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Secondary Prevention Medication Use after Myocardial Infarction among U.S. Nursing Home Residents

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Abstract

BACKGROUND—Secondary prevention medications are recommended for older adults after acute myocardial infarction (AMI), but little is known about whether nursing home (NH) residents receive these medications.

OBJECTIVES—To evaluate new use of secondary prevention medications after AMI in NH residents who were previously non-users, and to evaluate which factors were associated with use.

DESIGN—Retrospective cohort using linked national Minimum Data Set assessments; Online Survey, Certification and Reporting (OSCAR) records; and Medicare claims.

SETTING—U.S. NHs.

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Conflict of Interest Explanations:

D.D.D.

D.D.D. is an employee of Optum and stockholder in UnitedHealth Group, Optum's parent company.

M.A.S.

M.A.S. is a paid consultant for iodine.com.

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PARTICIPANTS—National cohort of 11,192 residents aged ≥65 years who were hospitalized for an AMI May 2007-March 2010, had no beta-blocker or statin usage for ≥4 months prior, and survived ≥14 days after NH readmission.

MEASUREMENTS—The outcome was the number of secondary prevention medications initiated within 30 days of NH readmission.

RESULTS—Thirty-seven percent of residents initiated no secondary prevention medications after AMI, 41% initiated one, and 22% two. After covariate adjustment, use of more secondary prevention medications declined with advancing age (down to proportional odds ratio (POR)=0.48, 95% confidence interval (CI)=0.40–0.57 for ≥95 versus 65–74 years), female sex (POR=0.88, 95% CI=0.80–0.96), do not resuscitate (DNR) order presence (POR=0.90, 95% CI=0.83–0.98), functional impairment (dependent or totally dependent versus independent to limited assistance, POR=0.77, 95% CI=0.69–0.86) and cognitive impairment (moderate to severe dementia versus cognitively intact, POR=0.79, 95% CI=0.70–0.89).

CONCLUSION—More than one-third of older NH residents in the U.S. do not initiate any secondary prevention medications after AMI, with fewer medications initiated among residents with older age, female sex, DNR orders, poor physical functioning, and cognitive impairment. A lack of evidence for the NH population and unmeasured patient-centered goals of care are both plausible explanations for these findings.

Keywords

Nursing homes; myocardial infarction; beta-blockers; statins; antiplatelets

INTRODUCTION

Approximately 1.4 million older Americans live in nursing homes (NHs), and over 50% of NH residents have cardiac disease.[1] Randomized clinical trials (RCTs) are used to inform practice guidelines for conditions like acute myocardial infarction (AMI), but NH residents are systematically excluded from RCTs.[2] The result is a profound lack of evidence to guide treatment decisions for older NH residents for whom the potential benefits of some medications may be counterbalanced by adverse effects to which older adults are particularly susceptible.[2]

Guidelines recommend that oral beta-blocker, statin, and antiplatelet (aspirin or clopidogrel) therapy be initiated for all patients after an AMI in the absence of contraindications.[3–8] These medications are a mainstay of secondary prevention. Guideline recommendations are supported by RCTs that have demonstrated that the use of beta-blocker, statin, and antiplatelet therapy following AMI substantially reduces mortality in individuals up to 75 years of age.[9–14] Observational studies have extended some of these findings to community-dwelling people up to and beyond age 85 years.[15–19] Even frail older NH residents may benefit.[20]

Data from community-dwelling older adults have shown that use of secondary prevention medications after AMI decreases as age increases.[21–25] These studies have presented conflicting data on whether functional limitations, frailty, and other geriatric syndromes are

associated with even lower rates of secondary prevention medication use [21–25], but substantially less is known about use of these medications in older NH residents. Since NH residents have different clinical characteristics and systems of care than their community-dwelling counterparts, patterns of medication use are often distinct.

A handful of prior studies in the NH setting found low utilization of secondary prevention medications.[26–31] Several important limitations of these prior NH studies constrain our understanding of current patterns of secondary prevention use. Because the studies used older data (from the 1990s), had small sample sizes, relied on hospital records only, and applied several important exclusion criteria, their generalizability to the current, national population of NH residents in the U.S. remains unclear. The studies also do not attempt to distinguish between continuation of secondary prevention therapies taken before AMI (prevalent use) from new prescribing after AMI. Further, there have been general improvements in adherence to ischemic heart disease-related guideline recommendations in the U.S. since publication of prior studies. Little evidence is available to determine whether prescribing practices for NH residents have changed in tandem. Understanding recent prescribing practices in the NH setting is essential for identifying potential gaps in the quality of care and corresponding opportunities to efficiently address gaps.

Therefore, the objective of this study was to describe the epidemiology of secondary prevention medication use after AMI within a national sample of U.S. nursing homes. We focused on individuals who were non-users of beta-blocker and statin therapy in order to understand how NH prescribers respond to widely accepted clinical practice guidelines that recommend initiating these medications after AMI. It was hypothesized that older age, poor functional status, and worse cognition would be associated with initiation of fewer secondary prevention medications.

METHODS

Data Sources

We linked the following national datasets: Medicare fee-for-service denominator (eligibility) information, Medicare Part A inpatient hospital claims, Medicare Part D prescription drug claims, and Minimum Data Set (MDS) 2.0. The MDS is a comprehensive, clinical assessment instrument used to document health status of nursing home residents, including demographic, medical, functional status, psychological, and cognitive status information.[32–34] Online Survey Certification and Reporting (OSCAR) data were used for facility-level information, including NH characteristics, staffing levels, and quality measures.[35, 36] A previously validated residential history file algorithm was used to track the timing and location of health service use.[37]

Study Population

This was a retrospective inception cohort study of a previously established [20, 38] national cohort of long-stay NH residents without a history of AMI who were hospitalized for AMI, had not taken beta-blockers or statins for at least 4 months before their AMI, and were readmitted to a U.S. NH directly after hospital discharge between May 1, 2007 and

December 31, 2010 (Supplementary Figure S1). We selected previous non-users to permit an evaluation of the decision to initiate secondary prevention medications after AMI, distinct from the decision to continue these agents in patients who had already been taking them before their AMI. Additional details of the cohort have been previously described.[20, 38]

Measurement of Secondary Prevention Medication Use

Oral beta-blocker and statin medications (Table S1) were identified according to generic name in Medicare Part D prescription drug claims.[39] The categorical secondary prevention medication use variable had 3 distinct levels: 0, 1, or 2 medication classes used. Details of the complementary approaches used to ascertain secondary prevention medication exposure, including a validation cohort using complete prescription drug dispensing data from a large, national private NH chain (HCR ManorCare, Inc., Toledo, OH), are described elsewhere.[20, 38] In brief, those approaches are important because Medicare Part D drug dispensing claims are not generated while NH residents receive care through the Skilled Nursing Facility (SNF) benefit.[20, 38]

Measures of Resident and NH Characteristics

Variables that could potentially predict secondary prevention medication use included demographics from Medicare enrollment files, concomitant medication use from Part D claims, and comorbidities from Part A claims, all measured in the year prior to AMI. Part A claims were also used to document recent hospital course (including procedures), severity of cardiovascular disease, and the Elixhauser Comorbidity Index score.[40] Pre-AMI medication use was included as a marker of residents' clinically active conditions and risk of future clinical events (e.g., residents prescribed warfarin may be at higher perceived risk of future cerebrovascular events).

A number of MDS items have been structured into reliable, valid measures of resident functional status.[41–43] The level of functional impairment for each resident was estimated with the MDS Activities of Daily Living (ADL) score documented in the assessment closest to the AMI date in the 90 days prior to AMI. This summary measure indicates the degree of dependence on staff assistance in seven areas of ADL function (bed mobility, transfer, locomotion, dressing, eating, toilet use, personal hygiene), and ranges from 0 (no assistance required) to 28 (total dependence in ADL functioning). [44] Cognitive function was measured with the Cognitive Performance Scale; scores range from 0 (intact) to 6 (severe impairment).[42] Other geriatric syndromes (weight loss, falls, presence and frequency of pain, and Changes in Health, End-Stage Disease, Signs, and Symptoms Scale (CHESS) score) and do not resuscitate (DNR) order status were also measured in the MDS. There are no explicit contraindications to using a greater number of secondary prevention medications, yet we examined potential contraindications to using individual medication classes to confirm our hypothesis that they were only weakly related to the number of medications prescribed.

Facility characteristics and indicators of care quality were obtained from the most recent OSCAR survey before the acute AMI hospitalization.

Statistical Analyses

Univariable associations between potential predictors and secondary prevention medication initiation were first evaluated using ordinal logistic regression models to estimate proportional odds ratios (POR). Ordinal logistic regression models were selected because the number of secondary prevention medication classes an individual receives can be logically ordered from smallest to largest and the cumulative probability was of greater interest.[45] A multilevel multivariable ordinal logistic regression model was used to test the hypothesis that certain individual and facility factors would be independently associated with secondary prevention medication prescribing for residents after AMI.[45] Because residents are clustered within NHs facilities, we included random intercepts for facilities in the model to ensure more accurate standard errors.[46] Resident and facility characteristics were modeled as fixed effects. Multivariable analyses were adjusted for the full set of variables shown in Tables 3 and 4, plus additional variables listed in Table S4.

Stability Analyses

We also evaluated several alternate approaches to determine if our results were robust to various decisions about the study design and estimation. Renin-Angiotensin-Aldosterone System (RAAS) medications (Angiotensin-converting enzyme inhibitors (ACEIs) or angiotensin II receptor blockers (ARBs)) are indicated after AMI primarily for patients with heart failure, with left ventricular systolic dysfunction (ejection fraction ≤0.40), hypertension, and diabetes mellitus. Since these medications are not indicated for all patients, we included these drugs as a possible secondary prevention medication class in stability analyses.[4] Guideline-recommended antiplatelet medications included clopidogrel and aspirin. Aspirin is available without a prescription and is underascertained in Medicare claims, thus we did not include antiplatelet measures in the primary outcome definition. Instead, we conducted a stability analysis in which the outcome variable included beta-blockers, statins and antiplatelet drugs. Finally, we used multinomial logistic regression models for estimation as an alternative to ordinal logistic regression models that does not require the proportional odds assumption.

Software

Data were analyzed using SAS, version 9.4 (SAS Institute, Inc., Cary, NC) and Stata, version 14.0 (Stata Corp., College Station, TX), software.

Ethics Approval

The institutional review boards of Brown University; the University of California San Francisco; and the San Francisco VA Health Care System approved the study protocol.

RESULTS

Residents readmitted to the NH after AMI had a mean age of 84; 28% were male, 83% were non-Hispanic white, 53% had a DNR order; and 72% returned to the NH on the Medicare SNF benefit (Table 1; Table S2); 74% of the cohort required extensive or greater assistance with ADLs, and 84% had some degree of cognitive impairment. Sixty-nine percent of residents had an Elixhauser score of three or more. Of the 6,888 unique NHs that residents

returned to after AMI, 73% were for-profit, and 67% had 100 beds or more. The number of residents returning to each NH post-AMI ranged from one to 13, with an average of two and median of one resident per NH.

Of the 11,192 residents in the study population, 4,094 (37%) initiated no secondary prevention medication, 4,610 (41%) initiated one, and 2,488 (22%) initiated two after returning to the NH after AMI (Table 2 and Table S3). There were 6,369 (56.9%) individuals who initiated beta-blockers and 3,217 (28.7%) individuals who initiated statins. The number of secondary prevention medications newly prescribed was stable each year of the study period; the proportion initiating no medications was 37.4% in 2007, 36.1% in 2008, 36.0% in 2009, and 39.3% in 2010 (chi squared p value=0.17). No secondary prevention medications were dispensed to 34% of those who returned to the NH on the Medicare SNF benefit and 44% of those discharged directly to long-term care (LTC). There was variation in secondary prevention medication use by geographic region, ranging from 31.4% of residents in the Northeast to 40.8% of residents in the South receiving no medications post-AMI.

In univariable analyses, several factors were meaningfully associated with initiation of more secondary prevention medications (Table 3, Table 4, and Table S4). Older age and diagnoses of angina pectoris or unstable angina were predictive of receiving fewer secondary prevention medications. Functional and cognitive impairment before AMI were predictive of less secondary prevention medication use in univariable analyses. Coronary revascularization or angioplasty during the AMI hospitalization were associated with a two-fold greater likelihood of receiving more secondary prevention medications.

These patterns persisted in multivariable analyses: residents with severe functional and cognitive impairment (functional, POR 0.77, 95%CI 0.69–0.86; cognitive, POR 0.79, 95%CI 0.70–0.89) and a DNR order (POR 0.90, 95%CI 0.83–0.98) were less likely to receive secondary prevention medications after returning to the NH post-AMI. Older age remained a significant predictor of less secondary prevention medication use in multivariable analyses, with the oldest residents (≥95 years) receiving the fewest medications compared to those aged 65 to 74 (POR 0.48, 95%CI 0.40–0.57). Female residents were significantly less likely to receive secondary prevention medications (POR 0.88, 95%CI 0.80–0.96). Non-Northeast geographic region of residence was independently associated with less secondary prevention medication use, while coronary revascularization or angioplasty were associated with more (Tables 3, 4, S4). Elixhauser Comorbidity Index and CHESS Score were not independently associated with greater secondary prevention medication use.

A broad set of NH characteristics examined was also not independently associated with secondary prevention medication use (Supplementary Table S4). When the analyses were stratified by initial post-AMI type of NH care, the independent associations between predictors and secondary prevention medication initiation were similar for residents who returned to the NH through the SNF and LTC pathways of care (data not shown).

Results from the stability analyses examining RAAS inhibitors as an included secondary prevention medication class (Tables S5, S6, S7), using multinomial logistic regression

models (Table S8), and examining beta-blocker, statin, and antiplatelet use post-AMI (Tables S9, S10) were also consistent with the main analysis.

DISCUSSION

Thirty-seven percent of this national sample of older NH residents did not receive any secondary prevention medications within 30 days of returning to the NH after AMI. Advanced age, functional dependence, and cognitive impairment explained some of the variation in secondary prevention medication use. Few other factors were as strongly predictive.

The presence of characteristics that were strongly predictive of not receiving secondary prevention medication use in our study suggests that many providers do not expect several important subgroups of NH residents to benefit from use of more treatments. The use of fewer guideline-recommended medications among residents with advanced age, functional dependence, and cognitive impairment may also suggest that providers are concerned that the potential harms of using more medications in those groups do not outweigh the benefits, or that more medication use is inconsistent with the goals of care.[20] Due to the exclusion of older NH residents from RCTs, few data are available to support the notion that such residents would benefit less from treatment (perhaps due to the limited life expectancy of these individuals) or be more susceptible to harms after AMI, though these are generally reasonable assumptions.[2, 47–50] Our findings reveal an opportunity for future pharmacoepidemiologic research to improve the evidence base for using more (or less) secondary prevention medications post-AMI in the NH setting. Previous studies have examined the benefits and harms of initiating individual secondary prevention medication classes after AMI in the NH setting [20]. For example, our research group has demonstrated that use of beta-blockers is associated with lower risk of mortality and an increased risk of functional decline, especially among those with pre-AMI cognitive or functional impairment.[20] But, understanding the effect of using more medications is a distinct and important question.

Prior studies done in older ambulatory populations have reported underutilization of secondary prevention medications post-AMI.[3, 15, 17, 18, 22–25] Likewise, studies done in the NH populations have reported underuse of individual secondary prevention medication classes.[26–31] The older estimates are difficult to directly compare to our study since they examined individual drug classes, but Chrischilles and colleagues recently conducted a study that examined the number of classes initiated after AMI. They used claims data from 2007 to 2008 to examine secondary prevention medication use among elderly (mean age, 78.1) Medicare beneficiaries discharged to a community-based setting from acute care hospitals in the United States after AMI.[23] The main finding of their study was that pre-AMI functional impairment was associated with less use of post-AMI secondary prevention medications. However, they found utilization of more medications than what we report, which is likely attributable to their younger, less multimorbid, and more functionally intact study population. It may also be due in part to our exclusion of individuals who were taking secondary prevention medications before the index AMI, thereby enriching the population with patients who have a contraindication to one of the drug classes or who may have

another reason (e.g., goals of care, suboptimal prescribing) for not receiving the drugs. Using claims-based measures of functional capacity, the study by Chrischilles and colleagues also reported qualitatively similar relationships between functional status and secondary medication use, whereby older adults with worse functional status were less likely to receive more medications after AMI.

This study has some limitations. First, aside from a validation cohort from HCR ManorCare, Inc., secondary prevention medication use was unobservable during the SNF stay in the NH. As a consequence, the use of secondary prevention medications may have been misclassified, although the validation cohort from HCR ManorCare, Inc., for whom medication use during SNF stay was observable, suggests that our approach to classifying secondary prevention medication use will be accurate for all but a small minority of patients. Second, the data were from 2007 to 2010, but given the lack of substantial changes in guidelines, guideline dissemination, or NH standards of practice, it is unlikely that prescribing practices have changed markedly in the intervening years. Third, we focused our study on people who were not using secondary prevention medications before AMI in order to evaluate new prescribing decisions about these drugs. Because individuals who use secondary prevention medications prior to AMI are likely to continue these drugs after AMI, overall use of secondary prevention medications after AMI is likely to be higher, and we are unable to directly compare our observed rates with other studies that combine incident and prevalent secondary prevention medication use. Fifth, we were unable to accurately differentiate ST-elevation MI (STEMI) from non-STI-elevation MI (NSTEMI), which may have influenced prescribing. Fourth, although the data included measures of several potential contraindications to secondary prevention medication use, including obstructive lung disease and concurrent use of calcium channel blockers with atrioventricular node-blocking activity, the data sources are unable to robustly capture other contraindications such as symptomatic bradycardia or hypotension.

In summary, many elderly NH residents do not receive secondary prevention medications after AMI. The low utilization of secondary prevention medications among residents with older age, impaired cognition, and worse functional status may be indicative that providers expect these important subgroups of NH residents with AMI to benefit less from more aggressive treatment. This is not surprising given the absence of evidence documenting the benefits of using more secondary prevention medications in older NH residents. The relatively low use may suggest 1) ongoing concern about the balance of these benefits and harms, especially detrimental effects on patient-centered outcomes, and 2) resident or provider assessment that use of the drugs is inconsistent with the goals of care. Given practical and ethical considerations, it is unlikely that any randomized controlled trials to study the effects of using more of the recommended secondary prevention medications will be forthcoming. Rather, rigorous observational studies will be critical for developing an evidence base to evaluate the effectiveness and safety of secondary prevention medication use in older NH residents.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Conflict of Interest Disclosures

Elements of Financial/Personal Conflicts	**A.R.Z.**		**S.S.**		**Y.L.**		**L.A.D.**		**N.R.S.**	
	Yes	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**
Employment or Affiliation		X		X		X		X		X
Grants/Funds		X		X		X		X		X
Honoraria		X		X		X		X		X
Speaker Forum		X		X		X		X		X
Consultant		X		X		X		X		X
Stocks		X		X		X		X		X
Royalties		X		X		X		X		X
Expert Testimony		X		X		X		X		X
Board Member		X		X		X		X		X
Patents		X		X		X		X		X
Personal Relationship		X		X		X		X		X

Elements of Financial/Personal Conflicts	**W.J.B.**		**D.D.D.**		**S.L.**		**M.A.S.**	
	Yes	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**
Employment or Affiliation		X	X			X		X
Grants/Funds		X		X		X		X
Honoraria		X		X		X		X
Speaker Forum		X		X		X		X
Consultant		X		X		X	X	
Stocks		X	X			X		X
Royalties		X		X		X		X
Expert Testimony		X		X		X		X
Board Member		X		X		X		X
Patents		X		X		X		X
Personal Relationship		X		X		X		X

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Table 1

Characteristics of Study Nursing Home Residents (N=11,192)

Characteristic	n (%)
Age in years, mean (SD)	84 (8)
Male	3,165 (28)
Race/ethnicity	
White, non-Hispanic	9,237 (83)
Black, non-Hispanic	1,325 (12)
Hispanic	427 (4)
Other	203 (2)
Nursing home length of stay in days, median (IQR)	555 (144–1,277)
Primary or secondary diagnoses (prior year)	
Congestive heart failure	5,413 (48)
Angina pectoris	1,386 (12)
Unstable angina	1,110 (10)
Asthma	171 (2)
Chronic obstructive pulmonary disease	2,924 (26)
CHESS score (overall health stability)[a]	
No instability	6,267 (56)
Minimal instability	3,227 (29)
Low instability	1,388 (12)
Moderate to very high instability	310 (3)
Cognitive performance	
Cognitively intact	1,844 (17)
Mild dementia	3,547 (32)
Moderate to severe dementia	5,801 (52)
Activities of daily living status	
Independent to limited supervision	2,933 (26)
Extensive assistance required	5,107 (46)
Dependent or totally dependent	3,152 (28)
Do not resuscitate order	5,918 (53)
Atypical antipsychotics	1,300 (12)
Calcium channel blockers	1,821 (16)
Warfarin	1,209 (11)
Number of Medications (last MDS assessment), mean (SD)	11 (5)
AMI index hospitalization characteristics	
Length of stay in days, median (IQR)	6 (4–9)
One or more days in CCU or ICU	6,319 (57)
Initial Post-AMI Type of Care	
Skilled Nursing Facility	8,027 (72)
Long-Term Care	3,165 (28)

SD, standard deviation; IQR, interquartile range; AMI, myocardial infarction; CCU, coronary care unit; ICU, intensive care unit. All characteristics measured before the acute myocardial infarction unless otherwise noted, please see Supplementary Table S2 for a complete list of variables.

[a]Measured according to Changes in Health, End-Stage Disease, Signs, and Symptoms Scale score.

Table 2

Prevalence of Demographics and Geriatric Syndromes Stratified by the Number of Secondary Prevention Medications Received after Acute Myocardial Infarction (AMI) among Nursing Home Residents who were Non-Users (N=11,192)

Number of Medications	None	One	Two
n (%)	4,094 (37)	4,610 (41)	2,488 (22)
Age in years			
65 to <75	479 (12)	644 (14)	487 (20)
75 to <85	1,320 (32)	1,572 (34)	953 (38)
85 to <95	1,851 (45)	1,981 (43)	932 (38)
≥95	444 (11)	413 (9)	116 (5)
Sex			
Male	1,062 (26)	1,289 (28)	814 (33)
Female	3,032 (74)	3,321 (72)	1,674 (67)
Race			
White, non-Hispanic	3,428 (83)	3,801 (83)	2,008 (81)
Black, non-Hispanic	442 (11)	552 (12)	331 (13)
Hispanic	152 (4)	172 (4)	103 (4)
Other	72 (2)	85 (2)	46 (2)
Region			
Northeast	875 (21)	1,168 (25)	743 (30)
Midwest	1,152 (28)	1,338 (29)	694 (28)
South	1,582 (39)	1,557 (34)	740 (30)
West	439 (11)	502 (11)	284 (11)
Caribbean	46 (1)	45 (1)	28 (1)
CHESS score (health instability)			
No instability	2,213 (54)	2,608 (57)	1,446 (58)
Minimal	1,218 (30)	1,307 (28)	702 (28)
Low	536 (13)	568 (12)	284 (11)
Moderate to very high	127 (3)	127 (3)	56 (2)
Cognitive impairment			
Cognitively intact	580 (14)	749 (16)	515 (21)
Mild	1,236 (30)	1,446 (31)	865 (35)
Moderate to severe	2,278 (56)	2,415 (52)	1,108 (45)
Dependence in activities of daily living			
Independent/limited	1,031 (25)	1,165 (25)	737 (30)
Extensive	1,838 (45)	2,116 (46)	1,153 (46)
Dependent	1,225 (30)	1,329 (29)	598 (24)
Do not resuscitate order			
No	1,756 (43)	2,173 (47)	1,345 (54)
Yes	2,338 (57)	2,437 (53)	1,143 (46)

Abbreviations: CHESS, Changes in Health, End-Stage Disease, Signs, and Symptoms Scale.

Table 3

Univariable and Multivariable Analysis of Demographics and Geriatric Syndromes Associated with Secondary Prevention Medication Initiation after Resident Admission to Nursing Home after Acute Myocardial Infarction (N=11,192)

Characteristic	Univariable Association (POR, 95% CI)	Multivariable Association (POR, 95% CI)[1]
Age in years		
65 to <75	Reference	Reference
75 to <85	0.78 (0.70–0.87)	0.79 (0.70–0.89)
85 to <95	0.62 (0.55–0.68)	0.66 (0.58–0.74)
≥95	0.44 (0.38–0.51)	0.48 (0.40–0.57)
Sex		
Male	Reference	Reference
Female	0.80 (0.74–0.87)	0.88 (0.80–0.96)
Race		
White, non-Hispanic	Reference	Reference
Black, non-Hispanic	1.19 (1.07–1.32)	1.17 (1.03–1.33)
Hispanic	1.10 (0.92–1.31)	1.07 (0.87–1.31)
Other	1.07 (0.72–1.38)	1.08 (0.81–1.45)
Region		
Northeast	Reference	Reference
Midwest	0.79 (0.72–0.87)	0.81 (0.72–0.91)
South	0.66 (0.60–0.72)	0.69 (0.62–0.77)
West	0.82 (0.73–0.93)	0.80 (0.68–0.93)
Caribbean	0.77 (0.54–1.08)	0.78 (0.53–1.14)
CHESS score (health instability)		
No instability	Reference	Reference
Minimal	0.91 (0.84–0.98)	0.96 (0.87–1.05)
Low	0.86 (0.78–0.96)	0.90 (0.79–1.02)
Moderate to very high	0.77 (0.62–0.95)	0.92 (0.73–1.17)
Cognitive impairment		
Cognitively intact	Reference	Reference
Mild	0.84 (0.76–0.94)	0.94 (0.84–1.06)
Moderate to severe	0.67 (0.60–0.74)	0.79 (0.70–0.89)
Dependence in activities of daily living		
Independent/limited	Reference	Reference
Extensive	0.92 (0.85–1.00)	0.88 (0.81–0.97)
Dependent	0.79 (0.72–0.87)	0.77 (0.69–0.86)
Do not resuscitate order		
No	Reference	Reference
Yes	0.74 (0.69–0.79)	0.90 (0.83–0.98)

Abbreviations: POR, proportional odds ratio; COPD, Chronic Obstructive Pulmonary Disease; CHF, Congestive Heart Failure; CCU/ICU, Coronary Care Unit/Intensive Care Unit.

[1]Multivariable analyses also adjusted for a wide range of variables not shown here including demographics, clinical conditions, baseline medications, geriatric syndromes, AMI characteristics, and nursing home characteristics; see Supplementary Table S4 for complete list.

Table 4

Univariable and Multivariable Analysis of Clinical Conditions and Myocardial Infarction Characteristics Associated with Secondary Prevention Medication Initiation after Resident Admission to Nursing Home after Acute Myocardial Infarction (N=11,192)

Characteristic	Univariable Association (POR, 95% CI)	Multivariable Association (POR, 95% CI)[1]
Atrial fibrillation		
No	Reference	Reference
Yes	0.90 (0.83–0.97)	0.90 (0.82–0.98)
Angina pectoris		
No	Reference	Reference
Yes	0.32 (0.29–0.36)	0.32 (0.28–0.36)
Unstable angina		
No	Reference	Reference
Yes	0.78 (0.69–0.87)	0.63 (0.56–0.72)
Asthma		
No	Reference	Reference
Yes	0.97 (0.73–1.30)	0.97 (0.71–1.32)
COPD		
No	Reference	Reference
Yes	0.87 (0.81–0.94)	0.88 (0.80–0.96)
CHF		
No	Reference	Reference
Yes	1.18 (1.11–1.27)	1.28 (1.18–1.38)
Elixhauser score		
0–2	Reference	Reference
3–4	1.10 (1.02–1.19)	0.98 (0.89–1.08)
≥5	1.12 (1.01–1.25)	0.98 (0.85–1.13)
Length of stay, days		
0–4	Reference	Reference
5–9	1.16 (1.07–1.26)	0.94 (0.85–1.04)
≥10	1.18 (1.07–1.30)	0.80 (0.71–0.91)
CCU or ICU use, days		
0	Reference	Reference
1–3	1.57 (1.44–1.72)	1.33 (1.21–1.47)
≥4	1.66 (1.53–1.80)	1.33 (1.21–1.47)
Coronary revascularization[2]		
No	Reference	Reference
Yes	2.31 (1.79–2.98)	1.62 (1.24–2.13)

Abbreviations: POR, proportional odds ratio; COPD, Chronic Obstructive Pulmonary Disease; CHF, Congestive Heart Failure; CCU/ICU, Coronary Care Unit/Intensive Care Unit.

[1]Multivariable analyses also adjusted for a wide range of variables not shown here including demographics, clinical conditions, baseline medications, geriatric syndromes, AMI characteristics, and nursing home characteristics; see Supplementary Table S4 for complete list.

[2]Coronary revascularization and angioplasty procedures.