ORIGINAL RESEARCH

Do Sex Differences Exist in the Establishment of "Do Not Attempt Resuscitation" Orders and Survival in Patients Successfully Resuscitated From In-Hospital Cardiac Arrest?

Sarah M. Perman, MD, MSCE; Brenda L. Beaty, MSPH; Stacie L. Daugherty, MD, MSPH; Edward P. Havranek, MD; Jason S. Haukoos, MD, MSc; Elizabeth Juarez-Colunga, PhD; Steven M. Bradley, MD; Timothy J. Fendler, MD; Paul S. Chan, MD, MSc; American Heart Association Get With The Guidelines-Resuscitation Investigators*

Background—Women have higher utilization of "do not attempt resuscitation" (DNAR) orders during treatment for critical illness. Occurrence of sex differences in the establishment of DNAR orders after resuscitation from in-hospital cardiac arrest is unknown. Whether differences in DNAR use by sex lead to disparities in survival remains unclear.

Methods and Results—We identified 71 820 patients with return of spontaneous circulation (ROSC) after in-hospital cardiac arrest from the Get With The Guidelines–Resuscitation registry. Multivariable models evaluated the association between de novo DNAR (anytime after ROSC, within 12 hours of ROSC, or within 72 hours of ROSC) by sex and the association between sex and survival to discharge accounting for DNAR. All models accounted for clustering of patients within hospital and adjusted for demographic and cardiac arrest characteristics. The cohort included 30 454 (42.4%) women, who were slightly more likely than male participants to establish DNAR orders anytime after ROSC (45.0% versus 43.5%; adjusted relative risk: 1.15 [95% CI, 1.10–1.20]; $P<0.0001$). Of those with DNAR orders, women were more likely to be DNAR status within the first 12 hours (51.8% versus 46.5%; adjusted relative risk: 1.40 [95% CI, 1.30–1.52]; $P<0.0001$) and within 72 hours after ROSC (75.9% versus 70.9%; adjusted relative risk: 1.35 [95% CI, 1.26–1.45]; $P<0.0001$). However, no difference in survival to hospital discharge between women and men (34.5% versus 36.7%; adjusted relative risk: 1.00 [95% CI, 0.99–1.02]; $P=0.74$) was appreciated.

Conclusions—In patients successfully resuscitated from in-hospital cardiac arrest, there was no survival difference between men and women while accounting for DNAR. However, women had a higher rate of DNAR status early after resuscitation (<12 and <72 hours) in comparison to men. **(*J Am Heart Assoc*. 2020;9:e014200. DOI: 10.1161/JAHA.119.014200.)**

Key Words: cardiac arrest • disparity • DNAR • DNR • sex

In the United States, in-hospital cardiac arrest affects ≈200 000 individuals per year, with significant survival variability observed among hospitals.[1,2] Sex differences have been uncovered in varying aspects of acute cardiac care,[3–5] but how these demographic factors contribute to variability in cardiac arrest outcomes remains an active area of investigation. "Do not attempt resuscitation" (DNAR) orders have been associated with poor survival to hospital discharge after cardiac arrest. How sex differences affect the utilization of DNAR orders in post–cardiac arrest care is relatively unknown, and whether overall differences exist in rates of survival to hospital discharge by sex remains unclear. We hypothesized that there is significant variability by sex in the utilization and timing of DNAR orders in patients successfully

From the Department of Emergency Medicine (S.M.P., J.S.H.), Adult and Child Consortium for Health Outcomes Research and Delivery Science (B.L.B., S.L.D., E.J.-C.), and Division of Cardiology (S.L.D.), University of Colorado School of Medicine, Aurora, CO; Departments of Medicine (E.P.H.) and Emergency Medicine (J.S.H.), Denver Health Medical Center, Denver, CO; Department of Epidemiology, Colorado School of Public Health, Aurora, CO (J.S.H.); Minneapolis Heart Institute and Minneapolis Heart Institute Foundation, Minneapolis, MN (S.M.B.); Department of Cardiology, Mid America Heart Institute, Kansas City, MO (T.J.F., P.S.C.).

An accompanying Table S1 is available at https://www.ahajournals.org/doi/suppl/10.1161/JAHA.119.014200

*A complete list of the American Heart Association Get With The Guidelines–Resuscitation investigators can be found in the Appendix at the end of the article.

Correspondence to: Sarah M. Perman, MD, MSCE, 12401 E. 17th Avenue, Aurora, CO 80045. E-mail: sarah.perman@cuanschutz.edu

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Clinical Perspective

What Is New?

- This study found that women have a greater likelihood of "do not attempt resuscitation" use anytime after in-hospital cardiac arrest and, most notably, greater incidence of earlier establishment of a "do not attempt resuscitation" order (defined as within 72 hours after return of spontaneous circulation).

What Are the Clinical Implications?

- Adhering to evidence-based guidelines may reduce differences in rates of early "do not attempt resuscitation" order implementation in patients after cardiac arrest and thus may reduce disparities in the incidence and timing of establishment of novel "do not attempt resuscitation" orders.

resuscitated from an in-hospital cardiac arrest and that these differences will translate into survival differences between men and women.

Prior studies of women who experienced cardiac arrest have shown variability in survival outcome, with studies showing both similar or reduced rates of survival in comparison to men[6–11]; however, few of these studies have accounted for the establishment of DNAR. This detail is relevant given that establishment of DNAR is associated with worse survival outcomes with cardiac arrest and lower utilization of potentially critical interventions and procedures that could improve the likelihood of survival.[12] In other aspects of critical illness, investigators have found that women have more frequent and often earlier utilization of DNAR. This use has been defined in advanced heart failure and sepsis, for which women experience higher rates of DNAR and early DNAR use.[13,14] The utilization and timing of DNAR by sex in in-hospital cardiac arrest has yet to be determined.

We sought to understand how patient sex affects the establishment of DNAR and, if a difference is appreciated, how DNAR affects survival to hospital discharge for women who have had cardiac arrest. Using the GWTG-R (Get With The Guidelines–Resuscitation) registry, we hypothesized that women would have more frequent early DNAR use and, as a result, worse overall survival to hospital discharge after in-hospital cardiac arrest.

Methods

Because of the sensitive nature of the data collected for this study, requests to access the data set from qualified researchers trained in human subject confidentiality protocols may be sent to GWTG-R (email: GWTGResuscitationResearch@heart.org).

Study Design

We performed a secondary analysis of the GWTG-R registry, which is a prospective, hospital-based, clinical registry of patients with in-hospital cardiac arrest in the United States. The design and maintenance of the registry has been described in detail previously.[15] Briefly, the registry consists of patients with cardiac arrest, identified as loss of palpable central pulse, apnea, and impaired consciousness. Patients who have received cardiopulmonary resuscitation and meet the definition of cardiac arrest, as defined by Utstein criteria,[16] are included. Specially trained personnel at each institution are charged with data abstraction from the medical record and inclusion in the GWTG-R database. To ensure that all cases are captured, multiple sources of case identification are explored, including hospital code logs, centralized collection of cardiac arrest flow sheets, inventory of code carts, and review of hospital-based billing for code drugs.[15] The registry is based on standardized Utstein definitions for clinical variables and outcomes.[16]

This study was approved by the Colorado Multiple Institutional Review Board with a waiver of the requirement for informed consent, as the study used deidentified data.

Study Population

We identified 127 172 adult patients (≥18 years of age) with an incident cardiac arrest event between April 1, 2006, and December 31, 2016, that achieved return of spontaneous circulation (ROSC), defined as a spontaneous pulse for at least 20 minutes after successful resuscitation (Figure).

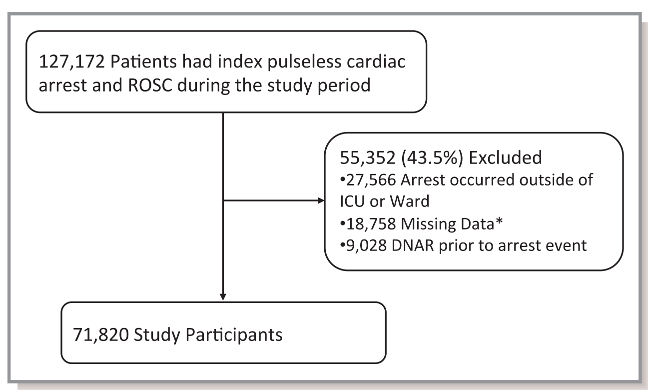

Figure. Patients with in-hospital cardiac arrest, April 1, 2006, to December 31, 2016. *Missing data include "do not attempt resuscitation" (DNAR) status, event duration, discharge status, discharge date, preexisting conditions, initial pulseless rhythm, and sex. ICU indicates intensive care unit; ROSC, return of spontaneous circulation.

Subsequent arrest events for an individual were not included in this cohort as this analysis focused on incident events. The DNAR variable was introduced into the registry on April 1, 2006; therefore, we did not consider patients in the registry before this date. Patients were excluded from the study cohort if the arrest occurred in a procedural area or the emergency department (27 566 patients) or if the patient had a DNAR that was time-stamped before the arrest event (9028 patients). Patients were also excluded if they had missing time data for the following events in order to calculate time to DNAR: time of ROSC, time of establishment of DNR, time of death, or discharge from the hospital (18 758 patients). Our final sample included 71 820 patients from 571 hospitals within the GWTG-R registry (Figure).

Study Outcomes and Variables

This study examined the relationship between patient sex and the primary outcome of de novo establishment of DNAR order at any time after ROSC, within 12 hours of ROSC, and within 72 hours of ROSC. We selected <12 hours after ROSC as a time when patients' goals of care might be altered given the gravity of having a cardiac arrest. The 72-hour time point was selected because this is a time when patients who are comatose after cardiac arrest begin to have neurologic findings that are indicative of poor neurologic recovery.[17,18] In addition, the AHA guidelines recommend that establishing a neurologic prognosis should be delayed until at least 72 hours after ROSC (or 72 hours after normothermia if temperature management was utilized), given that data have shown that neurologic prognosis cannot be predicted with sufficient accuracy before this time.[19,20] The secondary outcome was survival to hospital discharge.

Statistical Analysis

Baseline characteristics including patient demographics (age, sex, race/ethnicity), premorbid medical conditions, and arrest characteristics (initial arrest rhythm, chest compressions, witnessed event, duration of resuscitation) were compared by frequencies for categorical variables. Statistical comparisons of baseline variables between men and women were made using Poisson models with a log link and accounted for clustering of patients within hospitals through the use of robust standard errors.[21] The REPEATED statement in SAS PROC GENMOD was used.

Multivariable models adjusting for demographics and cardiac arrest factors were constructed to examine the associations between sex and de novo establishment of DNAR orders (at any time after ROSC and within 12 or 72 hours of ROSC). All models were adjusted for clustering of patients within hospital, using SAS PROC GENMOD. Log link models with Poisson distribution using robust standard errors and an offset term for time the individual was eligible for the outcome were utilized to get adjusted relative risk (ARR) and 95% CIs for DNAR outcomes. Patient sex was included in all models, regardless of significance. To determine whether there was effect modification between sex and race, the interaction term was included in all models and removed if nonsignificant, as prior literature has shown a positive interaction among race/ethnicity, sex, and DNAR in both sepsis care and heart failure admissions. The following variables were accounted for in all models because they can be associated with prognosis: calendar year of event; age at time of event; cerebral performance category at admission; illness category; preexisting conditions; assisted or mechanical ventilation in place; any vasoactive agent in place; first pulseless rhythm; ventricular fibrillation or pulseless ventricular tachycardia anytime; event witnessed; event duration in minutes; and exposure time between ROSC and DNAR, discharge, or death. Time between ROSC and DNAR, discharge, or death was included to account for the duration of time for which the patient was susceptible to the outcome measure. The preexisting conditions that were accounted for are as follows: acute central nervous system nonstroke event, acute stroke, congestive heart failure on the index admission, congestive heart failure on prior admissions, diabetes mellitus, hepatic insufficiency, hypotension or hypoperfusion, metastatic or hematologic malignancy, metabolic electrolyte abnormality, myocardial infarction during the index admission, myocardial infarction on prior admissions, pneumonia, renal insufficiency, respiratory insufficiency, and septicemia.

To examine the association between sex and survival (as a binary outcome), we again used a log link Poisson model with robust standard errors to account for clustering of patients within hospital. There was no offset term in this model because the outcome was not dependent on length of stay. Adjustment for DNAR was also considered in the survival model, with DNAR dichotomized as *early* (<72 hours after ROSC) or *late/no DNAR* (≥72 hours after ROSC or no DNAR order).

All statistical analyses were conducted with the use of SAS software v9.4 (SAS Institute). All hypothesis tests were 2-sided with a significance level of 0.05.

Results

An initial 127 172 in-hospital cardiac arrest events were identified from the GWTG-R registry (Figure). Events were excluded if they occurred outside of the intensive care unit or ward (27 566), had significant missing data (18 758), or if the individual had a DNAR order in place before the arrest (9028). The final cohort included 71 820 in-hospital cardiac arrest events across 571 hospitals, of which women accounted for 42.4% of the cohort.

In comparison to men, women were older (mean±SD: 65.5±15.8 versus 64.6±15.1 years; P<0.0001), less frequently of non-Hispanic white race (61.7% versus 67.5%, P<0.0001), more likely to have a nonshockable cardiac arrest rhythm (pulseless electrical activity or asystole; 81.6% versus 78.0%, P<0.0001), and more likely to have a noncardiac illness at the time of admission (47.2% versus 41.1%, P<0.0001). In contrast, men had higher incidence of cardiac premorbid conditions, including myocardial infarction and congestive heart failure, compared with women (Table 1).

DNAR by Sex

Of the total cohort, 44.1% (31 695/71 820) had an initial DNAR order placed after ROSC. Within the entire cohort, 45.0% (13 692/30 454) of women and 43.5% (18 003/41 366) of men had a DNAR order after ROSC (unadjusted RR: 1.16; 95% CI, 1.12–1.21). Subject demographics, premorbid conditions, and arrest characteristics by sex and DNAR are reported in Table S1. Adjusting for these factors through a multivariable model, women were 15% more likely to become DNAR at any time after ROSC (RR: 1.15; 95% CI, 1.10–1.20; Table 2).

When analyzing the incidence of DNAR by time from ROSC, a higher proportion of female patients had early DNAR. Of those who had any DNAR during the hospital admission (n=31 695), 51.8% (7096) of women and 46.5% (8367) of men had a DNAR order placed <12 hours after ROSC and 75.9% (10 388) of women and 70.9% (12 759) of men had a DNAR order placed <72 hours after ROSC. When accounting for the same patient and arrest characteristics as described previously, female sex was associated with a higher likelihood of early DNAR <12 hours after ROSC among those who made DNAR orders at any time (ARR: 1.40; 95% CI, 1.30–1.52) and DNAR <72 hours after ROSC (ARR: 1.35; 95% CI, 1.26–1.45; Table 2).

Survival by Sex

Unadjusted rates of survival to hospital discharge were 34.5% for women and 36.7% for men. After accounting for patient and arrest characteristics, except DNAR, female sex was associated with modestly lower rates of survival to hospital discharge (ARR: 0.98 [95% CI, 0.96–1.00]; P=0.04), which were essentially unchanged after additional adjustment for DNAR within 72 hours (ARR: 1.00 [95% CI, 0.99–1.02]; P=0.74). Within this same model, when patients had a DNAR established within 72 hours of ROSC, their chance of surviving was much lower than those without a DNAR placed (RR: 0.15 [95% CI, 0.14–0.17]; P<0.0001; Table 3). The interaction effect between sex and DNR within 72 hours was nonsignificant (P=0.16).

Discussion

In this national registry of in-hospital cardiac arrest, we found that women were more likely to become DNAR after successful resuscitation from an in-hospital cardiac arrest. Notably, among those made DNAR at any time after ROSC, the likelihood of early DNAR, defined as <12 and <72 hours after ROSC, was also higher among women compared with men. However, this variability in DNAR application did not translate to a meaningful survival difference between men and women. When exploring the association between DNAR and survival to hospital discharge, early DNAR was associated with worse survival than subjects who had late DNAR, defined as >72 hours after ROSC, or no DNAR. What is notable about these findings is that despite the higher prevalence of early DNAR, women were as likely to survive to discharge as men.

Studies exploring the incidence of DNAR in episodes of acute, unplanned, critical illness have found similar sex-based trends. Specifically, the incidence of DNAR is higher among women who have had cerebrovascular accidents and unplanned acute surgeries,[22–24] in comparison to men. In these studies, authors attributed the differences in rates of DNAR to women better expressing their wishes before an unplanned illness or to physician bias that resulted in women having increased rates of DNAR use.[23,24] We expanded on these observations to explore incidence and timing of DNAR use in post–cardiac arrest care. Timing of DNAR is not without consequence. Richardson et al found that early DNAR placement is associated with fewer critical interventions and procedures and with reduced survival to hospital discharge.[12] Conversely, it is possible that the early DNAR is indicative of a worse prognosis based on factors that cannot be measured within this study but that were apparent to the care team and family. Although a portion of this variability will be due to patient wishes, establishing an accurate neuroprognosis is critical to ensuring that families are able to align patient wishes with the potential for neurologic recovery.

A prior study based on the GWTG-R registry similarly demonstrated that DNAR placement after ROSC is strongly associated with death before hospital discharge[25]; our study builds on this work by exploring sex differences in the timing of DNAR. Because early DNAR is associated with worse outcomes and we found that women have higher rates of early DNAR, we hypothesized that reducing the difference in early DNAR in women could potentially improve current survival rates for women who have cardiac arrest. Elmer et al found that in patients in the Resuscitation Outcomes Consortium

Table 1. Baseline Characteristics by Patient Sex (n=71 820)

Characteristic	Category	All Patients, n	All Patients, %	Female (n=30 454, 42.4%). n (%)	Male (n=41 366, 57.6%), n (%)	*P* Value*
Year of event	2006	3395	4.7	1457 (4.8)	1938 (4.7)	0.07
	2007	4943	6.9	2219 (7.3)	2724 (6.6)	
	2008	5651	7.9	2398 (7.9)	3253 (7.9)	
	2009	5851	8.2	2527 (8.3)	3324 (8.0)	
	2010	4936	6.9	2142 (7.0)	2794 (6.8)	
	2011	5375	7.5	2296 (7.5)	3079 (7.4)	
	2012	6218	8.7	2676 (8.8)	3542 (8.6)	
	2013	8161	11.4	3421 (11.2)	4740 (11.5)	
	2014	8777	12.2	3654 (12.0)	5123 (12.4)	
	2015	9354	13.0	3863 (12.7)	5491 (13.3)	
	2016	9159	12.8	3801 (12.5)	5358 (13.0)	
Age at time of event, y	18–49	11 014	15.3	4759 (15.6)	6255 (15.1)	<0.0001
	50–59	12 862	17.9	5115 (16.8)	7747 (18.7)	
	60–69	17 638	24.6	7104 (23.3)	10 534 (25.5)	
	70–79	17 188	23.9	7272 (23.9)	9916 (24.0)	
	80+	13 118	18.3	6204 (20.4)	6914 (16.7)	
Race/ethnicity	Non-Hispanic white	46 708	65.0	18 774 (61.7)	27 934 (67.5)	<0.0001
	Non-Hispanic black	15 938	22.2	7916 (26.0)	8022 (19.4)	
	Hispanic/other/unknown	9174	12.8	3764 (12.4)	5410 (13.1)	
Cerebral performance category at admission	1: Good cerebral performance	32 750	45.6	13 341 (43.8)	19 413 (46.9)	<0.0001
	2: Moderate cerebral disability	10 773	15.0	4817 (15.8)	5956 (14.4)	
	3: Severe cerebral disability	5817	8.1	2653 (8.7)	3169 (7.7)	
	4,5: Coma/brain death	3878	5.4	1594 (5.2)	2296 (5.6)	
	6: Missing	18 601	25.9	8049 (26.4)	10 532 (25.5)	
Illness category	Medical-cardiac	24 726	34.4	10 055 (33.0)	14 671 (35.5)	<0.0001
	Medical-noncardiac	31 369	43.7	14 388 (47.2)	16 981 (41.1)	
	Surgical-cardiac	5952	8.3	2186 (7.2)	3766 (9.1)	
	Surgical-noncardiac	7660	10.7	3252 (10.7)	4408 (10.7)	
	Trauma/other	2113	2.9	573 (1.9)	1540 (3.7)	
Acute CNS nonstroke event		4715	6.6	2095 (6.9)	2620 (6.3)	0.006
Acute stroke		2875	4.0	1262 (4.1)	1613 (3.9)	0.10
CHF this admission		12 420	17.3	5115 (16.8)	7305 (17.7)	0.003
CHF prior admission		15 759	21.9	6548 (21.5)	9211 (22.3)	0.01
Diabetes mellitus		24 785	34.5	10 586 (34.8)	14 199 (34.3)	0.26
Hepatic insufficiency		5942	8.3	2222 (7.3)	3720 (9.0)	<0.0001
Hypotension/hypoperfusion		17 614	24.5	7504 (24.6)	10 110 (24.4)	0.57
Metastatic/hematologic malignancy		8096	11.3	3492 (11.5)	4604 (11.1)	0.22
Metabolic electrolyte abnormality		13 668	19.0	5926 (19.5)	7742 (18.7)	0.03

Continued

Table 1. Continued

Characteristic	Category	All Patients, n	All Patients, %	Female (n=30 454, 42.4%). n (%)	Male (n=41 366, 57.6%), n (%)	*P* Value*
MI this admission		10 132	14.1	3786 (12.4)	6346 (15.3)	<0.0001
MI prior admission		10 334	14.4	3661 (12.0)	6673 (16.1)	<0.0001
Pneumonia		11 141	15.5	4611 (15.1)	6530 (15.8)	0.03
Renal insufficiency		27 163	37.8	11 107 (36.5)	16 056 (38.8)	<0.0001
Respiratory insufficiency		32 611	45.4	14 023 (46.1)	18 588 (44.9)	0.007
Septicemia		14 027	19.5	6237 (20.5)	7790 (18.8)	<0.0001
Assisted or mechanical vent in place		23 793	33.1	10 133 (33.3)	13 660 (33.0)	0.51
Any vasoactive agent in place		17 838	24.8	7428 (24.4)	10 410 (25.2)	0.03
Induced hypothermia initiated	Yes	3503	4.9	1333 (4.4)	2170 (5.2)	<0.0001
	No/ND	59 499	82.8	25 297 (83.1)	34 202 (82.7)	
	NA	7437	10.4	3230 (10.6)	4207 (10.2)	
	Missing	1381	1.9	594 (2.0)	787 (1.9)	
First pulseless rhythm	Asystole	19 642	27.3	8741 (28.7)	10 901 (26.4)	<0.0001
	PEA	37 441	52.1	16 101 (52.9)	21 340 (51.6)	
	pVT	6841	9.5	2555 (8.4)	4286 (10.4)	
	VF	7896	11.0	3057 (10.0)	4839 (11.7)	
VF or pVT at any time		23 136	32.2	9031 (29.7)	14 105 (34.1)	<0.0001
Event witnessed		61 887	86.2	26 324 (86.4)	35 563 (86.0)	0.15
Compressions		70 770	98.5	30 030 (98.6)	40 740 (98.5)	0.18
Event duration, min	0–5	23 146	32.2	9902 (32.5)	13 244 (32.0)	0.15
	6–10	17 006	23.7	7243 (23.8)	9763 (23.6)	
	11–20	17 118	23.8	7124 (23.4)	9994 (24.2)	
	≥21	14 550	20.3	6185 (20.3)	8365 (20.2)	
Survived to hospital discharge		25 663	35.7	10 491 (34.5)	15 172 (36.7)	<0.0001
Declared DNAR order during this admission		31 695	44.1	13 692 (45.0)	18 003 (43.5)	0.0004
If declared DNAR,† DNAR was established <12 h after ROSC		15 463	48.8	7096 (51.8)	8367 (46.5)	<0.0001
If declared DNAR,† DNAR was established <72 h after ROSC		23 147	73.0	10 388 (75.9)	12 759 (70.9)	<0.0001

CHF indicates congestive heart failure; CNS, central nervous system; NA, not applicable; ND, not documented; DNAR, do not attempt resuscitation; MI, myocardial infarction; PEA, pulseless electrical activity; pVT, pulseless ventricular tachycardia; ROSC, return of spontaneous circulation; VF, ventricular fibrillation.
*All *P* values are adjusted for clustering within site.
†n=31 695.

who had withdrawal of life-sustaining therapy <72 hours after being resuscitated from out-of-hospital cardiac arrest, ≈3.5% of patients may have survived to hospital discharge neurologically intact had guidelines recommending delaying neuroprognostication until 72 hours after achieving normothermia been followed.[26] In this study, investigators also found an association between women and early withdrawal of life-sustaining therapy for neurologic reasons,[26] further supporting our hypothesis that sex differences exists in how patients are managed after cardiac arrest.

Although we were unable to clearly identify the reasons why DNAR was established in this large cohort, we assume that a proportion are due to concerns about poor neurologic recovery. In the study of out-of-hospital cardiac arrest by Elmer et al,[26] overall 38% of the study cohort had withdrawal of life sustaining therapy for neurologic reasons, of which 57% underwent early withdrawal of life-sustaining therapy (<72 hours after ROSC) due to poor perceptions of neurologic recovery. Current guidelines for determining neuroprognostication after cardiac arrest recommend delaying testing and

Table 2. ARR of Establishment of DNAR for Female Versus Male Patients

Characteristic	Denominator	ARR	Lower 95% CI	Upper 95% CI	*P* Value
DNAR at any time	71 820	1.15	1.10	1.20	<0.0001
Of those with DNAR at any time, DNAR <12 h	31 695	1.40	1.30	1.52	<0.0001
Of those with DNAR at any time, DNAR <72 h	31 695	1.35	1.26	1.45	<0.0001

All models adjusted for significant demographic variables, clinical characteristics, arrest characteristics, and length of time at risk for the outcome. ARR indicates adjusted relative risk; DNAR, do not attempt resuscitation.

examination until patients are without the effects of sedating medications, have become normothermic, and have had sufficient time for neurologic recovery.[20] As of 2015, the International Liaison Committee on Resuscitation and the American Heart Association stated that the earliest time when one could establish a neurologic prognosis is 72 hours after arrival at normothermia.[20] Investigators have begun to encourage even longer delays in establishing neuroprognosis because of a cohort of patients, called *delayed awakeners*, who return to prearrest conditions well after 72 hours following normothermia.[27,28] To this end, we a priori selected 72 hours as a cutoff for early DNAR. In our analysis, just >1 in 4 patients had early DNAR, and early DNAR was slightly more common for women. Understanding the contributors to goals of care decisions early after arrest will assist with future guidelines informing quality of care.

Although the variable nature of DNAR utilization found in this study might indicate better end-of-life planning by women or worse prognosis in women, the results of this study have implications for postarrest critical care practice moving forward. Guideline adherence has been found to reduce practice variability, and the provision of post–cardiac arrest care and neuroprognostic practice would benefit from further adherence to expert guideline. In addition, implicit bias has been culprit in previous findings of different practice between men and women; therefore, increasing awareness may reduce unequal practice.[29] We intend for these data to serve as a topic for further investigation to understand the barriers and facilitators to equal healthcare delivery and end-of-life decisions in post–cardiac arrest care.

Table 3. ARR of Survival to Hospital Discharge Utilizing a Multivariable Log Poisson Model With Robust SEs Adjusted For Clustering Within Hospital

Characteristic	ARR	Lower 95% CI	Upper 95% CI	*P* Value
Female	1.00	0.99	1.02	0.74
DNAR status				
No DNAR or DNAR ≥72 h	Referent	. . .	. . .	
DNAR <72 h	0.15	0.14	0.17	<0.0001

All models adjusted for demographic variables, clinical characteristics, arrest characteristics. ARR indicates adjusted relative risk; DNAR, do not attempt resuscitation.

This retrospective study has limitations that must be highlighted. First and foremost, we cannot account for patient preference, which is integral to making end-of-life decisions or decisions about aggressiveness of hospital intervention. More robust qualitative data are necessary to clearly understand the drivers of variability in DNAR use that were uncovered in this study. Understanding patient preference, provider implicit bias, and surrogate decision making in post–cardiac arrest care may be revealing in understanding the phenomenon uncovered in this quantitative study. Second, these data explore DNAR use and not withdrawal of life-sustaining therapy, and families might opt for a DNAR order in case their loved one rearrests but wish to have no restrictions on care. However, prior literature has shown the presence of a DNAR is associated with less aggressive interventions and is not restricted to cardiopulmonary resuscitation in the setting of rearrest.[12] How the establishment of a DNAR order correlates with the decision to withdraw life-sustaining therapy cannot be elucidated from the data maintained in this registry. In addition, we were unable to compare the severity of illness after ROSC between men and women. Understanding the processes, data interpretation, and humanistic properties of complex end-of-life decision making requires granular exploration with qualitative methodology.

Conclusions

In comparison to men, women who experience in-hospital cardiac arrest have a greater likelihood of having a DNAR established anytime after ROSC and early (<12 and <72 hours) after ROSC. This association persisted after accounting for observed differences in demographics and in patient and cardiac arrest characteristics. Despite higher rates of DNAR use, women were as likely to survive to hospital discharge as men. Future studies are needed to determine whether higher rates of early establishment of DNAR orders after ROSC have an effect on women's overall survival from cardiac arrest or reflect more appropriate end-of-life decision making.

Appendix

Get With The Guidelines–Resuscitation Investigators

Anne V. Grossestreuer, Ari Moskowitz, Dana Edelson, Joseph Ornato, Katherine Berg, Mary Ann Peberdy, Matthew Churpek, Michael Kurz, Monique Anderson Starks, Saket Girotra, Zachary Goldberger.

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Disclosures

None.

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SUPPLEMENTAL MATERIAL

Table S1. Characteristics by DNR for Females and Males Separately (n=71820).

		Females (n=30454)			Males (n=41366)		
		DNAR During Admission			DNAR During Admission		
Variable	Category	Yes (N=13692)	No (N=16762)	P-value*	Yes (N=18003)	No (N=23363)	P-value*
Calendar year of event	2006	633 (4.6%)	824 (4.9%)	0.01	780 (4.3%)	1158 (5.0%)	0.001
	2007	925 (6.8%)	1294 (7.7%)		1084 (6.0%)	1640 (7.0%)	
	2008	963 (7.0%)	1435 (8.6%)		1309 (7.3%)	1944 (8.3%)	
	2009	1086 (7.9%)	1441 (8.6%)		1336 (7.4%)	1988 (8.5%)	
	2010	896 (6.5%)	1246 (7.4%)		1130 (6.3%)	1664 (7.1%)	
	2011	1002 (7.3%)	1294 (7.7%)		1262 (7.0%)	1817 (7.8%)	
	2012	1155 (8.4%)	1521 (9.1%)		1457 (8.1%)	2085 (8.9%)	
	2013	1591 (11.6%)	1830 (10.9%)		2110 (11.7%)	2630 (11.3%)	
	2014	1749 (12.8%)	1905 (11.4%)		2372 (13.2%)	2751 (11.8%)	
	2015	1866 (13.6%)	1997 (11.9%)		2583 (14.3%)	2908 (12.4%)	
	2016	1826 (13.3%)	1975 (11.8%)		2580 (14.3%)	2778 (11.9%)	
Age at event in years	18-49	1678 (12.3%)	3081 (18.4%)	<0.001	2014 (11.2%)	4241 (18.2%)	<0.001
	50-59	1986 (14.5%)	3129 (18.7%)		3015 (16.7%)	4732 (20.3%)	
	60-69	3155 (23.0%)	3949 (23.6%)		4435 (24.6%)	6099 (26.1%)	
	70-79	3508 (25.6%)	3764 (22.5%)		4698 (26.1%)	5218 (22.3%)	
	80+	3365 (24.6%)	2839 (16.9%)		3841 (21.3%)	3073 (13.2%)	
Race/Ethnicity	Non-Hispanic White	8703 (63.6%)	10071 (60.1%)	0.001	12423 (69.0%)	15511 (66.4%)	0.001
	Non-Hispanic Black	3503 (25.6%)	4413 (26.3%)		3476 (19.3%)	4546 (19.5%)	

		Females (n=30454)			Males (n=41366)		
		DNAR During Admission			DNAR During Admission		
Variable	Category	Yes (N=13692)	No (N=16762)	P-value*	Yes (N=18003)	No (N=23363)	P-value*
	Hispanic / Other / Unknown	1486 (10.9%)	2278 (13.6%)		2104 (11.7%)	3306 (14.2%)	
Cerebral Performance Category at Admission	1: Good cerebral performance	5626 (41.1%)	7715 (46.0%)	<0.001	7924 (44.0%)	11489 (49.2%)	<0.001
	2: Moderate cerebral disability	2424 (17.7%)	2393 (14.3%)		2949 (16.4%)	3007 (12.9%)	
	3: Severe cerebral disability	1417 (10.3%)	1236 (7.4%)		1694 (9.4%)	1475 (6.3%)	
	4,5: Coma/Brain death	864 (6.3%)	730 (4.4%)		1177 (6.5%)	1119 (4.8%)	
	6: Missing	3361 (24.5%)	4688 (28.0%)		4259 (23.7%)	6273 (26.9%)	
Illness Category	Medical-Cardiac	4200 (30.7%)	5855 (34.9%)	<0.001	5905 (32.8%)	8766 (37.5%)	<0.001
	Medical-Noncardiac	7256 (53.0%)	7132 (42.5%)		8688 (48.3%)	8293 (35.5%)	
	Surgical-Cardiac	582 (4.3%)	1604 (9.6%)		930 (5.2%)	2836 (12.1%)	
	Surgical-Noncardiac	1428 (10.4%)	1824 (10.9%)		1907 (10.6%)	2501 (10.7%)	
	Trauma/Other	226 (1.7%)	347 (2.1%)		573 (3.2%)	967 (4.1%)	
Acute CNS Non-Stroke Event		1016 (7.4%)	1079 (6.4%)	0.02	1324 (7.4%)	1296 (5.5%)	<0.001
Acute Stroke		652 (4.8%)	610 (3.6%)	<0.001	835 (4.6%)	778 (3.3%)	<0.001
CHF Prior Admission		3115 (22.8%)	3433 (20.5%)	0.001	4182 (23.2%)	5029 (21.5%)	0.001
CHF This Admission		2309 (16.9%)	2806 (16.7%)	0.83	3171 (17.6%)	4134 (17.7%)	0.87
Diabetes Mellitus		4882 (35.7%)	5704 (34.0%)	0.009	6386 (35.5%)	7813 (33.4%)	<0.001
Hepatic Insufficiency		1181 (8.6%)	1041 (6.2%)	<0.001	2031 (11.3%)	1689 (7.2%)	<0.001
Hypotension or Hypoperfusion		3853 (28.1%)	3651 (21.8%)	<0.001	5038 (28.0%)	5072 (21.7%)	<0.001

		Females (n=30454)			Males (n=41366)		
		DNAR During Admission			DNAR During Admission		
Variable	Category	Yes (N=13692)	No (N=16762)	P-value*	Yes (N=18003)	No (N=23363)	P-value*
Metastatic / Hematologic Malignancy		1955 (14.3%)	1537 (9.2%)	<0.001	2599 (14.4%)	2005 (8.6%)	<0.001
Metabolic Electrolyte Abnormality		2994 (21.9%)	2932 (17.5%)	<0.001	3964 (22.0%)	3778 (16.2%)	<0.001
MI this Admission		1611 (11.8%)	2175 (13.0%)	0.007	2404 (13.4%)	3942 (16.9%)	<0.001
MI Prior Admission		1711 (12.5%)	1950 (11.6%)	0.04	2863 (15.9%)	3810 (16.3%)	0.35
Pneumonia		2284 (16.7%)	2327 (13.9%)	<0.001	3252 (18.1%)	3278 (14.0%)	<0.001
Renal Insufficiency		5509 (40.2%)	5598 (33.4%)	<0.001	7869 (43.7%)	8187 (35.0%)	<0.001
Respiratory Insufficiency		6885 (50.3%)	7138 (42.6%)	<0.001	8830 (49.0%)	9758 (41.8%)	<0.001
Septicemia		3306 (24.1%)	2931 (17.5%)	<0.001	4032 (22.4%)	3758 (16.1%)	<0.001
Assisted or Mechanical Vent		4900 (35.8%)	5233 (31.2%)	<0.001	6284 (34.9%)	7376 (31.6%)	<0.001
Any Vasoactive Agent		3632 (26.5%)	3796 (22.6%)	<0.001	4928 (27.4%)	5482 (23.5%)	<0.001
Induced hypothermia initiated	Yes	718 (5.2%)	615 (3.7%)	<0.001	1177 (6.5%)	993 (4.3%)	<0.001
	No / Not Documented	11218 (81.9%)	14079 (84.0%)		14637 (81.3%)	19565 (83.7%)	
	N/A	1534 (11.2%)	1696 (10.1%)		1945 (10.8%)	2262 (9.7%)	
	Missing	222 (1.6%)	372 (2.2%)		244 (1.4%)	543 (2.3%)	
First Pulseless Rhythm	Asystole	4120 (30.1%)	4621 (27.6%)	<0.001	4932 (27.4%)	5969 (25.5%)	<0.001
	Pulseless Electrical Activity (PEA)	7740 (56.5%)	8361 (49.9%)		10112 (56.2%)	11228 (48.1%)	
	Pulseless Ventricular Tachycardia	861 (6.3%)	1694 (10.1%)		1474 (8.2%)	2812 (12.0%)	

		Females (n=30454)			Males (n=41366)		
		DNAR During Admission			DNAR During Admission		
Variable	Category	Yes (N=13692)	No (N=16762)	P-value*	Yes (N=18003)	No (N=23363)	P-value*
	Ventricular Fibrillation (VF)	971 (7.1%)	2086 (12.4%)		1485 (8.2%)	3354 (14.4%)	
VFib or Pulseless VTach at any time		3641 (26.6%)	5390 (32.2%)	<0.001	5391 (29.9%)	8714 (37.3%)	<0.001
Event Witnessed		11686 (85.3%)	14638 (87.3%)	<0.001	15190 (84.4%)	20373 (87.2%)	<0.001
Compressions		13572 (99.1%)	16458 (98.2%)	<0.001	17845 (99.1%)	22895 (98.0%)	<0.001
Event duration in minutes	0-5 min	3842 (28.1%)	6060 (36.2%)	<0.001	4860 (27.0%)	8384 (35.9%)	<0.001
	6-10 min	3455 (25.2%)	3788 (22.6%)		4471 (24.8%)	5292 (22.7%)	
	11-20 min	3470 (25.3%)	3654 (21.8%)		4760 (26.4%)	5234 (22.4%)	
	21 min or more	2925 (21.4%)	3260 (19.4%)		3912 (21.7%)	4453 (19.1%)	
Died		12419 (90.7%)	7544 (45.0%)	<0.001	16357 (90.9%)	9837 (42.1%)	<0.001

* All p-values are adjusted for clustering within site