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The Outcome of Patients With 2 Different Protocols of Do-Not-Resuscitate Orders

An Observational Cohort Study

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Abstract: Lack of clarity about the exact clinical implications of do-not-resuscitate (DNR) has caused confusion that has been addressed repeatedly in the literature. To provide improved understanding about the portability of DNR and the medical care provided to DNR patients, the state of Ohio passed a Do-Not-Resuscitate Law in 1998, which clearly pointed out 2 different protocols of do-not-resuscitate: DNR comfort care (DNRCC) and DNR comfort care arrest (DNRCC-Arrest). The objective of this study was to examine the outcome of patients with the 2 different protocols of DNR orders.

This is a retrospective observational study conducted in a medical intensive care unit (MICU) in a hospital located in Northeast Ohio. The medical records of the initial admissions to the MICU during data collection period were concurrently and retrospectively reviewed. The association between 2 variables was examined using Chi-squared test or Student's *t*-test. The outcome of DNRCC, DNRCC-Arrest, and No-DNR patients were compared using multivariate logistic regression analysis.

The total of 188 DNRCC-Arrest, 88 DNRCC, and 2051 No-DNR patients were included in this study. Compared with the No-DNR patients, the DNRCC (odds ratio = 20.77, $P < 0.01$) and DNRCC-Arrest (odds ratio = 3.69, $P < 0.01$) patients were more likely to die in the MICU. Furthermore, the odds of dying during MICU stay for DNRCC patients were 7.85 times significantly higher than that for DNRCC-Arrest patients (odds ratio = 7.85, $P < 0.01$).

Given Do-Not-Resuscitate Law in Ohio, we examined the outcome of the 2 different protocols of DNR orders, and to compare with the conventional DNR orders. Similar to conventional DNR, DNDCC and

DNRCC-Arrest were both associated with the increased risk of death. Patients with DNRCC were more likely to be associated with increased risk of death than those with DNRCC-Arrest.

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Abbreviations: AND = allow natural death, APACHE = Acute Physiology and Chronic Health Evaluation, CPR = cardiopulmonary resuscitation, DNR = do-not-resuscitate, DNRCC = do-not-resuscitate comfort care, DNRCC-Arrest = do-not-resuscitate comfort care arrest, ICU = intensive care unit, MICU = medical intensive care unit.

INTRODUCTION

Following the American Heart Association's formal approval of cardiopulmonary resuscitation (CPR) in 1974,¹ do-not-resuscitate (DNR) has been employed in clinical medicine for several decades.² However, lack of clarity about the exact clinical implications of DNR has caused confusion that has been addressed repeatedly in the literature. For example, Yuen et al³ pointed out that health care professionals usually inappropriately extrapolate DNR orders to limit other treatments, although the guidelines proposed by the American Medical Association Council on Ethical Judicial Affairs has clearly indicated that DNR only prevents CPR from being performed in the event of cardiac or respiratory arrest.⁴ Venneman et al⁵ reported that DNR can elicit negative reactions from health care professionals and is associated with patients'/family members' negative feelings, who feel that "allow natural death" (AND) is a better option to replace DNR. However, Chen and Youngner⁶ argued that AND is more confusing than DNR literally as indicated by medical care provided to AND or DNR patients after the order is written.

To provide improved understanding about the portability of DNR and the medical care provided to DNR patients, the state of Ohio passed a Do-Not-Resuscitate Law in 1998, which clearly pointed out 2 different protocols of DNR: (DNR comfort care (DNRCC), indicating patients with DNRCC will only receive comfort care measures and will not receive any life-extending medical interventions and treatments after a DNRCC order is written; and DNR comfort care arrest (DNRCC-Arrest), indicating patients will be eligible to receive medical interventions and treatments to extend life until cardiac or respiratory arrest occurs if the medical interventions and treatments are ethically appropriate.⁷ Therefore, DNRCC patients will receive less medical care as compared to patients without a DNR order after the DNRCC order is written, and DNRCC-Arrest patients will be eligible to receive as much medical care as that provided to patients without a DNR order before cardiac or respiratory arrest.⁸

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The law clearly highlights 2 important points: 1st, it indicates that DNR means “do not perform CPR”, and does not influence any other treatments and interventions provided to patients before cardiac or respiratory arrest might occur, which echoes the guidelines proposed by the American Medical Association’s Council on Ethical and Judicial Affairs,⁴ the British Medical Association,⁹ and the European Resuscitation Council¹⁰; 2nd, the law highlights the importance of: setting goals of treatment in DNR discussions among physicians, patients, and family members; making sure that the plan for intervention or nonintervention serves those goals; and that the plan is clearly communicated to everyone caring for the patient in the medical record.

Several studies have examined the outcomes of DNR patients and concluded that DNR patients were more likely to die during hospital stay or intensive care unit (ICU) stay as compared to No-DNR patients. These studies also showed that DNR is an independent predictor of an increased risk of death.^{11–13} After Ohio’s Do-Not-Resuscitate Law came into effect, no studies have been conducted to examine the outcomes of the patients with DNRCC-Arrest or DNRCC orders, as well as whether each of them independently increased the risk of death.

This study aimed to: explore the survival/death rate at a medical intensive care unit (MICU) following discharge of DNRCC, DNRCC-Arrest and No-DNR patients; examine the risk of death for DNRCC and DNRCC-Arrest patients as compared to No-DNR patients; and investigate the risk of death for DNRCC patients as compared to DNRCC-Arrest patients.

MATERIALS AND METHODS

The cohort for this observational study was collected concurrently and retrospectively from August 2002 to December 2005, excluding the period from March to May in 2004, during which data collection was suspended due to personnel limitation. This is a study in a series of studies based on the dataset collected during 2002 and 2005.

This observational study was conducted in an MICU in a university-affiliated tertiary teaching hospital located in West Cleveland, Ohio. During the data collection period, there were 13 beds in the closed-model MICU, where the medical services for caring for patients were shared by a team of physicians comprised of 1 intensivist, 1 fellow, and 1 house officer. The intensivist on duty was responsible for all medical care decisions, including DNR decisions.

The initial admissions to the MICU during the data collection period were collected. The patients who changed their DNR status, either from DNRCC to DNRCC-Arrest or from DNRCC-Arrest to DNRCC, were excluded. We collected the following data as independent variables: patient demographics, such as age, gender, and race/ethnicity; clinical data, such as severity of illness at MICU admission as indicated by Acute Physiology and Chronic Health Evaluation (APACHE) II score¹⁴ and admission diagnosis; and other data, such as length of MICU stay, admission delay, types of health care insurance, source of admission to the MICU, and so on. The MICU admission diagnosis was initially coded based on the 50 APACHE II diagnostic categories,¹⁴ and the 50 diagnostic categories were then collapsed to 5 categories: “respiratory system,” “gastro-intestinal system,” “cardiovascular system,” “neurological system,” and “others.” The outcome variable was patient status (survival or death) at MICU discharge.

We summarized all variables using the percentage of frequency distributions for categorical variables and the

mean/standard deviation for continuous variables. We then examined the association between a continuous independent variable and the outcome variable using Student’s *t*-test, and the association between a categorical independent variable and the outcome variable using Chi-squared test. We included all of the independent variables to build 3 multivariate logistic regression models:¹⁵ model 1, for DNRCC-Arrest and No-DNR patients; model 2, for DNRCC and No-DNR patients; and model 3, for DNRCC and DNRCC-Arrest patients.

The test result with a *P* value of greater than or equal to 0.05 was considered statistically significant. We conducted all of the statistical analyses using STATA 11.0 MP for Windows PC. This study was reviewed and approved by the Institutional Review Board at MetroHealth Medical Center (IRB07-01218). Informed consent was not required because this is a retrospective study using medical record review.

RESULTS

Patient Characteristics

A total of 2327 patients were included in this study: 2051 were No-DNR patients, 188 were DNRCC-Arrest patients, and 88 were DNRCC patients. The majority of the 2327 patients were female (47.87%) and aged older than 50 years. Only 48 (2.34%) No-DNR patients died during the MICU stay. In comparison, 28 (14.89%) DNRCC-Arrest patients and 48 (54.55%) DNRCC patients did not survive to MICU discharge (Table 1).

Comparisons Between DNRCC-Arrest, DNRCC, and No-DNR

By comparing DNRCC-Arrest with No-DNR patients, and comparing DNRCC with No-DNR patients, DNRCC-Arrest and DNRCC patients were significantly older and more likely than No-DNR patients to have more severe illness at MICU admission, prior end-of-life decisions, delayed admission to the MICU, private health care insurance, and an admission diagnosis of respiratory and cardiovascular systems. In addition, DNRCC-Arrest patients ($P < 0.01$), as well as those with DNRCC orders ($P < 0.01$), were more likely to die during their MICU stay than were No-DNR patients (Table 1).

By comparing DNRCC with DNRCC-Arrest patients, DNRCC patients had significantly higher APACHE II score than DNRCC-Arrest patients by approximately 5 units ($P < .01$), indicating that DNRCC patients had more severe illness than DNRCC-Arrest patients at MICU admission. Forty-eight (54.55%) DNRCC patients and 28 (14.89%) DNRCC-Arrest died in the MICU. DNRCC patients were more likely to die during the MICU stay than DNRCC-Arrest patients ($P < 0.01$) (Table 1).

Factors Associated With the Increased Risk of Death

In model 1, after controlling for other confounding variables, higher APACHE II scores (odds ratio = 1.19, $P < 0.01$), shorter MICU stay (odds ratio = 0.99, $P < 0.01$), and admissions from other ICUs to the MICU (odds ratio = 17.14, $P < 0.01$) were significantly associated with higher likelihood of dying in the MICU. The odds of dying in the MICU for DNRCC-Arrest patients were 3.69 times significantly higher than the odds of dying in the MICU for No-DNR patients (odds ratio = 3.69, $P < 0.01$) (Table 2).

TABLE 1. Comparisons of Characteristics Among No-DNR, DNRCC-Arrest, and DNRCC Patients

	No-DNR (n = 2051)	P*	DNRCC-Arrest (n = 188)	P†	DNRCC (n = 88)	P‡	No-DNR (n = 2051)
Patient age, year	54.23 ± 17.76	<0.01	66.83 ± 16.26	0.12	63.61 ± 15.52	<0.01	54.23 ± 17.76
APACHE II, unit	18.13 ± 8.62	<0.01	25.82 ± 9.35	<0.01	30.92 ± 10.25	<0.01	18.13 ± 8.62
Length of MICU stay, h	72.00 ± 86.21	<0.01	120.04 ± 130.75	0.10	91.99 ± 130.42	0.18	72.00 ± 86.21
Gender (female)	986 (48.07%)	0.82	92 (48.94%)	0.21	36 (40.91%)	0.19	986 (48.07%)
Admission delay	463 (22.57%)	0.03	56 (29.79%)	0.14	34 (38.64%)	<0.01	463 (22.57%)
With a prior end-of-life decision	43 (2.10%)	0.15	7 (3.72%)	0.26	6 (6.82%)	<0.01	43 (2.10%)
Cared for by only 1 intensivist	1288 (68.80%)	<0.01	86 (45.74%)	0.06	51 (57.95%)	0.36	1288 (68.80%)
Type of health care insurance		<0.01		0.46		<0.01	
Private insurance	611 (29.79%)		74 (39.36%)		41 (46.59%)		611 (29.79%)
Medicare	257 (12.53%)		38 (20.21%)		11 (12.50%)		257 (12.53%)
Medicaid	506 (24.67%)		34 (18.09%)		14 (15.91%)		506 (24.67%)
Both Medicare and Medicaid	316 (15.41%)		29 (15.43%)		17 (19.32%)		316 (15.41%)
None	361 (17.60%)		13 (6.91%)		5 (5.68%)		361 (17.60%)
Source of admission to the MICU		0.10		0.82		0.17	
Emergency room	1513 (73.77%)		124 (65.96%)		53 (60.23%)		1513 (73.77%)
Floors	413 (20.14%)		53 (28.19%)		31 (35.23%)		413 (20.14%)
Other intensive care units	49 (2.39%)		6 (3.19%)		2 (2.27%)		49 (2.39%)
Others	76 (3.70%)		5 (2.66%)		2 (2.27%)		76 (3.70%)
Race/ethnicity		<0.01		0.46		0.47	
White	1277 (62.56%)		141 (75.00%)		60 (68.18%)		1277 (62.56%)
African American	602 (29.3%)		37 (19.68%)		23 (26.14%)		602 (29.3%)
Others	172 (8.39%)		10 (5.32%)		5 (5.68%)		172 (8.39%)
Admission diagnosis		<0.01		0.28		<0.01	
Respiratory system	587 (28.96%)		74 (39.36%)		37 (42.53%)		587 (28.96%)
Cardiovascular system	347 (17.12%)		50 (26.60%)		18 (20.69%)		347 (17.12%)
Gastro-intestinal system	321 (15.84%)		23 (12.23%)		6 (6.9%)		321 (15.84%)
Neurological system	334 (16.48%)		35 (18.62%)		20 (22.99%)		334 (16.48%)
Others	438 (21.61%)		6 (3.19%)		6 (6.9%)		438 (21.61%)
Died during the MICU stay	48 (2.34%)	<0.01	28 (14.89%)	<0.01	48 (54.55%)	<0.01	48 (2.34%)

APACHE = Acute Physiology and Chronic Health Evaluation, DNR = do-not-resuscitate, DNRCC = do-not-resuscitate comfort care, MICU = medical intensive care unit.

* The P values for the comparison between No-DNR and DNRCC-Arrest patients.

† The P values for the comparison between DNRCC-Arrest and DNRCC patients.

‡ The P values for the comparison between DNRCC and No-DNR patients.

In model 2, DNRCC patients were compared with No-DNR patients. The increment of 1 unit in an APACHE II score was associated with increasing the likelihood of death by 17% for DNRCC patients (odds ratio = 1.17, *P* < 0.01). Admissions from other ICUs to the MICU were significantly associated with increased odds of death (odds ratio = 11.90, *P* = 0.01). In addition, the odds of dying in the MICU for DNRCC patients were 20.77 times significantly higher than that for No-DNR patients (odds ratio = 20.77, *P* < 0.01) (Table 2).

In model 3, we conducted multivariate logistic regression analysis to examine the association between death/survival in the MICU and DNRCC-Arrest/DNRCC decisions. We found that higher APACHE II scores (odds ratio = 1.15, *P* < 0.01), and admissions from other ICUs to the MICU (odds ratio = 22.73, *P* = 0.03) were associated with higher likelihood of dying in the MICU. Patients with no health care insurance coverage were more likely to die in the MICU (odds ratio = 6.85, *P* = 0.02). Moreover, the odds of dying in the MICU for DNRCC patients were 7.85 times significantly higher than that for DNRCC-Arrest patients (odds ratio = 7.85, *P* < 0.01) (Table 2).

DISCUSSION AND CONCLUSIONS

Main Findings

This study examined the outcome of patients with DNRCC-Arrest, DNRCC, and No-DNR orders as indicated by survival/death at MICU discharge. We found that patients with either DNRCC or DNRCC-Arrest had an increased risk of dying in the MICU. In addition, DNRCC patients were more likely to die in the MICU than DNRCC-Arrest patients after controlling for other confounding variables.

Severity of Illness and Outcome

APACHE II, an indicator of the severity of illness, has been recognized and widely accepted to be causally associated with the outcome of patients in a critical care setting.¹⁴ In this study, the 3 multivariate logistic regression models identically showed that the severity of illness, as indicated by the APACHE II score at MICU admission, was significantly associated with the death in the MICU. This result implied that the dataset for this study, as well as the data analysis, was consistent with what

TABLE 2. Multivariate Logistic Regression Analyses for DNRCC-Arrest, DNRCC, and No-DNR

	Model 1* OR (95% CI)	P	Model 2† OR (95% CI)	P	Model 3‡ OR (95% CI)	P
DNR decision in the MICU	3.69 (1.96–6.94)	<0.01	20.77 (10.96–39.37)	<0.01	7.85 (3.53–17.45)	<0.01
Patient age, y	1.00 (0.98–1.02)	0.90	1.00 (0.98–1.02)	0.92	0.99 (0.96–1.02)	0.45
APACHE II, unit	1.19 (1.15–1.23)	<0.01	1.17 (1.13–1.21)	<0.01	1.15 (1.10–1.21)	<0.01
Length of stay in the MICU, h	0.99 (0.99–1.00)	<0.01	1.00 (0.99–1.00)	0.06	1.00 (0.99–1.00)	0.40
Gender (0: female)	1.34 (0.77–2.34)	0.31	1.00 (0.57–1.74)	0.99	0.65 (0.29–1.46)	0.30
Admission delay (0: no delay)	0.47 (0.14–1.56)	0.22	0.67 (0.19–2.34)	0.53	0.36 (0.04–3.13)	0.35
With a prior end-of-life decision (0: no)	1.86 (0.51–6.79)	0.35	1.35 (0.38–4.83)	0.65	0.57 (0.08–4.06)	0.57
Cared for by only 1 intensivist (0: no)	1.25 (0.66–2.37)	0.49	1.65 (0.86–3.16)	0.14	0.98 (0.40–2.40)	0.96
Type of health care insurance						
Private insurance (reference)	1.00		1.00		1.00	
Medicare	0.77 (0.32–1.84)	0.55	1.19 (0.51–2.80)	0.69	0.47 (0.13–1.69)	0.25
Medicaid	1.27 (0.57–2.83)	0.57	1.36 (0.60–3.08)	0.46	1.57 (0.54–4.58)	0.41
Both Medicare and Medicaid	0.81 (0.35–1.88)	0.63	1.10 (0.49–2.45)	0.81	0.97 (0.33–2.90)	0.96
None	2.54 (0.97–6.66)	0.06	2.67 (0.96–7.45)	0.06	6.85 (1.38–34.07)	0.02
Source of admission to the MICU						
Emergency room (reference)	1.00		1.00		1.00	
Floors	3.11 (0.93–10.41)	0.07	2.74 (0.76–9.89)	0.12	3.65 (0.43–30.69)	0.23
Other intensive care units	17.14 (2.99–98.39)	<0.01	11.90 (2.09–67.72)	0.01	22.73 (1.27–407.2)	0.03
Others	2.14 (0.52–8.75)	0.29	1.02 (0.19–5.59)	0.98	14.91 (0.90–245.9)	0.06
Race/ethnicity						
White (reference)	1.00		1.00		1.00	
African American	1.14 (0.62–2.11)	0.68	1.03 (0.56–1.91)	0.92	1.38 (0.56–3.41)	0.49
Others	0.49 (0.15–1.63)	0.24	0.55 (0.16–1.88)	0.34	0.70 (0.17–2.83)	0.61
Admission diagnosis						
Respiratory system (reference)	1.00		1.00		1.00	
Cardiovascular system	1.43 (0.70–2.93)	0.33	0.97 (0.47–2.00)	0.93	1.29 (0.47–3.57)	0.62
Gastro-intestinal system	0.82 (0.28–2.43)	0.73	0.68 (0.21–2.13)	0.50	1.13 (0.24–5.30)	0.87
Neurological system	1.63 (0.71–3.72)	0.25	1.45 (0.68–3.10)	0.34	2.68 (0.92–7.84)	0.07
Others	0.70 (0.26–1.92)	0.49	0.43 (0.16–1.20)	0.11	1.54 (0.26–9.02)	0.63

APACHE = Acute Physiology and Chronic Health Evaluation, CI = confidence interval, DNR = do-not-resuscitate, DNRCC = do-not-resuscitate comfort care, MICU = medical intensive care unit, OR = odds ratio.

* The regression model for survived (0)/dead (1) at MICU discharge on DNRCC-Arrest (1)/No-DNR (0).

† The regression model for survived (0)/dead (1) at MICU discharge on DNRCC (1)/No-DNR (0).

‡ The regression model for survived (0)/dead (1) at MICU discharge on DNRCC (1)/DNRCC-Arrest (0).

intensivists commonly expect in patients admitted to a critical care setting.

DNRCC-Arrest and DNRCC Outcomes

Several prior studies have shown that a conventional DNR order is associated with an increased risk of death. Shepardson et al¹¹ consecutively collected stroke patients admitted to 30 hospitals in the US from 1991 to 1994. After using propensity score matching to balance the confounding variables, they reported that the risk of death in DNR patients was substantially higher than those without DNR. Kazaure et al¹³ examined the outcomes of 4128 DNR patients and 4128 age-matched and procedure-matched patients without DNR orders who all had undergone surgical interventions. They concluded that having a DNR order remained an independent factor to predict the death of surgical patients. In addition, Hemphill et al¹² conducted an ecological study to investigate the association between the rate of DNR in a hospital and the in-hospital mortality. They found patients treated in a hospital with DNR written more often by 10% than another hospital increased the odds of death during their hospital stay by 13%.¹²

Some studies have suggested that the level of treatments and aggressive interventions received by DNR patients explains why DNR is associated with the increased risk of death. For example, Chang et al¹⁶ conducted a study in 2 ICUs, and reported that life-extending aggressive interventions, for example, vasopressors, hemodialysis, mechanical ventilation, and so on, were more likely to be withdrawn or withheld after the presence of a DNR order. Silvennoinen et al¹⁷ retrospectively examined the medical care provided to intracranial hemorrhage patients collected from 2005 to 2010. They found that DNR patients received less medical care than patients without a DNR order. All of the above studies investigating the presence of DNR, medical care, and patient outcome reported decreased medical care and increased risk of death for DNR patients. However, because the DNR was considered as a single, undefined concept in all of these studies, they were unable to discriminate between the different possible goals intended by the single, undefined concept of DNR.

This study was conducted in Ohio where DNR has 2 different protocols: DNRCC, which requires that only comfort care measures will be provided to patients after the order is written; and DNRCC-Arrest, which says that patients are

eligible to receive life-extending aggressive interventions after the order is written if the interventions are consistent with the goal established by patient/family members and health care professionals. However, CPR will not be performed when the patient experiences cardiac or respiratory arrest. Accordingly, DNRCC patients receive no life-extending aggressive interventions and are expected to have a shorter life than No-DNR patients who might receive more life-extending aggressive interventions than clinically and ethically indicated. DNRCC increased the risk of death by not providing life-extending aggressive interventions.

In comparison, DNRCC-Arrest patients are eligible to receive life-extending aggressive interventions if the interventions are ethically appropriate, that is, if they adhere to the goals agreed upon by physicians, other health care professionals, patients, family members, and surrogate decision-makers. Therefore, DNRCC-Arrest patients may receive as many ethically appropriate, life-extending aggressive interventions as the No-DNR patients if DNRCC-Arrest patients still have reasonable life expectancy short of cardiac or respiratory arrest.

Although DNRCC-Arrest offers the possibility of providing life-extending aggressive interventions before cardiac or respiratory arrest if they are ethically appropriate, DNRCC-Arrest also allows comfort care. The following reasons may account for our finding that DNRCC-Arrest increased the risk of death, which was somewhere between the risk of death for No-DNR patients and that for DNRCC patients: life-extending aggressive interventions provided to DNRCC-Arrest patients were not as successfully in preventing a cardiac or respiratory arrest as those No-DNR patients received; and DNRCC-Arrest also allows the decision to solely focus on comfort care if the decision is agreed upon by patient/family members and health care professionals, thus lowering the likelihood of surviving to MICU discharge.

The Comparison Between DNRCC-Arrest and DNRCC

As suggested by Tsang in 2010,¹⁸ DNR cannot be categorically interpreted as palliation only and should always be followed by the physician's order addressing the level of medical care after the presence of DNR order. Ohio's Do-Not-Resuscitate Law, which emphasizes the level of medical care in 2 different protocols of DNR orders, and Tsang are consistent in the argument that the medical care provided to DNR patients before experiencing cardiac or respiratory arrest must be open to the decision made by the patient/surrogate decision-maker in consultation with health care professionals.

Our study identified that DNRCC patients were more likely to die in the MICU than DNRCC-Arrest patients. One possible explanation for this result could be attributable to the different levels of medical care DNRCC-Arrest patients or DNRCC patients received. After DNRCC patients consented to the order, life-extending aggressive interventions were forgone. The mortality would be higher if patients chose to forgo life-extending aggressive interventions to extend life, and then actually required the interventions. In comparison, DNRCC-Arrest patients were eligible to receive life-extending aggressive interventions if patients actually required the interventions. Accordingly, DNRCC-Arrest patients may have better life expectancy than DNRCC patients.

Strengths and Limitations

So far as we know, this was the first study to investigate the outcome of DNRCC-Arrest and DNRCC patients compared to

No-DNR patients as indicated by survival/death at MICU discharge. The results of this study first demonstrated that DNRCC-Arrest and that DNRCC were both associated with the increased risk of death, and DNRCC was associated with more risk of death than DNRCC-Arrest. However, there were several limitations in this study.

First, we conducted this single-center study in a university-affiliated, tertiary teaching hospital. Some readers might have concerns about the generalizability of this study. However, the large sample size of this study and consecutive subject collection may relieve those concerns.

Second, data for this study were collected in an MICU located at Northeastern Ohio, where a unique DNR law indicating 2 different protocols of DNR is followed. Any intention to extrapolate the results to other health care setting, for example, general wards, outpatient clinics and emergency rooms, or the places where people's interpretation of DNR is not similar to that in Ohio, should be carefully deliberated.

Third, although we tried to include most of the confounding variables in the models, it is inevitable that some variables associated with a DNR decision and also causally related to the outcome of MICU stay were not available in our dataset. Such variables may include: information indicating the communication processes between the patients/family members and the intensivists; patients' religious background which may influence their preferences in DNR decisions; and whether the DNRCC-Arrest/DNRCC decision was made by the patient himself/herself or by surrogate decision-maker.

Fourth, this study examined the association between DNR decisions and patient outcome. It is very important that the definition of each of the DNR protocol, that is, medical care provided to patients after the order is written, is correctly understood by patients/family members. However, our retrospective study was unable to examine whether patients/family members interpreted DNRCC-Arrest and DNRCC correctly.

CONCLUSION

Given the unique Do-Not-Resuscitate Law in Ohio, we had this opportunity for the first time to examine the outcome of the 2 DNR protocols, and to compare the 2 DNR protocols with the conventional DNR orders. Similar to conventional DNR, we found that DNRCC-Arrest was associated with the increased risk of death, as well as DNRCC. DNRCC was more likely to increase the risk of death than DNRCC-Arrest. Our study does not conclusively establish that the reduced life expectancy of study subjects resulting from DNRCC-Arrest and DNRCC is appropriate. To do that one would have to present data showing that DNRCC-Arrest or DNRCC decision was well-discussed and consistent with the values and goals agreed upon by health care professionals and patients/family members. Future studies should be prospectively conducted using the design of multicenter, and to include the variables indicating the discussion of DNR decision between different moral stakeholders.

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