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Baseline Characteristics, Quality of Care, and Outcomes of Younger and Older Medicare Beneficiaries Hospitalized with Heart Failure: Findings from the Alabama Heart Failure Project

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Abstract

Background—Most studies of heart failure (HF) in Medicare beneficiaries have excluded patients age <65 years. We examined baseline characteristics, quality of care, and outcomes among younger and older Medicare beneficiaries hospitalized with HF in the Alabama Heart Failure Project.

Methods—Of the 8049 Medicare beneficiaries discharged alive with a primary discharge diagnosis of HF in 1998–2001 from 106 Alabama hospitals, 991 (12%) were younger (age <65 years). After excluding 171 patients discharge to hospice care, 7867 patients were considered eligible for left ventricular systolic function (LVSF) evaluation and 2211 patients with left ventricular ejection fraction <45% and without contraindications were eligible for angiotensin-converting enzyme (ACE) inhibitor or angiotensin receptor blocker (ARB) therapy.

Results—Nearly half of the younger HF patients (45% versus 22% for ≥65 years; $p<0.001$) were African American. LVSF was evaluated in 72%, 72%, 70% and 60% (overall $p<0.001$) and discharge prescriptions of ACE inhibitors or ARBs were given to 83%, 77%, 75% and 75% of eligible patients (overall $p=0.013$) among those <65, 65–74, 75–84 and ≥85 years, respectively. During 9 years of follow-up, all-cause mortality occurred in 54%, 61%, 71% and 80% (overall $p<0.001$) and hospital readmission due to worsening HF occurred in 65%, 60%, 55% and 48% (overall $p<0.001$) of those <65, 65–74, 75–84 and ≥85 years, respectively.

Conclusion—Medicare beneficiaries <65 years with HF, nearly half of whom were African American, generally received better quality of care, had lower mortality, but had higher re-hospitalizations due to HF.

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Keywords

heart failure; age; Medicare; quality of care; outcomes

Introduction

Heart failure (HF) is the leading cause of hospitalization among Medicare beneficiaries 65 years and older in the United States [1]. Medicare is a national health insurance program for people 65 years in the United States and individuals <65 years of age with certain disabilities including HF may qualify for Medicare benefits. However, because younger Medicare beneficiaries with HF have often been excluded from studies of HF in Medicare beneficiaries, little is known about these patients [2–9]. Therefore, in the current study, we examined baseline characteristics, quality of care, and natural history for younger and older Medicare beneficiaries in the Alabama Heart Failure Project (AHFP) registry.

Methods

Data Source

The AHFP was conducted by the Alabama Quality Assurance Foundation (AQAF), the Quality Improvement Organization for the state of Alabama, to assess and improve the quality of care of Medicare beneficiaries hospitalized with HF. It began as a part of the National Heart Failure Project implemented by the Centers for Medicare and Medicaid Services (CMS) [2] and was later complemented with additional state-level projects.

Medical records of fee-for-service Medicare beneficiaries discharged with a principle discharge diagnosis of HF from 106 Alabama hospitals between July 1, 1998 and October 31, 2001 were identified and abstracted in six different six-month periods (Box 1). The International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) codes 428, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91 and 404.93 were used to identify charts with a principle discharge diagnosis of HF. During each period, a systematic random sample of charts was drawn after stratifying by patients' age, sex, race and hospital. Patients who were transferred to another acute care hospital, had procedure codes indicating dialysis (ICD-9-CM codes: 39.95 or 54.98) or were discharged against medical advice were excluded.

Box 1

Alabama Heart Failure Project datasets by number of charts and discharge dates

Datasets	Discharge Dates	Number of Charts Abstracted
Cohort 1	July 1, 1998–December 31, 1998	874
Cohort 2	May 1, 1999–October 31, 1999	988
Cohort 3	November 1, 1999–April 30, 2000	1924
Cohort 4	May 1, 2000–October 31, 2000	1988
Cohort 5	November 1, 2000–April 30, 2001	1921
Cohort 6	May 1, 2001–October 31, 2001	1954
All	July 1998–October 2001	9649

The selected medical records were then transferred from participating hospitals to the Central Clinical Data Abstraction Centers (CDAC), located in York, Pennsylvania for data abstraction. Trained CDAC technicians abstracted data from the 9649 charts directly into a computer database using a data collection tool programmed by MedQuest Software. CDAC ensured reliability of the abstraction process through internal and external re-abstractions of 40 charts monthly. Reliability findings demonstrated agreement values >80% and Kappa values >0.60.

Using a set of unique identifiers including dates of birth, social security numbers, and Medicare claim numbers, AQA identified a cohort of 8555 unique patients from the database of 9649 hospitalizations. The final database of 8555 patients was deidentified by the Iowa Foundation for Medical Care, the Quality Improvement Organization for the state of Iowa, designated by the CMS for data deidentification. The project was approved by the Institutional Review Board of the University of Alabama at Birmingham.

Baseline Data Collection

Data on baseline characteristics and hospital course were collected by chart abstraction and included demographics, past medical history including use of medications, hospital course, discharge disposition and medications, and physician specialty. Data were also collected on the receipt of cardiology care, via consultation or as primary care.

Quality Indicators

Trained CDAC technicians abstracted the selected medical records for data on the four core evidence-based quality indicators for HF including evaluation of left ventricular systolic function (LVSF), discharge prescription of an angiotensin-converting enzyme (ACE) inhibitor or an angiotensin receptor blocker (ARB) for HF patients with reduced left ventricular ejection function (LVEF), receipt of a complete discharge instruction, and counseling for smoking cessation.

Data on LVSF evaluation was evaluated by both review of echocardiography, radionuclide ventriculography, or contrast ventriculography performed during index or prior hospitalizations. Because AHFP was a quality improvement project, data on future plans for LVSF evaluation were also collected. Data on LVEF were collected as a continuous variable. However, when data on LVEF were not available, descriptive data on LVSF were used, and normal, mildly impaired, moderately impaired, and severely impaired LVSF were categorized into LVEF 55%, 45%, 35%, and 25% respectively. Left ventricular systolic dysfunction (LVSD) was defined as LVEF <45%. LVSD of unknown severity was considered to have LVEF 35%.

In addition to the discharge prescription of ACE inhibitors and ARBs, data on discharge prescription of beta-blockers and other medications were also collected by chart abstraction. Discharge instructions included instructions on medication, weight monitoring, diet, activity, follow-up and warning symptoms. Data on counseling for smoking cessation were either documented as “given” or “missing”.

Outcomes Data

Data on mortality and hospitalization between July 1, 1998 and April 2, 2007 were obtained from CMS Medicare utilization files, which are based on fee-for-service claims data and do not include Medicare managed care claims. Because the earliest discharge date in the first AHFP project was July 1, 1998, data on outcomes were collected from that date. At the time of the linking to outcomes data, the latest data were available through April 2, 2007. Data on mortality and time of death were obtained from the CMS Denominator File, which contains

data on dates of birth and death for each Medicare beneficiary enrolled in Medicare during a calendar year. Data on hospitalization and time to hospitalization from July 1, 1998 through April 2, 2007, were obtained from the CMS Medicare Provider Analysis and Review (MedPAR) file, which contains inpatient hospital final action stay records. Each inpatient hospital MedPAR record represents a stay in that hospital and summarizes all services rendered to a beneficiary from the time of admission to a facility through discharge. Additional data on diagnosis, (ICD-9 diagnosis), procedure (ICD-9 procedure code), Diagnosis Related Group (DRG), dates of service, and reimbursement amount were obtained from the Inpatient Standard Analytical Files. Patients who were admitted to out-of-state hospitals or those who did not have Medicare pay for their hospitalizations were not included.

Statistical Analysis

For the current study, we restricted our analysis to 8049 patients who were discharged alive from the hospital. Patients were stratified into four groups based on their age: <65 years, 65–74 years, 75–84 years, and ≥85 years. Patient discharged to hospice care (n=171) were excluded from the denominator of the analysis of LVSF evaluation. The remaining 7867 patients were considered eligible for LVSF evaluation (past, present or future). Of these, 2211 with LVSD and without contraindication (Box 2) were eligible for discharge prescription of ACE inhibitors or ARBs. Overall, 83% (n=6676) were eligible for written discharge instructions and 11% (n=910) were eligible for smoking cessation counseling (Box 2). We also compared the rates of appropriate beta-blocker use by identifying a subset of 2675 eligible patients who were not discharged to hospice care and had an LVEF <45%, a heart rate ≥60 beats per minute, and a systolic blood pressure ≥100 mmHg.

Box 2

Quality Indicator Eligibility Criteria

Left ventricular systolic function evaluation

- Alive at discharge
- **Exclude:** discharged with hospice care

Discharge prescription of ACE inhibitors or ARBs

- Alive at discharge
- Left ventricular ejection fraction <45%
- Serum creatinine level <2.5 mg/dL
- Systolic blood pressure ≥100 mm Hg
- Serum potassium <5.5 mEq/L
- **Exclude:** discharged with hospice care, moderate or severe aortic stenosis, bilateral renal artery stenosis, and physician documentation of reasons for non-use of ACE inhibitors, including enrollment in an ACE inhibitor trial

Written discharge instructions

- Discharged to home
- **Exclude:** discharged with hospice care

Counseling for smoking cessation

- Smoker within the past month
- **Exclude:** discharged with hospice care

We used the Pearson's chi-square test and one-way ANOVA to compare baseline characteristics, index hospitalization events, all-cause mortality, all-cause hospitalization, HF hospitalization, and the combined end points of HF hospitalization or all-cause mortality and all-cause hospitalization and all-cause mortality for all patients discharged alive (n=8049) by four age groups: <65, 65–74, 75–84 and ≥85 years. Similar approach was used for quality of care analyses. However, those ineligible for specific quality indicators were excluded from their specific analyses. Kaplan-Meier survival analyses were used to determine the association of the age groups with all-cause mortality during about 9 years of follow-up. A p-value ≤0.05 was considered significant for all analyses. SPSS (Rel. 18, 2009. Chicago: SPSS Inc.) for Windows was used for statistical analysis.

Results

Baseline Characteristics

Patients (n=8049) had a mean age (±SD) of 76 (±11) years, 58% were women and 25% were African American. A higher proportion of younger HF patients were African American (45% versus 22% for ≥65 years; $P<0.001$), smokers (30% versus 9%; $p<0.001$) and had diabetes mellitus (58% versus 41%; $p<0.001$). However, a lower proportion of younger HF patients had chronic kidney disease (50% versus 66%; $p<0.001$). Baseline patient and care characteristics of patients by the four age categories are displayed in Table 1 and Table 2 respectively. Among HF patients <65, 65–74, 75–84, and ≥85 years of age who had data on LVEF, mean LVEF was 37%, 39%, 41%, and 44%, respectively.

Quality of Care

Overall, LVSF was evaluated in 69% of the patients, and 77% of the eligible patients with LVSD received a discharge prescription for ACE inhibitors or ARBs. Complete discharge instructions and smoking cessation counseling were provided to 1%, and 29% of patients respectively. A higher proportion of younger Medicare beneficiaries with HF received LVSF evaluation (72% versus 68%; $p=0.015$). However, except for those ≥85 years, older adults in general had similar rates of LVSF evaluation (Table 3). The rate of discharge prescription of ACE inhibitors or ARBs were also higher among younger eligible HF patients with LVSD (83% versus 76% for those ≥65 years; $p=0.007$). These rates were similar for the three older age categories (Table 3). Similarly, the rate proportion of eligible HF patients with LVSD who received a discharge prescription of beta-blocker was also higher among younger patients (40% versus 33%; $p=0.007$). There were no differences with respect to complete discharge instructions and smoking cessation counseling between age groups (Table 3). The distribution of the receipt of individual components of discharge instruction is displayed in Figure 1.

Outcomes

During 9 years of follow-up, all-cause mortality occurred in 54%, 61%, 71% and 80% of patients <65, 65–74, 75–84 and ≥85 years of age respectively (overall and trend $p<0.001$) (Figure 2 and Table 4). Proportions of events due to all-cause hospitalization, HF hospitalization, the combined end point of HF hospitalization or all-cause mortality, and the combined end point of all-cause hospitalization and all-cause mortality by age are displayed in Table 4.

Discussion

Findings of the current study demonstrate that nearly half of the younger Medicare beneficiaries with HF were African American, a proportion which was nearly twice as high as that among older Medicare beneficiaries with HF. Younger HF patients also had a

relatively higher burden of comorbidities and received care more often in large, urban hospitals. Although, the rate for LVSF evaluation was similar up to age 85, the rate of ACE inhibitor or ARB use declined after age 65 years. Younger Medicare beneficiaries with HF had lower all-cause mortality but higher hospitalization due to worsening HF. To the best of our knowledge, this is the most comprehensive report comparing baseline characteristics, quality of care and natural history of younger and older Medicare beneficiaries with HF.

The significantly higher proportion of African American among younger HF patients in our study may in part be explained by the early onset of HF among African American. HF among younger adults in the community is essentially HF among African American [10]. Findings from clinical trials of HF also suggest that compared to older HF patients, a significantly higher proportion of younger HF patients are African American [11–13]. An interesting observation of our study is that despite having a higher mean glomerular filtration rate, younger Medicare beneficiaries with HF also had a higher mean serum creatinine level. This is in contrast to the findings from HF patients in clinical trials [13]. This may in part be due to the higher proportion of African American and men among younger HF patients. Although renal failure is one of the criteria for Medicare eligibility for persons <65 years, those with renal failure were excluded from the AHFP registry.

The overall modest rates of LVSF evaluation and discharge use of ACE inhibitors or ARBs observed in our study are similar to previously reported rates based on contemporary HF registries [3, 4, 14]. The modest rate of ACE inhibitor or ARB use may in part be due to overestimation of the number of patients eligible for the receipt of these drugs based on chart abstracted data. For example, a patient with normal systolic blood pressure not receiving ACE inhibitors or ARBs would be considered eligible, yet his/her physician may have discontinued those drugs to correct hypotension, which is known to be associated with poor outcomes in HF [15–17]. Because many of the current HF quality indicators may not be associated with improved outcomes, it has been suggested that future quality measures should be restricted to accountability measures or those associated with improved outcomes [18, 19]. The higher HF hospitalization in older HF patients may in part be explained by their lower mortality. Further, older HF patients often attribute their HF symptoms to aging and avoid seeking care.

Our study has several limitations. We had no data on qualifying disability for younger Medicare beneficiaries. If younger adults with HF were eligible for Medicare benefits based on the advanced nature of their HF, they would likely not be representative of younger HF patients in the community. Future studies need to compare younger Medicare beneficiaries with HF with younger HF patients who are not Medicare beneficiaries. We also had no data on patient and physician preferences, and insurance status, which may explain part of the age-related variation in quality of care. Although we only had data on fee-for-service Medicare beneficiaries, during the AHFP study period, between 80% and 87% of all Medicare beneficiaries were enrolled in a fee-for-service plan.

In conclusion, younger Medicare beneficiaries with HF are characterized by a disproportionate higher proportion of African American, who generally receive better quality of care and had a lower total mortality but had higher re-hospitalization due to HF.

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Figure 1.
Receipt of individual written discharge instructions by age

Figure 2.
Kaplan-Meier plots comparing all-cause mortality by age

Table 1

Baseline patient characteristics by age

n (%) or mean (±SD)	<65 years (n=991)	65-74 years (n=2382)	75-84 years (n=2978)	85 years (n=1698)	P value
Age, years	56 (±7)	70 (±3)	79 (±3)	89 (±4)	<0.001
Female	416 (42%)	1217 (51%)	1765 (59%)	1229 (72%)	<0.001
African American	446 (45%)	630 (26%)	580 (20%)	338 (20%)	<0.001
Smoking history	293 (30%)	366 (15%)	222 (8%)	41 (2%)	<0.001
Admitted from nursing home	13 (1%)	73 (3%)	205 (7%)	254 (15%)	<0.001
Prior hospitalization (during 1 year)					
Due to any cause	544 (55%)	1187 (50%)	1498 (50%)	837 (49%)	0.028
Due to heart failure	212 (21%)	473 (20%)	538 (18%)	281 (17%)	0.005
Medical history					
Heart failure	722 (73%)	1672 (70%)	2149 (72%)	1269 (75%)	0.015
Coronary artery disease	523 (53%)	1414 (59%)	1702 (57%)	769 (45%)	<0.001
Myocardial infarction	258 (26%)	620 (26%)	698 (23%)	319 (19%)	<0.001
Angina pectoris	124 (13%)	377 (16%)	437 (15%)	239 (14%)	0.082
Percutaneous coronary intervention	179 (18%)	393 (17%)	405 (14%)	110 (7%)	<0.001
Coronary artery bypass graft surgery	249 (25%)	716 (30%)	760 (26%)	216 (13%)	<0.001
Atrial fibrillation	138 (14%)	545 (23%)	871 (29%)	572 (34%)	<0.001
Left bundle branch block	93 (9%)	319 (13%)	449 (15%)	218 (13%)	<0.001
Hypertension	737 (74%)	1703 (72%)	2103 (71%)	1075 (63%)	<0.001
Diabetes mellitus	574 (58%)	1237 (52%)	1218 (41%)	470 (28%)	<0.001
Chronic kidney disease	498 (50%)	1440 (61%)	2007 (67%)	1180 (70%)	<0.001
Stroke	186 (19%)	441 (19%)	673 (23%)	356 (21%)	0.001
Chronic obstructive pulmonary disease	415 (42%)	920 (39%)	1073 (36%)	447 (26%)	<0.001
Dementia	5 (1%)	89 (4%)	348 (12%)	310 (18%)	<0.001
Cancer	9 (1%)	68 (3%)	64 (2%)	27 (2%)	0.001
Clinical findings					
Pulse, beats per minute (n=8031)	93 (±22)	90 (±22)	89 (±23)	88 (±22)	<0.001
Systolic blood pressure, mm Hg	147 (±35)	150 (±33)	149 (±32)	150 (±31)	0.127
Diastolic blood pressure, mm Hg (n=8028)	84 (±21)	80 (±19)	79 (±19)	78 (±19)	<0.001
Respiration, per minute (n=8003)	23 (±6)	24 (±6)	24 (±6)	24 (±7)	0.006

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n (%) or mean ($\pm$ SD)	<65 years (n=991)	65–74 years (n=2382)	75–84 years (n=2978)	85 years (n=1698)	P value
Temperature (n=8003)	97.8 ($\pm$ 1.4)	97.7 ($\pm$ 1.3)	97.6 ($\pm$ 1.2)	97.6 ($\pm$ 1.2)	<0.001
Peripheral edema	734 (74%)	1691 (71%)	2049 (69%)	1155 (68%)	0.003
Admission medications					
Angiotensin-converting enzyme inhibitors	451 (46%)	1007 (42%)	1065 (36%)	605 (36%)	<0.001
Angiotensin receptor blockers	98 (10%)	253 (11%)	318 (11%)	144 (9%)	0.080
Beta blockers, any	303 (31%)	773 (33%)	829 (28%)	392 (23%)	<0.001
Beta blockers, evidence based for heart failure	208 (21%)	467 (20%)	464 (16%)	209 (12%)	<0.001
Diuretics, any	703 (71%)	1654 (69%)	2119 (71%)	1243 (73%)	0.076
Loop diuretics	666 (67%)	1533 (64%)	1946 (65%)	1146 (68%)	0.140
Potassium-sparing diuretics	113 (11%)	191 (8%)	193 (7%)	81 (5%)	<0.001
Potassium supplements	396 (40%)	861 (36%)	1160 (39%)	649 (38%)	0.101
Digoxin	323 (33%)	833 (35%)	1054 (35%)	686 (40%)	<0.001
Nitroglycerine, sublingual	124 (13%)	330 (14%)	438 (15%)	242 (14%)	0.373
Nitrites, long-acting	151 (15%)	365 (15%)	499 (17%)	306 (18%)	0.089
Hydralazine	58 (6%)	151 (6%)	159 (5%)	59 (4%)	0.001
Nitrites and hydralazine	12 (21%)	59 (39%)	69 (43%)	20 (34%)	0.020
Antiarrhythmic drugs	89 (9%)	288 (12%)	367 (12%)	147 (9%)	<0.001
Anticoagulant drugs	213 (22%)	528 (22%)	723 (24%)	320 (19%)	<0.001
Statins	205 (21%)	466 (20%)	438 (15%)	100 (6%)	<0.001
Nonsteroidal anti-inflammatory drugs	137 (14%)	374 (16%)	525 (18%)	309 (18%)	0.007
Tests and procedures					
Serum sodium, mEq/L (n=7871)	138 ($\pm$ 4)	138 ($\pm$ 5)	139 ($\pm$ 5)	138 ($\pm$ 6)	0.186
Serum potassium, mEq/L (n=7880)	4.21 ($\pm$ 0.78)	4.24 ($\pm$ 0.67)	4.27 ($\pm$ 0.65)	4.32 ($\pm$ 0.66)	<0.001
Serum creatinine, mEq/L (n=7927)	2.02 ($\pm$ 2.33)	1.64 ($\pm$ 1.36)	1.54 ($\pm$ 1.00)	1.43 ($\pm$ 0.75)	<0.001
Estimated glomerular filtration rate, ml/min/1.73 m ² (n=7927)	61 ($\pm$ 33)	56 ($\pm$ 26)	52 ($\pm$ 27)	51 ($\pm$ 23)	<0.001
Serum cholesterol, mg/dL (n=1201)	179 ($\pm$ 57)	172 ($\pm$ 49)	169 ($\pm$ 48)	168 ($\pm$ 47)	0.095
Serum albumin, gm/dL (n=4969)	3.39 ($\pm$ 0.56)	3.43 ($\pm$ 0.51)	3.44 ($\pm$ 0.51)	3.36 ($\pm$ 0.52)	<0.001
Blood urea nitrogen, mg/dL (n=7887)	28 ($\pm$ 21)	27 ($\pm$ 17)	29 ($\pm$ 18)	29 ($\pm$ 16)	0.008
Serum glucose, mg/dL (n=7850)	164 ($\pm$ 95)	157 ($\pm$ 75)	149 ($\pm$ 69)	139 ($\pm$ 60)	<0.001
Hematocrit, % (n=7684)	38 ($\pm$ 7)	37 ($\pm$ 6)	36 ($\pm$ 6)	36 ($\pm$ 6)	<0.001
White blood cell, 10 ⁹ cells per liter (n=7633)	9 ($\pm$ 4)	9 ($\pm$ 5)	9 ($\pm$ 5)	9 ($\pm$ 5)	0.857

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n (%) or mean (±SD)	<65 years (n=991)	65–74 years (n=2382)	75–84 years (n=2978)	85 years (n=1698)	P value
Pulmonary edema by chest x-ray	652 (66%)	1577 (66%)	2044 (69%)	1191 (70%)	0.020

Table 2

Hospital and care characteristics by age

n (%) or mean (±SD)	<65 years (n=991)	65–74 years (n=2382)	75–84 years (n=2978)	85 years (n=1698)	P value
Rural hospital	285 (29%)	704 (30%)	917 (31%)	606 (36%)	<0.001
Hospital size					
<100 beds	178 (18%)	467 (20%)	603 (20%)	436 (26%)	<0.001
100–299 beds	280 (28%)	789 (33%)	1049 (35%)	588 (35%)	
300–499 beds	318 (32%)	699 (29%)	841 (28%)	419 (25%)	
500 beds	215 (22%)	427 (18%)	485 (16%)	255 (15%)	
Hospital ownership					
Nonprofit	318 (32%)	719 (30%)	997 (34%)	585 (35%)	<0.001
Proprietary	232 (23%)	642 (27%)	825 (28%)	470 (28%)	
Other	441 (45%)	1021 (43%)	1156 (39%)	643 (38%)	
Care by a cardiologist	540 (55%)	1359 (57%)	1582 (53%)	690 (41%)	<0.001
Care in the intensive care unit	48 (5%)	93 (4%)	118 (4%)	53 (3%)	0.161
Events on admission					
Pneumonia	162 (16%)	447 (19%)	654 (22%)	407 (24%)	<0.001
Stroke	0 (0%)	4 (0%)	9 (0%)	10 (1%)	0.023
Acute myocardial infarction	36 (4%)	78 (3%)	104 (4%)	54 (3%)	0.897
Pressure ulcers	40 (4%)	101 (4%)	174 (6%)	148 (9%)	<0.001
Deep vein thrombosis	6 (1%)	6 (0%)	12 (0%)	15 (1%)	0.029
In-hospital events					
Pneumonia	43 (4%)	94 (4%)	139 (5%)	102 (6%)	0.020
Stroke	4 (0%)	5 (0%)	9 (0%)	5 (0%)	0.802
Acute myocardial infarction	5 (1%)	14 (1%)	29 (1%)	18 (1%)	0.182
Pressure ulcers	14 (1%)	42 (2%)	92 (3%)	68 (4%)	<0.001
Deep vein thrombosis	1 (0%)	6 (0%)	4 (0%)	1 (0%)	0.421

Table 3

Quality of care by age

Quality indicators (eligible patients)	<65 years	65-74 years	75-84 years	85 years	Overall P value	P value for trend
LVSF evaluation* (n=7867)	706 (72%)	1683 (72%)	2035 (70%)	983 (60%)	<0.001	<0.001
ACE inhibitors or ARBs at discharge (n=2211)	270 (83%)	572 (77%)	602 (75%)	253 (75%)	0.043	0.013
Written discharge instructions (n=6586)**						
All	10 (1%)	24 (1%)	18 (1%)	10 (1%)	0.500	0.241
Any	843 (92%)	1975 (93%)	2228 (93%)	1048 (92%)	0.212	0.677
Smoking cessation counseling (n=910)***	94 (32%)	105 (29%)	53 (24%)	8 (21%)	0.143	0.021

* Includes past, present or planned for the future

** Based on all patients discharged alive

Based on current smokers discharged alive and not discharged to hospice care

ACE =angiotensin-converting enzyme; ARBs=angiotensin receptor blockers; LVSF=left ventricular systolic function

Table 4

Outcomes by age

Outcomes	<65 years (n=991)	65–74 years (n=2382)	75–84 years (n=2978)	85 years (n=1698)	Overall P value	P value for trend
All-cause mortality	539 (54%)	1454 (61%)	2109 (71%)	1353 (80%)	<0.001	<0.001
All-cause hospitalization	882 (89%)	2104 (88%)	2554 (86%)	1365 (80%)	<0.001	<0.001
Heart failure hospitalization	641 (65%)	1425 (60%)	1643 (55%)	805 (48%)	<0.001	<0.001
All-cause mortality or all-cause hospitalization	953 (96%)	2289 (96%)	2889 (97%)	1653 (97%)	0.076	0.020
All-cause mortality or heart failure hospitalization	847 (86%)	2049 (86%)	2646 (89%)	1554 (92%)	<0.001	<0.001