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In-Hospital Cardiology Consultation and Evidence-Based Care for Nursing Home Residents with Heart Failure

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Abstract

Objectives—To determine the association between cardiology consultation and evidence-based care for nursing home (NH) residents with heart failure (HF).

Participants—Hospitalized NH residents (n= 646) discharged from 106 Alabama hospitals with a primary discharge diagnosis of HF during 1998–2001.

Design—Observational.

Measurements of Evidence-Based Care—Pre-admission estimation of left ventricular ejection fraction (LVEF) for patients with known HF (n=494), in-hospital LVEF estimation for HF patients without known LVEF (n=452), and discharge prescriptions of angiotensin-converting enzyme inhibitors or angiotensin receptor blockers (ACEIs-or-ARBs) to systolic HF (LVEF <45%) patients discharged alive who were eligible to receive those drugs (n=83). Eligibility for ACEIs-or-ARBs was defined as lack of prior allergy or adverse effect, serum creatinine <2.5 mg/dL, serum potassium <5.5 mEq/L, and systolic blood pressure >100 mm Hg.

Results—Pre-admission LVEF was estimated in 38% and 12% of patients receiving and not receiving cardiology consultation, respectively (adjusted odds ratio {AOR}, 3.49; 95% CI, 2.16–5.66; p <0.001). In-hospital LVEF was estimated in 71% and 28% of patients receiving and not receiving cardiology consultation, respectively (AOR, 6.01; 95% CI, 3.69–9.79; p <0.001). ACEIs-or-ARBs were prescribed to 62% and 82% of patients receiving and not receiving cardiology consultation, respectively (AOR, 0.24; 95% CI, 0.07–0.81; p=0.022).

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Conclusion—In-hospital cardiology consultation was associated with significantly higher odds of LVEF estimation among NH residents with HF. However, it did not translate into higher odds of discharge prescriptions for ACEIs-or-ARBs to NH resident with systolic HF who were eligible for the receipt of these drugs.

Keywords

heart failure; nursing home residents; cardiology consultation; evidence-based care

Left ventricular ejection fraction (LVEF) is estimated in heart failure (HF) patients to identify those with systolic HF or reduced LVEF for evidence-based therapy with neurohormonal antagonists such as angiotensin-converting enzyme inhibitors or angiotensin receptor blockers (ACEIs-or-ARBs), unless contraindicated.[1,2] In addition to reducing mortality and hospitalizations, these drugs improve symptoms.[3] Measurement of LVEF and prescription of these drugs constitute the basis of evidence-based HF care. However, the status of evidence-based HF care in nursing home (NH) residents with HF remains poorly known.[4-6] Cardiology consultation has been shown to be associated with evidence-based HF care.[7] However, whether cardiology consultation improves care in NH residents with HF remains unclear. The objective of this study was to examine the association of cardiology consultation with evidence-based HF care among hospitalized NH resident with HF.

Methods

The Alabama Heart Failure Project (AHFP)

The AHFP was conducted by AQAF, the quality improvement organization for Alabama, to assess and improve the quality of care of Medicare beneficiaries hospitalized with HF.[8] Charts of 9649 hospitalizations due to HF occurring in 106 Alabama hospitals between July 1, 1998 and October 31, 2001 were abstracted. All patients had a primary discharge diagnosis of HF based on 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. Of the 9649 charts, 8555 were of unique patients.

Nursing Home (NH) Residents

Of the 8555 hospitalized HF patients, 646 were NH residents. Patients were considered to be NH residents if they were admitted from a skilled nursing facility, an extended care facility, or an intermediate care facility. Of these 545 patients were discharged alive.

Cardiology Consultation

Data on in-hospital receipt of cardiology consultation, via consultation or as primary care, were collected via chart abstraction. Overall, 219 (34% of the 646) patients received cardiology consultation.

LVEF Evaluation

Data on LVEF estimation was obtained by review of current or past echocardiography, radionuclide ventriculography, or contrast ventriculography. When data on numeric values of LVEF in percentage was not available, descriptions of normal, mildly impaired, moderately impaired, and severely impaired systolic function were recorded as LVEFs of 55%, 45%, 35%, and 25%, respectively. A description of “systolic dysfunction with unknown severity” was coded as LVEF of 35%. Systolic HF was defined as LVEF <45%. Extensive data on other baseline characteristics and hospital course were also collected by chart abstraction.

Evidence-Based Care

Evidence-based care was defined as estimation of LVEF for those with HF and discharge prescription of ACEI-or-ARB and beta-blockers (BBs) for those with systolic HF.[9] Data on discharge prescription of ACEIs-or-ARBs were collected by chart abstraction. Although the evidence of the benefit of BBs in HF was emerging,[10-12] these drugs were not recommended for routine use in HF during 1998–2001. In addition to carvedilol, long-acting metoprolol succinate, and bisoprolol, we also included short-acting metoprolol tartrate in our analysis as the findings of the COMET trial were not yet published and the latter drug was still being used for HF.[13]

Statistical Analysis

Baseline characteristics of the 646 hospitalized NH residents with HF by the receipt of cardiology consultation were compared using Pearson's chi-square test and Student's t-test as appropriate and results are displayed in Table 1. Bivariate and multivariable logistic regression models were used to determine unadjusted and adjusted odds ratios (ORs) for pre-admission and in-hospital LVEF estimation. Covariates used in these two models are listed in Table 2. The overall fits and discriminations of these models were tested using the Hosmer-Lemeshow goodness-of-fit statistic and the receiver-operating characteristic curve c-statistic.

We then estimated the association of cardiology consultation with discharge prescription of ACEIs-or-ARBs in patients eligible for the receipt of these drugs. HF patients discharged alive who had systolic HF (LVEF <45), had no prior allergy or adverse reaction to ACEIs-or-ARBs, had serum creatinine <2.5 mg/dL, serum potassium <5.5 mEq/L, and systolic blood pressure >100 mm Hg, were considered eligible to receive these drugs. We then relaxed the criteria to include all systolic HF patients discharged alive regardless of eligibility. The covariates used in the models for discharge prescriptions for ACEIs-or-ARBs are displayed in Table 3. We then repeated our analysis for BBs. Systolic HF patients discharged alive with a heart rate >60 beats per minute and systolic blood pressure >100 mm Hg were considered eligible to receive BBs. A p value of ≤0.05 was considered significant for all analyses. SPSS Release 18 for Windows (SPSS, Inc., 2009, Chicago, IL) was used for statistical analysis.

Results

Patient Characteristics

Patients admitted to the hospital from the NH had a mean age of 83 years, 75% were female, 19% were African American, 50% had known LVEF (pre-admission or in-hospital), and 34% received care from a cardiologist while in the hospital. Those receiving cardiology consultation were younger but sicker with higher morbidity burden and were hospitalized in large urban hospitals (Table 1). Of the 646 patients, 101 (16%) died in the hospital. Compared with 20% of patients receiving cardiology consultation, 14% of those not receiving cardiology consultations died during hospitalization (chi square p =0.045).

Cardiology Consultation and LVEF Estimation

Among the 494 patients with known HF, pre-admission LVEF was estimated in 38% and 12% of those receiving and not receiving cardiology consultation respectively (adjusted OR, 3.49; 95% CI, 2.16–5.66; p <0.001; Table 2). Among the 452 HF patients without known LVEF, in-hospital LVEF was estimated in 71% and 28% of those receiving and not receiving cardiology consultation respectively (adjusted OR, 6.01; 95% CI, 3.69–9.79; p <0.001; Table 2). A new diagnosis of HF (adjusted OR, 1.95; 95% CI 1.21–3.15; p=0.006) was the only other covariate that was associated with LVEF estimation.

Cardiology Consultation and Discharge Prescription of ACEIs-or-ARBs

ACEIs-or-ARBs were prescribed to 62% and 82% of eligible patients receiving and not receiving cardiology consultation, respectively (adjusted OR, 0.24; 95% CI, 0.07–0.81; p=0.022; Table 3). The associations of cardiology consultation with the receipt of these drugs in all systolic HF patients regardless of eligibility are displayed in Table 3. Among the 545 NH residents with HF discharged alive, LVEF estimation had a significant association with discharge prescription of ACEIs-or-ARBs based on the multivariable-adjusted model (adjusted odds ratio, 1.93; 95 CI, 1.30–2.87; p=0.001).

Cardiology Consultation and Discharge Prescription of BBs

BBs were prescribed to 24% and 16% of eligible patients receiving and not receiving cardiology consultation, respectively (adjusted OR, 1.63; 95% CI, 0.54–4.96; p=0.389; Table 4). Similar associations were observed in all systolic HF patients regardless of eligibility (Table 4).

Cardiology Consultation and Discharge Prescription of Digitalis and Diuretics

Among the 545 patients discharged alive, digitalis was prescribed to 46% (81/176) and 40% (146/369) of patients (unadjusted OR, 1.30; 95% CI, 0.91–1.87; p=0.153) and diuretics were prescribed to 81% (142/176) and 81% (298/369) of patients (unadjusted OR, 1.00; 95% CI, 0.63–1.57; p=0.983) receiving and not receiving cardiology consultation, respectively. These associations did not alter after adjustment for age, sex, race, serum creatinine and LVEF estimation (adjusted ORs, 1.37; 95% CI, 0.91– 2.08; p=0.133 for digoxin and 0.83; 95% CI, 0.49–1.40; p=0.475 for diuretics).

Discussion

Findings of the current study demonstrate that nearly half of the NH residents hospitalized with HF did not receive LVEF estimation and that many eligible patients did not receive evidence-based therapy. About a third of the NH residents hospitalized with HF received in-hospital cardiology consultation, which was associated with higher odds of LVEF estimation, lower odds of discharge prescriptions of ACEIs-or-ARBs. Because the purpose of LVEF estimation is to guide evidence-based therapy, findings of the current study identify an apparent disconnect between LVEF estimation and the use of evidence-based therapy in NH residents with HF receiving cardiology consultation. These findings provide important insights about the quality of evidence-based care of NH residents with HF and how physician specialty may interact with the use of evidence-based care for this vulnerable subset of HF patients.

The very high odds of in-hospital LVEF estimation by the cardiologists may in part be explained by cardiologists' greater familiarity with guideline recommendation for LVEF estimation and the reimbursement associated with the performance of the procedure for LVEF estimation.[14] However, the position association of cardiology consultation with pre-admission LVEF estimation among NH resident with a prior history of HF is rather intriguing as NH residents often do not receive outpatient cardiology consultation. One potential explanation may be that some of these patients received cardiology consultation during prior hospitalizations when LVEF was estimated. However, it is also possible that cardiologists more consistently obtained and documented information about prior LVEF estimation than non-cardiologists. It is also possible that cardiologist were more eager to avoid repeat echocardiograms, which have been reported to be common and often inappropriate and unyielding of useful new information.[15] Although some insurance providers have policies prohibiting reimbursement for unjustified repeat echocardiograms, NH residents in our study were all Medicare beneficiaries.

The significantly lower rate of discharge prescription of ACEIs or ARBs among eligible systolic HF patients receiving cardiology consultation is rather surprising. However, these findings are consistent with findings from several other studies of HF patients in general.[16-21] In most of these studies, the rate of use of ACEIs-or-ARBs was less than 100% suggesting that there were opportunities to provide evidence-based care which were equally missed by both cardiologists and generalist physicians. However, none of the above studies focused on NH residents with HF. It is unknown to what extent patient and family preference and clinician bias may have contributed to this underuse. Findings from "Get with the Guidelines" demonstrated that only about a quarter of the eligible HF patients discharged to a NH received ACEIs-or-ARBs and BBs, and that both rates were lower than those among patients discharged home.[22]

NH residents with HF are a special subset of HF patients for whom there is little evidence to guide therapy.[23] Clinicians need to individualize therapy of NH residents with HF as comorbid illnesses, and preferences of patients, family members and care providers may explain non-adherence to guideline-directed therapy. For example, it may be appropriate to defer echocardiography in a newly-diagnosed HF patient who is already receiving an ACEI and a BB for hypertension and atrial fibrillation. Similarly, it may be appropriate to withhold ACEIs in a systolic HF patient with advanced dementia and poor life expectancy. Whether NH resident should receive target doses of these drugs remains unclear. Titration of these drugs has been reported to be difficult and is expected to be more difficult for NH residents with HF.[24] Future well-conducted prospective studies using randomized and propensity-matched designs need to examine the effect of these drugs on mortality in HF in the NH setting.[25]

There are several limitations to our study. We did not have data on prior cardiology consultation and whether the current cardiology care was provided as a consultation or primary care. Although we had data on dementia and the prevalence seemed lower in those receiving cardiology consultations, we had no data on functional impairment. Findings of this study based on one state needs to be replicated in other patient populations. The standard of HF care has changed in the past decade since the study was conducted. However, it is unlikely to have changed much in the long-term care setting, and the role of ACEIs-or-ARBs has remained unchanged. Although all patients had a primary discharge diagnosis of HF, as in most HF registries, HF was not centrally adjudicated.

In conclusion, NH residents hospitalized with HF receiving a cardiology consultation were more likely to have LVEF estimation but less likely to receive a discharge prescription for ACEIs-or-ARBs. Future studies need to determine the proper role of cardiology consultation, LVEF estimation, and use of ACEIs-or-ARBs and BBs in older NH residents with HF. Until these data are available, clinicians should individualize therapy for NH residents with HF.

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References

1. Aronow WS. Treatment of systolic and diastolic heart failure in the elderly. J Am Med Dir Assoc. 2006; 7:29–36. [PubMed: 16413432]

2. Ahmed A, Jones L, Hays CI. DEFEAT heart failure: assessment and management of heart failure in nursing homes made easy. J Am Med Dir Assoc. 2008; 9:383–389. [PubMed: 18585640]
3. Goodlin SJ. Palliative care in congestive heart failure. J Am Coll Cardiol. 2009; 54:386–396. [PubMed: 19628112]
4. Ahmed A, Allman RM, DeLong JF, Bodner EV, Howard G. Age-related underutilization of left ventricular function evaluation in older heart failure patients. South Med J. 2002; 95:695–702. [PubMed: 12144074]
5. Ahmed A, Allman RM, DeLong JF, Bodner EV, Howard G. Age-related underutilization of angiotensin-converting enzyme inhibitors in older hospitalized heart failure patients. South Med J. 2002; 95:703–710. [PubMed: 12144075]
6. Ahmed A, Weaver MT, Allman RM, DeLong JF, Aronow WS. Quality of care of nursing home residents hospitalized with heart failure. J Am Geriatr Soc. 2002; 50:1831–1836. [PubMed: 12410902]
7. Ahmed A, Allman RM, Kiefe CI, et al. Association of consultation between generalists and cardiologists with quality and outcomes of heart failure care. Am Heart J. 2003; 145:1086–1093. [PubMed: 12796767]
8. Feller MA, Mujib M, Zhang Y, et al. Baseline characteristics, quality of care, and outcomes of younger and older Medicare beneficiaries hospitalized with heart failure: Findings from the Alabama Heart Failure Project. Int J Cardiol. 2011 Epub ahead of print; DOI:10.1016/j.ijcard.2011.05.003.
9. ACC/AHA Committee on Evaluation and Management of Heart Failure. Guidelines for the evaluation and management of heart failure. Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines Circulation. 1995; 92:2764–2784.
10. Packer M, Bristow MR, Cohn JN, et al. The effect of carvedilol on morbidity and mortality in patients with chronic heart failure. U.S. Carvedilol Heart Failure Study Group. N Engl J Med. 1996; 334:1349–1355. [PubMed: 8614419]
11. The MERIT-HF Investigators. Effect of metoprolol CR/XL in chronic heart failure: Metoprolol CR/XL Randomised Intervention Trial in Congestive Heart Failure (MERIT-HF). Lancet. 1999; 353:2001–2007. [PubMed: 10376614]
12. The CIBIS-II Investigators. The Cardiac Insufficiency Bisoprolol Study II (CIBIS-II): a randomised trial. Lancet. 1999; 353:9–13. [PubMed: 10023943]
13. Poole-Wilson PA, Swedberg K, Cleland JG, et al. Comparison of carvedilol and metoprolol on clinical outcomes in patients with chronic heart failure in the Carvedilol Or Metoprolol European Trial (COMET): randomised controlled trial. Lancet. 2003; 362:7–13. [PubMed: 12853193]
14. United States Government Accountability Office Report to Congressional Committees. Medicare Ultrasound Procedures: Consideration of Payment Reforms and Technician Qualification Requirements. 2007. [Access date: May 19, 2011]; http://www.gao.gov/cgi-bin/getrpt?GAO-07-734
15. Ghatak A, Pullatt R, Vyse S, Silverman DI. Appropriateness criteria are an imprecise measure for repeat echocardiograms. Echocardiography. 2011; 28:131–135. [PubMed: 21210837]
16. Jong P, Gong Y, Liu PP, Austin PC, Lee DS, Tu JV. Care and outcomes of patients newly hospitalized for heart failure in the community treated by cardiologists compared with other specialists. Circulation. 2003; 108:184–191. [PubMed: 12821540]
17. Auerbach AD, Hamel MB, Davis RB, et al. Resource use and survival of patients hospitalized with congestive heart failure: differences in care by specialty of the attending physician. SUPPORT Investigators. Study to Understand Prognoses and Preferences for Outcomes and Risks of Treatments. Ann Intern Med. 2000; 132:191–200. [PubMed: 10651599]
18. Howlett JG, Cox JL, Haddad H, Stanley J, McDonald M, Johnstone DE. Physician specialty and quality of care for CHF: different patients or different patterns of practice? Can J Cardiol. 2003; 19:371–377. [PubMed: 12704481]
19. Reis SE, Holubkov R, Edmundowicz D, et al. Treatment of patients admitted to the hospital with congestive heart failure: specialty-related disparities in practice patterns and outcomes. J Am Coll Cardiol. 1997; 30:733–738. [PubMed: 9283533]

20. Chin MH, Wang JC, Zhang JX, Lang RM. Utilization and dosing of angiotensin-converting enzyme inhibitors for heart failure. Effect of physician specialty and patient characteristics. J Gen Intern Med. 1997; 12:563–566. [PubMed: 9294790]

21. Chin MH, Wang JC, Zhang JX, Sachs GA, Lang RM. Differences among geriatricians, general internists, and cardiologists in the care of patients with heart failure: a cautionary tale of quality assessment. J Am Geriatr Soc. 1998; 46:1349–1354. [PubMed: 9809755]

22. Allen LA, Hernandez AF, Peterson ED, et al. Discharge to a skilled nursing facility and subsequent clinical outcomes among older patients hospitalized for heart failure. Circ Heart Fail. 2011; 4:293–300. [PubMed: 21447803]

23. Boxer RS, Dolansky MA, Frantz MA, Prosser R, Hitch JA, Pina IL. The Bridge Project: Improving Heart Failure Care in Skilled Nursing Facilities. J Am Med Dir Assoc. 2011 DOI:10.1016/j.jamda.2011.01.005.

24. Dungen HD, Apostolovic S, Inkrot S, et al. Titration to target dose of bisoprolol vs. carvedilol in elderly patients with heart failure: the CIBIS-ELD trial. Eur J Heart Fail. 2011; 13:670–680. [PubMed: 21429992]

25. Ahmed A, Ekundayo OJ. Cardiovascular disease care in the nursing home: the need for better evidence for outcomes of care and better quality for processes of care. J Am Med Dir Assoc. 2009; 10:1–3. [PubMed: 19111846]

Table 1

Characteristics of nursing home residents hospitalized for heart failure by cardiology care

	Cardiology care		
n (%) or mean (±SD)	**No (n=427)**	**Yes (n=219)**	**P value**
Age, years	83 (±9)	82 (±8)	0.007
African American	73 (17%)	47 (22%)	0.177
Female	327 (77%)	159 (73%)	0.268
Past medical history			
Heart failure	316 (74%)	172 (79%)	0.204
Coronary artery disease	175 (41%)	116 (53%)	0.004
Myocardial infarction	65 (15%)	52 (24%)	0.008
Angina pectoris	32 (8%)	27 (12%)	0.043
Stroke	158 (37%)	92 (42%)	0.216
Hypertension	286 (67%)	156 (71%)	0.271
Chronic obstructive pulmonary disease	152 (36%)	80 (37%)	0.815
Diabetes mellitus	180 (42%)	98 (45%)	0.528
Dementia	208 (49%)	90 (41%)	0.066
Signs and symptoms			
Pulse, per minute	92 (±22)	93 (±26)	0.756
Systolic blood pressure, mm Hg	141 (±32)	143 (±33)	0.350
Diastolic blood pressure, mm Hg	73 (±19)	76 (±22)	0.061
Peripheral edema	262 (61%)	150 (69%)	0.074
Preadmission medications			
Angiotensin-converting enzyme inhibitors and/or angiotensin receptor blockers	150 (35%)	83 (38%)	0.488
Beta-blockers	68 (16%)	48 (22%)	0.060
Diuretics	257 (60%)	159 (73%)	0.002
Digoxin	141 (33%)	90 (41%)	0.043
Admission diagnostic tests and procedures			
Serum sodium, mEq/L	139 (±7)	138 (±6)	0.141
Serum potassium, mEq/L	4.50 (±0.76)	4.45 (±0.74)	0.474
Serum creatinine, mEq/L	1.50 (±0.93)	1.61 (±1.08)	0.148
Blood urea nitrogen, mg/dL	36 (±24)	37 (±21)	0.833
Pulmonary edema by chest x-ray	351 (82%)	179 (82%)	0.884
Atrial fibrillation by electrocardiography	110 (26%)	83 (38%)	0.001
Left bundle branch block by electrocardiography	37 (9%)	26 (12%)	0.193
Hospital bed size			
<100	142 (33%)	40 (18%)	<0.001
100-299	162 (38%)	75 (34%)	
300-499	79 (19%)	54 (25%)	

	Cardiology care		
n (%) or mean (±SD)	**No (n=427)**	**Yes (n=219)**	**P value**
>500	44 (10%)	50 (23%)	
Hospital owner			
Nonprofit	149 (35%)	75 (34%)	0.967
Proprietary	109 (26%)	55 (25%)	
Other	169 (40%)	89 (41%)	
Rural hospital location	200 (47%)	47 (22%)	<0.001
Accredited hospital	362 (85%)	197 (90%)	0.068

Table 2

Association of cardiology care with overall, pre-admission and in-hospital estimation of left ventricular ejection fraction (LVEF) among nursing home residents hospitalized with heart failure (HF)

LVSF evaluation	% (events/total)		Absolute difference (%)	Odds ratio (95% confidence interval)	P value
	Cardiology consultation				
	No	Yes			
Pre-admission (in patients with known HF) (n=494)					
Unadjusted	12% (38/321)	38% (66/173)	+ 26%	4.59 (2.91–7.25) 3.49	<0.001
Adjusted*	---	---	---	(2.16–5.66)	<0.001
In-hospital (in patients HF and unknown LVEF); n=452					
Unadjusted	28% (93/333)	71% (85/119)	+ 43%	6.45 (4.06–10.26)	<0.001
Adjusted†	---	---	---	6.01 (3.69–9.79)	<0.001

*Adjusted for age, sex, race, new heart failure diagnosis, coronary artery disease, serum creatinine, hypertension, chronic obstructive pulmonary disease, stroke, diabetes mellitus, dementia, teaching hospital, rural hospital, and hospital with <100 beds

†Adjusted for age, sex, race, coronary artery disease, hypertension, diabetes mellitus, chronic obstructive pulmonary disease, stroke, dementia, rural hospital, and hospital with <100 beds

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Table 3

Association of cardiology care with the discharge prescription of angiotensin-converting enzyme inhibitors (ACEIs) or angiotensin receptor blockers (ARBs) in nursing home (NH) residents hospitalized with heart failure (HF)

	% (events/total)		Absolute difference	Odds ratio (95% confidence interval)	
	Cardiology consultation			Unadjusted	Multivariable-adjusted**
	No	Yes			
Eligible patients* (n=83)	82% (31/38)	62% (28/45)	− 20%	0.37 (0.13–1.03); p=0.057	0.24 (0.07–0.82); p=0.022
All systolic HF patients regardless of eligibility (n=122)	74% (42/57)	57% (37/65)	− 17%	0.47 (0.22–1.02); p=0.055	0.38 (0.15–0.93); p=0.034

*Systolic HF patients discharged alive without prior allergy or intolerance, with serum creatinine <2.5 mg/dL, serum potassium <5.5 mEq/L, and systolic blood pressure >100 mm Hg

**Adjusted for age, sex, race, systolic blood pressure, serum creatinine, serum potassium, left ventricular ejection fraction, and discharge prescription of beta-blockers

Table 4

Association of cardiology care with the discharge prescription of evidence-based beta-blockers (included carvedilol, long-acting metoprolol succinate, short-acting metoprolol tartrate and bisoprolol) in nursing home (NH residents hospitalized with heart failure (HF)

	% (events/total)		Absolute difference	Odds ratio (95% confidence interval)	
	Cardiology consultation			Unadjusted	Multivariable-adjusted**
	No	Yes			
Eligible patients* (n=109)	16% (8/50)	24% (14/59)	+ 8%	1.63 (0.62–4.29); p=0.319	1.63 (0.54–4.96); p=0.389
All systolic HF patients regardless of eligibility (n=122)	18% (10/57)	25% (16/65)	+ 7%	1.54 (0.63–3.72); p=0.343	1.37 (0.50–3.74); p=0.539

*Systolic HF patients discharged alive with heart rate >60 bpm and systolic blood pressure >100 mm Hg

**Adjusted for age, sex, race, systolic blood pressure, heart rate, left ventricular ejection fraction, chronic obstructive pulmonary disease, and discharge prescription of ACEIs or ARBs