Influence of Patient Goals of Care on Performance Measures in Patients Hospitalized for Heart Failure

An Analysis of the Enhanced Feedback For Effective Cardiac Treatment (EFFECT) Registry

Finlay A. McAlister, MD, MSc; Julie Wang, MSc; Linda Donovan, BScN, MBA; Douglas S. Lee, MD, PhD; Paul W. Armstrong, MD; Jack V. Tu, MD, PhD

Background—Pay for performance programs compare metrics that are risk-adjusted, but goals of care are not considered in current models. We conducted this study to explore the associations between do not resuscitate (DNR) designations, quality of care, and outcomes.

Methods and Results—Retrospective cohort study with chart review for inpatient quality metrics, 30 day mortality, and readmissions or death within 30 days of discharge in 96 Ontario hospitals participating in the Enhanced Feedback For Effective Cardiac Treatment (EFFECT) study in 2004/05. Of 8339 patients (mean age 77 years) with new heart failure, 1220 (15%) had DNR documented at admission (admission DNR, varying from 0% to 36% between hospitals) and 892 (11%) were switched from full resuscitation to DNR during their index hospitalization (later DNR). Death at 30 days was more common in patients with admission DNR (27%) or later DNR (35%) than full resuscitation (3%)—admission DNR was a stronger predictor (adjusted OR 8.6, 95% confidence interval 6.8–10.7) than any of the variables currently included in heart failure 30 day mortality risk models. Hospital-level rankings differed considerably if DNR patients were excluded: 22 of the 39 EFFECT hospitals in the top and bottom quintiles for 30 day mortality rates (the usual thresholds for rewards/penalties in current performance-based reimbursement schemes) would not have been in those same quintiles if admission DNR patients were excluded.

Conclusions—Alternate goals of care are frequent and important confounders in heart failure comparative studies. Philosophy of care discussions should be considered for inclusion as a potential quality of care indicator.

Key Words: epidemiology ★ heart failure ★ outcome ★ risk adjustment

Heart failure (HF) hospitalization is a time when goals of care should be addressed with patients.1 Do not resuscitate (DNR) orders place limits on cardiopulmonary resuscitation and may be a proxy for patients in whom intent is palliation of symptoms rather than prolongation of life. Studies of quality of care and comparisons of performance across sites or between physician groups focus on ideal patients by excluding patients with severe comorbidities, such as advanced chronic kidney disease. Few studies (and certainly none using current administrative data sets)2 are able to accurately identify patients with goals of care designations that may alter the aggressiveness of care offered.

This raises ≥4 possible issues. First, and most importantly, we may be falsely attributing the reasons for variations in quality of care between different hospitals or physician groups if the frequency of alternate goals of care differs across categories. Second, we may be underestimating quality of care provided for HF patients in administrative data studies if we are inflating the denominators in these studies with patients who have palliative goals of care. Third, when discussing prognosis for patients admitted with HF, we may be overestimating morbidity and mortality risks if we are including events in patients with palliative intent who received less than currently recommended treatment. Fourth, because HF report cards and financial payments in some healthcare settings now depend on 30 day outcomes or other HF performance measures, it is essential that all variables which potentially affect these outcomes are recognized.

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and recorded in risk-adjustment models. Because goals of care
designations are not included in current Centers for Medicare
and Medicaid Services (CMS)–endorsed HF risk adjustment
models,3,4 it is important to explore the degree to which this fac-
tor may affect hospital-level rankings for HF quality metrics. To
our knowledge, there is no published information on how the
patterns of care and postdischarge outcomes differ between HF
patients with different goals of care designations.

Thus, we undertook this study to examine the frequency
of DNR designations in hospitalized HF patients and explore
the association between DNR orders, quality metrics, and out-
comes (both during and after hospitalization). We recognize
that not all DNR designations are the same—some patients
with DNR orders are palliative and wish comfort measures only,
others wish all medical therapies offered short of resus-
citation. However, we used DNR status in this study as a proxy
for an alternate goal of care short of full resuscitation.

Methods

Setting and Data Sources
Details of the Enhanced Feedback For Effective Cardiac Treatment
study have been previously published. In brief, charts of patients
with HF treated between April 1, 2004, and March 31, 2005, at the
96 Ontario hospitals (86 corporations) participating in the EFFECT
study were retrospectively reviewed by trained research assistants
who extracted baseline and outcome data using standardized case
definitions. A waiver of informed consent for collecting the study
data was approved by the participating hospital research ethics boards
because of the minimal risk nature of the study.

Study Cohort
For this study, we only analyzed data for those patients with a most
responsible diagnosis of HF (ie, the primary diagnosis assigned by
their attending physician for their index hospitalization) who had not
been hospitalized for HF in the prior 3 years.

Do Not Resuscitate Orders
Each patient had a goals of care designation (DNR versus full code) re-
corded on their admission history or orders. For the purpose of this study,
we classified partial DNR orders (ex intubation with mechanical ventila-
tion but no defibrillation) as DNR. We classified DNR orders recorded
at the time of admission as admission DNR. We classified those patients
who were deemed full code on their admission orders but switched to
DNR subsequently during their index hospitalization as later DNR.

Outcomes
Outcomes during the index hospitalization (including process of
care measures) were collected from review of the written inpatient
medical records. The EFFECT data were linked with the Canadian
Institutes of Health Information Discharge Abstract Database, the
National Ambulatory Care Reporting System Database (which cap-
tures emergency department visits), and the Ontario Registered Persons Database (using each patient’s unique healthcare identifier)
to collect postdischarge outcomes and to build the CMS-endorse-
d risk-adjustment models for mortality and rehospitalization.5,6

Analyses
We used chi-squared tests for dichotomous variables and Student’s t-
tests for continuous variables to compare baseline characteristics, pro-
cesses of care, and outcomes between those with/without DNR orders.
We examined the effect of admission DNR order on 30 day mortality
and whether it contributed additional information beyond the CMS-
endorsed risk-adjustment model for that outcome. We also examined
the effect of discharge DNR order on the outcome of rehospitaliza-
tion in the first 30 days after discharge, again adjusting for the CMS-
endorsed risk-adjustment model6 to see if it provided independent
information. We examined the association between discharge DNR sta-
tus and the composite outcome of death or all-cause readmission within
30 days of discharge after adjusting for covariates, including discharge
prescriptions, by selecting all clinically important variables (ie, age, sex,
presence/absence of CAD) and any other baseline factors (or dis-
charge medication data) with P<0.20 on bivariate analyses and a preva-
ience of 21%,) accepting statistical significance at P<0.05 for the main
model. For the multivariable logistic regression analyses, we excluded
patients in the later DNR group (for the 30 day mortality analysis), and
for the 30 day postdischarge analyses, we excluded those discharged to
palliative care or who discharged themselves against medical advice.

Finally, we also ranked hospitals and grouped them into 3 catego-
ries for achievement of HF performance measures—top 20%, middle
60%, and bottom 20%—and compared results if patients with DNR
status were included/excluded from the hospital performance mea-
surement. We chose those 3 categories as they reflect those most rel-
evant to pay for performance programs that include incentive bonuses
for high achievers (top quintile) and payment penalties for those in
the bottom 20% of performers.

Results
In the 8339 patients admitted with HF as their most responsible
diagnosis (mean age 77 years, 49% male), 1220 had DNR docu-
mented at admission (admission DNR) and 892 were switched from
full resuscitation to DNR during their index hospitalization
(later DNR). Of note, the vast majority of DNR orders included
both no resuscitation and no advanced life support (in the form
of ICU interventions, such as mechanical ventilation or inva-
sive cardiopulmonary support); only 141 (12%) of the 1220
admission DNR patients and 79 (9%) of the 892 later DNR
patients requested no cardiopulmonary resuscitation but wished
advanced life support. The median time when patients were
switched from full resuscitation to DNR was 3 days (IQR 1–7
days) after admission. The proportion of patients with admission
DNR orders varied across hospitals participating in EFFECT: range 0% to 36%, median 12%. Of note, only 1152 EFFECT
patients (14%) had formal documentation of a goals of care dis-
cussion being held with the patient and caregivers during their
index hospitalization (including 488 of those with admission
DNR and 664 of those who were designated full code on ad-
mission, 657 of whom were switched to DNR after the discussion).

Demographic Differences Between DNR and Full
Code Patients
Patients with DNR orders were older, more likely to be female and
admitted from an institutionalized setting, had more comor-
bidities, and had greater HF severity and poorer prognoses at
baseline (ie, higher EFFECT mortality scores, Table 1). How-
ever, the distribution of HF etiologies was similar and the pro-
portion of patients with left ventricular ejection fraction <0.40
was not appreciably different between DNR and full code
patients, although DNR patients were less likely to have their
left ventricular ejection fraction measured (40% admission
DNR, 59% later DNR, and 65% full code). Although patients
hospitalized in teaching hospitals were more likely to be des-
ignated DNR (25%) than those in nonteaching hospitals (22%,
P=0.006), this difference did not persist after multivariate
adjustment for clinical covariates (P=0.14). In the same vein,
although patients cared for by generalist physicians were more


likely to be designated DNR (30% versus 23%, P<0.001), this difference also disappeared after multivariate analysis (P=0.58).

Inpatient Process of Care and Outcome Differences Between DNR and Full Code Patients

Patients with admission DNR orders were less likely to be treated by cardiologists, admitted to critical care units, and to have their daily weights assessed (Table 2). Death during index hospitalization was more common in patients with admission DNR (20%) or later DNR (33%) than those who were designated full code throughout their index hospitalization (1%; Figure). Thirty-day mortality rates and index hospitalization lengths of stay were also substantially higher (Table 2). Of the 601 EFFECT patients who died during

<table>
<thead>
<tr>
<th>Table 1. Baseline Characteristics</th>
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<tr>
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<tr>
<td>Age at time of index hospitalization 85±8 82±8 74±12 &lt;0.001</td>
</tr>
<tr>
<td>Male                             392 (32) 381 (43) 3320 (53) &lt;0.001</td>
</tr>
<tr>
<td>Rural resident                   120 (10) 102 (11) 749 (12) 0.09</td>
</tr>
<tr>
<td>Resided in long term care facility prehospitalization 595 (49) 155 (17) 293 (5) &lt;0.001</td>
</tr>
<tr>
<td>NYHA class on presentation:</td>
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<tr>
<td>I                                16 (1) 10 (1) 141 (2) &lt;0.001</td>
</tr>
<tr>
<td>II                               118 (10) 79 (9) 1092 (18)</td>
</tr>
<tr>
<td>III                              341 (28) 286 (32) 2152 (35)</td>
</tr>
<tr>
<td>IV                               583 (48) 319 (36) 1960 (32)</td>
</tr>
<tr>
<td>Not reported                     162 (13) 198 (22) 882 (14)</td>
</tr>
<tr>
<td>Peak creatinine during index hospitalization, μmol/L 165±113 188±119 146±93 &lt;0.001</td>
</tr>
<tr>
<td>Proportion with eGFR &lt;30 mL/min (based on peak creatinine) 286 (24) 230 (26) 909 (15) &lt;0.001</td>
</tr>
<tr>
<td>Proportion of those who had LVEF measured with LVEF &lt;0.40 238/490 (49) 263/523 (50) 2117/4018 (53) 0.16</td>
</tr>
<tr>
<td>Co-morbidities</td>
</tr>
<tr>
<td>Prior history of CHF             737 (60) 527 (59) 2971 (48) &lt;0.001</td>
</tr>
<tr>
<td>Hypertension                     769 (63) 581 (65) 4115 (66) 0.12</td>
</tr>
<tr>
<td>Diabetes mellitus                358 (29) 295 (33) 2434 (39) &lt;0.001</td>
</tr>
<tr>
<td>Prior MI, CABB, or PCI/stent     471 (39) 386 (43) 2647 (43) 0.03</td>
</tr>
<tr>
<td>Peripheral arterial disease      177 (15) 138 (16) 799 (13) 0.04</td>
</tr>
<tr>
<td>Previous stroke/TIA              335 (28) 215 (24) 974 (16) &lt;0.001</td>
</tr>
<tr>
<td>Current smoker                   67 (6) 76 (9) 751 (12) &lt;0.001</td>
</tr>
<tr>
<td>Atrial fibrillation/flutter      476 (39) 366 (41) 2110 (34) &lt;0.001</td>
</tr>
<tr>
<td>Ventricular arrhythmias          35 (3) 27 (3) 199 (3) 0.82</td>
</tr>
<tr>
<td>Cancer                           173 (14) 147 (17) 677 (11) &lt;0.001</td>
</tr>
<tr>
<td>COPD or asthma                   356 (29) 319 (36) 1639 (26) &lt;0.001</td>
</tr>
<tr>
<td>Peptic ulcer disease             76 (6) 82 (9) 376 (6) 0.001</td>
</tr>
<tr>
<td>Liver disease                    13 (1) 12 (1) 110 (2) 0.16</td>
</tr>
<tr>
<td>Dementia                         386 (32) 132 (15) 321 (5) &lt;0.001</td>
</tr>
<tr>
<td>EFFECT 30 day risk score         111±23 107±23 85±24 &lt;0.001</td>
</tr>
<tr>
<td>Index hospital characteristics</td>
</tr>
<tr>
<td>Teaching hospital                297 (24) 234 (26) 1384 (22)</td>
</tr>
<tr>
<td>Large Community Hospital         887 (73) 629 (71) 4661 (75)</td>
</tr>
<tr>
<td>Small Community hospital         36 (3) 29 (3) 182 (3)</td>
</tr>
</tbody>
</table>

Data are presented as means±SD or n (%). The Enhanced Feedback For Effective Cardiac Treatment (EFFECT) 30 day risk score is for 30-day mortality, and variables include age, SBP, sodium level, respiratory rate, hemoglobin, urea, and history of cancer, COPD, cirrhosis, and dementia. CABG indicates coronary artery bypass grafting; CHF, chronic heart failure; COPD, chronic obstructive pulmonary disease; DNR, do not resuscitate; eGFR, estimated glomerular filtration rate; LVEF, left ventricular ejection fraction; MI, myocardial infarction; NYHA, New York Heart Association; PCI, percutaneous coronary intervention; SBP, systolic blood pressure; and TIA, transient ischemia attack.
their index HF hospitalization, 238 (40%) had an admission DNR order, 295 (49%) were later DNR, and only 68 (11%) were still designated full code at the time of their death. Of the 428 EFFECT patients who died in the first 30 days postdischarge, 54% was designated DNR at the time of discharge. Admission DNR status was by far the strongest independent predictor of 30-day mortality: Wald score 345 and adjusted odds ratio 8.6, 95% confidence interval 6.8 to 10.7, after adjustment for all variables included in the CMS-endorsed model for 30-day mortality (Table I in the Data Supplement).³

Post-Discharge Process of Care and Outcome Differences Between Patients Discharged With DNR Status Versus Full Code Status

Patients with DNR designations at the time of discharge were substantially less likely to be discharged home without support and were more likely to die in that first month (15% versus 3%, P<0.001; Table 3). Notwithstanding this, the vast majority of DNR patients survived (over half were still alive even 12 months after discharge), and 30 day readmission rates (19% versus 19%) and emergency department visit rates (26% versus 27%) were similar for patients discharged with/without a DNR designation (Table 3).

Patients with DNR orders at discharge (even ideal candidates) were less likely to receive angiotensin-converting enzyme inhibitor/angiotensin receptor blocker, β-blockers, spironolactone, or warfarin (in those with concomitant atrial fibrillation) and were substantially less likely to receive any discharge counseling on dietary/lifestyle maneuvers for HF (Table 3).

Patients with DNR orders in place at the time of discharge were more likely to suffer death or all-cause readmission within 30 days of discharge (29% versus 20%, unadjusted OR 1.43, P<0.001), and this excess risk persisted even after adjustment for covariates, including the lower use of angiotensin-converting enzyme inhibitor/angiotensin receptor blocker, β-blockers, and spironolactone in these patients: adjusted odds ratio 1.3 (95% confidence interval 1.1–1.5; Table II in the Data Supplement). Thus, although some of the adverse risk associated with DNR status may relate to underuse of proven efficacious therapies, this does not account for all of the excess risk in DNR patients. In fact, DNR status at time of discharge was the variable most strongly associated with risk of death/all-cause hospitalization in the first 30 days after discharge, even after adjustment for other variables commonly used in mortality risk prediction equations.³,⁷

Impact of Alternate Goals of Care on Hospital-Level Performance Measures

Given the marked differences in process of care indicators and outcomes for DNR versus full code patients, it is not surprising that hospital-level performance measures differ considerably (and between-hospital differences are less pronounced) if DNR patients are included or excluded. For example, the median risk-adjusted 30-day mortality rate among EFFECT hospitals was 10% (IQR 8% to 13%) if all patients were included, 7% (IQR 5% to 10%) if later DNR patients were excluded from the analyses, and 3% (IQR 2% to 5%) if admission or later
DNR patients were excluded. In fact, even after excluding later DNR patients (those where potential gaming of the system could occur), 10 of the 19 (53%) hospitals with the lowest risk-adjusted 30-day mortality rates (which would define them as being in the highest performing quintile of EFFECT hospitals for that outcome) were not in the same quintile when Admission DNR patients were excluded from calculations for all 96 EFFECT hospitals; on the other hand, 12 of the 20 (60%) hospitals ranked in the highest quintile for risk-adjusted mortality (ie, lowest performing hospitals for that outcome) moved out of that quintile when admission DNR patients were excluded from the calculations. Thus, 22 of the 39 EFFECT hospitals in the top/bottom quintiles (the usual thresholds for rewards/penalties in current performance measure-based reimbursement schemes) would not have been in those same quintiles if data from admission DNR patients were excluded (Table 4).

Discussion
We found that DNR status at admission is the strongest predictor of 30 day mortality, DNR status at discharge is the second strongest predictor of outcomes in the first month postdischarge, and both remain highly statistically significant independent predictors even after adjustment for use of evidence-based therapies and all of the covariates in currently recommended risk prediction equations. Thus, DNR designation is clearly a marker for disease severity or functional status not otherwise captured in current predictive models. A similar finding that DNR status was an independent predictor of mortality even...
after adjustment for age and Charlson comorbidities was also recently reported from the Mayo Clinic. Several studies have highlighted the poor correlation between current CMS-endorsed performance measures and clinical outcomes in HF, and we suspect that adjusting for goals of care and including advanced care directive discussions as a HF performance measure would help address this deficiency. Moreover, given the strong association between DNR status and length of stay, inclusion of a goals of care performance measure may also facilitate development of a predictive model for length of stay that is sufficiently robust that it can be used for risk adjustment, a major deficiency in the current HF health services and comparative effectiveness literature.

As the proportion of patients with an admission DNR designation is not evenly distributed between hospitals or physician specialties, alternate goals of care are a potential confounder of any comparison of inpatient performance measures, and failure to consider goals of care may induce substantial error in league tables. For example, we found that more than half of the EFFECT hospitals in the top and bottom quintiles for 30 day mortality rates would have been ranked in different quintiles outside of the reward/penalty zone if patients with admission DNR orders were excluded. Thus, we suggest that such comparisons be performed within strata defined by goals of care or using a risk-adjustment model that incorporates goals of care designations. Of note, we focused on admission DNR orders for comparisons of inpatient outcomes and did not include patients with later DNR orders because of potential concerns that decisions in such patients could be taken in ways to positively influence the profile of a particular hospital or physician. For comparisons of postdischarge quality of care or outcomes, a risk-adjustment model that incorporates discharge destination (ex. hospice versus home) may serve as a proxy for goals of care that could be extracted from current administrative records.

Although we found that more patients in the EFFECT HF cohort were designated DNR than previously reported in HF cohorts from the early 1990s, our proportion of admission DNR patients (15%) was actually very similar to that recently reported from the Mayo Clinic for 2007 to 2011 (15%). Moreover, our finding that >80% of patients who died during the index hospitalization had a DNR order before death closely mirrors the 79% recently reported from the Mayo Clinic. We think this reflects growing appreciation of the poor prognosis in HF since the 1990s, although other studies have demonstrated that HF patients migrate to DNR status later in their clinical course than cancer patients with similar prognoses. Regardless, until administrative coding for goals of care designations improves, health services researchers would be well advised to note that up to one quarter of patients hospitalized for a most responsible diagnosis of HF may have a DNR designation assigned at some point during their hospitalization and that one fifth of those discharged alive may carry a DNR designation. Studies that do not take this into account may systematically underestimate quality of care and overestimate morbidity, mortality, and length of stay for HF patients with non-DNR designations.

Although a HF hospitalization is an opportunity to address goals of care with patients and their families, our data suggests that this is infrequently done (or at least infrequently documented) with only 14% of EFFECT patients having formal documentation of a goals of care discussion having been held with the patient and caregivers during their index hospitalization. Despite a strong majority of HF patients expressing a wish to discuss life expectancy and philosophy of care decisions with their physicians, this is not always recognized or acted on by their physicians. Although discomfort in predicting the trajectory of disease for patients with HF has often been cited as a major barrier to such discussions, recently developed risk prediction models will hopefully simplify this task. We hope that this study will stimulate clinicians to incorporate goals of care discussions into their standard approach to hospitalized patients with HF.

Although the strong association between admission DNR orders and death during index hospitalization is not surprising, it is worth noting that most patients with a DNR order did survive their index hospitalization. Moreover, the rates of emergency department visits and readmissions in the first 30 days after discharge were similar for patients discharged with or without a DNR order. This phenomenon of DNR preferences not correlating with 18 month outcomes was also reported in an analysis of participants in the Trial of Intensified versus standard Medical therapy in Elderly patients with Congestive HF. Thus, our data serve as a reminder that some HF process of care measures (particularly for interventions proven to improve quality of life) should still be applied even to patients with DNR designations.

Finally, we found a negative association between DNR designation and quality of care for HF patients in the current era, at least using currently advocated performance measures. Although similar findings had been reported in older studies for a variety of medical conditions, many assumed that this outdated way of thinking had disappeared: “DNR does not mean do not treat” being a common admonition on the wards for nearly 2 decades. However, before too much is read into this result, it is worth emphasizing that we are unable to distinguish patients with true palliative intent from those who wished full medical treatment.

### Table 4. Comparison of the Rank of 96 EFFECT Hospitals for Risk-Adjusted 30 Day Mortality, Whether Patients With Admission DNR Are Included or Excluded

<table>
<thead>
<tr>
<th>If Patients With Admission DNR Designation Are Excluded</th>
<th>Highest Performing Quintile (Lowest Mortality Rate)</th>
<th>Quintiles 2–4</th>
<th>Lowest Performing Quintile (Highest Mortality Rate)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highest performing quintile (lowest mortality rate)</td>
<td>9</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>Quintiles 2–4</td>
<td>10</td>
<td>37</td>
<td>10</td>
</tr>
<tr>
<td>Lowest performing quintile (highest mortality rate)</td>
<td>0</td>
<td>12</td>
<td>8</td>
</tr>
</tbody>
</table>

Mortality rates risk-adjusted using CMS-endorsed model. Patients with later DNR were excluded from both samples because of concerns that this may be a potentially gameable variable (eg, if dying patients were made DNR just before demise). DNR indicates do not resuscitate; and EFFECT, Enhanced Feedback For Effective Cardiac Treatment.
short of resuscitation. Moreover, although DNR patients had lower scores on current HF quality metrics, ≥1 other study has documented that DNR patients do receive more nursing time, which positively affects their satisfaction and quality of life.36

Although our study reports on a large, well categorized, and heterogeneous population-based cohort of patients hospitalized for HF using data collected directly from patient charts, there are some limitations to our study. First, we cannot elabo-
rate the specifics of each patient’s DNR order; thus, we cannot distinguish between those patients who had advanced directives in place for some time and those patients where DNR was instituted because of treatment failure or impending death. Our examination of outcomes in those with admission DNR orders versus later DNR orders was an attempt to resolve this issue, but we recognize it is imperfect. We were also unable to dis-tinguish those patients with true palliative intent (ie, comfort measures only) from those requesting active medical treatment but DNR in the event of cardiopulmonary arrest. However, less than one tenth of our DNR patients fell into this latter category, and results were not appreciably different after exclusion of this subgroup. Second, we acknowledge that documentation prac-
tices may differ across hospitals participating in the EFFECT study and that goals of care discussions were likely undercaptured in the progress notes of hospital charts; however, space for documentation of resuscitation status was included in the standard admission order sheets at all participating hospitals and all of our patients had data in this field. Third, although we documented differences in frequency of DNR designations across attending physician groups, we are unable to determine whether the lower DNR rates in specialist-treated patients reflect spectrum bias (with patients deemed suitable for aggres-
sive therapy being more likely to be admitted to specialists), patient preferences, or a real difference between threshold for DNR discussions between specialty groups. Fourth, we only measured some quality metrics; others that may affect prognosis (such as outpatient follow-up with specialized teams) and could reasonably be expected to differ between DNR and full code patients were not captured. Finally, we were unable to explore the nature or quality of the goals of care discussions, but merely analyzed whether there was documentation in the hospital chart of a discussion having taken place or not.

In conclusion, although one quarter of total Medicare spending is spent on patients in the last 6 months of their life and 80% of patients are hospitalized at least once in that time-frame,37 few studies have explored the frequency and effect of alternate goals of care on quality metrics and performance measure comparisons in HF patients. We found that alternate goals of care (using our admittedly imperfect proxy of DNR status) is a frequent and potentially important confounder that can influence even multivariable-adjusted performance mea-
sures in HF. Failure to take into account goals of care may substantially influence comparisons of hospital or physician-level performance measures for HF currently advocated by CMS, the American College of Cardiology/American Heart Association, the American Medical Association Physicians Consortium for Performance Improvement, the National Quality Forum, and the Joint Commission, thereby lead-
ing to potentially spurious conclusions with serious conse-
quences for those identified as being in the bottom quintile of performers. Thus, we suggest that such comparisons be performed within strata defined by goals of care or using risk-adjustment models that incorporate goals of care designa-
tions. Discussions about goals of care should be one part of the standard treatment regimen for patients admitted with HF; we found a substantial care gap on this issue and suggest that increased attention should be paid to this by clinicians caring for these patients and those evaluating the quality of HF care.

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Disclosures

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References

10. Fonarow GC, Peterson ED. Heart failure performance measures and out-
be considered for inclusion as a potential quality of care indicator. Important confounders in any comparisons of quality of care or outcomes and suggest that goals of care discussions should be considered for inclusion as a potential quality of care indicator.


36. Sulmasy DP, Sood JR. Factors associated with the time nurses spend at the bedside of seriously ill patients with poor prognoses. Med Care. 2003;41:458–466.

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### Appendix Table 1: Multivariate predictors of 30 day mortality from time of admission

<table>
<thead>
<tr>
<th>Variable</th>
<th>OR       (95% CI)</th>
<th>Wald score</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Admission DNR</td>
<td>8.56 (6.82-10.73)</td>
<td>345.4</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Age (per year)</td>
<td>1.01 (1.00-1.02)</td>
<td>5.2</td>
<td>0.02</td>
</tr>
<tr>
<td>Male</td>
<td>1.19 (0.97-1.47)</td>
<td>2.8</td>
<td>0.09</td>
</tr>
<tr>
<td>History MI</td>
<td>1.55 (1.23-1.95)</td>
<td>13.9</td>
<td>0.0002</td>
</tr>
<tr>
<td>Angina</td>
<td>1.02 (0.77-1.35)</td>
<td>0.02</td>
<td>0.89</td>
</tr>
<tr>
<td>Cardiac Shock</td>
<td>1.26 (0.88-1.79)</td>
<td>1.6</td>
<td>0.20</td>
</tr>
<tr>
<td>Diabetes</td>
<td>0.86 (0.69-1.08)</td>
<td>1.6</td>
<td>0.20</td>
</tr>
<tr>
<td>Valvular Heart Disease</td>
<td>1.34 (1.03-1.74)</td>
<td>4.7</td>
<td>0.03</td>
</tr>
<tr>
<td>History Hypertension</td>
<td>0.64 (0.52-0.78)</td>
<td>18.0</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>History Atherosclerosis</td>
<td>1.08 (0.87-1.34)</td>
<td>0.5</td>
<td>0.46</td>
</tr>
<tr>
<td>Stroke</td>
<td>1.40 (0.84-2.33)</td>
<td>1.6</td>
<td>0.20</td>
</tr>
<tr>
<td>Chronic Kidney Disease</td>
<td>1.74 (1.40-2.15)</td>
<td>25.7</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>COPD</td>
<td>0.73 (0.57-0.93)</td>
<td>6.3</td>
<td>0.01</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>1.40 (1.13-1.73)</td>
<td>9.4</td>
<td>0.002</td>
</tr>
<tr>
<td>Protein Malnutrition</td>
<td>0.59 (0.28-1.26)</td>
<td>1.9</td>
<td>0.17</td>
</tr>
<tr>
<td>Dementia</td>
<td>1.36 (1.05-1.75)</td>
<td>5.5</td>
<td>0.02</td>
</tr>
<tr>
<td>Paralysis</td>
<td>0.77 (0.47-1.25)</td>
<td>1.1</td>
<td>0.28</td>
</tr>
<tr>
<td>Peripheral Vascular Disease</td>
<td>1.28 (0.96-1.71)</td>
<td>2.8</td>
<td>0.09</td>
</tr>
<tr>
<td>Metastatic Cancer</td>
<td>2.11 (1.42-3.14)</td>
<td>13.6</td>
<td>0.0002</td>
</tr>
<tr>
<td>Chronic Liver Disease</td>
<td>1.11 (0.53-2.33)</td>
<td>0.08</td>
<td>0.77</td>
</tr>
<tr>
<td>Trauma in prior 5 years</td>
<td>1.05 (0.82-1.33)</td>
<td>0.1</td>
<td>0.71</td>
</tr>
<tr>
<td>Psychiatric Disorders</td>
<td>1.18 (0.87-1.61)</td>
<td>1.1</td>
<td>0.29</td>
</tr>
<tr>
<td>PTCA in prior 5 years</td>
<td>0.44 (0.23-0.84)</td>
<td>6.2</td>
<td>0.01</td>
</tr>
<tr>
<td>CABG in prior 5 years</td>
<td>0.51 (0.25-1.01)</td>
<td>3.8</td>
<td>0.05</td>
</tr>
</tbody>
</table>

Adjusted for covariates included in the CMS-endorsed risk adjustment model.[11]
## e Appendix Table 2: Multivariate predictors of mortality or readmission within 30 days of discharge

<table>
<thead>
<tr>
<th>Variable</th>
<th>OR (95% CI)</th>
<th>Wald Score</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discharge DNR</td>
<td>1.32 (1.12-1.54)</td>
<td>12.5</td>
<td>0.0004</td>
</tr>
<tr>
<td>Age (per year)</td>
<td>0.98 (0.97-0.99)</td>
<td>25.3</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Male</td>
<td>0.98 (0.87-1.11)</td>
<td>0.08</td>
<td>0.78</td>
</tr>
<tr>
<td>Rural</td>
<td>1.02 (0.85-1.23)</td>
<td>0.05</td>
<td>0.82</td>
</tr>
<tr>
<td>Diabetes</td>
<td>0.96 (0.85-1.09)</td>
<td>0.5</td>
<td>0.50</td>
</tr>
<tr>
<td>Angina</td>
<td>1.05 (0.92-1.20)</td>
<td>0.6</td>
<td>0.46</td>
</tr>
<tr>
<td>Prev MI/CABG/PCI</td>
<td>1.12 (0.98-1.27)</td>
<td>2.7</td>
<td>0.10</td>
</tr>
<tr>
<td>Stroke</td>
<td>0.84 (0.72-0.99)</td>
<td>4.5</td>
<td>0.03</td>
</tr>
<tr>
<td>Current Smoker</td>
<td>0.83 (0.67-1.03)</td>
<td>2.9</td>
<td>0.09</td>
</tr>
<tr>
<td>Atrial fib</td>
<td>0.95 (0.84-1.08)</td>
<td>0.6</td>
<td>0.43</td>
</tr>
<tr>
<td>Cancer</td>
<td>0.99 (0.82-1.18)</td>
<td>0.02</td>
<td>0.88</td>
</tr>
<tr>
<td>COPD</td>
<td>0.80 (0.70-0.92)</td>
<td>9.6</td>
<td>0.002</td>
</tr>
<tr>
<td>Dementia</td>
<td>0.92 (0.75-1.14)</td>
<td>0.6</td>
<td>0.44</td>
</tr>
<tr>
<td>eGFR &lt; 30</td>
<td>1.00 (0.83-1.20)</td>
<td>0.0001</td>
<td>0.99</td>
</tr>
<tr>
<td>EFFECT CHF 30 day risk score</td>
<td>1.02 (1.01-1.02)</td>
<td>77.8</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Cardiologist Attending physician or consult</td>
<td>1.05 (0.92-1.19)</td>
<td>0.6</td>
<td>0.46</td>
</tr>
<tr>
<td>Discharge on ACEi/ARB</td>
<td>0.84 (0.73-0.95)</td>
<td>7.2</td>
<td>0.007</td>
</tr>
<tr>
<td>Discharge on BetaBlockers</td>
<td>0.93 (0.83-1.05)</td>
<td>1.2</td>
<td>0.27</td>
</tr>
<tr>
<td>Discharge on Spironolactone</td>
<td>0.89 (0.77-1.03)</td>
<td>2.5</td>
<td>0.12</td>
</tr>
</tbody>
</table>