Recent National Trends in Acute Myocardial Infarction Hospitalizations in Medicare: Shrinking Declines and Growing Disparities

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Studies reporting steep declines in AMI hospitalization rates through 2007 have found lesser declines among blacks.[1-4] While subsequent studies have reported continuing – albeit less steep – declines overall through 2011,[5] racial differences in declines have not been closely examined. Therefore, we looked at trends in AMI hospitalization rates among elderly Medicare beneficiaries over the 10-year period, 2002 to 2011, focusing specifically on whether the post-2007 declines are also more modest for blacks than for whites, potentially reflecting a growing gap in care.

Using the Centers for Medicare and Medicaid Services (CMS) 100% sample MedPAR (Medicare Provider Analysis and Review) files linked to Medicare Denominator files, we compared trends in hospitalizations with a principal discharge diagnosis of AMI (410.xx, excluding 410.x2) for black and white Medicare beneficiaries ages 65 and older, with fee-for-service (FFS) coverage between January, 2002 and December, 2011. We calculated annual AMI hospitalization rates per 100,000 beneficiary-years, adjusted to the age-sex distribution of the 2007 Medicare population. We examined time trends using multivariable Poisson regression, reporting annual changes in AMI hospitalization rates as incidence rate ratios (IRRs) with 99% confidence intervals (CI). (eAppendix).

Over ten years, AMI hospitalization rates declined 36.6% among whites (from 1,057 per 100,000 beneficiary-years in 2002 to just 670 in 2011), with average declines of 5.1% per year (IRR: 0.949; 99% CI 0.948 to 0.950). Declines were more modest among blacks, with AMI hospitalization rates dropping 26.4% (from 966 per 100,000 in 2002 to 711 per 100,000 in 2011); the average annual decline for blacks, 3.4% (IRR: 0.966; 99% CI: 0.964 to 0.968), was only 2/3 that for whites. Rates of decline slowed for both blacks and whites in the latter part of the study period, to 4.1% per year for whites (IRR: 0.959; 99% CI: 0.958 to 0.961), but only 2.7% (IRR: 0.973; 99% CI: 0.967 to 0.979) for blacks between 2007 and 2011. Strikingly, while AMI hospitalization rates were initially 9% *lower* among blacks than whites in 2002 (Blacks: 966 per 100,000 beneficiary-years vs. Whites: 1,057), the rates crossed over around 2007, and were 6% *higher* for blacks by 2011 (Blacks: 711 vs. Whites: 670). (**Figure**). (eAppendix).

Our finding that declines in AMI hospitalization rates among blacks continue to lag those in whites raises important questions for policy and clinical practice. It is unlikely that blacks in 2002 were more heart-healthy than their white peers; therefore, the lower AMI hospitalization rates for blacks at that time may have been due to problems with symptom recognition, mistrust of the healthcare system, or inequities in access.[6-8] If such barriers have been reduced, with blacks increasingly likely to be hospitalized when they have an AMI, our results may – paradoxically - reflect improvements in their quality of care. Nonetheless, our findings suggest that blacks continue to have more difficulty accessing care and have benefitted less from the national cardiovascular health initiatives that have been so effective for whites. To the extent that primary and secondary prevention efforts are more successfully disseminated among

whites, quality improvement initiatives could be contributing to increased health disparities in AMI prevalence.

In conclusion, over the 10 year period 2002-2011, the benefits of reductions in AMI hospitalizations through aggressive cardiovascular risk factor management may be slowing overall, with even smaller declines for blacks resulting in a crossover; AMI hospitalization rates, which had been lower for blacks than for whites in 2002, were comparable in 2007 and higher by 2011. The causes of this growing disparity should be elucidated.

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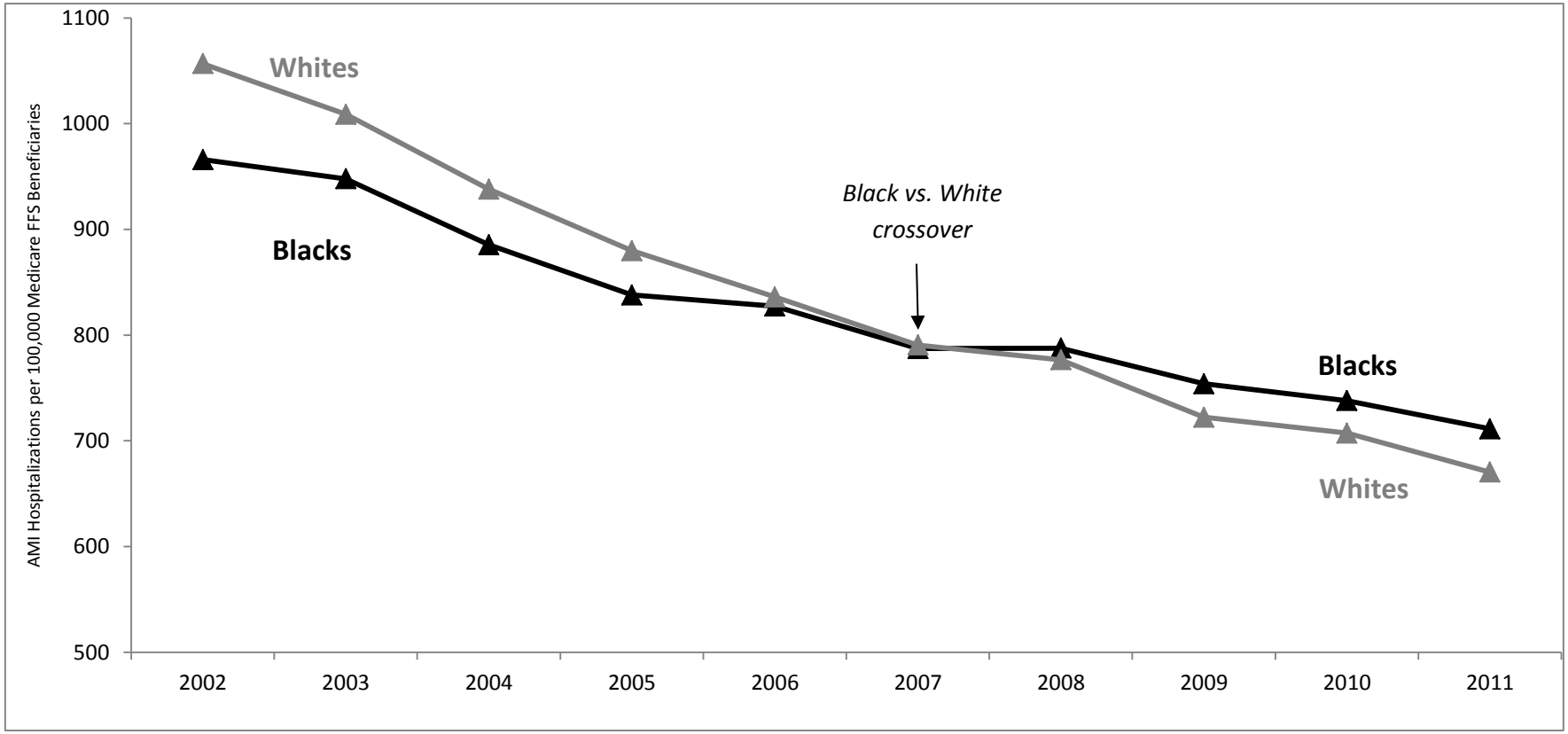
Figure. Declines in AMI Hospitalization Rates*: Blacks vs. Whites



	2002-2006*					2007-2011*					Relative Decline (%)			Annual Decline (%)**		
Year	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2002-2011**	**2002-2006**	**2007-2011**	**2002-2011**	**2002-2006**	**2007-2011**
White	1,057	1,009	938	880	836	791	777	722	707	670	-36.6	-20.9	-15.2	5.1	6.1	4.1
Black	966	948	886	838	827	787	788	754	738	711	-26.4	-14.3	-9.7	3.4	4.2	2.7

** Annual AMI hospitalizations per 100,000 Medicare FFS beneficiary-years (beneficiaries ages 65 age 65+)*

e-Appendix

Recent National Trends in Acute Myocardial Infarction Hospitalizations in Medicare: Shrinking Declines and Growing Disparities

INTRODUCTION

Acute myocardial infarction (AMI) is a leading cause of morbidity, mortality and cost among Medicare beneficiaries that results in over 200,000 hospital admissions and close to $10 billion in Medicare spending annually.[1] As such, AMI has been the target of numerous quality improvement initiatives,[2 3 4 5] and payers, policy makers and healthcare providers look to trends in AMI for evidence of the success of these efforts.

A recent study reports steep declines in AMI hospitalization rates, which dropped 38.0% from 1999-2011.[6] Other studies report similarly large declines through 2007, although several report declines that were more modest for blacks, compared to whites.[4,7-10] From 2002-2007, for example, AMI hospitalization rates declined 18.0% and 18.4% for black men and women respectively, compared to 24.4% and 23.3% for white men and women, respectively, although AMI hospitalization rates throughout that five year study period study period remained lower for blacks than for whites.[4] Other studies report similar trends over the same period.[11 12]

Although the large declines in AMI hospitalization rates suggest that decades of vigorous national cardiovascular risk reduction efforts have been successful,[11] it is not known whether

the rate of decline has remained constant, or whether the slower declines among blacks have persisted. To address these questions, we examined trends in AMI hospitalization rates among elderly Medicare beneficiaries over a 10-year period, 2002 to 2011. Our objectives were twofold: 1) to assess whether AMI hospitalization rate declines continued at the same rate throughout the 10 year period; and 2) to determine whether the declines in AMI hospitalization rates for blacks have remained more modest than for whites, potentially pointing to a growing gap in care.

METHODS

Data

This investigation used the Centers for Medicare and Medicaid Services (CMS) 100% sample MedPAR (Medicare Provider Analysis and Review) files linked to Medicare Denominator files for the years 2002-2011. The MedPAR files contain hospital discharge abstracts for the acute-care hospitalizations of all Medicare beneficiaries with Part A coverage, including data on admission and discharge dates, admission source, International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) diagnosis and procedure codes, and discharge disposition. The Medicare denominator files include beneficiaries' dates of birth, sex, race (categorized as black, white, or other), enrollment status, region of residence, and vital status (including date of death). We began our study in 2002 to limit the potential effects of a change in the definition of AMI made by the American College of Cardiology and the European Society of Cardiology in 2000.[13]

Study Population

Our study population consisted of residents of U.S. states, the District of Columbia and Puerto Rico ages 65 and older and enrolled in Medicare fee-for-service (FFS) coverage between January 1, 2002 and December 31, 2011. We excluded beneficiaries during months in which they lacked Medicare Part A coverage or were enrolled in a Medicare HMO, since their hospitalization claims would not be submitted for reimbursement. Because individuals can move in and out of FFS coverage, and because they become age-eligible for Medicare on the first day of the month in which they turn 65, our study denominator comprised eligible beneficiary-months, aggregated to beneficiary-years. **eAppendix A** contains an attrition table showing the numbers of beneficiaries and beneficiary-years meeting each inclusion criterion.

Outcomes

Our study outcome, AMI hospitalization rates, is based on events, rather than individual patients, allowing for multiple admissions for the same patient to be included. Consistent with earlier studies that used administrative data to estimate AMI trends, we counted only hospitalizations with a principal discharge diagnosis of AMI (defined by ICD-9-CM code 410.xx, excluding 410.x2), and excluded hospitalizations with length of stay of one day or less in which patients were discharged alive and not against medical advice.[4 5 14] Hospital transfers (i.e., hospital admissions occurring within one day of discharge from another hospital) were linked and counted as a single hospitalization. Hospitalizations where the admission and discharge dates spanned a calendar year were attributed to the year of admission.

Statistical Analyses

We calculated annual AMI hospitalization rates per 100,000 beneficiary-years for each year from 2002 to 2011. Rates, adjusted to the age-sex-race distribution of the 2007 Medicare population using direct standardization, were reported overall and by sex, age (65-74, 75-84, 85+ years) and race (black, white).

We used multivariable Poisson regression to estimate time trends in AMI hospitalization rates overall and within age, sex, and race subgroups for the entire study period and, separately, for the first five years (2002 to 2006) and the second five years (2007 to 2011). Annual changes in AMI hospitalization rates, adjusted for the contributions of the variables in the model, are reported as incidence rate ratios (IRRs) with 99% confidence intervals (CI). The individual data exhibit moderate extra-Poisson dispersion (the ratio of the variance to the mean exceeded 1 and decreased from 1.13 in 2002 to 1.10 in 2011); given the large numbers of cases analyzed, this had negligible effect on CI estimates, and all differences that we report as findings have two-sided P-values that are extremely small (corresponding to z-scores in the range of 5 to 20). Indeed, because these are full-population analyses, our statistical modeling is useful more for descriptive than inferential purposes. Although we report unadjusted hospitalization rates stratified by white, black, and other race, the multivariable analysis included only whites and blacks because 'other' combines highly heterogeneous subpopulations. All analyses used Stata version 13 (StataCorp. 2013. *Stata Statistical Software: Release 13*. College Station, TX: StataCorp LP).

RESULTS

Baseline Characteristics

As presented in **EeTable 1**, our eligible study denominator consisted of 288,873,509 beneficiary-years over the 10-year study window; the mean age was 75.4; the majority were female (57.2%) and white (86.8%). There were 2,425,179 hospitalizations over the 10-year study window (0.84% per beneficiary-year). The mean age of patients hospitalized for an AMI was 78.7 years; overall, 49.8% were female and 87.7%, white.

Trends in AMI Hospitalization Rates

Adjusted AMI hospitalization rates per 100,000 beneficiary-years are reported in **eTable 2** and shown graphically in **eFigure 1**. Overall, AMI hospitalization rates declined 36.4% (from 1,063 per 100,000 beneficiary-years in 2002 to just 677 in 2011), with an average annual decline of 5.0% over the 10-year study period (IRR: 0.950; 99% CI: 0.949 to 0.951). In each subgroup analysis, rates of decline closely followed the 36.4% seen in the overall population, except for blacks, for whom AMI hospitalization rates declined only 26.4% (from 966 per 100,000 in 2002 to 711 per 100,000 in 2011). The average annual decline for blacks, 3.4% (IRR: 0.966; 99% CI: 0.964 to 0.968), was barely 2/3 of the average annual decline for all other subgroups. Strikingly, AMI hospitalization rates were initially *lower* among blacks than whites in 2002 at the start of the study period (Blacks: 966 per 100,000 beneficiary-years vs. Whites: 1,057), but became *higher* by 2011 (Blacks: 711 vs. Whites: 670). Thus, AMI hospitalization rates for blacks were 9% lower than those of whites in 2002, but 6% higher by 2011. This crossover in absolute hospitalization rates by race occurred between 2007-2008 (See **Figure**.)

Trends in AMI Hospitalization Rates: 2002-2006 versus 2007-2011

AMI hospitalization rates declined throughout our study period, but declines were more modest in the second five years, as shown in **eTable 2**. AMI hospitalization rates dropped by 21.3% from 2002-2006 (from 1,063 per 100,000 beneficiary-years in 2002 to 837 in 2006), with average annual declines of 6.0% (IRR: 0.940; 99% CI: 0.938 to 0.941). AMI hospitalization rates continued to decline from 2007-2011, but at a slower rate, with a 14.4% relative decline (from 790 per 100,000 in 2007 to 677 in 2011), and an average annual decline of 4.0% (IRR: 0.960; 99% CI: 0.959 to 0.962). This slowing of the rate of decline in the second half of the study window was seen in both sexes, by race, and in all age groups except for those 85 years and older. Across all ten years, however, declines for blacks were considerably more modest than for all other subgroups, with slowdowns in more recent years. From 2002-2006, AMI hospitalization rates for blacks declined a relative 14.3%, with an average annual decline of 4.2% (IRR: 0.958; 99% CI: 0.952 to 0.963). From 2007-2011, however, these rates declined only 9.7%, with an average annual decline of only 2.7%; (IRR: 0.973; 99% CI: 0.967 to 0.979). (See **eTable 2**.)

DISCUSSION

AMI hospitalization rates continued to decline over the 10 years 2002-2011, but the rate of decline slowed considerably in the latter half of this period. Declines were far more modest for blacks than for whites, particularly from 2007-2011, when AMI hospitalization rates for blacks declined only 2.7% per year (in contrast to 4.1% for whites).

Several prior studies have reported substantial declines in AMI hospitalization rates starting as early as 1996 through 2011.[4 7 8 9 10] Our study updates prior literature, demonstrating that declines in AMI hospitalization rates among FFS Medicare beneficiaries have slowed considerably since 2007. Some have posited that the earlier declines in AMI hospitalization rates correspond to more aggressive risk factor management for both primary and secondary prevention, with smoking cessation and guideline-based medical and pharmaceutical risk factor management contributing to these improvements.[15 16 17 18 19 20] It is possible that the benefits of risk factor management began to level off after 2007, and that, while AMI hospitalization rates remain dramatically lower than in previous decades, further steep declines can no longer be expected.

Our study also extends prior studies showing that declines in AMI hospitalization rates have been smaller among blacks compared to whites.[4 7] In contrast to earlier studies ending in 2007, however, where whites still had higher absolute AMI hospitalization rates than blacks, using more recent data, we identified an important crossover between blacks and whites in the rates of AMI hospitalizations: blacks in 2002 had lower AMI hospitalization rates than whites but ended in 2011 with higher rates of AMI hospitalization.

Our finding that declines in AMI hospitalization rates among blacks lag those for whites raises important questions for policy and clinical practice. It is possible that problems with symptom recognition, mistrust of the healthcare system, and inequities in access for blacks[21,22 23-25] contributed to their lower rates of hospitalization for AMI in 2002. If such barriers to care

have been reduced, and blacks are increasingly likely to be hospitalized with an AMI, then our results suggest that quality of care for blacks has improved over time.

Nonetheless, our findings strongly suggest that national efforts in primary and secondary prevention are not working as well for blacks as for whites. A number of recently published studies find ongoing, persistent disparities in cardiovascular health, with blacks at higher risk of AMI and other acute coronary heart disease events.[24 26 27 28 29 30] Other studies report that adherence to cardiovascular medications is poorer among blacks, compared to whites, both before and after AMI.[30 31 32 33] To the extent that blacks have more difficulty accessing care than whites, and primary and secondary prevention efforts lag for black patients, our findings suggest that quality improvement initiatives have led to relatively uneven differences in rates of decline in AMI hospitalizations. To understand and address this emerging disparity, we must first identify its causes.

Strengths and Limitations

Our study has strengths and limitations. First, we counted all AMI hospitalizations, not just one per beneficiary. This approach is consistent with other literature reporting AMI trends.[4 7 9 10] Second, and also consistent with other trend studies, we considered only FFS beneficiaries, excluding beneficiary-months when individuals were enrolled in Medicare Advantage (managed care, or capitated) plans; this criterion excluded 14-15% of beneficiaries in the period 2002-2005, rising to 27% in 2011 (see **eAppendix A**), changes consistent with Kaiser Family Foundation reports on Medicare enrollment for the same time period.[34] While Medicare Advantage enrollees are thought to be healthier than beneficiaries remaining in FFS,[35 36] there is some evidence suggesting that favorable selection into Medicare Advantage plans has slowed.[37]

Therefore, we do not know whether the decreasing numbers of beneficiaries in FFS are more or less prone to AMI than those in Medicare Advantage; such differences could affect observed trends. Additionally, a revision of the definition of AMI in 2007[38] could have led to increased sensitivity of AMI diagnoses in that year, resulting in an artificial slowdown in AMI hospitalization rate declines. However, we would expect the effects of this change to level off in subsequent years. Instead, we observed slower declines in AMI hospitalization rates through 2011. Finally, none of our analyses provides insight into the causes for our findings.

CONCLUSION

AMI hospitalization rates among Medicare FFS beneficiaries declined substantially over the 10 year period 2002-2011, but rates of decline in the second half of this period were not as great as they were in earlier years, suggesting that the benefits of efforts to reduce AMI occurrence may be slowing. Further, because declines were slower among blacks than whites throughout the study period, a transition occurred during 2002-2011, in that blacks started with lower – but ended with higher – absolute AMI hospitalization rates. This transition points to an important, and apparently growing, disparity between whites and blacks in cardiovascular health and outcomes. The causes of these growing disparities should be elucidated and may warrant policy attention.

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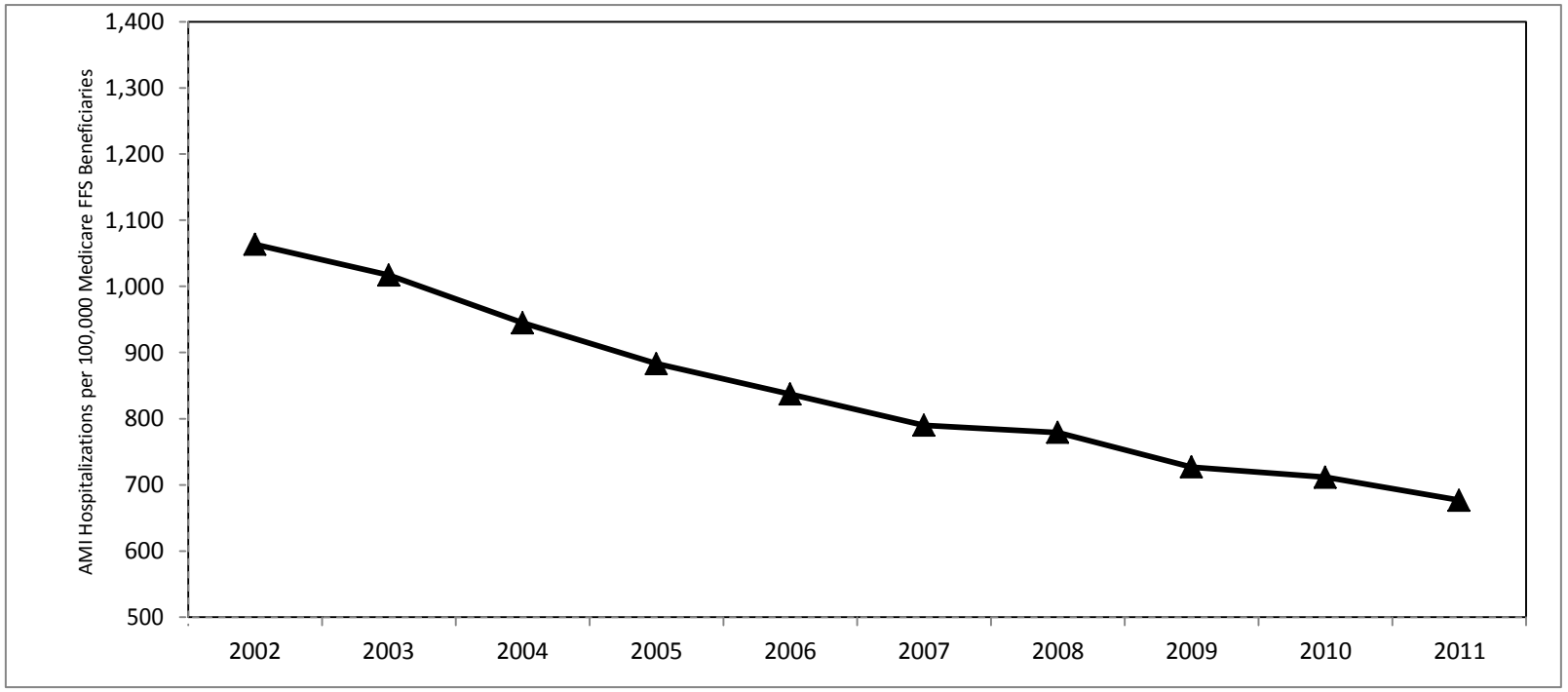
eTABLE 1. Baseline Characteristics of Medicare Beneficiaries and AMI Patients (Unadjusted)

	2002-2006					2007-2011					
Year	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**Total**
Denominator (millions of person years)	28.8	29.3	29.6	29.7	29.1	28.6	28.3	28.2	28.5	28.9	288,873,509
Mean Age	75.4	75.4	75.4	75.4	75.4	75.4	75.3	75.3	75.3	75.2	75.4
Age 65-74, %	51.2	51.2	51.4	51.4	51.4	51.7	52.5	53.1	53.5	54.2	52.1
Age 75-84, %	35.6	35.6	35.4	35.1	34.7	34.0	33.1	32.3	31.7	31.1	33.9
Age ≥ 85, %	13.1	13.2	13.3	13.5	13.9	14.3	14.4	14.6	14.8	14.8	14.0
Male, %	41.8	42.0	42.2	42.4	42.7	42.9	43.3	43.5	43.7	44.0	42.8
Female, %	58.2	58.0	57.8	57.6	57.3	57.1	56.7	56.5	56.3	56.0	57.2
White, %	87.5	87.3	87.1	86.9	87.0	86.9	86.8	86.5	86.2	85.9	86.8
Black, %	8.0	8.0	8.1	8.0	7.9	7.8	7.8	7.8	7.9	8.0	7.9
Other, %	4.6	4.7	4.9	5.1	5.1	5.3	5.5	5.7	5.9	6.2	5.3

	2002-2006					2007-2011					
Year	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**Total**
# of AMI Hospitalizations	302,829	295,030	277,389	260,792	243,040	225,744	220,026	204,213	202,114	194,002	2,425,179
# of AMI	285,675	278,755	263,303	248,412	231,951	215,184	209,734	194,983	192,948	185,244	2,306,189
Mean Age	78.3	78.5	78.5	78.6	78.7	79.7	78.8	78.6	78.6	78.5	78.7
Age 65-74, %	35.1	34.5	34.5	34.3	34.4	34.4	34.5	35.7	36.2	37.0	35.0
Age 75-84, %	41.1	41.0	40.9	40.4	39.5	38.9	38.1	36.9	36.5	36.0	39.2
Age ≥ 85, %	23.7	24.5	24.5	25.3	26.1	26.7	27.4	27.4	27.3	27.0	25.8
Female, %	50.7	50.5	50.5	50.0	50.0	49.7	49.8	49.1	48.8	48.2	49.8
Male, %	49.3	49.5	49.5	50.0	50.0	50.3	50.2	50.9	51.2	51.8	50.2
White, %	88.6	88.2	88.0	87.9	87.9	87.8	87.6	87.2	87.0	86.7	87.8
Black, %	7.4	7.6	7.6	7.7	7.9	7.8	7.8	8.1	8.2	8.4	7.8
Other, %	4.0	4.2	4.4	4.4	4.2	4.4	4.6	4.7	4.8	5.0	4.4

eFigure 1. Trends in AMI Incidence: 2002-2011



eTABLE 2. Acute Myocardial Infarction (AMI) Hospitalization Rates*

	2002-2006					2007-2011					Relative Decline (%)	Average Annual Decline (%)**		
Year	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2002-2011**	**2002-2011**	**2002-2006**	**2007-2011**
All	1,063	1,017	945	883	837	790	779	727	711	677	-36.4	5.0	6.0	4.0
White	1,057	1,009	938	880	836	791	777	722	707	670	-36.6	5.1	6.1	4.1
Black	966	948	886	838	827	787	788	754	738	711	-26.4	3.4	4.2	2.7
Gender														
Men	1,252	1,194	1,106	1,039	979	926	904	852	834	798	-36.2	5.0	6.1	3.7
Women	922	884	824	766	730	688	685	633	619	585	-36.5	5.0	5.9	4.2
Age Categories														
65-74	725	681	632	588	559	526	510	487	480	459	-36.7	5.0	6.5	3.3
75-84	1,221	1,166	1,087	1,012	952	903	894	827	814	774	-36.6	5.0	6.2	3.9
≥ 85	1,918	1,880	1,742	1,649	1,571	1,481	1,478	1,353	1,303	1,226	-36.1	4.9	5.1	4.9

** Annual AMI hospitalizations per 100,000 Medicare FFS beneficiary-years*

*** Average annual decline, calculated as 1-IRR; all reported IRRs significant at P <0.0001*

eAppendix A: Attrition Table.

		Inclusion Criteria*									
	All Beneficiaries	**Alive**		**65+**		**Part A**		**FFS**		**Residence (50 US states, DC, PR)**	
2002	42,532,218	41,612,668	98%	34,708,576	82%	34,254,933	81%	29,088,250	68%	28,766,922	68%
2003	43,139,493	42,238,120	98%	35,024,596	81%	34,568,285	80%	29,613,324	69%	29,285,716	68%
2004	43,788,893	42,886,833	98%	35,356,340	81%	34,945,389	80%	29,934,366	68%	29,600,756	68%
2005	44,629,648	43,705,054	98%	35,815,508	80%	35,405,931	79%	30,045,082	67%	29,705,098	67%
2006	45,455,982	44,553,780	98%	36,332,025	80%	35,928,587	79%	29,432,648	65%	29,085,408	64%
2007	46,519,589	45,614,722	98%	37,013,369	80%	36,616,093	79%	28,925,111	62%	28,570,190	61%
2008	47,674,775	46,737,297	98%	37,926,982	80%	37,524,964	79%	28,673,221	60%	28,309,627	59%
2009	48,922,869	48,014,614	98%	38,859,828	79%	38,435,584	79%	28,586,166	58%	28,175,086	58%
2010	50,088,947	49,168,510	98%	39,721,086	79%	39,284,966	78%	28,930,717	58%	28,509,989	57%
2011	51,717,260	50,764,148	98%	40,638,305	79%	40,207,875	78%	29,297,096	57%	28,864,718	56%

* *Inclusion criteria reported as beneficiary-years. Percents shown are relative to all beneficiaries in each calendar year.*

Sacks et al. Responses to Reviewer Comments

REVIEWER 1:

The major limitation of this analysis is that similar results have been already published. For example, Wang et al reported similar observations using data from the National Inpatient Sample for the period 2001-2007, with higher incidence in whites than blacks at the beginning of the period, but steeper declines in whites and as a consequence lower rates in whites than blacks at the end of follow-up.

An article published in *Circulation* in September 2014 (referenced by Reviewer 2) reports trends in AMI hospitalizations from 1999-2011. While this article does not focus on trends by race, several earlier articles do, as the reviewer notes. Our goal was to examine whether slower rates of decline for blacks, compared to whites, have persisted since 2007, when rates for whites remained lower than for blacks. Wang et al. (*Am J Cardiol* 2012) report higher AMI rates for whites than for blacks in all years of their 2001-2007 study timeframe, including the last year of their study, 2007 (Whites: 226 per 100,000 vs. Blacks: 199 per 100,000). Rates increased among blacks in the last 3 years of their study period, the increases were not statistically significant. Wang et al.'s results are consistent with Chen et al. (*Circulation,* 2010), who reported slower rates of decline in AMI hospitalization rates for blacks compared to whites between 2002-2007, with rates higher for whites in all individual study years. We build on these findings, and find that rates are now higher for blacks than for whites. While this finding would be a logical extension of trends reported in earlier studies, it has been reported (to the best of our knowledge!)

Other problems with this analysis include the inclusion of hospitalized MI (and exclusion of out-of-hospital fatal events). If out-of-hospital MI mortality rates have improved more for blacks than for whites, the consequence would be similar to what this study report, i.e. a slower decline in the incidence rates of hospitalized MIs in blacks than whites. I am not saying that is the cause responsible for the observed trends, but it is a possibility and the authors need to consider it.

We agree that our findings could reflect greater improvements in out-of-hospital mortality for blacks than for whites, thereby leading to smaller declines in AMI hospitalization rates among blacks. In our discussion, we suggest that our findings could reflect improvements in care, with blacks who have an AMI increasingly likely to be treated in a hospital (and therefore show up in Medicare hospitalization data). We assume that this change would come about if blacks who have an AMI are less likely to die before they reach the hospital.

REVIEWER 2:

The authors have performed a surveillance study for the epidemiology of AMI in the US. A recent publication in 8/2014 in Circ has also performed this detailed analysis from 1999-2011.

We recognize that our research updating trends in AMI hospitalization rates since 2007 is no longer novel. T Consequently, our research letter focuses on whether racial differences in AMI hospitalization rate declines have persisted since; this topic is not discussed in the *Circulation* article. We have modified the eAppendix to focus on these differences, and on whether declines have continued at the same rate since 2007 (which is also not explicitly addressed in the *Circulation* article).

In addition, the discussion of this study revolves around the fact that declines in AMI hospitalizations slowed down after 2007. Of note, the definition of AMI was revised in 2007.It is possible that the revision of the definition of AMI in 2007 led to increased sensitivity of AMI diagnosis leading to an artificial shift in trends that may explain the slowing of the decline. It is worth adding this to the discussion.

Ref: Thygesen K, Alpert JS, White HD,et al. Universal definition of myocardial infarction. Circulation. 2007;116(22):2634-2653.

We agree that that the publication of universal guidelines for AMI definitions could have led to increased coding of AMI diagnoses. We would expect such a change to have a one-time effect, however, with rates of decline bouncing back to earlier levels, which we do not observe. We now note this possibility in the limitations section of the eAppendix.

Although the authors have performed the analyses stratified by age, sex and race, I did not see much discussion about gender differences. I think it is worth noting that there were no gender differences in hospitalization for AMI as opposed to the younger age group seen in other studies.

We agree that gender differences could contribute to differences in rates of decline in AMI hospitalizations for blacks vs. whites. We have conducted analyses stratified by race-sex, race-age, and race-sex-age. We do not include them in the research letter for reasons of space. These analyses could be part of a separate manuscript.

The authors have used 'incidence' in place of hospitalization rates throughout the manuscript. I am not sure if this is a good approach, particularly because this analysis captures only people who are hospitalized and excludes out-of-hospital AMIs and deaths, thus not truly reflecting incidence. Would favor using the term 'hospitalization rates' instead.

We have replaced the term “incidence” with “hospitalization rates” in our research letter and eAppendix.

Also, this analysis does not provide insight into the clinical characteristics of the sample, which would allow us to get an overarching sense of whether patients with AMI were less or more sick through the decade. While an administrative database is not ideal for this data, it should at least be acknowledged as a limitation.

While we adjusted our estimates to the age-sex-race distribution of the 2007 Medicare FFS beneficiary population, we did not adjust for illness burden. This decision was deliberate. To calculate illness burden, we would have needed to examine both outpatient and inpatient claims for the 12 months prior to each AMI hospitalization. These outpatient claims, however, are available only for the Medicare “20%” sample; instead, our results reflect the entire (100%) Medicare Fee-for-Service population. Our results are very close to Chen et al. (2010), who used similar methods in their analyses of administrative data.

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