinos, and 39% for Blacks. The authors also studied the proportions of having unmet needs, when beneficiaries went without medication or delayed the medication. They found that the proportion of having unmet needs decreased 4% for Blacks and stayed the same for White and Latino Medicare-only beneficiaries; differences in unmet needs between Whites and Blacks were no longer significant. Based on the findings from all these previous studies, it would also be important to examine the effects of Medicare Part D on the potential effect of MTM eligibility criteria on racial and ethnic disparities in health services utilization and costs and medication utilization patterns.

MTM eligibility criteria are value-based strategies because individuals eligible have more chronic conditions and have more complicated medical regimen than individuals ineligible. Therefore, MTM providers are more likely to be able to make improvement on the health status of MTM-eligible individuals than the health status of the MTM-ineligible individuals.¹ Value-based strategies are typically based on economic considerations that often conflict with the equity doctrine.⁴⁸ The use of value-based strategies is on the rise in the United States due to more keenly realized budget limits. This study serves a framework for evaluating the disparity implications of value-based strategies.

MTM services only cover 10–13% of the Medicare population since the program inception.⁴ However, CMS intends to increase the coverage of these services to a quarter of the Medicare population. Therefore, this study is expected to have wider implications in the future.⁴

Limitations

While making a unique contribution, this study has limitations. This study is based on the analysis of policy scenarios but not the analysis of the patient enrollment data for MTM services. However, national representative patient enrollment data for MTM services are not available to researchers currently or in the near future. Waiting to answer the important research questions examined in this study would deprive decision makers valuable information for the potential of MTM eligibility criteria on racial and ethnic disparities in health outcomes. Additionally, this study examines the eligibility criteria for MTM services but not actual receipt of the services. However, due to the established benefits of these services this study still examines an important research question.^{6–8,20–26} Additionally, when determining MTM eligibility criteria, this study included all prescription drugs instead of just Part D drugs because data prior to Part D implementation was used. However, because of the well-documented racial and ethnic disparities in the utilization and costs of prescription medications, it is hard to imagine that a study including only Part D drugs would produce different study findings.^{15–19} Furthermore, the proportions of MTM eligibility individuals were approximately 10% for all racial and ethnic groups according to the main analysis of this study, which is close to the national estimate. This attests to the reliability of the study findings. Additionally, racial and ethnic disparities are only one type of disparities. There are other types of disparities as well such as those across gender, geographic regions and income groups. The methods used in this study may serve as an example of how all types of disparities can be examined.

CONCLUSIONS

Using a nationally representative database of Medicare beneficiaries prior to Part D implementation, this study found that there would be greater racial and ethnic disparities in self-reported good health status among MTM-ineligible individuals than MTM-eligible individuals. This study did not find differential racial and ethnic disparity patterns in other health status measures, health services utilization and costs, and medication utilization patterns between MTM-ineligible and MTM-eligible individuals. Future studies should examine whether the implementation of Medicare Part D has impacted these patterns.

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APPENDIX

Table 5

Racial and ethnic disparities in meeting 2006 eligibility criteria for MTM services based on logistic regression (sensitivity analysis 1).^a

	Estimate	Standard error	Wald chi-square	P	Odds ratio (OR)	95% confidence interval for OR
Intercept	-1.48	0.58	6.56	0.01	-	-
Non-Hispanic Whites	-	-	-	-	-	-
Non-Hispanic Blacks	-0.33	0.14	5.26	0.02	0.72	0.54–0.95
Hispanics	-0.17	0.13	1.74	0.19	0.85	0.66–1.09
Age	-0.05	0.01	17.17	<.0001	0.95	0.93–0.98
Female	-	-	-	-	-	-
Male	-0.44	0.09	22.55	<.0001	0.65	0.54–0.77
Not married	-	-	-	-	-	-
Married	0.002	0.09	0.0004	0.98	1.00	0.83–1.21
Lower than high school	-	-	-	-	-	-
High school	0.05	0.09	0.37	0.54	1.06	0.89–1.26
Higher than high school	0.23	0.09	6.21	0.01	1.26	1.05–1.52
100% FPL ^b	-	-	-	-	-	-
100%–149% FPL	0.20	0.12	3.01	0.08	1.23	0.97–1.54
150%–199% FPL	0.18	0.13	1.76	0.18	1.19	0.92–1.55
200%–300% FPL	0.40	0.13	9.29	0.002	1.49	1.15–1.93
Higher than 300% FPL	0.43	0.12	12.84	0.0003	1.54	1.21–1.94
Northeast	-	-	-	-	-	-
Midwest	-0.14	0.13	1.27	0.26	0.87	0.68–1.11
South	-0.26	0.11	5.85	0.02	0.77	0.63–0.95
West	-0.46	0.17	6.99	0.01	0.63	0.45–0.88
Not MSA ^c	-	-	-	-	-	-
Yes MSA	-0.14	0.12	1.45	0.23	0.87	0.69–1.09

	Estimate	Standard error	Wald chi-square	<i>P</i>	Odds ratio (OR)	95% confidence interval for OR
Excellent self-perceived health status	-	-	-	-	-	-
Very good self-perceived health status	0.89	0.16	30.44	<.0001	2.44	1.78–3.35
Good self-perceived health status	1.42	0.16	81.45	<.0001	4.13	3.03–5.62
Fair self-perceived health status	2.09	0.16	161.94	<.0001	8.08	5.86–11.15
Poor self-perceived health status	2.48	0.21	145.67	<.0001	11.90	7.96–17.79
Risk adjustment summary score	2.99	0.52	32.40	<.0001	19.84	7.09–55.51

^aEligibility thresholds examined: 2 Part D drugs, 2 chronic conditions, and \$4,000 in drug costs. Wald's statistic: 598.61 (*P* < .0001).

^bFPL=Federal poverty level.

^cMSA=Metropolitan statistical Area.

Table 6

Racial and ethnic disparities in meeting 2006 eligibility criteria for MTM services based on logistic regression (sensitivity analysis 2).^a

	Estimate	Standard error	Wald chi-square	<i>P</i>	Odds ratio (OR)	95% confidence interval for OR
Intercept	-1.76	0.60	8.59	0.003	-	-
Non-Hispanic Whites	-	-	-	-	-	-
Non-Hispanic Blacks	-0.30	0.15	4.15	0.04	0.74	0.55–0.99
Hispanics	-0.15	0.13	1.31	0.25	0.86	0.66–1.12
Age	-0.04	0.01	14.75	0.0001	0.96	0.94–0.98
Female	-	-	-	-	-	-
Male	-0.37	0.09	16.02	<.0001	0.69	0.58–0.83
Not married	-	-	-	-	-	-
Married	-0.02	0.10	0.04	0.84	0.98	0.81–1.19
Lower than high school	-	-	-	-	-	-
High school	0.04	0.09	0.21	0.65	1.04	0.87–1.24
Higher than high school	0.19	0.09	3.89	0.05	1.20	1.00–1.45
100% FPL ^b	-	-	-	-	-	-
100%–149% FPL	0.24	0.12	4.46	0.03	1.28	1.02–1.60
150%–199% FPL	0.23	0.14	2.70	0.10	1.25	0.96–1.64
200%–300% FPL	0.46	0.14	10.92	0.001	1.59	1.21–2.10
Higher than 300% FPL	0.46	0.12	14.70	0.0001	1.58	1.25–2.00
Northeast	-	-	-	-	-	-

	Estimate	Standard error	Wald chi-square	P	Odds ratio (OR)	95% confidence interval for OR
Midwest	-0.12	0.13	0.82	0.37	0.90	0.69–1.15
South	-0.23	0.11	4.64	0.03	0.79	0.64–0.98
West	-0.43	0.18	5.86	0.02	0.65	0.46–0.92
Not MSA ^c	-	-	-	-	-	-
Yes MSA	-0.18	0.12	2.19	0.14	0.84	0.66–1.06
Excellent self-perceived health status	-	-	-	-	-	-
Very good self-perceived health status	0.88	0.17	27.16	<.0001	2.40	1.73–3.34
Good self-perceived health status	1.45	0.16	79.50	<.0001	4.25	3.09–5.83
Fair self-perceived health status	2.14	0.17	161.58	<.0001	8.48	6.10–11.78
Poor self-perceived health status	2.56	0.21	155.32	<.0001	12.95	8.66–19.38
Risk adjustment summary score	2.86	0.53	29.40	<.0001	17.46	6.21–49.10

^aEligibility thresholds examined: 2 Part D drugs, 3 chronic conditions, and \$4,000 in drug costs. Wald's statistic: 631.45 ($P < .0001$).

^bFPL=Federal poverty level.

^cMSA=Metropolitan statistical Area.

Table 7

Racial and ethnic disparities in meeting 2006 eligibility criteria for MTM services based on logistic regression (sensitivity analysis 3).^a

	Estimate	Standard error	Wald chi-square	P	Odds ratio (OR)	95% confidence interval for OR
Intercept	-2.17	0.75	8.46	0.004	-	-
Non-Hispanic Whites	-	-	-	-	-	-
Non-Hispanic Blacks	-0.40	0.16	5.90	0.02	0.67	0.49–0.93
Hispanics	-0.40	0.20	3.82	0.10	0.67	0.45–1.00
Age	-0.05	0.01	15.02	0.05	0.95	0.93–0.98
Female	-	-	-	-	-	-
Male	-0.39	0.11	14.10	0.0001	0.67	0.55–0.83
Not married	-	-	-	-	-	-
Married	0.02	0.11	0.04	0.0002	1.02	0.83–1.26
Lower than high school	-	-	-	-	-	-
High school	0.01	0.11	0.01	0.83	1.01	0.82–1.26
Higher than high school	0.19	0.11	2.90	0.91	1.21	0.97–1.52
100% FPL ^b	-	-	-	-	-	-

	Estimate	Standard error	Wald chi-square	P	Odds ratio (OR)	95% confidence interval for OR
100%–149% FPL	0.20	0.12	2.32	0.09	1.22	0.96–1.56
150%–199% FPL	0.13	0.16	0.71	0.11	1.14	0.84–1.55
200%–300% FPL	0.43	0.15	8.00	0.40	1.54	1.14–2.08
Higher than 300% FPL	0.40	0.13	10.15	0.005	1.49	1.17–1.91
Northeast	-	-	-	-	-	-
Midwest	-0.11	0.14	0.58	0.45	0.90	0.68–1.18
South	-0.28	0.13	4.95	0.03	0.76	0.59–0.97
West	-0.51	0.19	7.33	0.01	0.60	0.41–0.87
Not MSA ^c	-	-	-	-	-	-
Yes MSA	-0.23	0.12	3.74	0.05	0.80	0.63–1.00
Excellent self-perceived health status	-	-	-	-	-	-
Very good self-perceived health status	0.77	0.23	11.48	0.0007	2.15	1.38–3.36
Good self-perceived health status	1.67	0.24	50.54	<.0001	5.32	3.36–8.44
Fair self-perceived health status	2.44	0.24	101.97	<.0001	11.47	7.14–18.41
Poor self-perceived health status	3.07	0.26	134.99	<.0001	21.61	12.87–36.29
Risk adjustment summary score	3.38	0.60	31.41	<.0001	29.26	8.98–95.30

^aEligibility thresholds examined: 2 Part D drugs, 5 chronic conditions, and \$4,000 in drug costs. Wald's statistic: 935.44 ($P < .0001$).

^bFPL=Federal poverty level.

^cMSA=Metropolitan statistical Area.

Table 8

Racial and ethnic disparities in meeting 2006 eligibility criteria for MTM services based on logistic regression (sensitivity analysis 4).^a

	Estimate	Standard error	Wald chi-square	P	Odds ratio (OR)	95% confidence interval for OR
Intercept	-1.56	0.58	7.12	0.01	-	-
Non-Hispanic Whites	-	-	-	-	-	-
Non-Hispanic Blacks	-0.31	0.14	4.89	0.03	0.73	0.55–0.97
Hispanics	-0.23	0.13	3.16	0.08	0.79	0.61–1.02
Age	-0.05	0.01	16.50	<.0001	0.95	0.93–0.98
Female	-	-	-	-	-	-
Male	-0.45	0.09	22.77	<.0001	0.64	0.53–0.77
Not married	-	-	-	-	-	-
Married	0.03	0.09	0.12	0.73	1.03	0.86–1.24

	Estimate	Standard error	Wald chi-square	P	Odds ratio (OR)	95% confidence interval for OR
Lower than high school	-	-	-	-	-	-
High school	0.02	0.09	0.06	0.81	1.02	0.85–1.23
Higher than high school	0.21	0.10	4.79	0.03	1.24	1.02–1.50
100% FPL ^b	-	-	-	-	-	-
100%–149% FPL	0.20	0.12	2.78	0.10	1.22	0.97–1.54
150%–199% FPL	0.20	0.13	2.14	0.14	1.22	0.94–1.58
200%–300% FPL	0.41	0.13	9.65	0.002	1.50	1.16–1.94
Higher than 300% FPL	0.40	0.12	10.95	0.0009	1.49	1.18–1.89
Northeast	-	-	-	-	-	-
Midwest	-0.11	0.13	0.70	0.40	0.90	0.69–1.16
South	-0.22	0.11	4.05	0.04	0.80	0.65–1.00
West	-0.43	0.18	5.51	0.02	0.65	0.45–0.95
Not MSA ^c	-	-	-	-	-	-
Yes MSA	-0.14	0.12	1.34	0.25	0.87	0.69–1.10
Excellent self-perceived health status	-	-	-	-	-	-
Very good self-perceived health status	0.90	0.17	28.97	<.0001	2.46	1.77–3.41
Good self-perceived health status	1.44	0.16	76.43	<.0001	4.20	3.04–5.79
Fair self-perceived health status	2.14	0.17	161.09	<.0001	8.51	6.11–11.85
Poor self-perceived health status	2.51	0.21	138.80	<.0001	12.32	8.11–18.70
Risk adjustment summary score	2.97	0.53	31.18	<.0001	19.61	6.90–55.72

^aEligibility thresholds examined: 6 Part D drugs, 2 chronic conditions, and \$4,000 in drug costs. Wald's statistic: 555.18 ($P < .0001$).

^bFPL=Federal poverty level.

^cMSA=Metropolitan statistical Area.

Table 9

Racial and ethnic disparities in meeting 2006 eligibility criteria for MTM services based on logistic regression (sensitivity analysis 5).^a

	Estimate	Standard error	Wald chi-square	P	Odds ratio (OR)	95% confidence interval for OR
Intercept	-2.24	0.75	8.93	0.003	-	-
Non-Hispanic Whites	-	-	-	-	-	-
Non-Hispanic Blacks	-0.38	0.17	5.25	0.02	0.69	0.50–0.95
Hispanics	-0.46	0.22	4.48	0.03	0.63	0.42–0.97

	Estimate	Standard error	Wald chi-square	<i>P</i>	Odds ratio (OR)	95% confidence interval for OR
Age	-0.05	0.01	14.94	0.0001	0.95	0.93–0.98
Female	-	-	-	-	-	-
Male	-0.41	0.11	14.64	0.0001	0.66	0.54–0.82
Not married	-	-	-	-	-	-
Married	0.04	0.11	0.12	0.73	1.04	0.84–1.28
Lower than high school	-	-	-	-	-	-
High school	-0.01	0.11	0.01	0.93	0.99	0.80–1.23
Higher than high school	0.19	0.12	2.62	0.11	1.21	0.96–1.51
100% FPL ^b	-	-	-	-	-	-
100%–149% FPL	0.20	0.13	2.56	0.11	1.23	0.96–1.57
150%–199% FPL	0.15	0.15	0.97	0.32	1.16	0.86–1.58
200%–300% FPL	0.43	0.15	8.09	0.005	1.54	1.14–2.08
Higher than 300% FPL	0.40	0.12	10.35	0.001	1.49	1.17–1.91
Northeast	-	-	-	-	-	-
Midwest	-0.09	0.15	0.36	0.55	0.92	0.69–1.22
South	-0.24	0.13	3.49	0.06	0.79	0.61–1.01
West	-0.47	0.19	6.02	0.01	0.63	0.43–0.91
Not MSA ^c	-	-	-	-	-	-
Yes MSA	-0.22	0.11	3.61	0.06	0.81	0.65–1.01
Excellent self-perceived health status	-	-	-	-	-	-
Very good self-perceived health status	0.82	0.24	11.58	0.0007	2.28	1.42–3.65
Good self-perceived health status	1.73	0.25	46.86	<.0001	5.62	3.43–9.21
Fair self-perceived health status	2.50	0.26	94.83	<.0001	12.22	7.38–20.23
Poor self-perceived health status	3.14	0.28	122.31	<.0001	23.07	13.23–40.23
Risk adjustment summary score	3.38	0.61	30.67	<.0001	29.48	8.90–97.63

^a Eligibility thresholds examined: 6 Part D drugs, 5 chronic conditions, and \$4,000 in drug costs. Wald's statistic: 897.75 (*P* < .0001).

^b FPL=Federal poverty level.

^c MSA=Metropolitan statistical Area.

Table 10

Racial and ethnic disparities in meeting 2006 eligibility criteria for MTM services based on logistic regression (sensitivity analysis 6).^a

	Estimate	Standard error	Wald chi-square	P	Odds ratio (OR)	95% confidence interval for OR
Intercept	-1.56	2.47	0.40	0.53	-	-
Non-Hispanic Whites	-	-	-	-	-	-
Non-Hispanic Blacks	-15.12	0.31	2453.51	<.0001	<0.001	<0.001–<0.001
Hispanics	-1.37	0.64	4.53	0.03	0.25	0.07–0.90
Age	-0.14	0.04	14.59	0.0001	0.87	0.81–0.93
Female	-	-	-	-	-	-
Male	-1.06	0.32	11.11	0.0009	0.35	0.19–0.65
Not married	-	-	-	-	-	-
Married	0.10	0.33	0.09	0.76	1.11	0.58–2.10
Lower than high school	-	-	-	-	-	-
High school	-0.50	0.37	1.84	0.17	0.61	0.30–1.25
Higher than high school	-0.19	0.37	0.27	0.60	0.82	0.40–1.71
100% FPL ^b	-	-	-	-	-	-
100%–149% FPL	0.31	0.68	0.21	0.64	1.37	0.36–5.15
150%–199% FPL	0.21	0.65	0.10	0.75	1.23	0.35–4.36
200%–300% FPL	0.55	0.70	0.62	0.43	1.74	0.44–6.87
Higher than 300% FPL	1.47	0.58	6.51	0.01	4.36	1.41–13.48
Northeast	-	-	-	-	-	-
Midwest	0.29	0.57	0.26	0.61	1.33	0.44–4.04
South	0.15	0.54	0.08	0.77	1.17	0.41–3.35
West	0.72	0.61	1.41	0.24	2.05	0.63–6.74
Not MSA ^c	-	-	-	-	-	-
Yes MSA	0.27	0.48	0.32	0.57	1.31	0.51–3.35
Excellent self-perceived health status	-	-	-	-	-	-
Very good self-perceived health status	0.69	1.17	0.35	0.55	2.00	0.20–19.59
Good self-perceived health status	1.19	1.12	1.13	0.29	3.30	0.37–29.73
Fair self-perceived health status	3.46	1.03	11.33	0.0008	31.97	4.25–240.43
Poor self-perceived health status	4.42	1.10	16.18	<.0001	83.08	9.64–715.94
Risk adjustment summary score	6.38	1.63	15.28	<.0001	589.08	24.06–>999.99

^aEligibility thresholds examined: 23 Part D drugs, 2 chronic conditions, and \$4,000 in drug costs. Wald's statistic: 9654.49 ($P < .0001$).

^bFPL=Federal poverty level.^cMSA=Metropolitan statistical Area.**Table 11**Racial and ethnic disparities in meeting 2006 eligibility criteria for MTM services based on logistic regression (sensitivity analysis 7).^a

	Estimate	Standard error	Wald chi-square	P	Odds ratio (OR)	95% confidence interval for OR
Intercept	-1.34	2.50	0.29	0.59	-	-
Non-Hispanic Whites	-	-	-	-	-	-
Non-Hispanic Blacks	-15.11	0.31	2411.10	<.0001	<.0001	<.0001-<.0001
Hispanics	-1.36	0.65	4.40	0.04	0.26	0.07-0.91
Age	-0.14	0.04	14.72	0.0001	0.87	0.81-0.93
Female	-	-	-	-	-	-
Male	-1.05	0.32	10.76	0.001	0.35	0.19-0.66
Not married	-	-	-	-	-	-
Married	0.15	0.33	0.19	0.66	1.16	0.60-2.22
Lower than high school	-	-	-	-	-	-
High school	-0.53	0.38	1.94	0.16	0.59	0.28-1.24
Higher than high school	-0.16	0.37	0.19	0.67	0.85	0.41-1.77
100% FPL ^b	-	-	-	-	-	-
100%-149% FPL	0.31	0.68	0.21	0.65	1.36	0.36-5.13
150%-199% FPL	0.20	0.65	0.10	0.75	1.23	0.35-4.36
200%-300% FPL	0.55	0.70	0.60	0.44	1.73	0.43-6.87
Higher than 300% FPL	1.44	0.58	6.14	0.01	4.20	1.35-13.07
Northeast	-	-	-	-	-	-
Midwest	0.29	0.57	0.26	0.61	1.33	0.44-4.04
South	0.15	0.54	0.08	0.78	1.16	0.40-3.33
West	0.65	0.62	1.12	0.29	1.93	0.57-6.48
Not MSA ^c	-	-	-	-	-	-
Yes MSA	0.26	0.48	0.30	0.59	1.30	0.51-3.34
Excellent self-perceived health status	-	-	-	-	-	-
Very good self-perceived health status	0.69	1.17	0.35	0.55	2.00	0.20-19.64
Good self-perceived health status	1.04	1.15	0.82	0.36	2.83	0.30-26.91
Fair self-perceived health status	3.46	1.03	11.28	0.0008	31.86	4.23-240.01
Poor self-perceived health status	4.41	1.10	16.06	<.0001	82.36	9.53-712.09
Risk adjustment summary score	6.47	1.66	15.22	<.0001	647.97	25.08->999.99

^aEligibility thresholds examined: 23 Part D drugs, 3 chronic conditions, and \$4,000 in drug costs. Wald's statistic: 9243.42 ($P < .0001$).

^bFPL=Federal poverty level.

^cMSA=Metropolitan statistical Area.

Table 12

Racial and ethnic disparities in meeting 2006 eligibility criteria for MTM services based on logistic regression (sensitivity analysis 8).^a

	Estimate	Standard error	Wald chi-square	P	Odds ratio (OR)	95% confidence interval for OR
Intercept	-0.89	2.67	0.11	0.74	-	-
Non-Hispanic Whites	-	-	-	-	-	-
Non-Hispanic Blacks	-15.17	0.34	2047.97	<0.0001	0.74	<.0001-<.0001
Hispanics	-1.23	0.66	3.45	0.063	0.80	0.80-1.07
Age	-0.16	0.04	14.50	0.0001	0.96	0.79-0.93
Female	-	-	-	-	-	-
Male	-1.09	0.39	7.67	0.006	0.68	0.16-0.73
Not married	-	-	-	-	-	-
Married	0.09	0.38	0.55	0.82	1.01	0.52-2.32
Lower than high school	-	-	-	-	-	-
High school	-0.52	0.42	1.53	0.22	1.01	0.26-1.36
Higher than high school	-0.22	0.43	0.25	0.62	1.18	0.35-1.88
100% FPL ^b	-	-	-	-	-	-
100%-149% FPL	0.04	0.68	0.003	0.95	1.25	0.27-3.96
150%-199% FPL	0.29	0.67	0.18	0.67	1.26	0.35-5.00
200%-300% FPL	0.51	0.76	0.45	0.50	1.57	0.38-7.44
Higher than 300% FPL	1.37	0.64	4.65	0.03	1.52	1.13-13.71
Northeast	-	-	-	-	-	-
Midwest	0.63	0.59	1.11	0.29	0.90	0.59-5.98
South	0.37	0.58	0.40	0.53	0.81	0.46-4.47
West	0.90	0.62	2.13	0.14	0.66	0.74-8.26
Not MSA ^c	-	-	-	-	-	-
Yes MSA	0.30	0.46	0.44	0.51	0.85	0.55-3.33
Excellent self-perceived health status	-	-	-	-	-	-
Very good self-perceived health status	0.06	1.22	0.002	0.96	2.49	0.10-11.53
Good self-perceived health status	0.86	1.17	0.54	0.46	4.41	0.24-23.64
Fair self-perceived health status	3.37	1.02	10.98	0.0009	9.05	3.97-214.94
Poor self-perceived health status	4.15	1.05	1.55	<.0001	13.55	8.05-502.82

	Estimate	Standard error	Wald chi-square	<i>P</i>	Odds ratio (OR)	95% confidence interval for OR
Risk adjustment summary score	7.05	1.70	1.70	<.0001	17.71	40.78->999.99

^aEligibility thresholds examined: 23 Part D drugs, 5 chronic conditions, and \$4,000 in drug costs. Wald's statistic: 7152.38 ($P < .0001$).

^bFPL=Federal poverty level.

^cMSA=Metropolitan statistical Area.

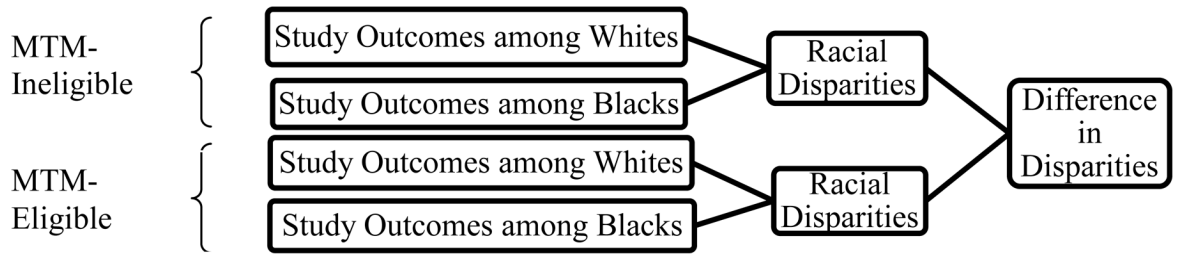


Figure 1. Difference in racial disparities in study outcomes between the MTM-ineligible and MTM-eligible individuals

Table 1
Sociodemographic characteristics across racial and ethnic groups among the Medicare population in 2004–2005.

Variables	Groups	Non-Hispanic Whites		Non-Hispanic Blacks		Hispanics	
		No.	%	No.	%	No.	%
Age ^{a,b}	65–74	5314	50.26	580	56.60	502	60.25
	75–84	4999	36.96	400	31.76	322	29.25
	>85	2263	12.78	193	11.64	156	10.50
Gender	Female	7003	55.78	705	58.72	560	56.75
	Male	5573	44.22	468	41.28	420	43.25
Marital status ^{a,b}	Not married	5658	42.05	795	66.86	516	50.24
	Married	6912	57.95	378	33.14	463	49.76
Education ^{a,b}	Lower than high school	3054	27.58	652	57.99	562	61.37
	High school	3977	39.38	245	25.12	190	22.59
	Higher than high school	3225	33.04	159	16.89	140	16.04
Poverty status ^{a,b}	100% FPL ^c	1199	9.00	388	30.60	331	32.51
	100%–149% FPL	1854	13.74	270	21.36	210	21.41
	150%–199% FPL	1631	12.22	145	12.62	124	11.90
	200%–300% FPL	1894	14.97	124	11.67	105	11.40
	Higher than 300% FPL	5998	50.08	246	23.75	210	22.78
Medicaid ^{a,b}	No	11476	91.91	766	68.67	576	60.73
	Yes	1100	8.09	407	31.33	404	39.27
U.S. census region ^b	Northeast	2179	17.36	181	15.43	113	15.03
	Midwest	3376	26.89	206	17.56	73	9.71
	South	4942	39.37	703	59.93	247	32.85
Metropolitan statistical area ^{a,b}	West	2057	16.39	83	7.08	319	42.42
	No	3905	28.04	250	17.17	110	10.88
Self-perceived health status ^{a,b}	Yes	8657	71.96	923	82.83	869	89.12
	Excellent	2188	18.72	129	11.69	130	14.91
	Very good	3861	31.34	261	21.28	208	22.91
	Good	3985	31.22	416	35.80	340	33.53

Variables	Groups	Non-Hispanic Whites		Non-Hispanic Blacks		Hispanics	
		No.	%	No.	%	No.	%
	Fair	1805	13.59	294	25.18	245	23.65
	Poor	686	5.13	70	6.05	55	5.01

^a $P < .05$ for the difference between non-Hispanic Whites (Whites) and non-Hispanic Blacks.

^b $P < .05$ for the difference between Whites and Hispanics.

^c FPL=Federal poverty level.

Numbers and proportions of individuals across racial and ethnic groups that would be eligible for MTM services in 2004–2005 according to 2006 and 2010 eligibility criteria.

Table 2

Analyses	Number of Part D drugs	Number of chronic conditions	Groups	Number eligible	Number eligible weighted	Proportion eligible (%)
Main analysis 06	6	3	Whites	1315	4609875	9.76
			Blacks	117	411750	9.19
			Hispanics	99	326784	8.86
Sensitivity analysis 1	2	2	Whites	1485	5222225	11.06
			Blacks	126	443235	9.90
			Hispanics	112	376271	10.20
Sensitivity analysis 2	2	3	Whites	1368	4790155	10.14
			Blacks	119	419430	9.37
			Hispanics	105	351304	9.52
Sensitivity analysis 3	2	5	Whites	884	3071998	6.50
			Blacks	72	254934	5.69
			Hispanics	62	199450	5.41
Sensitivity analysis 4	6	2	Whites	1417	4982298	10.55
			Blacks	124	435556	9.73
			Hispanics	105	346417	9.39
Sensitivity analysis 5	6	5	Whites	863	2994000	6.34
			Blacks	72	254934	5.69
			Hispanics	59	187536	5.08
Sensitivity analysis 6	23	2	Whites	56	198009	0.42
			Blacks	0	.	.
			Hispanics	3	8032	0.22
Sensitivity analysis 7	23	3	Whites	54	191052	0.40
			Blacks	0	.	.
			Hispanics	3	8032	0.22
Sensitivity analysis 8	23	5	Whites	44	160884	0.34
			Blacks	0	.	.
			Hispanics	3	8032	0.22
Main analysis 10	5	3	Whites	2682	9320282	19.73
			Blacks	0	.	.
			Hispanics	3	8032	0.22

Analyses	Number of Part D drugs	Number of chronic conditions	Groups	Number eligible	Number eligible weighted	Proportion eligible (%)
Sensitivity analysis 1 ^a	2	2	Blacks	217	778300	17.38
			Hispanics	193	637126	17.27
			Whites	3097	10880219	23.04
Sensitivity analysis 2	2	3	Blacks	249	888878	19.85
			Hispanics	222	745896	20.22
			Whites	2793	9751925	20.65
Sensitivity analysis 3 ^a	5	2	Blacks	225	808056	18.04
			Hispanics	201	670274	18.17
			Whites	2950	10317877	21.85
Sensitivity analysis 4	8	2	Blacks	239	852187	19.03
			Hispanics	212	706805	19.16
			Whites	2245	7852332	16.63
Sensitivity analysis 5	8	3	Blacks	177	626848	14.00
			Hispanics	168	559077	15.15
			Whites	2088	7268611	15.39
			Blacks	164	585112	13.06
			Hispanics	158	523003	14.18

Whites: Non-Hispanic Whites; Blacks: Non-Hispanics Blacks; Differences between Whites and Hispanics were not significant for any criteria.

^a*P* < .05 for the difference between Whites and Blacks.

Table 3

Racial and ethnic disparities in meeting 2006 eligibility criteria for MTM services based on logistic regression (main analysis).^a

	Estimate	Standard error	Wald chi-square	P	Odds ratio (OR)	95% confidence interval for OR
Intercept	-1.77	0.62	8.24	0.004	-	-
Non-Hispanic Whites	-	-	-	-	-	-
Non-Hispanic Blacks	-0.30	0.15	4.08	0.04	0.74	0.55-0.99
Hispanics	-0.22	0.14	2.61	0.10	0.80	0.61-1.05
Age	-0.05	0.01	14.55	0.0001	0.96	0.93-0.98
Female	-	-	-	-	-	-
Male	-0.39	0.09	17.33	<.0001	0.68	0.56-0.81
Not married	-	-	-	-	-	-
Married	0.01	0.10	0.01	0.90	1.01	0.84-1.23
Lower than high school	-	-	-	-	-	-
High school	0.01	0.09	0.01	0.93	1.01	0.84-1.21
Higher than high school	0.17	0.09	3.04	0.08	1.18	0.98-1.43
100% FPL ^b	-	-	-	-	-	-
100%-149% FPL	0.22	0.12	3.49	0.06	1.25	0.99-1.59
150%-199% FPL	0.23	0.14	2.75	0.10	1.26	0.96-1.65
200%-300% FPL	0.45	0.14	10.55	0.001	1.57	1.20-2.06
Higher than 300% FPL	0.42	0.12	11.48	0.0007	1.52	1.19-1.93
Northeast	-	-	-	-	-	-
Midwest	-0.10	0.14	0.57	0.45	0.90	0.69-1.18
South	-0.22	0.12	3.56	0.06	0.81	0.64-1.01
West	-0.42	0.19	4.99	0.03	0.66	0.45-0.95
Not MSA ^c	-	-	-	-	-	-
Yes MSA	-0.16	0.12	1.77	0.18	0.85	0.67-1.08
Excellent self-perceived health status	-	-	-	-	-	-
Very good self-perceived health status	0.91	0.18	26.48	<.0001	2.49	1.76-3.53
Good self-perceived health status	1.48	0.17	74.33	<.0001	4.41	3.15-6.17
Fair self-perceived health status	2.20	0.18	158.54	<.0001	9.05	6.42-12.76
Poor self-perceived health status	2.61	0.22	146.26	<.0001	13.55	8.88-20.66

	Estimate	Standard error	Wald chi-square	P	Odds ratio (OR)	95% confidence interval for OR
Risk adjustment summary score	2.87	0.54	28.46	<.0001	17.71	6.16–50.92

^aEligibility thresholds examined: 6 Part D drugs, 3 chronic conditions, and \$4,000 in drug costs. Wald's statistic: 574.61 ($P < .0001$).

^bFPL=Federal poverty level.

^cMSA=Metropolitan statistical Area.

Table 4

Descriptive results for outcomes across racial and ethnic groups for the MTM-eligible and MTM-ineligible individuals based on the main analysis for 2006 eligibility criteria.

Variables	MTM eligibility	Non-Hispanic Whites	Non-Hispanic Blacks	Hispanics
<i>Health status</i>				
Self-perceived good health status	MTM-ineligible	82.82%	70.75%	72.24%
	MTM-eligible	56.98%	52.14%	43.43%
Self-perceived health status				
Excellent		18.93%	11.87%	14.22%
Very good		32.12%	23.55%	23.55%
Good	MTM-ineligible	31.76%	35.33%	34.47%
Fair		12.74%	23.36%	23.21%
Poor		4.44%	5.89%	4.55%
Self-perceived health status				
Excellent		4.96%	3.42%	5.05%
Very good		19.76%	11.11%	1.01%
Good	MTM-eligible	32.27%	37.61%	37.37%
Fair		28.68%	41.03%	41.41%
Poor		14.34%	6.84%	15.15%
Number of chronic conditions	MTM-ineligible	3.20	3.13	2.71
	MTM-eligible	5.60	5.38	5.30
Activities of daily living	MTM-ineligible	0.54	0.82	0.23
	MTM-eligible	1.17	1.26	1.36
Instrumental activities of daily living	MTM-ineligible	0.74	1.17	0.80
	MTM-eligible	1.52	1.72	2.06
<i>Health services utilization and costs</i>				
Number of physician visits	MTM-ineligible	25.16	22.14	22.22
	MTM-eligible	49.03	45.52	49.48
Costs of physician visits	MTM-ineligible	3105.79	2501.86	2935.55
	MTM-eligible	6269.54	4952.13	6423.32
Number of emergency room visits	MTM-ineligible	0.16	0.16	0.20
	MTM-eligible	0.30	0.14	0.38
Costs of emergency room visits	MTM-ineligible	70.78	77.36	87.21
	MTM-eligible	120.63	205.43	130.92
Number of hospitalizations	MTM-ineligible	0.30	0.36	0.25
	MTM-eligible	0.66	0.61	0.59
Costs of hospitalizations	MTM-ineligible	2723.32	3888.61	2387.10
	MTM-eligible	5414.19	5007.72	4784.11
Total health care costs	MTM-ineligible	9474.39	9981.45	8557.10
	MTM-eligible	21544.45	18657.81	19686.20
<i>Medication utilization patterns</i>				
Two high risk medications	MTM-ineligible	4.17%	2.94%	2.95%

Variables	MTM eligibility	Non-Hispanic Whites	Non-Hispanic Blacks	Hispanics
	MTM-eligible	11.71%	11.97%	10.10%
Generic dispensing ratio	MTM-ineligible	0.21	0.22	0.23
	MTM-eligible	0.21	0.22	0.21