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Racial and Ethnic Disparities in Meeting MTM Eligibility Criteria among Patients with Asthma

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Abstract

Background—Asthma is one of the most frequently targeted chronic diseases in the medication therapy management (MTM) programs of the Medicare prescription drug (Part D) benefits. While racial and ethnic disparities in meeting eligibility criteria for MTM services have been reported, little is known about whether there would be similar disparities among adults with asthma in the United States.

Methods—Adult patients with asthma (age ≥ 18) from Medical Expenditure Panel Survey (2011–2012) were analyzed. Bivariate analyses were conducted to compare the proportions of patients who would meet Medicare MTM eligibility criteria between Whites and minority groups (Blacks and Hispanics). Survey-weighted logistic regression was performed to adjust for patient characteristics. Main and sensitivity analyses were conducted to cover the entire range of the eligibility thresholds used by Part D plans in 2011–2012.

Results—The sample included 4,455 patients with asthma, including 2,294 non-Hispanic Whites (Whites), 1,218 non-Hispanic Blacks (Blacks), and 943 Hispanics. Blacks and Hispanics had lower proportions of meeting MTM eligibility criteria than did Whites ($P < 0.001$). According to the main analysis adjusting for patient characteristics, Blacks and Hispanics had 36% and 32% lower, respectively, likelihood of MTM eligibility than Whites (odds ratio [OR]: 0.64, 95% confidence interval [CI]: 0.45–0.90; OR: 0.68, 95% CI: 0.47–0.98, respectively). Similar results were obtained in sensitivity analyses.

Conclusions—There are racial and ethnic disparities in meeting Medicare Part D MTM eligibility criteria among adult patients with asthma. Future studies should examine the

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implications of such disparities on health outcomes of patients with asthma and explore alternative MTM eligibility criteria.

Keywords

asthma; race; ethnicity; disparity; medication therapy management services; eligibility criteria

INTRODUCTION

Asthma is a major and growing public health problem in the United States.¹ In 2010, a total of 25.7 million people had asthma, and the prevalence of asthma increased from 7.3% in 2001 to 8.4% in 2010.² Asthma has a substantial impact on patients' quality of life and health care utilization and costs. For example, in 2009, asthma treatments resulted in 479,300 hospitalizations, 1.9 million emergency department visits, and \$56 billion in total healthcare expenditures.³

Pharmacotherapy remains the mainstay for guideline-based control and management for asthma. Better adherence and compliance with asthma medication plays a pivotal role in relieving asthma symptoms, and reducing the risk of exacerbations, hospitalizations and death from asthma.⁴ However, asthma-related medication adherence rates are low, ranging from 30% to 70%. This low adherence may lead to poor health care outcomes and increased medical costs.⁵

As part of the Medicare prescription drug (Part D) benefit, the medication therapy management (MTM) program is aimed at improving drug therapy and eliminating adverse drug events for patients enrolled in the Part D program.^{6,7} The value of MTM has been established by increasing medication adherence, improving clinical outcomes, and leading to potential economic benefits.^{8–14} For example, the Asheville project has shown that asthma patients achieved and maintained improvements in lung function and had asthma-related cost savings in health care after receiving MTM services.¹³ In another study, pharmacists in collaboration with physicians in providing MTM services that resulted in reduced hospitalizations and emergency room visits and improved patient quality of life among patients with asthma.¹⁴

To qualify for Medicare MTM services, the beneficiaries are required to meet three eligibility criteria.^{15,16} In 2012, to be eligible for MTM services, beneficiaries had to have 2–3 chronic diseases, take 2–8 Part D drugs, and exceed a drug cost threshold of inflation-adjusted \$3,100.20.¹⁶ In addition to the Medicare Part D program, non-Medicare insurance programs for populations other than Medicare beneficiaries also have offered MTM programs and used similar eligibility criteria for MTM services as Medicare Part D.^{6,7,17–20}

Minorities could particularly benefit from MTM services because some chronic diseases such as hypertension and diabetes targeted by MTM services are more prevalent among minorities than among non-Hispanic Whites (Whites).^{21–24} However, compared to Whites, non-Hispanic Blacks (Blacks) and Hispanics tended to use fewer medications and incur lower drug costs.^{25–29} Because Medicare MTM eligibility criteria are predominantly based

on the utilization and costs of medications, Blacks and Hispanics may have a lower likelihood of being eligible for MTM services.^{30–32}

Marked racial and ethnic disparities have been reported in asthma prevalence and disease burden.^{33,34} Studies have found that certain racial and ethnic minorities have a higher prevalence of asthma and suffer disproportionately more from asthma-related problems, such as hospitalizations and emergency department visits, but have a lower likelihood of being able to afford prescription asthma medications.^{21,33,34} Therefore, these minority patients with asthma are in particularly greater need of MTM services to improve their health status and reduce unnecessary health care utilization. Although approximately half of Part D plans target asthma for MTM programs,^{15,16} no study has been conducted on racial and ethnic disparities in meeting MTM eligibility criteria among patients with asthma.^{30–32} The objective for the present study was to determine if there are racial and ethnic disparities in meeting the MTM eligibility criteria according to Medicare Part D among patients with asthma.

METHODS

Data Sources and Study Sample

This study used data from Medical Expenditure Panel Survey (MEPS; 2011 and 2012). MEPS is a comprehensive national survey with data on health services utilization and costs, sources of payment, and insurance coverage for the non-institutionalized civilian population in the United States.³⁵ Three types of data files were used in this study: Full Year Consolidated Data file, Medical Conditions file, and Prescribed Medicines file. Data from two years were combined to increase the statistical power of the study. Data from the years 2011 and 2012 were the most recent data available at the time of this analysis. This study was conducted using MEPS following examples of previous research that analyzed MEPS to study issues related to MTM disparities.^{30–32}

The analyses included patients with asthma who were 18 or older at the time of the survey. Asthma diagnosis was determined based on patients' self-report in Full Year Consolidated Data file, and a Clinical Classification Code of 128 (ICD-9-CM=493) for asthma in Medical Conditions file in MEPS.³⁶

Study Variables

The primary outcome was whether a patient was eligible for MTM according to MTM eligibility criteria in Medicare Part D. Andersen's Behavioral Model of Health Services Utilization was used as a conceptual framework to identify factors that might play a role in racial and ethnic disparities in access to health care.³⁷ According to this model, predisposing factors, enabling factors, and need factors are the three main determinants for health care utilization.³⁸ In this study, predisposing factors included race and ethnicity, age, gender, and marital status. Enabling factors included health insurance, family income, education, employment status, U.S. census regions, and residence of metropolitan statistical area (MSA). Need factors included whether a patient needed help with activities of daily living (ADLs), whether a patient needed help with instrumental activities of daily Living (IADLs),

and self-perceived health status.³⁸ Three racial and ethnic categories were included: Whites, Blacks, and Hispanics; other racial and ethnic groups were excluded due to small sample size. All independent variables were from the Full Year Consolidated Data file of MEPS.

Determination of MTM eligibility

According to 2011 Medicare MTM eligibility thresholds, individuals were required to: 1) have at least 2–3 chronic diseases; 2) take at least 2–8 covered Part D drugs; and 3) be likely to incur \$3,000 or more for covered Part D drugs.¹⁵ The eligibility criteria in 2012 were similar as in 2011, except that the eligibility threshold based on annual Part D drug costs was \$3,100.20.¹⁶ The MTM eligibility criteria from 2011 and 2012 were applied to 2011 and 2012 data, respectively. Therefore, costs in 2011 did not need to be converted to 2012 dollars.

Because a range of thresholds of MTM eligibility criteria were used by Part D plans for number of chronic diseases and number of Part D drugs, the lower limit, median, and upper limit of the MTM eligibility thresholds were examined as representative values to cover the entire range of the thresholds.³⁹ These three representative values for the number of chronic conditions were 2, 3, 3 (2 unique values), respectively, and 2, 8, and 8 (2 unique values), respectively, for the number of drugs. There was only one drug cost threshold for both 2011 (\$3,000) and 2012 (\$3,100.20). Because all three criteria had to be met simultaneously, four different combinations ($2 \times 2 \times 1 = 4$) of these representative thresholds were examined. The combination of median threshold values was examined in main analysis; other combinations of thresholds were examined in sensitivity analyses.

When determining MTM eligibility, all prescription medications were included in the calculation of the number of drugs used and drug costs based on information from the Prescribed Medicines file. The calculation of the number of chronic conditions is conducted based on a raw count of chronic conditions among a list compiled by Daniel and Malone that includes all applicable conditions that the MTM programs can target.⁴⁰ The diagnosis of the chronic conditions was based on the Clinical Classification Codes in Medical Conditions File.

Statistical Analysis

Chi-square tests were used to compare proportions of MTM eligible individuals across racial and ethnic groups. A multivariate logistic regression was conducted to adjust for patients' socio-demographic characteristics and health status based on the Andersen's Behavioral Model of Health Services Utilization when comparing MTM eligibility across racial and ethnic groups. Because costs per se were not included as a dependent variable in the model, strategies such as log of dependent variable or generalized linear regression were not employed. Dummy variables were included for Blacks and Hispanics with Whites as the reference group. Regarding the result interpretation, an odds ratio (OR) lower than 1 would indicate racial and/or ethnic disparities in MTM eligibility. All analyses accounted for survey parameters of MEPS survey design including primary sampling units, strata and personal weights which are devised to provide representative national estimates. While a power analysis was not conducted, this study was deemed adequately powered because of

large sample size and significant findings with various aspects of analyses. Observations with missing values were minimal in MEPS and were not included in the respective analyses. All analyses were conducted using SAS 9.4 (SAS Institute Inc., Cary, North Carolina) and STATA 12.0 (Stata Corp LP, College Station, TX). The statistical significance level was set a *priori* at 0.05. This study was deemed exempt by the IRB Office of the senior author's institution.

RESULTS

Sociodemographic and Health Characteristics

By using MEPS, 47,940 adult survey respondents were identified and a total of 4,455 patients with asthma (weighted to 44,576,310) were included in the final study sample. Among them were 2,294 Whites (weighted to 32,436,564 or 72.77%), 1,218 Blacks (weighted to 6,626,044 or 14.86%) and 943 Hispanics (weighted to 5,513,703 or 12.37%). Compared to Whites, both Blacks and Hispanics were significantly younger, less likely to be married, and less likely to have private insurance, higher income, and higher education ($P < 0.05$, Table 1). Minorities and Whites also had different geographic distributions across geographic regions. Both Blacks and Hispanics were more likely to reside in MSA than were Whites ($P < 0.05$). More Whites reported having a better health status compared to Hispanics ($P < 0.05$), but the difference between Whites and Blacks was not significant in self-perceived health status ($P > 0.05$). There was no significant difference in gender, employment status, limitations with ADLs and IADLs between Whites and Blacks or Whites and Hispanics ($P > 0.05$) (Table 1).

MTM-Eligibility Based on Bivariate Analysis

The proportions of individuals meeting each component of MTM eligibility criteria were compared (Table 2). A higher proportion of Whites met each MTM eligibility criterion than Blacks or Hispanics ($P < 0.001$). For example, the percentage of individuals who had 3 or more chronic conditions was 56.67% for Whites, 43.99% for Blacks, and 42.87% for Hispanics ($P < 0.001$ for comparisons between Whites and both minority groups). Blacks and Hispanics were 8.56% and 8.83% less likely to take 8 or more drugs than Whites ($P < 0.001$ for comparisons of Whites and both minority groups), and 8.67% and 11.11% less likely to incur the required amount of drug costs ($P < 0.001$ for comparisons between Whites and both minority groups).

The proportions of individuals who met MTM eligibility criteria were also compared between Whites and minority groups (Table 3). Whites had significantly higher proportions of being eligible for MTM than did Blacks or Hispanics in the main and sensitivity analyses for all comparisons ($P < 0.001$). For example, in the main analysis, the percentages of eligible individuals were 16.53% among Whites, 11.23% among Blacks, and 10.42% among Hispanics.

MTM-Eligibility Based on Logistic Regression

To compare the likelihood of being eligible for each component of MTM eligibility criteria between Whites and the two minority groups, multivariate survey-weighted logistic

regressions were conducted adjusting for patient characteristics according to the Andersen's Behavioral Model of Health Services Utilization. A higher likelihood of meeting MTM eligibility was found among Whites than Blacks and Hispanics ($P < 0.05$; Results not shown). For example, Blacks were found to be 47% (OR: 0.53; 95% CI: 0.39–0.71) and Hispanics were 39% (OR: 0.61; 95% CI: 0.44–0.84) less likely to have 3 chronic conditions than Whites. Blacks were found to be 40% (OR: 0.60; 95% CI: 0.43–0.84) and Hispanics were 32% (OR: 0.68; 95% CI: 0.50–0.94) less likely to take 8 or more medications than Whites. Blacks were 42% (OR: 0.58; 95% CI: 0.42–0.81) and Hispanics were 53% (OR: 0.47; 95% CI: 0.33–0.67) less likely to incur the required drug cost than Whites.

This study also conducted both unadjusted and adjusted survey-weighted logistic regression analysis on overall MTM eligibility (Table 4). All differences in MTM eligibility were significant between Whites and Blacks and between Whites and Hispanics ($P < 0.05$). For instance, in the main analysis, the unadjusted OR was 0.63 (95% confidence interval [CI]: 0.48–0.83) comparing Blacks to Whites and 0.59 (95% CI: 0.40–0.87) comparing Hispanics to Whites.

After adjusting for patient characteristics, the comparison of patterns between Whites and minorities groups is still similar (Table 4). For instance, in the main analysis, OR was 0.64 (95% CI: 0.45–0.90) between Blacks to Whites and 0.68 (95% CI: 0.47–0.98) between Hispanics to Whites. The results indicated that the likelihood of MTM eligibility for Blacks and Hispanics are 36% and 32% lower, respectively, than for Whites. The sensitivity analysis showed similar patterns.

Some patient characteristics were also associated with an individual's likelihood of meeting MTM eligibility criteria (main analysis in Table 5 for example). Specifically, in the main analysis of the adjusted regression model, factors such as age, uninsured status, employment status, and self-perceived health status were associated with MTM eligibility. Specifically, aged one year older was associated with 4% higher likelihood of qualifying for MTM eligibility (OR: 1.04; 95% CI: 1.03–1.05). Uninsured patients were 64% less likely than patients with private insurance to be eligible (OR: 0.36; 95% CI: 0.20–0.66). Individuals who were employed were 64% less likely than those were not to meet MTM eligibility criteria (OR: 0.36; 95% CI: 0.26–0.51). The association with MTM eligibility varied by self-perceived health status. Compared to self-perceived excellent health status, the ORs were 2.10 for very good health status, 3.60 for good health status, 8.22 for fair health status, and 14.00 for poor health status ($P < 0.05$ for all).

DISCUSSION

In a nationally representative sample of adult patients with asthma, Blacks and Hispanics had significantly lower likelihood of meeting Medicare Part D MTM eligibility criteria than Whites. These findings concurred with results from recent studies reported by Wang and colleagues.^{30–32} Their studies found that Blacks and Hispanics both would have a lower likelihood of meeting MTM eligibility criteria than Whites among both the Medicare population and non-Medicare population.

The reasons for racial and ethnic disparities in meeting the Part D MTM eligibility criteria for patients with asthma are complicated. The differences in population characteristics may contribute to these disparities. Whites had higher proportions of belonging to older age groups than Blacks and Hispanics, which may be associated with increased expenditures among Whites because older groups may experience more chronic conditions associated with higher utilization and costs of health care and medications.^{41,42} Additionally, Blacks and Hispanics had lower socioeconomic status and were less likely to be insured than Whites, which may partially account for disparities in the utilization of prescription drugs resulting in MTM disparities. However, the study findings are still concerning because MTM disparities are still significant after controlling for patient characteristics according to Andersen's Behavioral Model of Health Services Utilization.

Moreover, patients' health beliefs, attitudes and behavior, and trust in the health care system vary systematically across racial and ethnic groups, which may contribute to MTM disparities.^{43,44} In a cohort of low-income, inner-city adults with asthma, it was found that most minority patients believed they had asthma only when they were symptomatic, and this belief was associated with lower likelihood of receiving appropriate asthma care.⁴³ Le and colleagues also reported that Blacks with asthma used less inhaled corticosteroids than Whites due to negative medication beliefs.⁴⁴

Additionally, underestimation of asthma severity was associated with deficiencies in asthma care, including underuse of daily inhaled corticosteroids and suboptimal allergy treatment.⁴⁵ It was found that severity of asthma symptom among racial and ethnic minorities tended to be underestimated, which may cause a lower likelihood of asthma-related medication utilization and spending.⁴⁶

The importance of eliminating racial and ethnic disparities has been stressed by national policies and strategies. For example, reducing health disparities was one of the goals of Healthy People initiatives 2010.⁴⁷ In Healthy People 2020, such a goal was again included: "to achieve health equity, eliminate disparities, and improve the health of all groups".⁴⁸ MTM disparity issues identified in this study need to be addressed in order to be consistent with these policies and initiatives.

The current statistics regarding MTM enrollment are suboptimal. MTM enrollment rates have decreased from 11% in 2008 to 9.1% in 2010 and have remained at 8% after 2010.^{49,50} Therefore, lowering MTM eligibility thresholds may be considered in order for MTM services to cover more patients. Stuart and colleagues estimated that if the drug count threshold required for MTM services was lowered from 8 to 2, the percentage of MTM-eligible beneficiaries would increase by almost two-thirds.⁵¹ MTM services are predominantly based on utilization of medications and associated expenditures, which may be the main reason for racial and ethnic disparities in MTM eligibility. A strategy of lowering the drug count threshold may increase the percentage of MTM-eligible beneficiaries, but because such a strategy still will base MTM eligibility on utilization of drugs, it may not completely resolve MTM disparity issues.

Targeting patients with high costs and utilization is a value-based strategy because these patients probably have more complicated health conditions and may be more likely to benefit from MTM services. However, Medicare eligibility criteria unintentionally disproportionately exclude certain vulnerable populations from MTM services. Further, previous studies have also found that these disparities may exacerbate the racial and ethnic disparities in health outcomes.⁵² Thus, in future studies, the implications of MTM disparities on health outcomes among patients with asthma should be determined. Future studies also need to develop alternative MTM eligibility criteria, which may be based on medication utilization issues such as medication adherence, medication interactions, high risk medications, and appropriate dosages.

LIMITATIONS

This study constitutes an important contribution to the literature regarding disparity implications of Part D MTM eligibility criteria. However, this study also has limitations. First, identification of the chronic conditions by self-report may be subject to respondent bias although a strong coherence has been shown between self-reported chronic conditions and medical records.^{53–56} Second, MTM eligibility determination included not only drugs covered by health plans but the entire medication regimen. This is because covered medications are not specially labeled in MEPS. Third, although the Medicare Part D MTM eligibility criteria were imitated by other health plans, these plans do not typically use exactly the same MTM eligibility criteria as the ones used for the Medicare population. Fourth, not being able to include smoking status in the analysis is an important limitation due to the association of smoking status with asthma outcomes. Finally, this study could not analyze asthmatic patients' beliefs and preferences, which may partially explain racial and ethnic disparities in MTM eligibility. However, the consistency of the findings testifies to the reliability of the findings from this study despite these limitations.

CONCLUSIONS

There are racial and ethnic disparities in meeting Medicare Part D MTM eligibility criteria among adult patients with asthma in the United States. Future studies should examine the implications of such disparities on health outcomes of patients with asthma across racial and ethnic groups. Future researchers should also assist decision makers to identify strategies for eliminating racial and ethnic disparities in MTM eligibility.

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References

1. Berair R, Brightling CE. Asthma therapy and its effect on airway remodeling. *Drugs*. 2014; 74(12): 1345–1369. [PubMed: 25056652]
2. Akinbami LJ, Moorman JE, Bailey C. Trends in asthma prevalence, health care use, and mortality in the United States, 2001–2010. *NCHS Data Brief*. 2012; (94):1–8.

3. Asthma's Impact on the Nation. Centers for Disease Control and Prevention; http://www.cdc.gov/asthma/impacts_nation/AsthmaFactSheet.pdf [Accessed August 20, 2015]
4. Global strategy for asthma management and prevention Update 2015. Global Initiative for Asthma; http://www.ginasthma.org/local/uploads/files/GINA_Report_2015.pdf [Accessed August 20, 2015]
5. Lindsay JT, Heaney LG. Nonadherence in difficult asthma-facts, myths, and a time to act. *Patient Prefer Adherence*. 2013; 7:329–336. [PubMed: 23723690]
6. Centers for Medicare & Medicaid Services (CMS), HHS. Medicare program; Medicare prescription drug benefit. Final rule. *Fed Regist*. 2005; 70(18):4193–4585. [PubMed: 15678603]
7. Ai AL, Carretta H, Beitsch LM, Watson L, Munn J, Mehriary S. Medication therapy management programs: promises and pitfalls. *J Manag Care Spec Pharm*. 2014; 20(12):1162–1182. [PubMed: 25443511]
8. Ferrell KW, Woodard LM, Woodard TJ. Role of medication therapy management in preexposure prophylaxis therapy for HIV prevention. *J Pharm Pract*. 2015; 28(1):10–12. [PubMed: 25500557]
9. Truong HA, Groves CN, Congdon HB, Dang DT, Botchway R, Thomas J. Potential cost savings of medication therapy management in safety-net clinics. *J Am Pharm Assoc (2003)*. 2015; 55(3):269–272. [PubMed: 25816340]
10. Ramalho de Oliveira D, Brummel AR, Miller DB. Medication therapy management: 10 years of experience in a large integrated health care system. *J Manag Care Pharm*. 2010; 16(3):185–195. [PubMed: 20331323]
11. Viswanathan M, Kahwati LC, Golin CE, et al. Medication therapy management interventions in outpatient settings: a systematic review and meta-analysis. *JAMA Intern Med*. 2015; 175(1):76–87. [PubMed: 25401788]
12. Hui RL, Yamada BD, Spence MM, Jeong EW, Chan J. Impact of a Medicare MTM program: evaluating clinical and economic outcomes. *Am J Manag Care*. 2014; 20(2):e43–51. [PubMed: 24738554]
13. Bunting BA, Cranor CW. The Asheville Project: long-term clinical, humanistic, and economic outcomes of a community-based medication therapy management program for asthma. *J Am Pharm Assoc (2003)*. 2006; 46(2):133–147. [PubMed: 16602223]
14. Gums TH, Carter BL, Milavetz G, et al. Physician-pharmacist collaborative management of asthma in primary care. *Pharmacotherapy*. 2014; 34(10):1033–1042. [PubMed: 25142870]
15. 2011 Medicare Part D Medication Therapy Management (MTM) Programs. Centers for Medicare and Medicaid Services; <http://www.cms.gov/Medicare/Prescription-Drug-Coverage/PrescriptionDrugCovContra/downloads/MTMFactSheet2011063011Final.pdf> [Accessed August 20, 2015]
16. 2012 Medicare Part D Medication Therapy Management (MTM) Programs. Centers for Medicare and Medicaid Services; <https://www.cms.gov/Medicare/Prescription-Drug-Coverage/PrescriptionDrugCovContra/Downloads/CY2012-MTM-Fact-Sheet.pdf> [Accessed August 20, 2015]
17. Snyder ME, Frail CK, Jaynes H, Pater KS, Zillich AJ. Predictors of medication-related problems among Medicaid patients participating in a pharmacist-provided telephonic medication therapy management program. *Pharmacotherapy*. 2014; 34(10):1022–1032. [PubMed: 25051943]
18. Schommer JC, Planas LG, Johnson KA, Doucette WR. Pharmacist-provided medication therapy management (part 2): Payer perspectives in 2007. *J Am Pharm Assoc (2003)*. 2008; 48(4):478–486. [PubMed: 18647710]
19. Shoemaker SJ, Hassol A. Understanding the landscape of MTM programs for Medicare. Part D: Results from a study for the Centers for Medicare & Medicaid services. *J Am Pharm Assoc (2003)*. 2011; 51(4):520–526. [PubMed: 21752775]
20. Shimp LA, Kucukarslan SN, Elder J. Employer-based patient-centered medication therapy management program: evidence and recommendations for future programs. *J Am Pharm Assoc (2003)*. 2012; 52(6):768–776. [PubMed: 23229963]
21. Moorman JE, Rudd RA, Johnson CA, et al. National surveillance for asthma-United States, 1980–2004. *MMWR Surveill Summ*. 2007; 56(8):1–54.
22. Byrd L, Fletcher A, Menifield C. Disparities in health care: minority elders at risk. *ABNF J*. 2007; 18(2):51–55. [PubMed: 17608287]

23. Lackland DT. Racial differences in hypertension: implications for high blood pressure management. *Am J Med Sci*. 2014; 348(2):135–138. [PubMed: 24983758]
24. Peek ME, Cargill A, Huang ES. Diabetes health disparities: a systematic review of health care interventions. *Med Care Res Rev*. 2007; 64(5 Suppl):101S–56S. [PubMed: 17881626]
25. Wang J, White-Means SI, Hufstader MA, Walker GD. The economic implications of the racial and ethnic disparities in the use of selective serotonin reuptake inhibitors. *Curr Med Res Opin*. 2007; 23(4):853–863. [PubMed: 17407642]
26. Wang J, Zuckerman IH, Miller NA, Shaya FT, Noel JM, Mullins CD. Utilizing new prescription drugs: disparities among non-Hispanic whites, non-Hispanic blacks, and Hispanic whites. *Health Serv Res*. 2007; 42(4):1499–1519. [PubMed: 17610435]
27. Schore J, Brown R, Lavin B. Racial disparities in prescription drug use among dually eligible beneficiaries. *Health Care Financ Rev*. 2003; 25(2):77–90. [PubMed: 15124379]
28. Gaskin DJ, Briesacher BA, Limcangco R, Briganiti BL. Exploring racial and ethnic disparities in prescription drug spending and use among Medicare beneficiaries. *Am J Geriatr Pharmacother*. 2006; 4(2):96–111. [PubMed: 16860257]
29. Cook BL, Manning WG. Measuring racial/ethnic disparities across the distribution of health care expenditures. *Health Serv Res*. 2009; 44(5 Pt 1):1603–1621. [PubMed: 19656228]
30. Wang J, Brown LM, Hong SH. Racial and ethnic disparities in meeting Part D MTM eligibility criteria among the non-Medicare population. *J Am Pharm Assoc* (2003). 2012; 52:e87–96. [PubMed: 23023863]
31. Wang J, Qiao Y. Historical trend of disparity implications of Medicare MTM eligibility criteria. *Res Social Adm Pharm*. 2013; 9(6):758–769. [PubMed: 23062785]
32. Wang J, Zhang Z, Spivey CA, Chisholm-Burns M. Historical trend of racial and ethnic disparities in meeting Medicare medication therapy management eligibility in non-Medicare population. *Res Social Adm Pharm*. 2014; 10(6):904–917. [PubMed: 25458405]
33. Gorman BK, Chu M. Racial and ethnic differences in adult asthma prevalence, problems, and medical care. *Ethn Health*. 2009; 14(5):527–552. [PubMed: 19533477]
34. Asthma facts. Department of Health & Human Services CDC's National Asthma Control Program Grantees; http://www.cdc.gov/asthma/pdfs/asthma_facts_program_grantees.pdf [Accessed August 20, 2015]
35. Medical Expenditure Panel Survey. Agency for Healthcare Research and Quality; http://meps.ahrq.gov/mepsweb/about_meps/survey_back.jsp [Accessed August 20, 2015]
36. Marcus P, Braman SS. International classification of disease coding for obstructive lung disease: does it reflect appropriate clinical documentation? *Chest*. 2010; 138(1):188–192. [PubMed: 20605817]
37. Andersen, RM, Rice, TH., Kominski, GF., editors. *Changing the U.S. Health Care System: Key Issues in Health Services Policy and Management*. 3. San Francisco, CA: Jossey-Bass; 2007.
38. Jahangir E, Irazola V, Rubinstein A. Need, enabling, predisposing, and behavioral determinants of access to preventative care in Argentina: analysis of the national survey of risk factors. *PLoS One*. 2012; 7(9):e45053. [PubMed: 22984608]
39. Wang J, Mullins CD, Brown LM, et al. Disparity implications of Medicare eligibility criteria for medication therapy management services. *Health Serv Res*. 2010; 45(4):1061–1082. [PubMed: 20500223]
40. Daniel GW, Malone DC. Characteristics of older adults who meet the annual prescription drug expenditure threshold for Medicare medication therapy management programs. *J Manag Care Pharm*. 2007; 13(2):142–54. [PubMed: 17330975]
41. Lee DC, Shi L, Pierre G, Zhu J, Hu R. Chronic conditions and medical expenditures among non-institutionalized adults in the United States. *Int J Equity Health*. 2014; 13(1):105. [PubMed: 25424127]
42. Naessens JM, Stroebel RJ, Finnie DM, et al. Effect of multiple chronic conditions among working-age adults. *Am J Manag Care*. 2011; 17(2):118–122. [PubMed: 21473661]
43. Halm EA, Wisnivesky JP, Leventhal H. Quality and access to care among a cohort of inner-city adults with asthma: who gets guideline concordant care? *Chest*. 2005; 128(4):1943–1950. [PubMed: 16236839]

44. Le TT, Bilderback A, Bender B, et al. Do asthma medication beliefs mediate the relationship between minority status and adherence to therapy? *J Asthma*. 2008; 45(1):33–37. [PubMed: 18259993]
45. Wolfenden LL, Diette GB, Krishnan JA, Skinner EA, Steinwachs DM, Wu AW. Lower physician estimate of underlying asthma severity leads to undertreatment. *Arch Intern Med*. 2003; 163(2): 231–236. [PubMed: 12546615]
46. Okelo SO, Wu AW, Merriman B, Krishnan JA, Diette GB. Are physician estimates of asthma severity less accurate in black than in white patients? *J Gen Intern Med*. 2007; 22(7):976–981. [PubMed: 17453263]
47. Sondik EJ, Huang DT, Klein RJ, Satcher D. Progress toward the healthy people 2010 goals and objectives. *Annu Rev Public Health*. 2010; 31:271–281. [PubMed: 20070194]
48. Healthy People 2020. HealthyPeople.gov Website; Disparities. <http://www.healthypeople.gov/2020/about/foundation-health-measures/Disparities> [Accessed August 20, 2015]
49. Rucker, NL. [Accessed August 20, 2015] Medicare Part D's medication therapy management: shifting from neutral to drive. Insight on the Issues. http://www.aarp.org/content/dam/aarp/research/public_policy_institute/health/medicare-part-d-shifting-from-neutral-to-drive-insight-AARP-ppi-health.pdf. Published on June 2012
50. Centers for Medicare & Medicaid Services (CMS), HHS. Medicare program; Contract Year 2015 Policy and Technical Changes to the Medicare Advantage and the Medicare Prescription Drug Benefit Programs. Final rule. *Fed Regist*. 2014 May 23; 79(100):29843–29968. [PubMed: 24855709]
51. Stuart B, Loh E, Miller L, Roberto P. Should eligibility for medication therapy management be based on drug adherence? *J Manag Care Pharm*. 2014; 20(1):66–75. [PubMed: 24511767]
52. Wang J, Qiao Y, Tina Shih YC, et al. Potential effects of racial and ethnic disparities in meeting Medicare medication therapy management eligibility criteria. *J Pharm Health Serv Res*. 2014; 5(2):109–118. [PubMed: 25045406]
53. Weakley J, Webber MP, Ye F, et al. Agreement between obstructive airways disease diagnoses from self-report questionnaires and medical records. *Prev Med*. 2013; 57(1):38–42. [PubMed: 23597657]
54. Bai JR, Mukherjee DV, Befus M, Apa Z, Lowy FD, Larson EL. Concordance between medical records and interview data in correctional facilities. *BMC Med Res Methodol*. 2014; 14:50. [PubMed: 24716525]
55. Colditz GA, Martin P, Stampfer MJ, et al. Validation of questionnaire information on risk factors and disease outcomes in a prospective cohort study of women. *Am J Epidemiol*. 1986; 123(5): 894–900. [PubMed: 3962971]
56. Okura Y, Urban LH, Mahoney DW, Jacobsen SJ, Rodeheffer RJ. Agreement between self-report questionnaires and medical record data was substantial for diabetes, hypertension, myocardial infarction and stroke but not for heart failure. *J Clin Epidemiol*. 2004; 57(10):1096–1103. [PubMed: 15528061]

Table 1

Sociodemographic characteristics and health status across race and ethnicity groups

Variables	Non-Hispanic Whites				Non-Hispanic Blacks				Hispanics			
	Number	Weighted frequency	Weighted percentage (%)	Number	Weighted frequency	Weighted percentage (%)	Number	Weighted frequency	Weighted percentage (%)	Number	Weighted frequency	Weighted percentage (%)
Age												
18–40	839	11,840,126	36.50	571	3,232,762	48.79	485	2,890,323	48.79			52.42
41–60	806	11,645,365	35.90	413	2,251,055	33.97	317	1,850,319	33.97			33.56
61	649	8,951,073	27.60	234	1,142,227	17.24	141	773,061	17.24			14.02
Gender												
Female	1,454	20,803,432	64.14	798	4,208,059	63.51	630	3,452,325	63.51			62.61
Male	840	11,633,132	35.86	420	2,417,984	36.49	313	2,061,378	36.49			37.39
Marital status												
Not married	1,163	15,846,940	48.86	922	4,901,814	73.98	571	3,353,152	73.98			60.81
Married	1,131	16,589,624	51.14	296	1,724,230	26.02	372	2,160,551	26.02			39.19
Health insurance												
Any private	1,513	23,043,487	71.04	503	3,129,769	47.23	419	2,976,304	47.23			53.98
Public only	545	6,460,507	19.92	531	2,548,140	38.46	348	1,657,259	38.46			30.06
No insurance	236	2,932,569	9.04	184	948,134	14.31	176	880,141	14.31			15.96
Family income [*]												
Poor	402	4,355,378	13.43	425	1,956,253	29.52	280	1,237,010	29.52			22.44
Near poor	142	1,651,300	5.09	103	497,227	7.50	68	314,556	7.50			5.71
Low income	325	4,151,335	12.80	207	1,037,035	15.65	174	921,417	15.65			16.71
Middle income	665	9,380,711	28.92	312	1,886,042	28.46	270	1,787,124	28.46			32.41
High income	760	12,897,840	39.76	171	1,249,486	18.86	151	1,253,596	18.86			22.74
Education												
Less than high school	323	3,963,984	12.24	297	1,333,361	20.27	333	1,594,045	20.27			29.04
General equivalency diploma or high school	662	8,506,115	26.26	443	2,242,896	34.10	240	1,311,612	34.10			23.89
College	1,051	15,689,405	48.45	420	2,721,313	41.39	328	2,282,157	41.39			41.57
Beyond college	251	4,227,380	13.05	45	279,147	4.24	35	301,591	4.24			5.49
Employment status												
Not employed	995	13,164,813	40.64	597	2,933,300	44.42	405	2,128,276	44.42			39.10

Variables	Non-Hispanic Whites						Non-Hispanic Blacks						Hispanics					
	Number	Weighted frequency	Weighted percentage (%)	Number	Weighted frequency	Weighted percentage (%)	Number	Weighted frequency	Weighted percentage (%)	Number	Weighted frequency	Weighted percentage (%)	Number	Weighted frequency	Weighted percentage (%)	Number	Weighted frequency	Weighted percentage (%)
Employed	1,295	19,226,865	59.36	614	3,669,717	55.58	531	3,314,472	60.90									
U.S. Census regions																		
Northeast	403	6,014,081	18.54	220	1,218,098	18.38	250	1,230,371	22.31									
Midwest	625	8,520,434	26.27	256	1,401,960	21.16	100	500,495	9.08									
South	767	11,303,360	34.85	609	3,200,621	48.30	235	1,588,042	28.80									
West	499	6,598,689	20.34	133	805,364	12.15	358	2,194,795	39.81									
Metropolitan statistical area																		
No	441	6,339,665	19.54	105	445,293	6.72	74	461,235	8.37									
Yes	1,853	26,096,899	80.46	1,113	6,180,751	93.28	869	5,052,468	91.63									
Needed help with activities of daily living																		
No	2,209	31,318,735	97.01	1,150	6,329,087	95.80	907	5,251,935	95.35									
Yes	72	964,353	2.99	63	277,491	4.20	34	256,016	4.65									
Needed help with instrumental activities of daily living																		
No	2,145	30,459,319	94.39	1,128	6,175,146	93.47	894	5,220,457	94.88									
Yes	136	1,811,736	5.61	85	431,432	6.53	46	281,891	5.12									
Self-Perceived health status																		
Excellent	347	5,184,305	16.05	211	1,133,211	17.14	133	980,657	17.80									
Very good	660	9,892,579	30.63	311	1,917,470	29.01	234	1,348,091	24.48									
Good	681	9,832,047	30.44	359	1,979,169	29.94	287	1,582,864	28.74									
Fair	388	4,707,509	14.57	243	1,156,666	17.50	206	1,079,885	19.61									
Poor	207	2,684,216	8.31	90	424,002	6.41	81	516,454	9.38									

* Family income: poor, less than 100% of poverty line; near poor, less than 125%; low income, 125% to less than 200%; middle income, 200% to less than 400%; high income, more than 400%.

P was lower than 0.05 for most comparisons between Whites and minority groups, except that *P* was greater than 0.05 for comparison between Whites and both Blacks and Hispanics on gender, employment status, and limitations with ADLs and IADLs, and for comparison between Whites and Hispanics on self-perceived health status.

Table 2

Individuals meeting each component of MTM criteria across racial and ethnic groups

Criterion	Non-Hispanic Whites			Non-Hispanic Blacks			Hispanics		
	Number	Weighted frequency	Weighted percentage (%)	Number	Weighted frequency	Weighted percentage (%)	Number	Weighted frequency	Weighted percentage (%)
No. of conditions 2									
Yes	1,635	23,092,104	71.19	695	3,722,006	56.17	536	3,214,434	58.30
No	659	9,344,460	28.81	523	2,904,038	43.83	407	2,299,269	41.70
No. of conditions 3									
Yes	1,305	18,380,577	56.67	557	2,914,883	43.99	398	2,363,900	42.87
No	989	14,055,986	43.33	661	3,711,161	56.01	545	3,149,803	57.13
No. of drugs 2									
Yes	1,751	25,437,313	78.42	782	4,358,954	65.79	577	3,466,663	62.87
No	543	6,999,251	21.58	436	2,267,090	34.21	366	2,047,040	37.13
No. of drugs 8									
Yes	708	10,052,640	30.99	289	1,486,298	22.43	206	1,221,946	22.16
No	1,586	22,383,924	69.01	929	5,139,746	77.57	737	4,291,757	77.84
Drug cost thresholds *									
Yes	554	7,815,334	24.09	203	1,021,725	15.42	119	715,446	12.98
No	1,740	24,621,230	75.91	1,015	5,604,318	84.58	824	4,798,257	87.02

 $P < 0.001$ for all the difference between Whites and Blacks. $P < 0.001$ for all the difference between Whites and Hispanics.* Drug cost threshold: $>\$3,000$ for 2011, $>\$3,100.20$ for 2012.

Table 3
Individuals eligible for medication therapy management services across racial and ethnic groups

Analyses	Number of drugs	Number of conditions	Groups	Number Eligible	Number Eligible Weighted	Weighted Percentage (%)
Main analysis	8	3	Non-Hispanic Whites	389	5,360,496	16.53
			Non-Hispanic Blacks	160	743,795	11.23
			Hispanics	92	574,385	10.42
Sensitivity analysis 1	2	2	Non-Hispanic Whites	538	7,583,568	23.38
			Non-Hispanic Blacks	196	970,742	14.65
			Hispanics	116	696,522	12.63
Sensitivity analysis 2	2	3	Non-Hispanic Whites	505	7,102,087	21.90
			Non-Hispanic Blacks	188	933,457	14.09
			Hispanics	111	660,333	11.98
Sensitivity analysis 3	8	2	Non-Hispanic Whites	398	5,496,620	16.95
			Non-Hispanic Blacks	160	743,795	11.23
			Hispanics	93	580,839	10.53

$P < 0.001$ for all differences between non-Hispanic Whites and non-Hispanic Blacks.

$P < 0.001$ for all differences between non-Hispanic Whites and Hispanics.

Table 4

Regression models of ratios among asthma adults who met eligibility criteria in the main and sensitivity analyses

Analyses	Unadjusted odds ratio	95% confidence interval	P	Adjusted odds ratio	95% confidence interval	P
Main analysis						
Non-Hispanic Whites	1.00	Reference		1.00	Reference	
Non-Hispanic Blacks	0.63	0.48–0.83	0.001	0.64	0.45–0.90	0.011
Hispanics	0.59	0.40–0.87	0.008	0.68	0.47–0.98	0.042
Sensitivity analysis 1						
Non-Hispanic Whites	1.00	Reference		1.00	Reference	
Non-Hispanic Blacks	0.55	0.44–0.70	<0.001	0.58	0.44–0.77	<0.001
Hispanics	0.48	0.35–0.66	<0.001	0.52	0.38–0.72	<0.001
Sensitivity analysis 2						
Non-Hispanic Whites	1.00	Reference		1.00	Reference	
Non-Hispanic Blacks	0.58	0.45–0.73	<0.001	0.60	0.45–0.81	0.001
Hispanics	0.49	0.35–0.69	<0.001	0.53	0.39–0.74	<0.001
Sensitivity analysis 3						
Non-Hispanic Whites	1.00	Reference		1.00	Reference	
Non-Hispanic Blacks	0.61	0.46–0.79	<0.001	0.62	0.44–0.87	0.006
Hispanics	0.58	0.39–0.85	0.006	0.66	0.45–0.95	0.027

Variables included in adjusted models were based on Andersen's Model of Health Services Utilization: predisposing factors included race and ethnicity, age, gender, and marital status; enabling factors included health insurance, family income, education, employment status, U.S. census regions, and residence of metropolitan statistical area; need factors included whether a patient needed help with activities of daily living and whether a patient needed help with instrumental activities of daily living, and self-perceived health status.³⁸

Table 5
Disparities in MTM eligibility among adult population with asthma in 2011–2012 according to main analysis[#]

Variables	Groups	Estimate	Std. Error	t	P	Odds Ratio (OR)	95% Confidence Interval for OR
Race and ethnicity	Non-Hispanic Whites	--	--	--	--	--	--
	Non-Hispanic Blacks	−0.45	0.17	−2.55	0.01	0.64	0.45–0.90
	Hispanics	−0.39	0.19	−2.05	0.04	0.68	0.47–0.98
Age (years)	Age	0.04	0.01	8.17	<0.0001	1.04	1.03–1.05
Gender	Female	--	--	--	--	--	--
	Male	−0.05	0.14	−0.32	0.75	0.96	0.72–1.27
Marital status	Not married	--	--	--	--	--	--
	Married	0.05	0.16	0.31	0.76	1.05	0.77–1.43
Health insurance	Any private	--	--	--	--	--	--
	Public only	0.15	0.17	0.92	0.36	1.17	0.84–1.62
	No insurance	−1.01	0.30	−3.35	0.001	0.36	0.20–0.66
	Poor	--	--	--	--	--	--
Family income [*]	Near poor	−0.42	0.23	−1.82	0.07	0.66	0.42–1.04
	Low income	−0.20	0.20	−0.99	0.32	0.82	0.56–1.21
	Middle income	0.11	0.21	0.53	0.60	1.12	0.73–1.70
	High income	0.16	0.22	0.75	0.46	1.18	0.77–1.81
	Less than high school	--	--	--	--	--	--
	General equivalency diploma or high school	0.09	0.21	0.44	0.66	1.10	0.73–1.66
Education	College	0.04	0.22	0.18	0.86	1.04	0.67–1.62
	Beyond college	0.15	0.30	0.50	0.62	1.16	0.64–2.11
	Not employed	--	--	--	--	--	--
Employment status	Employed	−1.02	0.17	−5.81	<0.0001	0.36	0.26–0.51
U.S. Census regions	Northeast	--	--	--	--	--	--
	Midwest	−0.03	0.28	−0.10	0.92	0.97	0.56–1.68
	South	−0.01	0.21	−0.07	0.95	0.99	0.65–1.50
	West	−0.44	0.22	−1.97	0.05	0.64	0.41–1.01
	No	--	--	--	--	--	--
Metropolitan statistical area							

Variables	Groups	Estimate	Std. Error	t	P	Odds Ratio (OR)	95% Confidence Interval for OR
Needed help with activities of daily living	Yes	0.27	0.21	1.32	0.19	1.32	0.87–1.98
	No	--	--	--	--	--	--
Needed help with instrumental activities of daily living	Yes	0.38	0.27	1.40	0.16	1.46	0.86–2.49
	No	--	--	--	--	--	--
Self-Perceived health status	Yes	0.15	0.29	0.54	0.59	1.17	0.66–2.06
	Excellent	--	--	--	--	--	--
	Very good	0.74	0.31	2.40	0.02	2.10	1.14–3.85
	Good	1.28	0.32	4.02	<0.0001	3.60	1.92–6.74
	Fair	2.11	0.31	6.87	<0.0001	8.22	4.49–15.06
	Poor	2.64	0.32	8.20	<0.0001	14.00	7.42–26.41

Std. Error=standard error.

* Family income: poor, less than 100% of poverty line; near poor, less than 125%; low income, 125% to less than 200%; middle income, 200% to less than 400%; high income, more than 400%.

In the sample used for this analysis, 292 observations were excluded from a total of 4,669 (weighted: 44,468,514) observations due to missing values (81) or non-positive personal weights (211), so 4,377 (weighted: 43,997,198) observations were used in the regression. Wald's statistics=19.53 ($P < 0.0001$).