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Racial/Ethnic and Gender Gaps in the Use and Adherence of Evidence-Based Preventive Therapies among Elderly Medicare Part D Beneficiaries after Acute Myocardial Infarction

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Abstract

Background—It is unclear whether gender and racial/ethnic gaps in the use of and patient adherence to β-blockers, angiotensin-converting-enzyme inhibitors (ACEIs)/angiotensin receptor blockers (ARBs), and HMG-CoA reductase inhibitors (statins) post-acute myocardial infarction (AMI) have persisted following establishment of the Medicare Part D prescription program.

Methods and Results—This retrospective cohort study used 2007-2009 Medicare service claims among Medicare beneficiaries ≥ 65 years who were alive 30 days after an index AMI hospitalization in 2008. Multivariable logistic regression models examined racial/ethnic (white, black, Hispanic, Asian, and Other) and gender differences in the use of these therapies in the 30 days post-discharge and patient adherence at 12-months post-discharge, adjusting for patient baseline sociodemographic and clinical characteristics. Out of 85,017 individuals, 55%, 76%, and 61% used ACEIs/ARBs, β-blockers, and statins within 30 days post-discharge, respectively. No marked differences in use were found by race/ethnicity but women were less likely to use ACEI/ARBs and β-blockers compared with men. However, at 12-months post-discharge compared with white men, black and Hispanic women had the lowest likelihood (approximately 30-36% lower, $p < 0.05$) of being adherent, followed by white, Asian, and other women and black and Hispanic men (approximately 9-27% lower, $p < 0.05$). No significant difference was shown between Asian/other men and white men.

Conclusions—While minorities were initially no less likely to use the therapies post-AMI discharge compared with white patients, black and Hispanic patients had significantly lower adherence over 12 months. Strategies to address gender and racial/ethnic gaps in the elderly are needed.

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Keywords

Medication Adherence; Disparities; Acute Myocardial Infarction; Secondary Prevention

Introduction

Hospitalizations and mortality in acute myocardial infarction (AMI) have declined considerably in the general population in the past 4 decades due to improvements in AMI care and use of evidence-based prevention therapies.[1-4] However, racial and ethnic disparities in outcomes persist, as the reduction of these outcomes in racial and ethnic minorities is much smaller with these groups continuing to experience an excessive burden of coronary artery disease.[1-4] Recent studies have also shown that women are at higher risk of mortality after AMI than men.[5-8] Differences in gender and racial/ethnic outcomes may be due in part to gender and racial differences in the aggressive use and timely initiation of medical treatments in the earlier management of AMI during hospital admission[5-7, 9-12]

Moreover, the benefit of the evidence-based preventive therapies not only relies on initiation but also on long-term adherence to therapies.[13-15] Clinical guidelines support the long-term use of evidence-based pharmacologic therapies following AMI for secondary prevention, including a β-blocker, a lipid lowering agent, an angiotensin converting enzyme inhibitor (ACEI) or angiotensin receptor blocker (ARB), and low-dose aspirin.[16, 17] Nonetheless, both initial use and long-term adherence following AMI have been shown to be alarmingly low in general. Some patients never fill their first prescription after discharge.[18] One year after hospital discharge, approximately 50% of Medicare patients, prior to implementation of Medicare Part D, have been shown to be non-adherent to statins, β-blockers, and ACEI/ARB treatments.[19, 20] If there are significant differential use and adherences to the preventive therapies, these differences may also contribute considerably to the racial/ethnic and gender disparities in health outcomes after AMI.

Lack of pharmacy benefit and low quality care services may contribute to racial/ethnic differences in using preventive therapies.[21-23] It is unclear whether gender and racial/ethnic gaps still exist in the use of and patient adherence to evidence-based therapies for secondary prevention post-AMI compared with findings prior to the Medicare Part D program for pharmacy benefits and years after implementation of the Get With The Guidelines (GWTG) program.[24] This is particularly important in the elderly since the prevalence of AMI is highest in this population. Therefore, the aim of our study was to assess whether there were gender and racial/ethnic gaps in the use of and patient adherence to evidence-based preventive therapy in a large national cohort of elderly Medicare Part D beneficiaries following AMI in 2008. In addition, we explored whether follow-up with a cardiologist or primary care physician and the total patient out-pocket costs for the 3 therapies post-AMI discharge affects the association between gender and race/ethnicity and adherence to the therapies.

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Methods

Setting and Participants

All Medicare beneficiaries satisfying the following criteria were included in the cohort: 1) ≥ 65 years of age; 2) continuous enrollment for at least 12 months before and after the index AMI hospitalization in the Medicare fee-for-service and prescription Part D benefits; 3) hospitalization for the index AMI between 1/1/2008 and 12/31/2008 and surviving at least 30 days post-discharge; and 4) discharge to home or to skilled-nursing and long-term care facilities and had prescription claims within 30 days after discharge. A 30-day post-discharge window was chosen to ensure that the prescription fills were most likely related to the AMI event itself.[18]

The Center for Medicare and Medicaid Services (CMS) Medicare Chronic Condition Data Warehouse (CCW) enrollment summary, inpatient, outpatient, skilled nursing facility, physician office visits, and prescription Part D event service claims files were data sources for this study. To obtain the index AMI hospitalization, individuals were identified if they had an international classification of disease (ICD)-9 code of 410.x1 in either the primary or secondary discharge diagnosis field in the Medicare inpatient claims. Specifically, each patient's first instance of AMI hospitalization within the study period was defined as the index AMI hospitalization. The study was approved by the Institutional Review Board of the University of North Carolina at Chapel Hill.

Race/Ethnicity and Gender Identification

Due to historical issues in how race/ethnicity has been captured in CMS enrollment file, the accuracy of race/ethnicity for non-black minorities has been low, and many non-black minorities have been misclassified into the ‘other’ category in the CMS enrollment file.[25-28] A 2-step approach was implemented to identify patient race/ethnicity to address this issue.[25, 28, 29] Patient race/ethnicity was first classified using the race/ethnicity status in the Medicare enrollment files. If the patient's race/ethnicity was classified as ‘Unknown’ or ‘Other’ in the CMS enrollment file, they were then reclassified to either ‘white’, ‘black’, ‘Hispanic’, ‘Asian’, or “Other” based on the race/ethnicity status if defined by the Research Triangle Institute (RTI) race/ethnicity first and last name algorithm variable in the Medicare files, which has been shown to increase accuracy of identification.[25, 28, 29] This method increases sensitivity of race/ethnicity categorization from 29.5 to 76.6% for Hispanic and from 54.7 to 79.2% for Asian and Pacific Islander beneficiaries, with no loss of specificity, and Kappa coefficients up to 0.80 compared to self-reported race/ethnicity.[25, 28]

Patient gender was identified by the CMS enrollment file. After gender identification, 10 race/ethnic and gender groupings were created (i.e., white men, white women, black men).

Measure of Preventive Therapy Use after AMI

Preventive therapy use was defined as filling a prescription within 30 days after the index AMI discharge for any ACEIs/ARB, β-blocker, or statin respectively. If an individual had a prescription for a drug within the therapeutic class with a remaining supply greater than 30 days prior to the index AMI admission and filled a prescription for that therapy within 60

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days after discharge, that therapy was also classified as therapy use post-AMI. Prescription drug use was identified through national drug codes in the Part D prescription event files in the CCW.

Measure of Adherence to the Preventive Therapies

Adherence to each preventive therapy was calculated as the proportion of days covered by the prescription supply calculated from the prescription refill records in the prescription Part D claims in the 12 months post-AMI discharge (or until death if occurring within 12 months) among patients who had the respective preventive therapy within 30 days after AMI discharge.[30, 31] The adherence measure was also adjusted for overstock of prescription supply in the prescription refills and hospital stays during the study period after AMI discharge. Conforming to current literature, a patient was defined as adherent if the patient had ≥ 80% of days covered with prescription supply in the study period.[15, 30]

Baseline Characteristics/Covariates

Patient sociodemographic information was ascertained from the CCW enrollment summary files at baseline. These characteristics included age, Census average household income at ZIP code residence, status in the Medicare Part D benefit plan coverage gap (“doughnut-hole”) prior to index-AMI admission, and Medicare and Medicaid dual eligibility status. The “doughnut-hole” refers to the coverage gap between the initial coverage limit and the catastrophic-coverage threshold in the Medicare Part D program, whereby the beneficiary's cost-sharing percentage is higher in the “doughnut-hole”. Patient discharge location (e.g., home versus skilled nursing facility or other care settings) and geographic region defined by US Census regions were also measured.

Levels of comorbidities were measured using the Charlson comorbidity index (CCI) in the index year using the CCW claims files in the 12-month baseline period prior to index AMI admission.[32] Other clinical characteristics measured were diagnosis of cardiovascular disease and other related risk factors in the 12-month baseline period (including AMI, coronary artery bypass surgery [CABG], stent/percutaneous transluminal coronary angioplasty [PTCA], stroke/transient ischemic attack, unstable angina, ischemic heart disease, heart failure, atrial fibrillation, peripheral vascular disease, hypertension, diabetes, and hyperlipidemia), baseline potential contraindications or intolerant conditions to the preventive therapies (chronic kidney disease [CKD], chronic obstructive pulmonary disease [COPD], asthma, liver disease, angioedema, hyperkalemia, hypotension, sinus bradycardia, heart block, and rhabdomyolysis/other myopathy), prescriptions of β-blockers, ACEIs/ARBs, and statins in the 6 months prior to the index AMI, AMI type (subendocardial or transmural infarction), procedures (CABG, stent/PTCA, cardiac catheterization, infusion of thrombolytic, infusion of platelet inhibitors) and complications (heart failure, cardiogenic shock, acute renal failure, hypotension, cardiac dysrhythmias) during the index AMI hospitalization, and total intensive care unit (ICU) and inpatient stays for the index AMI. Those characteristics were measured based on the standardized algorithms in the CCW[33] and other published algorithms.[32, 34]

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Follow-up with a cardiologist or primary care physician was measured by whether patient had service(s) from a cardiologist or primary care physician within 30 days after AMI discharge in outpatient and physician office visit claims files. The patient's total out-of-pocket costs ($0, $1-$10, $11-$50, >$50) for the 3 therapies within 30 days post-discharge were calculated using prescription files.

Statistical Analysis

The distribution of patient sociodemographic and clinical characteristics among those who had the 3 preventive therapies post-AMI discharge was described. Multivariable logistic regression models were applied to examine gender and racial/ethnic differences in the initial use and patient adherence of the 3 preventive therapies at 12-months post-index AMI hospitalization, respectively. The multivariable models assessed the associations (odds ratio) between each racial/ethnic and gender group versus white men as the reference and the use and adherence to preventive therapy, adjusting for all measured patient baseline sociodemographic and clinical characteristics. The impacts of follow-up with cardiologist/primary care physician and total out-of-pocket costs for the therapies on the gender and racial/ethnic gaps in adherence to the therapies were assessed by additionally adjusting for the 3 variables in the models.

Statistical significance was determined at a two-sided alpha < 0.05 level. All analyses were conducted using SAS 9.2 (Cary, NC).

Results

There were 85,017 individuals included in the final cohort. The distributions of patient sociodemographic and clinical characteristics among the 3 drug therapies (ACEIs/ARBs, β-blockers, statins) are displayed in Table 1. Of the 85,017 individuals, 47,124 (55%) used ACEIs/ARBs, 64,939 (76%) used β-blockers, and 52,185 (61%) used statins within 30 days post-AMI hospitalization. Within the race/ethnicity and gender groups, no marked differences occurred between race/ethnicity and gender groups between users and non-users.

The distribution of medication use by patient race/ethnicity and gender groups to each therapy is displayed in Table 2. The results from multivariable logistic regression models for therapy use within the first 30 days post-AMI are presented in Table 3, including adjustments for all the baseline characteristics listed in Table 1. A full list of the odds ratios (ORs) associated with the use of therapy is presented in Supplemental Table 1. Compared to white men, with a few exceptions, there were no significant differences in preventive therapy use across race/ethnicity and gender groups. Specifically, white women had a 9% lower likelihood of using ACEI/ARB therapy (OR=0.91, 95% CI: 0.88-0.94) and 7% lower likelihood of using β-blocker therapy (OR=0.93, 95% CI: 0.90-0.97). Black women had a 15% lower likelihood of using β-blocker therapy (OR=0.85, 95% CI: 0.77-0.94). Conversely, Hispanic women had a 20% greater likelihood of using ACEI/ARB therapy (OR=1.20, 95% CI: 1.05-1.37), and Asian women had a 20% greater likelihood of using statin therapy (OR=1.20, 95% CI: 1.02-1.41). Sensitivity analysis by 1st or 2nd discharge diagnosis of AMI for the index AMI admission yielded consistent results (Supplemental Table 2).

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Among all those receiving respective therapies, 63% were adherent to ACEIs/ARBs, 66% were adherent to β-blockers, and 66% were adherent to statins over 12 months following index AMI discharge. The distribution of adherence by patient race/ethnicity and gender categories to each therapy is displayed in Table 4. The distribution of medication adherence as a continuous variable is displayed in Supplemental Table 3. The percentage of patients who were adherent to the therapies ranged from 54% of black women adherent to ACEIs/ARBs and 72% of Asian men adherent to statins. Within race/ethnicity classes, a lower percentage of women were adherent to the therapies.

Table 5 presents the adjusted associations between patient race/ethnicity and gender and 12-month adherence for each therapy in the 30 days following discharge, including adjustments for all baseline characteristics listed in Table 1. For the 12-month adherence to ACEIs/ARBs post-AMI discharge, black women compared to white men had the lowest likelihood (30% lower) of being adherent (OR=0.70, 95% CI: 0.62-0.78). White women and black men had about a 10% lower likelihood of being adherent compared to white men. No significant difference was found between Asians or others versus white men. In β-blocker use, black and Hispanic women again had the lowest likelihood of being adherent (36% and 30% lower, respectively) compared to white men. Asian/other women and black/Hispanic men had a 17% to 26% lower likelihood of being adherent while white women had a 10% lower likelihood of being adherent compared to white men. No significant difference was found between Asian/other men versus white men. Black and Hispanic men and black, Hispanic and other women had an approximately 30% lower likelihood of being adherent to statins compared to white men. Comparatively, white women had a 5% greater likelihood of being adherent compared with white men to statins. No significant difference was found between all other groups and white men. A full list of adjusted ORs of covariates (patient baseline characteristics) is available in Supplemental Table 4. For example, higher annual income and use of the preventive therapies prior to hospitalization were associated with higher adherence.

Additionally adjusting for follow-up with a cardiologist, a primary care physician, and patient out-of-pocket medication costs for the 3 therapies did not affect the associations between gender and racial/ethnic and groups and adherence to the therapies (Supplemental Table 5).

Discussion

In our study of 85,017 Medicare Part D beneficiaries surviving AMI in 2008, 55% received an ACEI/ARB, 76% received a β-blocker, and 61% received a statin within 30 days after hospital discharge. Similar rates of preventive therapy initiation post-AMI occurred across racial/ethnic and gender groups, though women were slightly less likely to initiate ACEI/ARBs and β-blockers compared with their male counterparts. However, among patients who received preventive therapy within 30 days of discharge, 63% were adherent to ACEIs/ARBs, 66% were adherent to beta-blockers, and 66% were adherent to statins at 12 months post-discharge. Black and Hispanic patients had the lowest likelihood of adherence to β-blockers and statins compared with white men regardless of gender. Black patients also had the lowest likelihood of adherence to ACEIs/ARBs. Differences in medication adherence

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did not extend to Asian patients, with the exception of lower Asian women's adherence to β-blockers. This study also showed that women, particularly black and Hispanic, resoundingly had decreased adherence across the therapy classes regardless of race/ethnicity, with the exception of white women to statins, despite similar rates of use within 30 days post-discharge.

This study demonstrates that despite remarkable progress in eliminating gaps in initiation of treatment by elderly racial/ethnic and gender groups following acute AMI, considerable differences in continuing care, such as medication adherence, still strongly persist. The similar rates of use of the preventive therapies within 30 days post-discharge in 2008 suggests that racial/ethnic gaps in the initiation of preventive drug use after AMI have been considerably mitigated after the establishment of the Part D prescription program and years following implementation of the GWTG program.[24] These findings are consistent with a recent study examining racial differences in AMI care in 443 hospitals in the GWTG – Coronary Artery Disease program from 2002 to 2007.[11] In this study, the gap between minorities (black and Hispanic) and white in prescribing of lipid lowering therapy, ACEIs/ARBs and β-blockers at discharge improved over time and was no longer significant after 2004.[11] Our study further highlights that no significant racial/ethnic gaps exist in filling discharge prescriptions for the preventive therapies post-AMI.

However, our study demonstrates that much more still needs to be done to address gaps in continuity of receiving life and cost-saving preventive therapies for older adults of racial/ethnic minorities and women, which to our knowledge has not been elucidated in any other recent research. Our study still found a considerable gap between black and Hispanic patients compared to white patients in long-term adherence to preventive therapies even after adjustment for patient baseline sociodemographic and clinical characteristics. This unexplained gap may suggest racial/ethnic differences in the quality of care issues related to patient adherence. Notably, this study found that disparities were not equally distributed across all minority groups. Asians tended to have better adherence than other minority groups. Previous research has indicated that underlying heterogeneity in Asian populations in medication use may exist; it is unclear whether disparities in medication adherence exist within various Asian racial/ethnic subgroups.[35]

Qualitatively compared with studies assessing adherence to secondary preventive therapies following AMI prior to implementation of the Medicare Part D program[20, 36], our study suggests that the percentage of patients adherent to these medications has increased slightly. However, the association between race/ethnic and gender gaps in adherence warrants additional consideration. Our findings suggested a fairly strong association of gender with medication adherence in that women, particularly black and Hispanic, were considerably less likely to be adherent than men post-AMI discharge. Lack of social support, lack of community resources, and individual-level characteristics such as cognitive deficiencies, may also lead to gaps in medication adherence and may differentially affect women of ethnic minorities.[37, 38] In addition, this finding may suggest a continued controversy of women receiving less aggressive treatment with preventive therapies than men for AMI even though the mortality risk after AMI is higher in women.[5, 7, 10, 12] Recent studies have suggested that women tend to present different AMI symptoms (e.g., less chest pain) than

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men, and women with less chest pain or discomfort were less likely to receive aggressive AMI management and preventive therapies.[8, 39] A gender bias in physicians' attitude has been suggested in the use of secondary prevention therapies in patients with coronary artery disease.[40] This gender bias may also have influenced women's adherence.

Further, the differential gaps across the preventive therapies raised an interesting clinical question. For example, white women were significantly more adherent to statins but less adherent to ACEIs/ARBs and beta-blockers at 12 months post-discharge compared with white men. Asian women had comparatively better adherence to statins and ACEIs/ARBs than to β-blockers. If therapy use and adherence were influenced in part by physician and patient expectations of treatment benefit and risk, the differential therapy use and adherence may signal different beliefs on benefit and risk of the therapies post-AMI in specific racial/ethnic and gender groups. However, the legitimacy of such beliefs needs to be addressed. Further research may need to study why patients exhibit stronger preferences towards adherence to certain therapy classes but not others following AMI.

Many factors, for example physician follow-up, follow-up lab tests, continuity of care, coordination of care, and medication copayment, have been shown to affect patients' adherence to cardiovascular preventive therapies.[41-43] In our study, adjusting for follow-up with cardiologist, primary care physician or total patient out-of-pocket medication costs of the 3 preventive therapies did not diminish the gaps in adherence post-AMI, suggesting that adherence post-AMI can be complex. A previous study has suggested that black patients received care services from lower quality primary care providers than white patients.[22] It is possible that the quality of the visit may be more influential in the gender and racial-ethnic gaps in patient adherence than just a visit itself. Communication between providers and patients is also significantly associated with adherence.[44, 45] Future studies are needed to assess the impact of quality of care on gaps in adherence across gender and racial/ethnic groups.

Care services related to patient adherence involve multiple care providers (cardiologists, primary care physicians, and pharmacists) across institutional and community settings. However, the GWTG program traditionally focuses on the prescribing of evidence-based therapies at hospital discharge. Only recently has the GWTG program begun expanding efforts to the outpatient setting. Our study finding shows a great need for the uptake of such programs focused on medication adherence by healthcare providers serving minorities as well. Also, the program may need to emphasize the equal importance of AMI care quality measures in both men and women.

Our study has several limitations. First, using prescription refill records may not fully represent actual intake of the medication. However, prescription refill records have been shown to have good validity, correlation, and similar sensitivity and specificity as other adherence measurements, including self-report, pill counts, and electronic records.[15, 30, 46] Use of over-the-counter therapies, such as low-dose aspirin, is not available within Medicare Part D prescription data. The accuracy of race/ethnicity identification for non-black minorities has been low in the Medicare enrollment file due to historical issues. To address this limitation, we applied the race/ethnicity status coded by RTI in a first and last names

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algorithm to improve the sensitivity of non-black minority categorizations in Medicare enrollment data files.[25, 28] Despite this improvement, some individuals may still be categorized as "other" as the RTI imputations are based on name algorithms. While this algorithm may not fully resolve misclassification, it significantly improves the classifications in Medicare data.[25, 28] The direct impact of racial/ethnic and gender gaps in adherence on cardiovascular outcomes were also not examined in this study. However, the clinical significance of gender and racial/ethnic gaps in adherence to post-AMI preventive therapies is supported by the literature that the lack of medication adherence is associated with an increase in adverse outcomes.[15, 47] Post-AMI patients with low 1-year adherence to statins were shown to have 25% and 12% higher mortality risk compared to patients with high and intermediate 1-year adherence. [15] Similar dose-response adherence-mortality association was also observed for β-blockers. [15]

There are several strengths of this study. This study used a large national cohort from a 100% sample of Medicare beneficiaries enrolled in fee-for-service and prescription Part D programs and survived AMI in 2008. The large sample well represented the general elderly population. Most prior studies examining racial/ethnic and gender gaps in the management and care for AMI have been focused on the prescribing at discharge and before the beginning of the Medicare Part D program.[5-7, 9-12] This study assessed prescriptions for preventive therapies filled after discharge after the Medicare Part D program was well established.

Conclusion

Our study showed no evidence of racial/ethnic/gender differences in the use of β-blockers, ACEIs/ARBs, and statins following AMI within 30 days with a few specific exceptions. However, minority patients, as compared to white patients, were significantly less adherent to the 3 preventive therapies at 12 months post-discharge. Minority women particularly black and Hispanic women had largely decreased medication adherence compared to white men. Thus, even after the introduction of the Medicare Part D program and years of GWTG implementation, gender and racial/ethnic gaps in patient long-term adherence to evidence-based preventive therapies following AMI appear to still persist. Clinicians, researchers, and policy-makers should continue to focus attention on eliminating differences in care following AMI, even months after the initial event.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Baseline characteristics of Medicare Part D patients following AMI by drug therapy

	ACEIs/ARBs		β-blockers		Statins	
	Users N = 47,124	**Non-users N=37,893**	**Users N = 64,939**	**Non-users N=20,078**	**Users N = 52,185**	**Non-users N=32,832**
Sociodemographics, %	55.43%	44.57%	76.38%	23.62%	61.38%	38.62%
Race/Ethnic and Gender groups						
White Men	49.20	47.53	48.47	48.41	46.82	51.05
White Women	35.30	38.25	36.92	35.62	38.19	34.12
Black Men	6.16	5.67	5.77	6.49	5.67	6.36
Black Women	2.76	2.98	2.72	3.30	2.84	2.89
Hispanic Men	1.80	1.41	1.62	1.63	1.64	1.60
Hispanic Women	1.37	1.14	1.29	1.18	1.33	1.16
Asian Men	1.13	0.93	1.03	1.07	1.08	0.98
Asian Women	1.08	0.96	1.03	1.04	1.19	0.77
Other Men	0.70	0.65	0.65	0.77	0.70	0.65
Other Women	0.51	0.47	0.49	0.49	0.53	0.43
Age						
65-74	36.33	33.89	36.11	32.46	38.51	30.06
75-84	38.60	37.27	38.08	37.79	38.95	36.52
85+	25.07	28.84	25.82	29.75	22.55	33.42
Average household income at ZIP code of residence						
$30,000 and below	1.52	1.47	1.49	1.52	1.44	1.58
$30,001-$60,000	63.29	64.05	63.50	64.06	62.86	64.85
$60,001-$100,000	28.78	28.06	28.68	27.72	29.12	27.39
$100,001-$150,000	5.10	5.05	5.03	5.21	5.19	4.89
$150,001 and above	1.32	1.37	1.30	1.49	1.38	1.28
Geographic Region						
South	38.78	41.43	39.12	42.67	38.25	42.68
West	15.74	14.31	14.91	15.72	16.07	13.57
Northeast	18.75	18.72	19.15	17.40	19.32	17.81

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	ACEIs/ARBs		β-blockers		Statins	
	Users N = 47,124	**Non-users N=37,893**	**Users N = 64,939**	**Non-users N=20,078**	**Users N = 52,185**	**Non-users N=32,832**
Midwest	26.73	25.54	26.81	24.21	26.36	25.94
Prescription drug benefit						
Part D “doughnut hole” prior to index admission	11.68	11.44	11.18	12.85	11.41	11.83
Medicare & Medicaid dual eligibility						
Dually eligible	29.68	26.36	27.98	28.92	28.90	27.10
Clinical characteristics (12-months prior to index admission), %						
AMI	4.21	4.90	4.32	5.15	4.21	5.00
CABG	0.58	0.60	0.62	0.52	0.66	0.48
Stent/PTCA	3.28	3.37	3.21	3.67	3.37	3.24
Unstable Angina	3.26	3.76	3.32	4.01	3.30	3.78
IHD	3.82	3.93	3.78	4.15	3.97	3.70
CHF	14.86	18.10	14.98	20.56	13.66	20.50
Atrial Fibrillation	2.72	3.23	2.77	3.54	2.52	3.63
Hypertension	29.88	32.90	29.72	36.09	28.21	36.00
PVD	5.63	7.04	5.91	7.40	5.76	7.05
Diabetes	16.28	17.43	15.85	19.84	15.54	18.79
Hyperlipidemia	15.56	16.74	15.59	17.70	16.21	15.89
CKD	8.41	13.26	9.84	12.94	9.25	12.68
ESRD	2.95	4.99	3.60	4.72	3.47	4.48
COPD	2.01	2.78	2.08	3.24	1.79	3.25
Asthma	2.74	3.15	2.52	4.23	2.63	3.39
Liver Disease	6.03	7.65	6.37	8.00	6.12	7.77
Osteoporosis	2.36	2.91	2.42	3.19	2.13	3.36
Charlson Comorbidity Index						
0	63.62	57.79	63.16	54.11	64.70	55.18
1-2	9.40	10.06	9.25	11.12	9.21	10.47
3-5	12.77	14.42	12.62	16.37	11.47	16.74
6-8	6.60	8.97	7.03	9.69	6.74	9.12

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	ACEIs/ARBs		β-blockers		Statins	
	Users N = 47,124	**Non-users N=37,893**	**Users N = 64,939**	**Non-users N=20,078**	**Users N = 52,185**	**Non-users N=32,832**
9+	3.27	4.71	3.61	4.87	3.34	4.82
Angioedema and Hyperkalemia	3.57	5.38	4.18	5.03	3.99	5.00
Hypotension	4.61	6.68	4.95	7.41	4.77	6.75
Sinus Bradycardia & Heart Block	14.17	15.89	14.20	17.32	13.64	16.99
Rhabdomyolysis	0.40	0.56	0.43	0.60	0.38	0.62
Cerebrovascular disease	18.28	21.91	18.42	24.65	16.96	24.56
Baseline medication use prior to index AMI admission, %						
β-blockers	52.80	49.33	55.11	38.80	51.38	51.05
ACEIs/ARBs	67.22	34.93	53.76	49.84	54.53	50.13
Statins	48.50	41.71	46.53	42.05	56.73	27.59
Characteristics of index inpatient hospital stay, %						
NSTEMI	72.45	76.85	73.26	78.15	72.07	78.14
CHF	36.02	34.91	35.10	36.91	32.63	40.14
Cardiogenic Shock	2.50	1.99	2.39	1.89	2.54	1.85
Acute Renal Failure	10.76	15.64	12.69	13.70	12.04	14.34
Hypotension	4.74	5.51	4.90	5.69	5.08	5.09
Cardiac Dysrhythmias	30.47	31.07	30.39	31.85	29.72	32.35
CABG	5.97	7.02	7.17	4.08	7.88	4.15
Stent/PTCA	36.98	27.91	35.65	24.14	39.99	21.72
Cardiac Catheterization	53.85	44.37	52.62	39.94	57.38	37.29
Angiocardiography	52.81	43.63	51.61	39.38	56.21	36.81
Thrombolytic use for AMI	0.60	0.46	0.55	0.49	0.58	0.46
Anti-platelet use for AMI	4.49	3.65	4.45	3.04	5.00	2.72
ICU Stay Length						
0 days	48.42	49.61	48.45	50.57	48.06	50.36
1-3 days	29.45	27.30	29.05	26.67	29.90	26.24
4-10 days	19.35	19.64	19.52	19.32	19.07	20.12

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	ACEIs/ARBs		β-blockers		Statins	
	Users N = 47,124	**Non-users N=37,893**	**Users N = 64,939**	**Non-users N=20,078**	**Users N = 52,185**	**Non-users N=32,832**
11+ days	2.79	3.45	2.98	3.44	2.97	3.27
Index Stay Length						
1 day	4.40	4.80	4.41	5.15	4.60	4.54
2-5 days	57.57	53.02	56.28	53.15	57.36	52.64
6-10 days	37.87	39.04	38.08	39.38	36.77	40.96
11+days	11.01	14.02	12.04	13.34	11.75	13.29
Discharge location						
Home	81.80	75.00	80.95	71.70	83.12	71.85
SNF or other care setting	18.20	25.00	19.05	28.30	16.88	28.15

Abbreviations: AMI, Acute Myocardial Infarction; ACEIs, Angiotensin Converting Enzyme Inhibitor; ARB, Angiotensin Receptor Blocker; CABG, Coronary Artery Bypass Graft; PTCA, Percutaneous Transluminal Coronary Angioplasty; IHD, Ischemic Heart Disease; PVD, Peripheral Vascular Disease; CKD, Chronic Kidney Disease; End-stage Renal Disease, ESRD; COPD, Chronic Obstructive Pulmonary Disorder; Intensive Care Unit, ICU; SNF, Skilled Nursing Facility

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Table 2

Distribution of use of ACEIs/ARBs, β-blockers and statins within 30 days post-AMI by race/ethnicity and gender

Race/Ethnic and Gender groups	No. of patients in race/ethnic and gender groups	ACEIs/ARBs % use	β-blockers % use	Statins % use
White Men	41,196	56.28	76.41	59.31
White Women	31,130	53.44	77.03	64.02
Black Men	5,050	57.47	74.18	58.63
Black Women	2,431	53.52	72.73	60.92
Hispanic Men	1,382	61.22	76.27	62.08
Hispanic Women	1,076	59.94	78.07	64.59
Asian Men	884	60.07	75.79	63.69
Asian Women	875	58.29	76.23	71.09
Other Men	576	57.47	73.26	63.19
Other Women	417	57.07	76.26	66.43

Abbreviations: AMI, Acute Myocardial Infarction; ACEI, Angiotensin Converting Enzyme Inhibitor; ARB, Angiotensin Receptor Blocker

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Table 3

Association between use of ACEIs/ARBs, β-blockers and statins within 30 days following discharge from AMI hospitalization and race/ethnicity and gender categories

	ACEIs/ARBs* N = 47,124		β-blockers* N = 64,939		Statins* N = 52,185	
Race/Ethnicity and Gender	**Adjusted OR†**	**95% CI (p-value)**	**Adjusted OR†**	**95% CI (p-value)**	**Adjusted OR†**	**95% CI (p-value)**
White Men	Ref	-	Ref	-	Ref	-
White Women	0.91	0.88-0.94 (<0.001)	0.93	0.90-0.97 (<0.001)	0.98	0.95-1.02 (0.26)
Black Men	1.06	0.99-1.13 (0.08)	0.96	0.90-1.03 (0.28)	1.04	0.97-1.11 (0.26)
Black Women	0.98	0.89-1.07 (0.64)	0.85	0.77-0.94 (0.001)	1.08	0.98-1.18 (0.12)
Hispanic Men	1.04	0.92-1.17 (0.52)	1.03	0.90-1.17 (0.70)	1.02	0.90-1.15 (0.81)
Hispanic Women	1.20	1.05-1.37 (0.009)	1.09	0.94-1.27 (0.25)	1.04	0.90-1.20 (0.60)
Asian Men	0.98	0.84-1.14 (0.76)	0.97	0.82-1.14 (0.70)	0.95	0.81-1.11 (0.53)
Asian Women	1.01	0.87-1.17 (0.89)	0.94	0.80-1.11 (0.46)	1.20	1.02-1.41 (0.03)
Other Men	0.98	0.82-1.17 (0.81)	0.84	0.70-1.02 (0.08)	1.04	0.86-1.25 (0.71)
Other Women	1.00	0.81-1.24 (0.99)	0.91	0.70-1.13 (0.36)	1.02	0.82-1.27 (0.87)

*Out of all 85,017 beneficiaries

†Adjusted for all the measured demographic, clinical and baseline characteristics listed in Table 1

Abbreviations: OR, Odds Ratio; AMI, Acute Myocardial Infarction; ACEI, Angiotensin Converting Enzyme Inhibitor; ARBs, Angiotensin Receptor Blocker

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Table 4

Distribution of medication adherence to ACEIs/ARBs, β-blockers and statins in the 12-months post-AMI hospitalization by race/ethnicity and gender

Race/Ethnic and Gender groups	No. of ACEI/ARB users (N = 47,124)	ACEIs/ARBs,% adherent*	No. of β-blocker users (N = 64,939)	β-Blockers, % adherent*	No. of statin users (N = 52,185)	Statins, % adherent*
White Men	23,184	64.30	31,476	68.44	24,435	66.93
White Women	16,636	61.46	23,978	65.36	19,929	67.61
Black Men	2,902	60.72	3,746	60.57	2,961	59.03
Black Women	1,301	53.57	1,768	56.28	1,481	57.73
Hispanic Men	846	64.18	1,054	63.00	858	61.66
Hispanic Women	381	59.07	491	58.45	411	59.14
Asian Men	355	66.85	460	68.66	407	72.29
Asian Women	316	61.96	418	62.67	420	67.52
Other Men	222	67.07	272	64.45	252	69.23
Other Women	143	60.08	193	60.69	167	60.29

*Adherence defined by ≥80% adherent to therapy in the 12 months post-AMI discharge

Abbreviations: AMI, Acute Myocardial Infarction; ACEI, Angiotensin Converting Enzyme Inhibitor; ARB, Angiotensin Receptor Blocker

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Table 5

Medication adherence to ACEIs/ARBs, β-blockers and statins following discharge from AMI hospitalization by race/ethnicity and gender

	ACEIs/ARBs N = 47,124		β-blockers N = 64,939		Statins N = 52,185	
Race/Ethnicity and Gender	**Adjusted OR***	**95% CI (p-value)**	**Adjusted OR***	**95% CI (p-value)**	**Adjusted OR***	**95% CI (p-value)**
White Men	Ref	-	Ref	-	Ref	-
White Women	0.91	0.87-0.95 (<0.001)	0.90	0.86-0.93 (<0.001)	1.05	1.01-1.09 (0.03)
Black Men	0.88	0.81-0.96 (0.004)	0.74	0.69-0.79 (<0.001)	0.73	0.67-0.79 (<0.001)
Black Women	0.70	0.62-0.78 (<0.001)	0.64	0.58-0.71 (<0.001)	0.72	0.66-0.89 (<0.001)
Hispanic Men	0.95	0.82-1.11 (0.53)	0.81	0.71-0.92 (0.002)	0.77	0.66-0.89 (<0.001)
Hispanic Women	0.85	0.72-1.00 (0.05)	0.70	0.60-0.80 (<0.001)	0.71	0.61-0.83 (<0.001)
Asian Men	1.06	0.88-1.28 (0.53)	1.06	0.89-1.26 (0.50)	1.15	0.95-1.40 (0.14)
Asian Women	0.92	0.77-1.11 (0.39)	0.83	0.70-0.97 (0.02)	0.95	0.80-1.13 (0.58)
Other Men	1.10	0.87-1.40 (0.42)	0.86	0.70-1.06 (0.16)	1.08	0.86-1.36 (0.53)
Other Women	0.85	0.65-1.11 (0.24)	0.76	0.60-0.95 (0.02)	0.74	0.58-0.95 (0.02)

*Adjusted for all the measured demographic, clinical and baseline characteristics listed in Table 1

Abbreviations: OR, Odds Ratio; AMI, Acute Myocardial Infarction; ACEI, Angiotensin Converting Enzyme Inhibitor; ARB, Angiotensin Receptor Blocker