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ORIGINAL RESEARCH

Do Not Attempt Resuscitation Order Rates in Hospitalized Patients With Heart Failure, Acute Myocardial Infarction, Chronic Obstructive Pulmonary Disease, and Pneumonia

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BACKGROUND: Descriptions of do not attempt resuscitation (DNAR) orders in heart failure (HF) are limited. We describe use of DNAR orders in HF hospitalizations relative to other common conditions, focusing on race.

METHODS AND RESULTS: This was a retrospective study of all adult hospitalizations for HF, acute myocardial infarction (AMI), chronic obstructive pulmonary disease (COPD), and pneumonia from 2010 to 2016 using the California State Inpatient Dataset. Using a hierarchical multivariable logistic regression model with random effects for the hospital, we identified factors associated with DNAR orders for each condition. For racial variation, hospitals were divided into quintiles based on proportion of Black patients cared for. Our cohort comprised 399816 HF, 190802 AMI, 192640 COPD, and 269262 pneumonia hospitalizations. DNAR orders were most prevalent in HF (11.9%), followed by pneumonia (11.1%), COPD (7.9%), and AMI (7.1%). Prevalence of DNAR orders did not change from 2010 to 2016 for each condition. For all conditions, DNAR orders were more common in elderly people, women, and White people with significant site-level variation across 472 hospitals. For HF and COPD, hospitalizations at sites that cared for a higher proportion of Black patients were less likely associated with DNAR orders. For AMI and pneumonia, conditions such as dementia and malignancy were strongly associated with DNAR orders.

CONCLUSIONS: DNAR orders were present in 12% of HF hospitalizations, similar to pneumonia but higher than AMI and COPD. For HF, we noted significant variability across sites when stratified by proportion of Black patients cared for, suggesting geographic and racial differences in end-of-life care.

Key Words: acute myocardial infarction ■ chronic obstructive pulmonary disease ■ do not attempt resuscitation ■ heart failure ■ pneumonia

Heart failure (HF) is a widely prevalent, chronic, progressive, and lethal condition.[1] Although therapies have advanced tremendously in recent decades, 40% of hospitalized patients with HF still die within the first year of their diagnosis, and end-stage HF is associated with the worst quality of life among all advanced diseases.[2,3] Moreover, annual costs related to HF exceed $40 billion annually, and over half of this is incurred because of patients with HF spending 1 out of 4 days in the hospital in their last 6 months of life.[4] Accordingly, all major cardiovascular societies endorse provision of high-quality end-of-life care for patients with end-stage HF to facilitate provision of patient-centric care respecting patient preferences and values.[5]

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CLINICAL PERSPECTIVE

What Is New?

- In a large claims data set, do not attempt resuscitation order rates were most prevalent in heart failure (11.9%), followed by pneumonia (11.1%), chronic obstructive pulmonary disease (7.9%), and acute myocardial infarction (7.1%) with no change over time from 2010 to 2016 for each condition.
- For heart failure and chronic obstructive pulmonary disease, there were geographic and racial differences in do not attempt resuscitation order rates as hospitalizations at sites that cared for a higher proportion of Black patients were less likely associated with do not attempt resuscitation orders.

What Are the Clinical Implications?

- These findings highlight that site-level and racial disparities extend to end-of-life care for patients with heart failure.

Nonstandard Abbreviations and Acronyms

DNAR	do not attempt resuscitation
MOR	median odds ratio

Discussions about life-sustaining treatments including do not attempt resuscitation (DNAR) orders are important because success rates of cardiopulmonary resuscitation are exceedingly low in chronic conditions such as HF.[6] Current descriptions of DNAR orders in patients with HF are limited to single-center cohorts or trials that are not representative of real-world practices.[7,8] In addition, how these preferences contrast with other acute and chronic conditions, such as acute myocardial infarction (AMI), pneumonia, and chronic obstructive pulmonary disease (COPD), which share similar symptoms like dyspnea with frequent hospitalizations, is not known. Furthermore, an understanding of patient- and site-level characteristics that are associated with presence of DNAR orders among hospitalized patients with HF can help improve provision of patient-centric care by identifying cohorts that need to be engaged in shared decision making.

Accordingly, we aimed to describe contemporary patterns of resuscitation preferences in a large, diverse cohort of patients hospitalized for HF. Next, we assessed clinical characteristics associated with presence of a DNAR order among hospitalized patients with HF compared with AMI, COPD, and pneumonia. Finally, we examined site-level variation in the presence of such orders to identify opportunities for improvement in provision of patient-centric care for patients with HF, focusing on race as earlier work has suggested differences between Black and White patients.[9]

METHODS

Data Sources

We used the California State Inpatient Database for our study, which has been previously described.[10] Briefly, it includes administrative claims data generated from all nonfederal hospital discharges in the state of California during a given calendar year. It is the only administrative claims data set that captures patient DNAR status within 24 hours of hospitalization.[11] The database includes patient demographics, inpatient claims including primary and secondary diagnostic codes, as well as other salient hospital discharge record information commonly found on inpatient administrative claims. As patient-level data are deidentified, the study was determined to be exempt by the University of Michigan Institutional Review Board. Data cannot be made public as access is by agreement with the Agency of Healthcare Research and Quality.

Study Design, Setting, and Population

This is a retrospective cohort study of hospitalizations from the California State Inpatient Database from January 1, 2010, to December 31, 2016. We included all hospitalizations for adults ≥18 years, with a primary admission *International Classification of Diseases, Ninth Revision, Current Modification* (*ICD-CM-9*) or *International Classification of Diseases, Tenth Revision, Current Modification* (*ICD-CM-10*) revision code for HF, AMI, pneumonia, and COPD as defined by the chronic condition data warehouse (Table S1).[12] We specifically chose these conditions as they represent a chronic cardiac condition (HF), an acute cardiac condition (AMI), chronic lung disease (COPD), and an acute lung disease (pneumonia) to contrast how end-of-life decisions are made between acute and chronic conditions during hospitalization. These 4 conditions share similar symptoms such as dyspnea and are also among the most common causes for hospitalizations. Because all inpatient claims for these patients represent discharge-level records, the unit of analysis was hospitalizations.

We excluded all hospitalizations that were transfers from another hospital, nonacute care encounters, hospitalizations <24 hours, and hospitalizations whose length of stay was >365 days. Exclusions because of transfers or nonacute care encounters were to ensure attribution of DNAR status to the hospital where the index hospitalization had occurred. Very short and long-stay hospitalizations were excluded owing to extremes in clinical complexity and represent a different clinical composition that is not the focus of this study

(Figure 1). To examine hospital site-level variation, we excluded hospitals that, throughout the entire study period, had <120 hospitalizations over 6 years for these conditions.

Covariates

Variables of interest included patient demographics, comorbidities, and site-level characteristics. Patient demographics considered were patient age, sex, race, and ethnicity. Race is self-reported and characterized as White, Black, Native American, Asian, other, or unknown. Other races include individuals belonging to multiple races or not identifying with any of the races listed. Ethnicity was defined as Hispanic versus non-Hispanic. We identified comorbidities using previously validated *ICD-9* or *ICD-10* codes from the chronic conditions data warehouse in any position during the hospitalization. An Elixhauser score at the time of the index hospitalization was also assessed. We also included all-cause rehospitalizations within 30 days before the index hospitalization.

Site-level variables included were availability of palliative care services and cardiac transplant services. A site was classified as a center with palliative care services or with cardiac transplant services if there were *ICD 9/10* codes for these services with any hospitalization included in our analysis during the study period. Because racial disparity in DNAR status was hypothesized to be a site-specific phenomenon, each hospital's proportion of all hospitalizations that treated Black patients was calculated. All hospitals were ranked from lowest to highest proportion of hospitalized Black patients and divided into quintiles.

Outcome

The outcome of interest was the presence of a DNAR order during a hospitalization. The California State Inpatient Database captures presence of a DNAR order within the first 24 hours of hospitalization. This variable has been shown to have an accuracy of 84.3% when compared with chart abstraction in patients with AMI, HF, and pneumonia and has been used in previous work as well.[11,13,14]

Statistical Analysis

Comparison of baseline characteristics was made between hospitalizations among patients with DNAR orders for each of the 4 conditions: HF, AMI, COPD, and pneumonia. For categorical variables we used the χ^2 test, and for continuous variables we used ANOVA. To identify factors associated with presence of a DNAR order during a hospitalization, we used a hierarchical multivariable logistic regression model with a random intercept for the hospital site adjusted for salient and clinically relevant fixed effects covariates including patient demographics, clinical characteristics, and site-level variables. To avoid collinearity, we did not include race in our regression model. Instead, we included the quintile scoring of proportion of Black

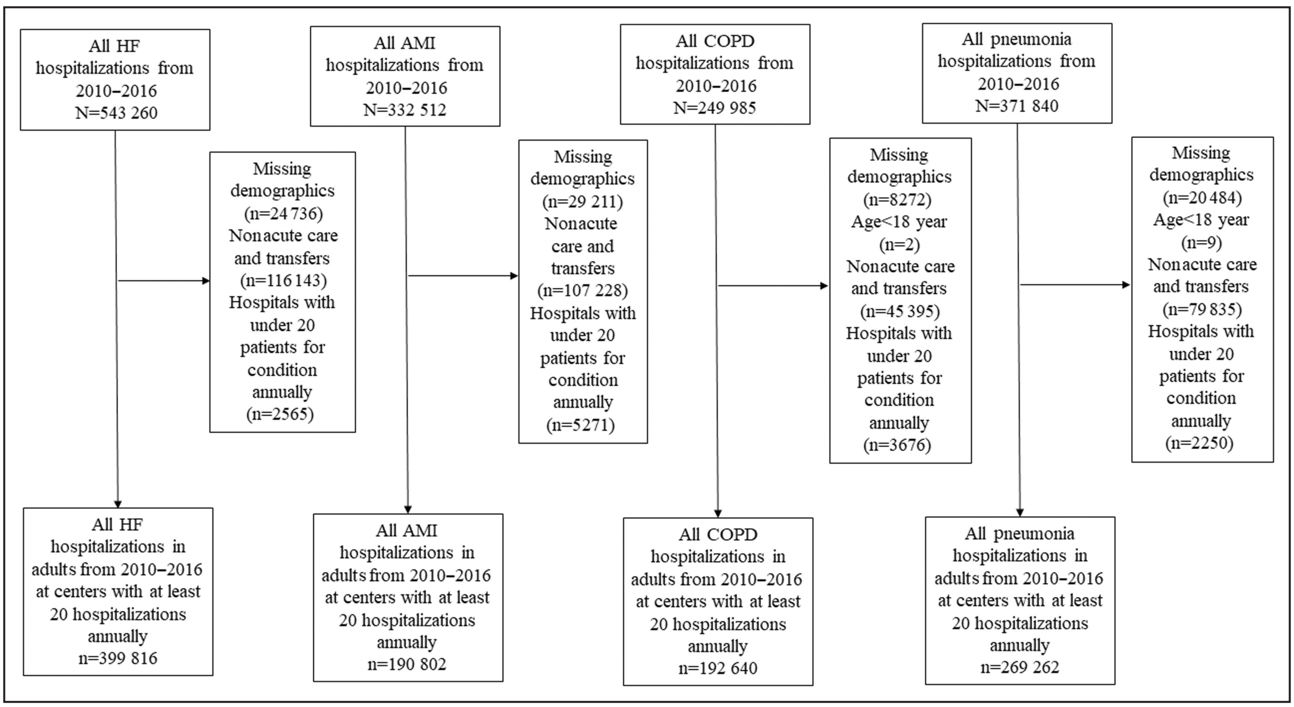


Figure 1. Cohort creation.
AMI indicates acute myocardial infarction; COPD, chronic obstructive pulmonary disease; and HF, heart failure.

patient hospitalizations at a facility as a covariate as it is a measure of race and also takes into account geographical variation across sites.

Ordinarily, the intraclass correlation coefficient can be used to measure the percentage of variation in DNAR attributable to the hospital. However, given the limitations of this measure for dichotomous outcomes and a logistic distribution, the median odds ratio (MOR) was calculated. The MOR is a far more interpretable measure of variation and is always greater than or equal to 1. We used the MOR to summarize the magnitude of site-level variation in the presence of DNAR order. For 2 hospitalizations with the same patient covariates at different sites, the ratio of the odds of having a DNAR order during hospitalization when moving from a higher performing site to a lower performing site were calculated for all possible pairs of hospitalizations. Use of the MOR has been well described for quantifying between site variation in previous work.[15,16] This was performed separately for patients with HF, AMI, COPD, and pneumonia.

All statistical analysis was performed using SAS software Version 9.4 (SAS Institute, Cary, NC), and statistical testing was 2 tailed at the 0.05 significance level.

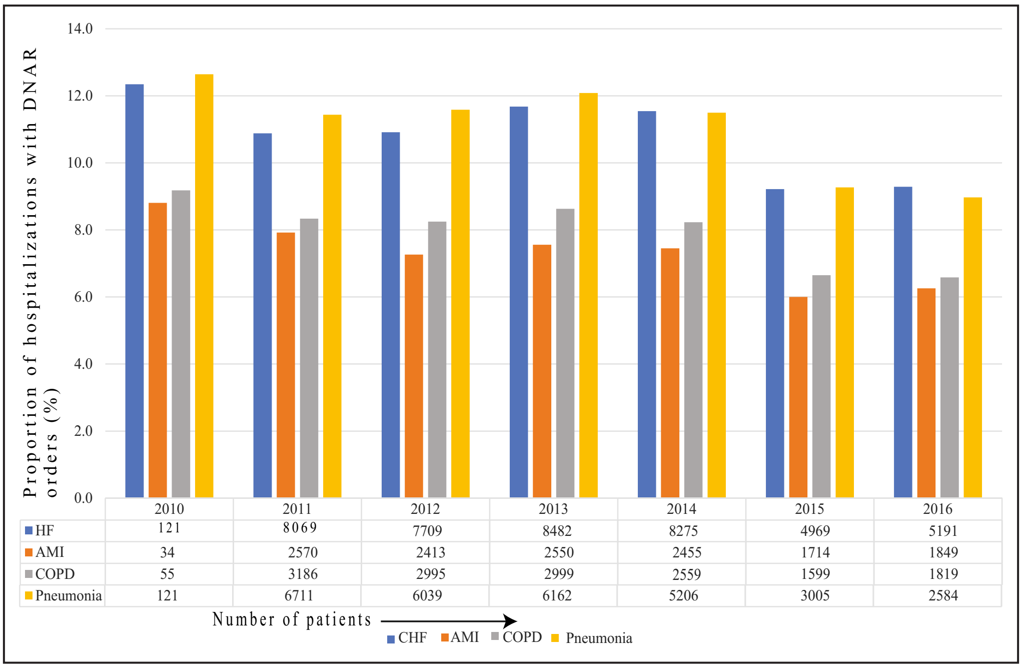
RESULTS

Baseline Characteristics

Our cohort comprised 399 816 hospitalizations for HF, 190 802 hospitalizations for AMI, 192 640 hospitalizations for COPD, and 269 262 hospitalizations for pneumonia from 2010 to 2016. We included 472 hospitals in our site-level analyses. Rate of DNAR order was highest in hospitalizations for HF (n=42 816; 11.9%), followed by pneumonia (n=29 828; 11.1%), COPD (n=15 212; 7.9%), and AMI (n=13 585; 7.1%). Overall, there was no significant change in proportion of hospitalizations with DNAR orders from 2010 to 2016 for each condition (Figure 2).

Table 1 shows baseline characteristics of hospitalizations with DNAR orders with each of the 4 conditions. Across all 4 conditions, hospitalizations with DNAR orders were more common among elderly, female, and White patients. Compared with COPD hospitalizations with DNAR orders, HF hospitalizations with DNAR orders were higher among older patients (83.1±11.0 versus 78.1±10.8 years). Compared with COPD hospitalizations with DNAR orders, prevalence of all comorbidities was substantially higher in HF hospitalizations with DNAR orders.

In contrast to HF hospitalizations, AMI and pneumonia hospitalizations with DNAR orders had similar demographic characteristics. Although prevalence of most comorbidities was higher in HF hospitalizations with DNAR orders, prevalence of irreversible terminal chronic diseases, such as malignancy and dementia, was higher in pneumonia and AMI hospitalizations with DNAR orders. Thirty-day readmission rates were significantly lower for AMI and pneumonia hospitalizations compared with HF hospitalizations with DNAR orders (2.0% versus 2.5% versus 8.4%, respectively).



	2010	2011	2012	2013	2014	2015	2016
HF	121	8069	7709	8482	8275	4969	5191
AMI	34	2570	2413	2550	2455	1714	1849
COPD	55	3186	2995	2999	2559	1599	1819
Pneumonia	121	6711	6039	6162	5206	3005	2584

Figure 2. Trend in DNAR orders from 2010 to 2016.
AMI indicates acute myocardial infarction; HF, heart failure; COPD, chronic obstructive pulmonary disease; and DNAR, do not attempt resuscitation.

Table 1. Baseline Characteristics of Patients With DNAR Order When Hospitalized for HF, AMI, COPD, and Pneumonia

	HF hospitalizations with DNAR	AMI hospitalizations with DNAR	COPD hospitalizations with DNAR	Pneumonia hospitalizations with DNAR
	N=42816	N=13585	N=15212	N=29828
Age, y (mean±SD)	83.1 ±11.0	83.0 ±11.1	78.1 ±10.8	82.0 ±12.0
Female sex	24096 (56.3%)	7407 (54.5%)	9260 (60.9%)	16983 (56.9%)
Race				
White	34259 (80.0%)	10794 (79.4%)	13138 (86.4%)	24783 (83.1%)
Black	2278 (5.3%)	561 (4.1%)	676 (4.4%)	896 (3.0%)
Asian	2921 (6.8%)	1143 (8.4%)	678 (4.5%)	2059 (6.9%)
Other*	3358 (7.8%)	1087 (8.0%)	720 (4.7%)	2090 (7.0%)
Hispanic ethnicity	5007 (11.7%)	1689 (12.4%)	1072 (7.1%)	3466 (11.6%)
Hypertension	34650 (80.9%)	10946 (80.6%)	10607 (70.2%)	20793 (69.7%)
Diabetes	15969 (37.3%)	4983 (36.7%)	3713 (24.4%)	7692 (25.8%)
Chronic kidney disease	27194 (63.5%)	7712 (56.8%)	4239 (27.9%)	11307 (37.9%)
Heart failure	…	7643 (56.3%)	5268 (34.6%)	10075 (33.8%)
Coronary artery disease	23484 (54.8%)	…	4768 (31.3%)	8895 (29.8%)
Dementia	8046 (18.8%)	3558 (26.2%)	2098 (13.8%)	8319 (27.9%)
COPD	12362 (28.9%)	2640 (19.4%)	…	10922 (36.6%)
Obesity	5156 (12.0%)	1081 (8.0%)	1490 (9.8%)	1967 (6.6%)
Chronic liver disease	2154 (5.0%)	674 (5.0%)	335 (2.2%)	822 (2.7%)
Peripheral vascular disease	10751 (25.1%)	3136 (23.1%)	2593 (17.0%)	4765 (16.0%)
Stroke/transient ischemic attack	383 (0.9%)	379 (2.8%)	52 (0.3%)	247 (0.8%)
Mobility Impairment	1365 (3.2%)	578 (4.2%)	318 (2.1%)	1113 (3.7%)
Depression	5663 (13.2%)	1642 (12.1%)	2764 (18.2%)	4512 (15.1%)
Malignancy	2577 (6.0%)	1006 (7.4%)	1272 (8.4%)	4431 (14.8%)
Cardiac arrhythmia	28963 (67.6%)	6589 (48.5%)	5880 (38.6%)	12463 (41.7%)
Psychosis	471 (1.0%)	171 (1.2%)	262 (1.7%)	451 (1.5%)
Cachexia	5161 (12.0%)	1423 (10.5%)	1907 (12.5%)	5149 (17.3%)
Elixhauser score†				
0	59 (0.1%)	134 (0.1%)	8 (0.05%)	334 (1.1%)
1–3	3405 (7.9%)	3485 (25.6%)	4515 (29.7%)	9655 (32.4%)
4–6	20836 (48.7%)	6669 (49.1%)	7940 (52.2%)	14524 (48.7%)
7+	18516 (43.2%)	3297 (24.3%)	2749 (18.1%)	5315 (17.8%)
30-d readmission	3613 (8.4%)	271 (2.0%)	969 (6.4%)	755 (2.5%)
Treated in hospital with palliative care	42750 (99.9%)	13585 (100%)	15149 (99.6%)	29680 (99.5%)
Treated in hospital with cardiac transplants	2685 (6.3%)	906 (6.7%)	838 (5.5%)	1559 (5.2%)

AMI indicates acute myocardial infarction; COPD, chronic obstructive pulmonary disease; DNAR, do not attempt resuscitation; anHF, heart failure.
*Other races include individuals belonging to multiple races or not identifying with any of the other races listed
†Calculated at time of hospitalization.

Overall, 376 hospitals (79.7%) had palliative care services and 14 hospitals (3%) had cardiac transplant services. Nearly all hospitalizations for these conditions were at centers with palliative care services. The proportion of hospitalizations at centers with cardiac transplant services was small and similar across all 4 conditions.

Factors Associated With DNAR Orders

Table 2 provides results of our logistic regression model examining association between patient and site characteristics and presence of DNAR orders in all 4 conditions studied. Demographic factors associated with DNAR orders in HF hospitalizations included increasing age (odds ratio [OR] 2.06 per decade, [95% CI, 2.04–2.08]) and female sex (OR, 1.26 [95% CI, 1.23–1.29]). Hispanic ethnicity was less likely to be associated with presence of DNAR orders (OR, 0.78 [95% CI, 0.75–0.81]). All chronic conditions were associated with higher odds for DNAR orders except diabetes (OR, 0.85 [95% CI, 0.83–0.87]), hypertension (OR, 0.75 [95% CI, 0.73–0.78]), and obesity (OR, 0.79 [95% CI, 0.76–0.82]). However, the proportion of Black patients cared for at the site of hospitalization was strongly associated with the presence of DNAR orders among HF hospitalizations. Compared with hospitals with the highest proportion of Black patients, hospitals with the least proportion of Black patients had an adjusted OR of 3.18 (95% CI, 2.13–4.75) for DNAR order. We also observed noteworthy site-level variation in presence of DNAR orders in HF hospitalizations with an MOR of 2.80.

Factors associated with DNAR orders in COPD hospitalizations were similar to HF hospitalizations. The proportion of Black patients cared for at the site of hospitalization was strongly associated with presence of DNAR orders in COPD hospitalizations. There was also noteworthy site-level variation in presence of DNAR orders in COPD hospitalizations with an MOR of 2.78.

For AMI and pneumonia hospitalizations, odds for DNAR orders were higher with increasing age and for female sex and lower with Hispanic ethnicity. However, dementia was strongly associated with presence of DNAR orders in AMI hospitalizations (OR, 2.48 [95% CI, 2.35–2.61]). There was noteworthy site level variation in presence of DNAR orders with AMI hospitalizations with an MOR of 2.18. In contrast with HF and COPD hospitalizations, hospitals stratified into quintiles based on proportion of Black patients cared for at the site of hospitalization were not significantly associated with DNAR orders in AMI hospitalizations.

For pneumonia hospitalizations, demographic characteristics associated with DNAR orders were similar to the other conditions studied. Dementia (OR, 2.25 [95% CI, 2.17–2.33]) and malignancy (OR, 2.08 [95% CI, 1.99–2.17]) were strongly associated with presence of DNAR orders in hospitalizations for pneumonia. Similar to HF and COPD hospitalizations, hospitals stratified into quintiles based on proportion of Black patients cared for were also a significant predictor for DNAR orders. Sites with the lowest proportion of Black patients cared for had higher odds for DNAR orders compared with sites with the highest proportion of Black patients (OR, 2.70 [95% CI, 1.95–3.75]). There was again substantial site-level variation in presence of DNAR orders in pneumonia hospitalizations with an MOR of 2.39.

DISCUSSION

Our study has 3 important findings. First, using a large, widely representative sample, we observed that a DNAR order was present in 12% of HF hospitalizations with no substantial change over time. These rates were similar to DNAR orders in pneumonia hospitalizations but higher compared with COPD and AMI hospitalizations (7.9% and 7.1%, respectively). Second, across all 4 conditions, DNAR orders were more common among elderly patients and women. However, for HF and COPD hospitalizations, the proportion of Black patients cared for at a hospital exhibited strong association with presence of a DNAR order. For both the acute conditions, pneumonia and AMI, presence of a chronic terminal condition (ie, malignancy or dementia) correlated strongly with presence of DNAR orders. Third, there was large site-level variability in the presence of DNAR orders for all 4 conditions.

Rates of DNAR order in hospitalized patients range widely depending on patient- and disease-associated characteristics despite similar prognosis. Our observation matches previously reported rates of DNAR orders in HF and AMI hospitalizations and is significantly lower than rates reported among patients with malignancies and strokes.[7,8,17] The rates of DNAR orders we noted across all conditions are also substantially less than the previously reported 45-day mortality after hospitalization for these conditions in Medicare beneficiaries (approximately 14% for HF, AMI, and pneumonia).[18] These lower DNAR rates among patients with HF despite greater symptom burden and worse prognosis compared with certain malignancies are likely multifactorial. Despite several medical advancements, patients with HF continue to experience an oscillating clinical course that often leads to difficulty in projecting disease trajectory.[19] Major society recommendations suggest that advanced care planning in HF should occur early in the course of the disease.[20] Previous studies show that the rates of DNAR orders are higher among patients encouraged to fill out advanced care directive documents.[21] However, such discussions often take a substantial amount of time, and current reimbursement systems do not incentivize them, hampering shared decision making regarding end-of-life preferences.

We also noticed a stark contrast in factors associated with presence of DNAR orders across the 4 conditions studied. For both chronic conditions, the proportion of Black patients cared for at a hospital was strongly associated with presence of DNAR orders. For both acute conditions, clinical factors such as presence of a terminal chronic condition like dementia and malignancy play a large role. Racial disparities in medical care for both acute and chronic conditions have been widely described. Several studies have shown that Black patients hospitalized with HF and AMI are less likely to receive guideline-directed therapies.[22–26] Studies have also shown that medical teams that care predominantly for Black patients provide lower quality care than that received by Black patients treated

Table 2. Factors Associated With DNAR Orders in Hospitalizations for HF, AMI, COPD, and Pneumonia

	AMI	HF	COPD	Pneumonia
Adjusted odds ratio (95% CI)				
Age, per 10 y	2.26 (2.22–2.31)	2.06 (2.04–2.08)	1.86 (1.82–1.89)	1.87 (1.85–1.89)
Elixhauser score at index hospitalization	1.13 (1.11–1.15)	1.08 (1.07–1.09)	1.08 (1.06–1.10)	1.09 (1.07–1.10)
Female sex	1.35 (1.29–1.40)	1.26 (1.23–1.29)	1.31 (1.26–1.36)	1.26 (1.23–1.30)
Hispanic ethnicity	0.81 (0.77–0.87)	0.78 (0.75–0.81)	0.67 (0.62–0.72)	0.74 (0.71–0.77)
Hypertension	0.68 (0.64–0.72)	0.75 (0.73–0.78)	0.84 (0.81–0.88)	0.79 (0.77–0.82)
Diabetes	0.88 (0.84–0.92)	0.85 (0.83–0.87)	0.79 (0.76–0.83)	0.81 (0.79–0.84)
Chronic kidney disease	1.35 (1.29–1.42)	1.19 (1.16–1.22)	0.96 (0.91–1.00)	1.06 (1.03–1.10)
Dementia	2.48 (2.35–2.61)	1.83 (1.77–1.89)	1.80 (1.70–1.91)	2.25 (2.17–2.33)
Heart failure	1.25 (1.19–1.31)	…	1.13 (1.08–1.19)	1.09 (1.05–1.13)
Coronary artery disease	…	1.01 (0.99–1.03)	1.01 (0.97–1.06)	1.01 (0.97–1.04)
COPD	1.10 (1.04–1.16)	1.12 (1.09–1.15)	…	1.06 (1.03–1.09)
Obesity	0.68 (0.63–0.73)	0.79 (0.76–0.82)	0.73 (0.68–0.78)	0.74 (0.71–0.79)
Chronic liver disease	1.31 (1.19–1.44)	1.21 (1.15–1.28)	0.96 (0.85–1.09)	1.02 (0.94–1.10)
Peripheral vascular disease	0.97 (0.91–1.02)	1.05 (1.02–1.09)	1.12 (1.05–1.19)	1.07 (1.02–1.12)
Stroke/transient ischemic attack	1.17 (1.03–1.33)	1.21 (1.06–1.37)	1.13 (0.82–1.56)	1.14 (0.97–1.33)
Mobility impairment	1.58 (1.42–1.76)	1.45 (1.36–1.56)	1.51 (1.32–1.73)	1.62 (1.50–1.75)
Depression	1.23 (1.15–1.31)	1.20 (1.15–1.24)	1.16 (1.10–1.22)	1.11 (1.07–1.16)
Cardiac arrhythmias	0.91 (0.87–0.95)	0.98 (0.95–1.00)	1.03 (0.98–1.08)	0.99 (0.96–1.03)
Cachexia	1.39 (1.29–1.50)	1.40 (1.34–1.46)	1.58 (1.49–1.69)	1.53 (1.47–1.60)
Psychosis	1.12 (0.93–1.34)	1.07 (0.96–1.20)	0.86 (0.75–0.98)	0.92 (0.83–1.03)
Malignancy	1.72 (1.58–1.87)	1.32 (1.26–1.39)	1.76 (1.64–1.90)	2.08 (1.99–2.17)
30-d readmission	1.22 (1.06–1.42)	1.34 (1.28–1.39)	1.32 (1.23–1.42)	1.32 (1.21–1.44)
Site level characteristics				
Treated at a hospital with palliative care services	…[†]	1.27 (0.30–5.30)	0.73 (0.20–2.68)	0.47 (0.18–1.23)
Treated at a hospital with cardiac transplant services	1.39 (0.82–2.35)	1.35 (0.70–2.58)	1.70 (0.88–3.29)	1.29 (0.74–2.24)
1st quintile Black patients treated*	1.66 (1.12–2.45)	3.18 (2.13–4.75)	3.19 (2.13–4.79)	2.70 (1.95–3.75)
2nd quintile Black patients treated*	1.27 (0.90–1.80)	2.33 (1.59–3.42)	2.25 (1.53–3.33)	2.02 (1.45–2.80)
3rd quintile Black patients treated*	1.46 (1.03–2.07)	2.08 (1.40–3.09)	1.98 (1.33–2.96)	1.81 (1.29–2.54)
4th quintile Black patients treated*	1.15 (0.79–1.68)	1.62 (1.06–2.47)	1.60 (1.04–2.46)	1.50 (1.04–2.14)

$P<0.05$ considered statistically significant using a hierarchical multivariable logistic regression model with random effects for the hospital. AMI indicates acute myocardial infarction; COPD, chronic obstructive pulmonary disease; and HF, heart failure.

*Hospitals were divided by proportion of Black patients treated at each hospital into quintiles. Reference group was the 5th (highest) quintile of Black patients treated. Proportion of Black patients in each quintile: Quintile 1: 0%–2.0%, Quintile 2: 2.0%–4.1%, Quintile 3: 4.1%–7.6%, Quintile 4: 7.6%–14.4%, Quintile 5: 14.4%–70.0%.

[†]Odds ratio not calculated as all patients with AMI received treatment at a center with palliative care services.

by teams caring for other races as well.[27] Our study shows that these findings extend to end-of-life care in patients with HF too.

Black patients face several barriers that limit access to high-quality care, including geographical segregation to low-income communities. Hospitals providing care to low-income, predominantly Black communities are often safety net hospitals, lacking resources that results in low-quality care.[28,29] Furthermore, poor communication between Black patients and health care professionals,[30,31] lack of trust in health care systems among Black patients,[32,33] and cultural differences[34] likely also contribute to a lack of discussion regarding resuscitation preferences, which leads to low-quality end-of-life care.

Findings from our study are not meant to imply that more patients should elect to be DNAR. We aim to highlight that a low proportion of hospitalized patients with HF are DNAR despite a high associated mortality following a single hospitalization. Furthermore, we noted a substantial site-level and racial variability in these orders not explained by patient-level characteristics. Additionally, presence of palliative care services or availability of cardiac transplant services did not correlate with DNAR status. This highlights that there are opportunities to improve shared decision making regarding end-of-life care to provide care in accordance with patient preferences. Our findings provide a call to action for providers to address advanced care directives for patients with HF in a timely fashion. Ideally, such discussions should be initiated in the outpatient setting and not during an acute hospitalization when decision-making capacity can be hampered. More important, such discussions should be considered standard of care. American College of Cardiology/American Heart Association performance and quality measures for HF that address patient education and therapeutics should consider including shared conversations regarding chronicity and prognosis at least annually as an added measure. Furthermore, targeted efforts that are culturally sensitive to engage Black people and other racial and ethnic minority groups in such conversations should be prioritized to mitigate significant end-of-life differences by race.

Findings from our study should be interpreted in the light of several considerations. First, we used an administrative claims data set that captures only billable codes and does not capture detailed clinical characteristics of these hospitalizations. However, the California State Inpatient Database is a unique data set that captures DNAR orders at hospitalization and reflects real-world practice in large, well-represented sample. Second, we cannot account for unmeasured factors that may have influenced results of our regression model looking at factors associated with DNAR orders. For example, we did not have data on site-level variables such as bed size or hospital location. However, point estimates describing association between presence of DNAR orders and site-level characteristics are large and unlikely to be explained entirely by unmeasured confounders.

CONCLUSIONS

In our study from a large administrative claims data set, rates of DNAR orders in HF remain low. These rates were similar to DNAR orders in pneumonia hospitalizations but higher than in AMI and COPD hospitalizations. There was significant site-level variation in presence of DNAR orders during hospitalizations across these 4 conditions. For both HF and COPD, the proportion of Black patients cared for at a hospital site was strongly associated with presence of DNAR orders. These findings highlight geographic and racial disparities that extend to end-of-life care for patients with HF. Further studies are needed to understand reasons behind differences in adoption of DNAR rates across different patient groups and identify factors that promote discussion of advanced care directives between patients and physicians.

ARTICLE INFORMATION

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Supplemental Material

Table S1

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SUPPLEMENTAL MATERIAL

Table S1. ICD 9 and 10 codes used

Condition	ICD 9 codes	ICD 10 codes
Heart failure	398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 428.xx	I09.81, I11.0, I13.0, I13.2, I25.5, I42.0, I42.5-42.9, I43.x, I50.x, I 50.xx, I50.xxx
Acute myocardial infarction	410.01, 410.11, 410.21, 410.31, 410.41, 410.51, 410.61, 410,71, 410.81, 410.91	I21.01, I21.02, I21.09, I21.11, I21.19, I21.21, I21.29, I21.3, I21.4, I21.9, I21.A1, I21.A9, I22.0, I22.1, I22.2, I22.8, I22.9
COPD	490, 491.0, 491.1, 491.8, 491.9, 492.0, 492.8, 491.20, 491.21, 491.22, 494.0, 494.1, 496	J40, J41.0, J41.1, J41.8, J42, J43.0, J43.1, J43.2, J43.8, J43.9, J44.0, J44.1, J44.9, J47.0, J47.1, J47.9
Pneumonia	481, 482.0, 482.1, 482.2, 482.30, 482.31, 482.32, 482.39. 482.40, 482.41, 482.42, 482.49, 482.82, 482.83., 482.84, 482.89, 482.9, 483.0, 483.1, 483.8, 485, 486	J13, J18.1, J14, J15.0, J15.1, J15.4, J15.3, J15.20, J15.211, J15.212, J15.29, J15.5, J15.6, A48.1, J15.8, J15.9, J15.7, J16.0, J16.8, J18.0, J18.8, J18.9