Statin Utilization in Nursing Home Patients after Cardiac Hospitalization

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BACKGROUND: Coronary artery disease (CAD) is highly prevalent in nursing home residents and is associated with a substantial clinical and economic burden. Statins reduce mortality and hospitalization rates in older patients with CAD.
OBJECTIVES: To assess rates and predictors of statin use among high-risk patients with symptomatic coronary artery disease (CAD) admitted to nursing homes after acute cardiac hospitalization.
DESIGN: Cohort study.
PARTICIPANTS: Medicare beneficiaries enrolled in either a state-run drug assistance program or Medicaid in nursing homes in New Jersey from 1994 through 2005.
MEASUREMENTS: Statin utilization within 60 days of nursing home admission was determined for patients recently hospitalized with symptomatic CAD in whom statins are indicated consisting of those with: acute coronary syndrome (ACS) without revascularization, ACS with revascularization and congestive heart failure (CHF) with revascularization. Predictors of statin use were evaluated with multivariate logistic regression models.
RESULTS: While statin use over the 11-year period increased from 1.2% to 31.8%, overall utilization was very low. Predictors of greater statin use included prior cardiac hospitalization [odds ratio (OR) 1.32, 95% confidence interval (95% CI) 1.13 to 1.57], prior statin use (OR 6.92, 95% CI 5.86 to 8.82) and receipt of a concurrent cardiac medication (range of odds ratios, 2.36–3.40). Older patients admitted for ACS with or without revascularization were less likely to receive a statin. Patients who had received anti-platelets or angiotensin-modifying agents prior to their hospitalization were less likely to receive statins after discharge. Renal disease, prior stroke, diabetes, hypertension and hyperlipidemia did not influence statin utilization. Predictors of treatment did not change when the cohort was dichotomized according to length of stay.
CONCLUSIONS: Patients are infrequently treated with statins when discharged to nursing homes following hospitalization for a symptomatic cardiovascular event. Barriers to statin treatment in this setting require closer examination.

KEY WORDS: geriatrics; drugs; pharmacoepidemiology; prevention.
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BACKGROUND

More than 40% of individuals over 65 years of age will stay in a nursing home at least once during their lifetime[1]. Coronary artery disease (CAD) is the leading cause of death among nursing home patients[2], with the prevalence of CAD estimated to be in excess of 40%[3]. CAD events that are symptomatic, such as acute coronary syndromes (ACS) and congestive heart failure (CHF), are associated with a particularly high risk of mortality, recurrent hospitalization[4] and functional impairment that adversely affects quality of life[5,6]. In the year 2000 alone, nursing home costs of CAD were estimated at $15.1 billion[7]. Thus, efforts to reduce symptomatic CAD may be particularly important in elderly patients in nursing home settings.

Statins are highly effective for the secondary prevention of CAD and are well tolerated in the elderly[8] and cost effective[9]. Studies of community-dwelling elderly patients have found that these agents are underused for reasons including fear of polypharmacy and physician and patient preference[10]. In contrast, frail older adults admitted to a nursing home after acute coronary hospitalization offer a unique opportunity to maximize secondary prevention strategies in a monitored environment, allowing for issues of tolerability to be directly observed and dosages to be titrated. Practice guidelines now recognize and endorse aggressive lipid reduction for secondary prevention in high risk patients[11]. No guidelines exist specifically for nursing home residents; however, statins have been associated with reduced mortality and hospitalization among these patients[12]. Additionally, the average length of stay for a patient in a nursing home is 2.44 years[13], suggesting that secondary prevention may play an important role in these elderly patients. Given published recommendations[14], we

conducted a cohort study to define the rate and pattern of statin utilization in this frail population.

METHODS

Study Setting and Data Sources

We assembled a cohort of Medicare beneficiaries who received pharmacy benefits from the New Jersey Pharmaceutical Assistance to the Aged and Disabled (PAAD) programs or Medicaid and who were admitted to a nursing home after hospitalization for symptomatic CAD. The New Jersey Medicaid program provides prescription drug benefits without medication copayments to eligible individuals, and there is no maximum spending limit to the benefit. PAAD provides prescription drug coverage for individuals whose income is too high to qualify for Medicaid; the benefit has no deductible or maximum benefit and has only a nominal $2 copayment with each prescription. During the study period, there were no prescribing or reimbursement restrictions for statin medications.

Data from Medicaid, PAAD and Medicare were incorporated into a relational database consisting of data for all filled prescriptions, procedures, physician encounters, hospitalizations, long-term care admissions and deaths for the patients in this cohort. These data sources have been used extensively to study population-based health outcomes[15,16]. All traceable person-specific identifying factors were transformed into anonymous, coded study numbers to protect subjects' privacy. This study was approved by the institutional review board of the Brigham and Women's Hospital.

Study Cohort

Our sample consisted of patients hospitalized with symptomatic CAD (i.e., patients for whom statins are indicated) between January 1, 1994 and December 31, 2005 who were subsequently admitted into a nursing home. Specifically, we included patients discharged with an ACS who underwent coronary revascularization, those with an ACS who did not undergo revascularization and those with CHF who underwent revascularization. ACS included both acute myocardial infarction (ICD-9 410.01-.09) and unstable angina (ICD-9 411). Revascularization procedures were identified based on diagnostic procedural codes for coronary bypass grafting (CABG), percutaneous coronary angioplasty or atherectomy, and thrombolysis (intra-coronary or systemic).

We included only patients who were admitted to a nursing home within 7 days of hospital discharge. Nursing homes included long-term care and skilled-nursing facilities but not assisted-living facilities. Patients were excluded if they did not fill any medication in each of the two 6-month periods preceding and following their index cardiac hospitalization to reduce the possibility that patients were obtaining medication from another source. Therefore, each subject had a uniform period of eligibility at which time medication coverage was in place and covariate assessment occurred. The date of the nursing home admission was considered as the index date for all analyses. For patients with more than one eligible event, only the first was included.

Statin Use

We assessed statin use by patients in our cohort within 60 days of nursing home admission. Patients were censored when the first prescription for statin medication was filled or at death, discharge from the nursing home or at the end of the study database. All statins were evaluated, including generic and brand names; other forms of lipid-lowering therapies (e.g., fibrates) were not studied.

Covariate Assessment and Predictors of Treatment

We determined patient co-morbidities by searching physician service and hospital claims submitted to Medicare for relevant diagnostic codes in the 1-year period prior to the index date. ICD-9 codes were reviewed in conjunction with medications filled to create specific covariates of interest. These included: hypertension, diabetes, stroke, peripheral vascular disease, chronic obstructive pulmonary disease, chronic renal insufficiency, dementia, falls, fracture, number of prior hospitalizations and number of unique medications. Additionally filled prescriptions were examined in the 60 days after the index date to determine concurrent usage of cardiac medication [angiotensin-converting enzyme inhibitors (ACEI)/angiotensin receptor blockers (ARB), beta blockers, nitrates, digoxin, warfarin and anti-platelet agents (clopidogrel and ticlopidine)]. Information about aspirin utilization was not available. Age, gender and race were identified from program enrollment information.

Statistical Analyses

Our primary outcome was the filling of a statin prescription within 60 days of nursing home admission following their hospitalization for symptomatic CAD. Sub-group analyses were also conducted by the type of symptomatic CAD (± revascularization). Separate analyses were also conducted for patients who remained in the nursing home for less than 90 days and 90 days or more. We compared statin users and nonusers using unpaired two-sided Student's t tests, Fisher's exact tests or chi-squared trend tests, as appropriate. We then categorized patients based on the year of their symptomatic coronary event and plotted the annual proportion of patients who received a statin. We tested whether the proportion of patients who received a statin changed over time using bivariate logistic regression models. We also evaluated rates of prescribing of other cardiovascular medications after nursing home admission. Multivariate logistic regression models were created to identify independent predictors of statin use. Covariates included age, gender, co-morbidities, prior and concurrent cardiac medication use, number of prior cardiac hospitalizations and number of unique medications used.

We conducted sensitivity analyses assessing statin use within 30, 90, 120 and 180 days after the index date. All

analyses were performed with SAS version 9.1 (SAS Institute Inc, Cary, NC).

RESULTS

Study Population

Our cohort consisted of 21,328 patients who were admitted to a nursing home after hospital admission for symptomatic CAD. The baseline characteristics of these patients are presented in Table 1. Patients had a mean age of over 76 years (range 35-107 years), and more than 75% were female. The vast majority had hypertension, and almost half had diabetes. Patients used an average of 15.7 unique medications and were hospitalized an average of 2.3 times in the year prior to cohort entry. The mean length of hospitalization was 15.3 days (±12.2 days), and 30% of patients received a statin prescription prior to their index hospitalization. Of the entire study population, 24.7% (n=5,268) remained in a nursing home for more than 90 days after hospital discharge, with a mean length of stay of 291 days (range 91–382 days). Those patients who were in the nursing home for 90 days or less (n=15,932) had a mean length of stay of 20 days (range 1–90 days).

At 12 months, 17.7% of all patients remained in a nursing home, whereas 33.0% had died. Almost half of the patients were living in the community 12 months after their index hospitalization.

During the index hospitalization, 68.0% of the study sample underwent revascularization. These patients had a higher prevalence of cardiovascular co-morbidities than patients admitted with an ACS who did not undergo revascularization. The mean length of hospitalization was greatest in patients admitted with CHF requiring revascularization (15.6 days).

Statin Utilization

The rate of statin utilization increased steadily over the 11-year period to an overall peak of 31.8% in 2005 (Fig. 1). Overall, only 16.4% of our study patients filled a statin prescription within 60 days of nursing home admission. Patients who remained in the nursing home for 90 days or less had a higher rate of statin use (16.8%) than patients with longer nursing home stays (14.3%) (p<0.001). Patients admitted with an ACS who underwent revascularization were more likely to receive a statin (19.8%) compared to patients who did not receive revascularization (18.4%), those with CHF requiring revascularization (13.4%) or those with CHF requiring revascularization (13.4%) (p<0.001). Statin users were less likely to have died within 1 year of nursing home admission than non-statin users (23.6% vs. 37.0%) (p<0.001).

Concurrent Cardiac Medication Utilization

Beta blockers and ACEI/ARBs were the most commonly prescribed cardiac medications in all three identified subgroups (Table 2). They were utilized almost twice as often as

Table 1. Baseline Characteristics of Patients Discharged to Nursing Homes After Cardiac Hospitalization Stratified by Post-discharge Statin Use

Patient characteristics	Overall study population (n=21,328)	Statin user (n=3,508)	Non-user (n=17,820)	P value
Demographics				
Female (%)	76.4	78.4	76.0	0.65
Mean age (years) (±SD)	80.3 (±9.9)	78.0(±9.4)	81.1 (±10.1)	<0.01
White race (%)	77.2	82.2	76.2	0.50
Co-morbidities (%)				
Congestive heart failure	82.6	76.4	83.8	0.67
Diabetes	49.8	58.4	48.1	<0.01
Stroke	35.1	35.9	35.0	0.62
Hyperlipidemia	0.2	0.2	0.2	0.30
Hypertension	95.3	98.7	94.6	<0.01
Peripheral vascular disease	9.9	11.2	9.7	0.01
Renal disease	26.1	22.3	26.9	0.28
Dementia	22.9	21.6	23.2	<0.01
Fall/fracture	14.6	20.0	13.5	0.19
Chronic obstructive pulmonary disease	45.6	43.5	46.0	0.09
Prior medication use (%)				
Statin	33.4	85.2	23.2	<0.01
Beta blockers	52.7	56.5	51.9	<0.01
Warfarin	16.8	15.2	17.1	0.20
Anti-platelets	38.6	40.3	38.3	0.02
Nitrates	23.9	22.2	24.2	0.04
Post-admission medications use (%)				
ACEI/ARB	45.8	63.2	42.4	<0.01
Beta blockers	43.6	55.2	41.3	<0.01
Anti-platelets	50.2	75.2	45.3	<0.01
Hospitalization characteristics				
Mean length of stay (days) (±SD)	15.4 (±15.8)	14.4 (±11.8)	15.7 (±16.1)	0.64
Prior hospital admission	25.4	36.2	23.3	<0.01
Mean unique generic medication (±SD)	15.7 (±8.8)	15.5 (±8.5)	15.8 (±8.9)	0.80

ACEI denotes angiotensin-converting enzyme inhibitor; ARB, angiotensin II receptor blocker

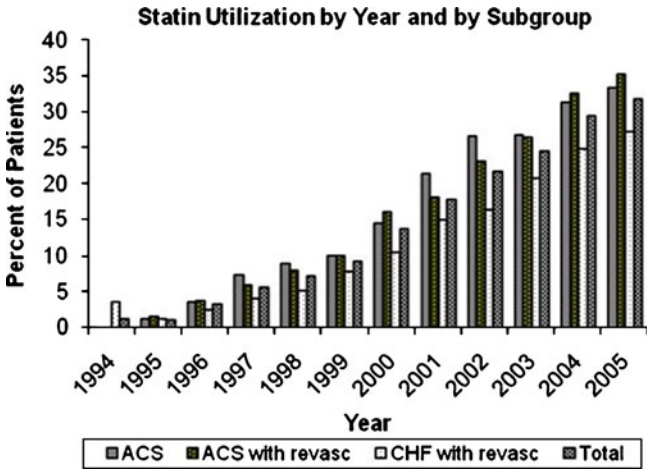

Figure 1. Statin utilization by year and by subgroup.

statins in all groups. The rate of anti-platelet therapy was comparable to statin utilization.

Predictors of Statin Use

Independent predictors of statin use are presented in Figure 2. The strongest predictors of use among the cohort were prior use of statin therapy [adjusted odds ratio (OR) 6.92, 95% Confidence Interval (CI) 5.86 to 8.82], concurrent utilization of ACEI/ARBs (OR 2.81, CI 2.40 to 3.29), beta-blockers (OR 3.20, CI 2.85 to 3.72) and anti-platelet agents (OR 2.98, CI 2.51 to 3.54), and prior cardiac hospitalization (OR 1.32, CI 1.13 to 1.57). The odds of statin use were lower if the patient had past, but not concurrent, use of anti-platelet agents (OR 0.71, CI 0.58 to 0.86) and ACEI/ARBs (OR 0.78, CI 0.67 to 0.92).

There was some variation among the three subgroups in regards to other patient characteristics. Among patients admitted for ACS with revascularization, greater statin use was also associated with peripheral vascular disease (OR 1.34, CI 1.04–1.72) and prior beta-blocker use (OR 1.34, CI 1.05–1.39). Older age was associated with lower statin use in patients hospitalized for ACS with or without revascularization. Prior digoxin use was associated with lower statin use for ACS and CHF patients who underwent revascularization. Prior stroke, diabetes, CHF, COPD and hypertension were not significant predictors of statin use in any of the three subgroups studied.

When the cohort was dichotomized by length of nursing home stay, similar predictors were identified (Table 3), although short-stay patients with a prior history of renal disease were less likely to be prescribed a statin (OR 0.62, CI 0.42–0.92). In sensitivity analyses assessing statin use within 30, 90, 120 and 180 days after the index date, the strongest predictors of statin use remained the following: prior statin use, concurrent utilization of ACEI/ ARB, beta-blockers and anti-platelet agents.

DISCUSSION

In our large cohort study we found that the majority of patients admitted to nursing homes after hospital discharge for symptomatic CAD did not receive a statin within 60 days of nursing home admission. While rates of prescribing have increased significantly over time, they remained surprisingly low throughout the period of observation in our study. This was true even among patients with nursing home stays of less than 90 days who are less likely to be severely disabled or have poor functional status after their acute cardiac event. In addition, patients at the highest risk of recurrent coronary events, such as those with congestive heart failure, were no more likely to receive statin treatment. It is important to note that 65.0% of our cohort was still alive 1 year after hospital discharge, highlighting the possible benefit of secondary preventative measures at reducing cardiovascular morbidity. Furthermore, 61.4% of the study population had an invasive procedure in order to treat symptomatic CAD; statins probably should be given even greater consideration under these circumstances[17].

Prior studies of statin utilization among community-dwelling elders have shown great variation. One study examining utilization over a 10-year period documented an increase from 11% to almost 61% within 90 days of hospital discharge[18]. Another recent study of 17,631 patients reported that 8% received a statin within 6 months of hospitalization for coronary heart disease[19]. Prior studies in nursing home patients have also demonstrated variation. In one study of 54 nursing home residents with CAD, 87% were using a statin[20]. In another, statins were only used by 16% of 77 nursing home residents with CAD[21]. A larger but older study of over 51,000 patients newly admitted to nursing homes examined utilization between 1992–1997 and found that only 2.6% of patients with cardiovascular disease used statin therapy[12]. Clinical recommendations have changed substantially since that time. Variation in these studies may be a function of sample size and differences in the cohort. Unlike other studies, our results provide contemporary estimates of statin utilization among high-risk patients after cardiac hospitalization.

The possible reasons for low utilization of statins in nursing homes are complex. Patients admitted to nursing homes after hospitalizations are more frail and have higher levels of disability than community-dwelling patients. Multiple comorbidities and concerns about polypharmacy, tolerability and adverse drug events may make physicians reluctant to start statins. Underutilization may reflect patient and family choice, although underutilization of secondary preventative measures is well documented in the elderly across many health domains[22–24]. Alternately, physicians may make a decision about the relative importance of cardiac medications

Table 2. Concurrent Utilization of Cardiovascular Medications

	ACEI/ ARB(%)	Beta-blocker (%)	Anti-platelet (%)	Statin (%)
Overall	36.7	33.9	15.1	17.1
ACS without revascularization	38.0	38.1	16.9	18.4
ACS with revascularization	36.8	37.8	17.0	19.8
CHF with revascularization	35.4	27.1	11.9	13.7

ACS denotes acute coronary syndrome; CHF, congestive heart failure; ACEI, angiotensin-converting enzyme inhibitor; ARB, angiotensin receptor blocker

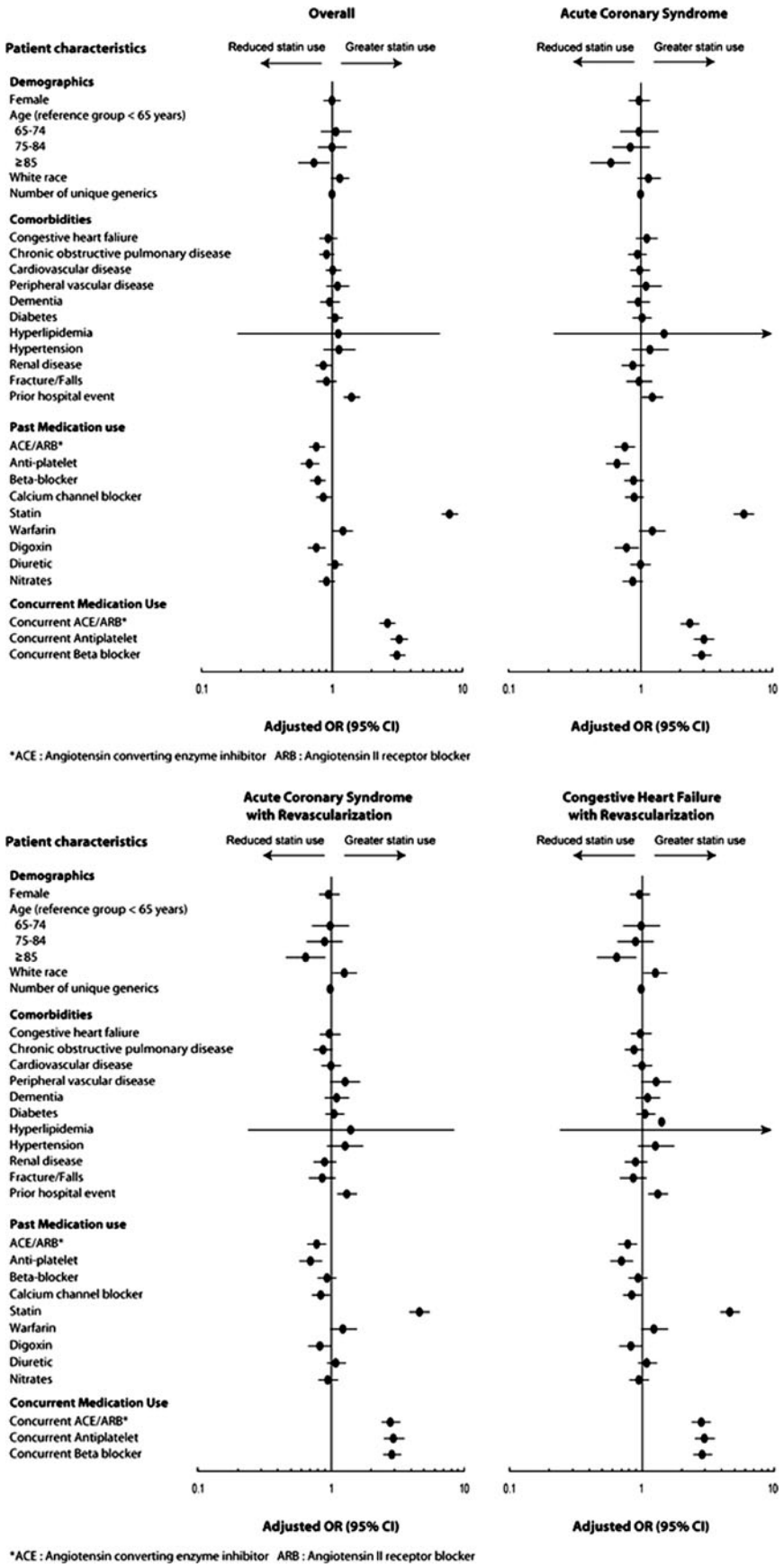

Figure 2. Adjusted odds ratio (OR) of receiving a statin among subgroups and overall cohort.

Table 3. Multivariate Analysis of Statin Use, Stratified by Duration of Nursing Home Admission

Characteristic	Duration of nursing home stay<90 days (n=15,932). Adjusted OR (95% confidence interval)	P value	Duration of nursing home stay≥90 days (n=5,268). Adjusted OR (95% confidence interval)	P value
Demographics				
Female	1.22 (0.84, 1.77)	0.65	0.96 (0.82, 1.13)	0.23
Age (reference: <65 years)				
65–74	1.62 (0.90, 2.91)	0.55	1.10 (0.80, 1.50)	0.12
75–84	1.02 (0.58, 1.79)	0.51	1.12 (0.82, 1.49)	0.95
≥85	0.75 (0.41, 1.39)	0.14	0.78 (0.56, 1.08)	0.36
White race	1.75 (0.97, 2.54)	0.40	1.08 (0.90, 1.29)	0.30
Co-morbidities				
Congestive heart failure	0.74 (0.50, 1.08)	0.57	0.96 (0.80, 1.13)	0.12
Diabetes	1.06 (0.76, 1.47)	0.52	1.05 (0.91, 1.21)	0.74
Stroke	1.24 (0.90, 1.70)	0.75	0.98 (0.84, 1.13)	0.20
Hyperlipidemia	1.25 (0.24, 5.60)	0.87	1.16 (0.16, 6.83)	0.99
Hypertension	0.73 (0.42, 1.24)	0.15	1.23 (0.91, 1.18)	0.24
Peripheral vascular disease	1.39 (0.84, 2.30)	0.71	1.04 (0.84, 1.31)	0.20
Renal disease	0.62 (0.41, 0.92)	0.03	0.94 (0.80, 1.11)	0.20
Dementia	0.84 (0.61, 1.16)	0.78	0.97 (0.79, 1.12)	0.28
Fall/fracture	0.92 (0.62, 1.37)	0.30	0.90 (0.74, 1.10)	0.69
Chronic obstructive pulmonary disease	0.86 (0.62, 1.19)	0.33	0.93 (0.81, 1.07)	0.37
Prior medication use				
Statin	42.41 (29.67, 60.64)	<0.01	5.47 (4.71, 6.36)	<0.01
Beta blockers	0.72 (0.49, 1.05)	<0.01	0.80 (0.69, 0.92)	<0.01
Warfarin	1.80 (0.72, 2.78)	0.33	1.10 (0.91, 1.33)	0.13
Anti-platelets	0.40 (0.25, 0.62)	<0.01	0.74 (0.62, 0.88)	<0.01
Nitrates	1.16 (0.82, 1.66)	0.23	0.86 (0.74, 1.00)	0.40
Calcium channel blocker	1.03 (0.74, 1.43)	0.45	0.86 (0.75, 1.02)	0.86
Digoxin	0.56 (0.38, 0.83)	<0.01	0.80 (0.67, 0.94)	<0.01
Diuretic	1.23 (0.92, 1.42)	0.08	1.12 (0.92, 1.62)	0.07
Number unique generic medication (±SD)	0.99 (0.97, 1.01)	0.82	0.99 (0.98, 1.01)	0.85
Post-admission medication use				
ACEI/ARB	1.60 (1.16, 2.22)	<0.01	2.65 (2.31, 3.05)	<0.01
Beta blockers	2.88 (2.00, 4.16)	<0.01	3.19 (2.77, 3.68)	<0.01
Anti-platelets	2.64 (1.80, 3.88)	<0.01	3.42 (2.89, 4.03)	<0.01
Prior hospital admission	1.94 (1.20, 3.14)	<0.01	1.48 (1.28, 1.72)	<0.01

ACEI denotes angiotensin-converting enzyme inhibitor; ARB, angiotensin receptor blocker

considering that many older patients take multiple medications. In order to maximize long-term adherence, they may opt to concentrate on beta-blockers and angiotensin-modifying agents, accounting for the higher concurrent rate of these medications during the study period. This may also, in part, explain a decline of statin use from the pre-hospitalization period to the post-hospitalization period.

While no practice guidelines about the use of cardiac preventative therapies exist for nursing home patients, current guidelines for ACS are generally advocated for these patients[25] as statins have been shown to be effective and well tolerated in the elderly[26,27]. Statins may be particularly important in this vulnerable subgroup given the high prevalence of concurrent co-morbidities such as diabetes. Additionally, the nursing home in both the long-term care and post-acute care setting presents a unique opportunity to maximize secondary prevention strategies in a monitored environment, allowing for issues of tolerability to be directly observed and dosages to be titrated. Accordingly, with the escalating cost of medical care, an aging population and generic statin availability, prevention should remain at the forefront of standard medical care for nursing home patients and should be strongly considered.

There are several limitations to our study. First, we evaluated statin use among patients in one US state who received drug benefits through a statewide pharmacy assistance program or Medicaid; this may limit the generalizability of our findings. However, our results are consistent with those of studies conducted in other jurisdictions[12,21,28]. Second, we did not have detailed clinical information, such as lipid levels or functional status, which may have influenced statin prescribing decisions. However, we studied a high-risk group of patients, all of whom had been recently hospitalized for ACS or revascularization, and most of whom should receive statin therapy regardless of cholesterol level[11]. Third, we only examined patient characteristics as predictors of statin use and thus are unable to comment on the impact of physician and nursing home characteristics. Fourth, we were unable to determine if patients experienced prior statin side effects. However, the rate of side effects from this class of medications is fairly low and is highly unlikely to explain the low utilization patterns we observed. In fact, patients who had used statins previously were more likely to be prescribed statins after hospitalization. Fifth, our study relied on administrative data that was analyzed retrospectively; thus, the possibility of unmeasured confounding cannot be eliminated. Finally, we were unable to determine whether patients were prescribed a statin at the time of hospital discharge.

Despite these limitations, our study highlights the ongoing underutilization of statins in this high-risk elderly population. More appropriate prescribing may prevent further disease, morbidity and mortality. Further research is needed to understand statin prescribing in elderly patients in nursing homes so that effective interventions can be designed and implemented.

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