



## Clinical paper

Code status and resuscitation options in the electronic health record<sup>☆</sup>

Haresh L. Bhatia<sup>a,\*</sup>, Neal R. Patel<sup>a,b</sup>, Neesha N. Choma<sup>c</sup>, Jonathan Grande<sup>d</sup>,  
Dario A. Giuse<sup>a,d</sup>, Christoph U. Lehmann<sup>a,b</sup>

<sup>a</sup> Department of Biomedical Informatics, Vanderbilt University School of Medicine, Nashville, TN, United States

<sup>b</sup> Department of Pediatrics, Vanderbilt University School of Medicine, Nashville, TN, United States

<sup>c</sup> Department of Medicine, Vanderbilt University School of Medicine, Nashville, TN, United States

<sup>d</sup> Informatics Center, Vanderbilt University School of Medicine, Nashville, TN, United States

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## ABSTRACT

**Aim:** The advance discussion and documentation of code-status is important in preventing undesired cardiopulmonary resuscitation and related end of life interventions. Code-status documentation remains infrequent and paper-based, which limits its usefulness. This study evaluates a tool to document code-status in the electronic health records at a large teaching hospital, and analyzes the corresponding data. **Methods:** Encounter data for patients admitted to the Medical Center were collected over a period of 12 months (01-APR-2012–31-MAR-2013) and the code-status attribute was tracked for individual patients. The code-status data were analyzed separately for adult and pediatric patient populations. We considered 131,399 encounters for 83,248 adult patients and 80,778 encounters for 55,656 pediatric patients in this study.

**Results:** 71% of the adult patients and 30% of the pediatric patients studied had a documented code-status. Age and severity of illness influenced the decision to document code-status. Demographics such as gender, race, ethnicity, and proximity of primary residence were also associated with the documentation of code-status.

**Conclusion:** Absence of a recorded code-status may result in unnecessary interventions. Code-status in paper charts may be difficult to access in cardiopulmonary arrest situations and may result in unnecessary and unwanted interventions and procedures. Documentation of code-status in electronic records creates a readily available reference for care providers.

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## 1. Introduction

Resuscitation management in hospitals is driven by the patient's code-status. Discussing the end of life (EoL) decisions prior to clinical deterioration is labor intensive and potentially stressful for both patients and providers; however, it can improve care and quality of life, lead to the end-of-life experience desired by the patient,<sup>1,2</sup> and decrease the cost of care.<sup>3</sup> A recent study showed that the patients who had prepared advance directives received care that was strongly associated with their preferences.<sup>4</sup> While patients may have advance directives for EoL care prepared prior to hospitalization, operationalizing these instructions requires

translating them into a code-status. The establishment of code-status requires first a discussion between a provider and a patient or his designee, exploring the patient's preferences in the case of a cardiopulmonary arrest. The code-status document is subsequently created to describe and share the patients' desires for EoL care in and is important in preventing undesired resuscitation.<sup>5</sup> It provides a predictable environment for patients, families, and providers.<sup>6</sup> Rates of code-status documentation remain low even among terminally ill patients,<sup>7</sup> and racial disparities in the implementation of advanced EoL directives have been observed.<sup>8</sup>

A code-status is only useful if it can be easily located when needed. At Vanderbilt University Medical Center (VUMC), documentation of code-status was previously done on paper and remained elusive for decision-making purposes. Capturing code-status in the hospital electronic health record was anticipated to facilitate better distribution of information and improved decision making.

In 2012, VUMC introduced a tool for electronic documentation of code-status for patients admitted to the hospital. Providers place

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\* Corresponding author at: 2209 Garland Avenue, 400 EBL, Nashville, TN 37232-8340, United States.

E-mail address: [haresh.bhatia@vanderbilt.edu](mailto:haresh.bhatia@vanderbilt.edu) (H.L. Bhatia).

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## CODE STATUS Form

Date 01/02/2012 Time 14:18

PREVIOUS CODE STATUS:

ESTABLISH CODE STATUS AS:

[Link to quick reference guide](#)[Link to policy](#)

- ☐ DO NOT RESUSCITATE (DNR): In the event of a pulseless cardiac arrest resuscitative measures, including endotracheal intubation, are not attempted
- ☐ DO NOT RESUSCITATE (DNR) / DO NOT INTUBATE (DNI): In the event of impending respiratory failure, endotracheal intubation is not attempted. In the event a pulseless cardiac arrest resuscitative measures are not attempted
- ☐ FULL CODE: In the event of a pulseless cardiac arrest resuscitative measures are initiated

## 1. REASONS FOR CODE STATUS ORDER (Check all that apply):

- ☐ Patient's condition in ...
- ☐ Req... by ...p
- ☐ Designated Power of Attorney (POA) or surrogate consistent with patient wishes and best interests.
- ☐ Advance Directive (specify): \_\_\_\_\_
- ☐ Other (specify): \_\_\_\_\_

2. PATIENT'S DECISION MAKING CAPACITY: ☐ Present ☐ Absent ☐ Variable

## 3. Discussion OF CODE STATUS WAS HAS OCCURRED WITH (check all that apply)

- ☐ Patient
- ☐ POA (Power of Attorney for Health Care Decisions)
- ☐ Other (specify): \_\_\_\_\_

Name if not patient: \_\_\_\_\_

## 4. DISCUSSION OF CODE STATUS WAS PERFORMED BY:

- ☐ Primary Attending Physician
- ☐ Consulting Physician (specify): \_\_\_\_\_
- ☐ Fellow (specify): \_\_\_\_\_
- ☐ Resident (specify): \_\_\_\_\_
- ☐ Nurse Practitioner (specify): \_\_\_\_\_
- ☐ Other (specify): \_\_\_\_\_

☐ I am an attending physician☐ Attending MD to approve

Note: Please contact the Help Desk if the attending to approve can not be found in the autocomplete.

Comments:

(Clear)

(insert time)

**Save As Final****Cancel and Exit****Fig. 1.** Code status documentation form lists the five questions that are addressed when provider discusses code status options with a patient.

code-status orders in the Computerized Provider Order Entry system after documenting answers to five questions (Fig. 1). The tool provides links to a user-friendly reference guide and the hospital policy within the body of the documentation form. Completion of the code-status form populates the corresponding code-status field in the electronic health records, indicating the (un)desired interventions in the header of the patient's chart. Completion of the form is optional; if not completed, the code-status field in the electronic health record remains undocumented. Electronic storage enables automatic display of the code-status in handover tools,

provider communication, or other documentation. At the time of readmission, a patient's code-status from the previous encounter automatically populates the field with the prior date and a reminder for verification. The patient may change or re-affirm the status at this time.

The new code-status field offered the opportunity to assess its documentation. Earlier code-status studies have focused on smaller subsets of patient populations,<sup>8,9</sup> often constrained to terminally ill patients.<sup>2</sup> This descriptive study considers the complete inpatient population for a 909-bed university teaching hospital over a period

**Table 1**  
Description of the end-of-life care code (code status) used for this study for respective patient population.

Code	Description	Adult patient	Pediatric patient
Undocumented	Not provided by patient. [Would default to "FULL.CODE".]	X	X
FULL.CODE	Take every measure to resuscitate the patient	X	X
DNR	Do not resuscitate	X	X
DNR.DNI	Do not resuscitate and for impending respiratory failure, do not intubate	X	
LIMITED	The DNR is limited NOT to take one or more of the following steps/actions as requested by patient. - WITHHOLD Antiarrhythmics - WITHHOLD IV Vasoactive Drugs - WITHHOLD Defibrillation/Cardioversion - WITHHOLD Chest Compression - WITHHOLD Ventilation by Mask - WITHHOLD Endotracheal Intubation - WITHHOLD Mechanical Ventilation - WITHHOLD Other CPR measures		X

of one year. The study design allows understanding of the factors influencing the code-status documentation and explores the utilization of the code-status tool. The study was approved by the Vanderbilt IRB after an expedited review.

## 2. Methods

In this retrospective study, we analyze the existing code-status data in the VUMC electronic health records with respect to patient age, gender, race, length of stay (LoS), severity of illness as measured by days in an ICU (ICU-days), death during the visit, proximity of primary residence to the hospital, and code-status updates during the hospital encounter.

We collected encounter data for patients admitted to the Vanderbilt University Hospital (VUH) and Monroe Carrel Jr. Children's Hospital at Vanderbilt (VCH) for 12 months (01-APR-2012–31-MAR-2013). For each encounter, we tracked the code-status attribute (Table 1). In the design of the tool, adult and pediatric providers expressed different needs for code-status states. While adults had the status DNR.DNI (do not resuscitate, do not intubate), the pediatric providers had the option to document a LIMITED status where interventions could be individually declined by patients and families. An undocumented (NULL value) code-status attribute in the patient record indicated that the code-status was not recorded for the patient. VUMC policy treats an undocumented code-status as a desire for the standard of care, which is full resuscitation (FULL.CODE). With a documented FULL.CODE, however, a team knows that a discussion took place and that resuscitation is desired. This understanding is missing for an undocumented code-status.

The adult and pediatric patients' data were analyzed separately. Encounter records for patients admitted before their 18th birthday were included in the pediatric set, the remainder in the adult set.

Some anomalies in the data records required data cleaning:

- Some patients had multiple notes by different providers (resident, attending) documenting the death. Since notes are written after the fact, the time-stamp of the earliest note was taken as the time of death.
- A small proportion (476 of 213,037) of encounter records with duplicate encounter numbers were discarded.

Patients were categorized by code-status, which was then compared to age, number of encounters, LoS, and ICU-days during the 12 months study period. The LoS and ICU-days were summed over all the encounters of an individual patient. Chi-square analysis was used for parameters such as gender, race, ethnicity, etc., while *T*-test was used for the continuous variables like number of encounters, LoS, and ICU-days. We used statistical package R [64-bit version 2.15.2 (2012-10-26)] for statistical analyses and a *p*-value of 0.05 as the threshold for statistical significance.

## 3. Results

There were 83,248 distinct adult patients with 131,399 encounters (average 1.6 per adult patient) and 55,656 distinct pediatric patients with 80,778 encounters (average 1.5 per pediatric patient). Table 2 shows the code-status distribution and survival status at the end of the study for adult and pediatric populations along with the respective proportions.

### 3.1. Adult patients – code status

Adult patients with documented code-status were older. Patients with a recorded FULL.CODE status were younger than those with a DNR (DNR/DNR.DNI). The average age of adult patients with a documented code-status was 15 years higher than those without one (Table 3). Among the patients with a code-status, those with FULL.CODE were almost 11 years older than those with a DNR code (DNR/DNR.DNI).

During the study period, the adult patients with a documented code-status had more encounters (2.6) compared to those without code-status (1.5). Among the adult patients with a code-status, those with FULL.CODE had more encounters (3.1) than those with a DNR code (2.2).

Adult patients with a code-status had over 4 times the LoS compared to those without (13.2 vs. 2.9). Among the adult patients with a code-status, those with FULL.CODE had a mean LoS of 13.9 days compared to 12.8 days for those with a DNR (DNR/DNR.DNI). Adult ICU patients without a code-status (*n* = 8,873) had a mean ICU stay of 5.8 days compared to 8.2 days for those admitted to an ICU with a code-status (*n* = 2,486). Among the adult patients with a code-status, those with FULL.CODE and admitted to an ICU (*n* = 898) had a mean ICU stay of 8.4 days compared to 8.1 days for patients with a DNR code (*n* = 1,588).

#### 3.1.1. Survival status

Among the adult patients who died during the study period, over two thirds (892 of 1,300) had a DNR (DNR/DNR.DNI) code documented. About a third of the adult patients (892 of 2,373) with a DNR code died during the study period, compared to less than 2% (34 of 2,052) of those with a FULL.CODE (Table 2).

### 3.2. Adult patients – demographic distributions

Table 4 shows the association of gender, race, ethnicity, and distance of residence from hospital to the documentation of code-status for adult patients. Men were more likely than women to have a code-status documented, Hispanics were less likely to have

**Table 2**  
Survival status and code status categories.

Cohort	Survival status (% of all patients)	Code status [% of patients with given survival status]				
		Undocumented	FULL.CODE	DNR	DNR.DNI	LIMITED
<b>Adult</b>	All (100)	78,823	2,052	494	1,879	N/A
	83,248	[94.7]	[2.5]	[0.6]	[2.3]	
	Death (1.56)	374	34	322	570	N/A
	1,300	[28.8]	[2.6]	[24.8]	[43.8]	
	Survival (98.44)	78,449	2,018	172	1,309	N/A
	81,948	[95.7]	[2.5]	[0.2]	[1.6]	
<b>Pediatric</b>	All (100)	55,567	9	66	N/A	14
	55,656	[99.8]	[0.02]	[0.12]		[0.03]
	Death (0.35)	137	1	49	N/A	8
	195	[70.3]	[0.52]	[25.1]		[4.1]
	Survival (99.65)	55,430	8	17	N/A	6
	55,461	[99.9]	[0.01]	[0.03]		[0.01]

a code-status documented, and those living farther away from hospital were more likely to have a code-status.

### 3.3. Adult patients – code-changes

There were 1,901 distinct adult patients, who had a change in code-status during the study period with a total of 2,015 changes – this includes those who changed from previously undocumented status. The number of encounters, LoS and ICU-days were 3.9, 18.3 days, and 9.4 days, respectively, for the patients who had a changed code-status during the study; the respective values for those with no code-status change were 1.5, 3.1 days, and 6 days. Table 5 provides the comparison of the number of encounters, LoS and ICU days for the adult patients with and without a change in the code-status – along with respective *p*-values.

### 3.4. Pediatric patients – code status

The average age of pediatric patients with a code-status was 5.8 years as compared to 6.1 years for those without (Table 3). Among the pediatric patients with a code-status, those with a FULL.CODE had an average age of 10.2 years and those with a DNR (DNR/LIMITED) code 5.3 years.

Pediatric patients with a documented code-status had more number of encounters (3.4) compared to those without (1.4). Among the pediatric patients with a code-status, those with a FULL.CODE had fewer encounters (3.2) compared to those with a DNR code (3.5) – but this difference was insignificant.

Pediatric patients with a code-status had almost 16 times the LoS compared to those without (39.9 days vs. 2.5 days). The longer LoS for the pediatric patients with a code-status is mainly attributable to those with a DNR (DNR/LIMITED) since the mean

**Table 3**  
Age, encounters, LoS, and ICU-days for different code status categories [adult (*n* = 83,248) and pediatric patients (*n* = 55,656)].

Parameter	No code status	Some code status	FULL.CODE	DNR/DNR.DNI <sup>a</sup>	p-value
<b>Adult patients</b>					
Avg. age (years)	47.0 <sup>b</sup>	62.2 <sup>c</sup>			<0.01
	47.0 <sup>b</sup>		56.4 <sup>c</sup>		<0.01
Encounters	1.5	2.6		67.2 <sup>c</sup>	<0.01
	1.5		56.4 <sup>c</sup>		<0.01
Length of stay (days)			3.1		<0.01
			3.1	2.2	<0.01
ICU (days)	2.9 <sup>d</sup>	13.3 <sup>d</sup>			<0.01
	2.9 <sup>d</sup>		13.9 <sup>d</sup>	12.8 <sup>d</sup>	<0.01
			13.9 <sup>d</sup>		<0.05
	5.8 <sup>d</sup>	8.2 <sup>d</sup>			<0.01
	5.8 <sup>d</sup>		8.4 <sup>d</sup>	8.1 <sup>d</sup>	<0.01
			8.4 <sup>d</sup>		0.47
<b>Pediatric patients</b>					
Avg. age (years)	6.1 <sup>b</sup>	5.8 <sup>c</sup>			0.67
	6.1 <sup>b</sup>		10.2 <sup>c</sup>		0.14
Encounters		3.4		5.3 <sup>c</sup>	0.09
			10.2 <sup>c</sup>		<0.01
Length of stay (days)	1.4	39.9 <sup>d</sup>	3.2		0.19
	1.4		3.2	3.5	0.86
ICU (days)	2.5 <sup>d</sup>	33.1 <sup>d</sup>			<0.05
	2.5 <sup>d</sup>		17.6 <sup>d</sup>	42.4 <sup>d</sup>	<0.05
			17.6 <sup>d</sup>		<0.01
	11.9 <sup>d</sup>	33.1 <sup>d</sup>			<0.01
	11.9 <sup>d</sup>		13.2 <sup>d</sup>	34.9 <sup>d</sup>	0.75
			13.2 <sup>d</sup>		<0.05

<sup>a</sup> DNR/LIMITED for pediatric patients.

<sup>b</sup> Age calculated at the earliest encounter.

<sup>c</sup> Age calculated at the earliest code-status recorded.

<sup>d</sup> Days indicating avg. of sum over all encounters of individual patients.

**Table 4**  
Chi-square test for association with demographics for adult and pediatric patients. The counts exclude – 53 adult (20 pediatric) patients with unknown gender, 3 adult (1 pediatric) patients with race attribute unpopulated, and 147 adult (60 pediatric) patients with ethnicity attribute unpopulated. [These numbers may not be mutually exclusive].

Parameter	Value	With code status [count (%)]	Without code status [count (%)]	p-Value for Chi-Sq. comparing distributions (with and without CS)
<b>Adult patients</b>				
Gender	M	2,308 (6.2)	34,892 (93.8)	<0.01
	F	2,117 (4.6)	43,878 (95.4)	
Race	Alaskan/Indian	14 (5.2)	256 (94.8)	<0.01
	Asian/Pacific Island	37 (2.7)	1,345 (97.3)	
	Black	624 (4.6)	13,004 (95.4)	
	Unknown/declined	212 (6.7)	2,952 (93.3)	
	White	3,538 (5.5)	61,263 (94.5)	
Ethnicity	Hispanic/Latino	75 (2.7)	2,740 (97.3)	<0.01
	Not Hispanic/Latino	3,642 (5.1)	68,333 (94.9)	
	Declined/unknown	708 (8.5)	7,603 (91.5)	
Dist. from hospital	Within 25 miles	2,103 (4.3)	46,538 (95.7)	<0.01
	>25 miles	2,322 (6.7)	32,285 (93.3)	
<b>Pediatric patients</b>				
Gender	M	54 (0.2)	30,321 (99.8)	0.31
	F	35 (0.1)	25,226 (99.9)	
Race	Alaskan/Indian	0 (0)	222 (100)	0.11
	Asian/Pacific Island	2 (0.2)	1,313 (99.8)	
	Black	13 (0.1)	13,576 (99.9)	
	Unknown/declined	4 (0.1)	4,413 (99.9)	
	White	70 (0.2)	36,042 (99.8)	
Ethnicity	Hispanic/Latino	4 (0.1)	6,695 (99.9)	<0.01
	Not Hispanic/Latino	69 (0.2)	45,526 (99.8)	
	Declined/unknown	16 (0.5)	3,286 (99.5)	
Dist. from hospital	Within 25 miles (40.2 km)	37 (0.1)	40,713 (99.9)	<0.01
	>25 miles (>40.2 km)	52 (0.3)	14,854 (99.7)	

LoS for them was significantly longer (42.4 days) compared to those with a FULL\_CODE (17.6 days). Pediatric patients without a code-status, who were admitted to an ICU ( $n=3,589$ ), had a mean ICU stay of 11.9 days compared to 33.1 days for those ICU patients with a code-status ( $n=75$ ). Among the pediatric patients with a code-status, those with a DNR (DNR/LIMITED) code ( $n=69$ ) had a mean ICU stay of 34.9 days compared to that of 13.2 days for those with a FULL\_CODE.

#### 3.4.1. Survival status

Among the pediatric patients who died during the study period, over a quarter (57 of 195) had a DNR (DNR/LIMITED) code documented. Of all pediatric patients with a DNR code, ~71% (57 of 80) died during the study period, compared to ~11% (1 of 9) of those with a FULL\_CODE (Table 2).

**Table 5**  
LoS and ICU-days for adult and pediatric patients who did/did-not change the Code Status during the study period.

Parameter	Code status changed <sup>b</sup>	Code status not changed <sup>b</sup>	p-Value
<b>Adult patients</b>			
Number of encounters	3.9 <sup>c</sup>	1.5 <sup>c</sup>	<0.01
Length of stay (days)	18.3 <sup>a</sup>	3.1 <sup>a</sup>	<0.01
ICU (days)	9.4 <sup>a</sup>	6.0 <sup>a</sup>	<0.01
<b>Pediatric patients</b>			
Number of encounters	6.2 <sup>c</sup>	1.4 <sup>c</sup>	<0.01
Length of stay (days)	33.1 <sup>a</sup>	2.5 <sup>a</sup>	<0.01
ICU (days)	15.7 <sup>a</sup>	12.3 <sup>a</sup>	0.30

<sup>a</sup> Days indicating avg. of sum over all encounters for individual patient.

<sup>b</sup> Code status change including the change from previous undocumented status.

<sup>c</sup> Avg. number of encounters.

#### 3.5. Pediatric patients – demographic distributions

Table 4 gives the  $p$ -values for association of gender, race, ethnicity, and distance of the primary residence from hospital to the recording of code-status for pediatric patients. Similar to the adult population, Hispanics were less likely to have code-status documented, while those living farther away from hospital appear more likely to have a documented code-status. The association of gender and race was not statistically significant.

#### 3.6. Pediatric patients – code-changes

There were 42 pediatric patients, whose code-status changed during the study period with a total of 44 changes – this includes those who changed from previously undocumented status. The number of encounters, LoS and ICU-days were 6.2, 33.1 days, and 15.7 days, respectively, for the patients who had changed their code-status during the study; the respective values for those who had no change were 1.5, 2.5 days, and 12.3 days. The comparison for ICU-days between the two groups was not statistically significant ( $p$ -value > 0.05). Table 5 provides the comparison of the number of encounters, LoS, and ICU-days for the pediatric patients with and without a change in the code-status – along with respective  $p$ -values.

## 4. Discussion

End of life care decisions are frequently made for individuals with a critical health condition and are often prompted by health care providers, who approach the patient or her kin.

Although screening for advance directives is performed for every patient during the admission process, the additional step of establishing a code-status can be quite time consuming and



may not be feasible for every admitted patient. Establishing a code-status during the admission may not be possible for patients admitted with altered mental status or inability to communicate. Moreover, establishing a code-status on every patient could add unnecessary emotional distress to patients who are admitted for a minor illness or procedure. Therefore, the tool is available for widespread use but the discussion is optional.

Despite the limitations on when a code-status can or should be documented, we saw excellent adoption of the new code-status tool. Moreover, because the new tool was tied to attending verification, all code-status documented were guaranteed to have been reviewed by an attending physician. Further, the information is easily accessible and available for use automatically in handoff tools, white boards, or other documentation forms.

For the adult patient cohort, the age at which a patient (or the kin) opts to limit EoL care, and provides DNR choices, tends to be higher. This finding may reflect a provider preference to initiate EoL discussions for older patients. Younger patients tend to opt for FULL\_CODE, while DNR is preferred by/for the older individuals.

Number of encounters, LoS, and ICU-days indicate a patient's health status. Sicker patients spend longer time in hospital and the ICU. Additionally, these patients may have more hospital visits (indicated by higher number of encounters and longer LoS). Our study shows that adult patients with a recorded code-status have higher number of encounters, longer LoS, and more ICU-days (Table 3). This indicates that a patient's health condition may also influence the EoL care decisions. Patients with FULL\_CODE have a longer LoS and ICU-days compared to those with a DNR (DNR/DNR.DNI) status. This may be because of more aggressive treatment of patients with FULL\_CODE. A similar (though statistically non-significant) trend is observed for the pediatric patient cohort (Table 3). For pediatric patients, therefore, the EoL care decisions appear to be influenced more by the severity of illness than by the age.

The health status of a patient influencing the EoL care decisions is also evident from the number of changes in the code-status by individuals in the adult patient cohort when number of encounters, LoS, and ICU-days are used as proxy for severity of illness. A statistically significant trend of higher number of encounters, LoS, and ICU-days was observed for those who had a change in code-status (Table 5). A similar behavior is observed for pediatric patient cohort as well.

Analysis of survival status (Table 2) indicated that the death rate among those with a DNR (DNR/DNR.DNI/LIMITED) code is higher compared to those with a FULL\_CODE or no documented code. The proportion of death is higher for pediatric patients with a DNR code.

Aggressive medical treatment many not necessarily ease a patient's suffering.<sup>10</sup> Lack of a code-status in the final moments of life may mean unnecessary interventions and procedures, associated with prolonged pain, suffering, and increased avoidable costs. With the introduction this tool, more than 71% of adult patients who died during the admission had a documented code-status, which reduced uncertainty at the time of cardiopulmonary arrest. This study provides the first measure of the presence of code-status in hospitalized patients. Further studies will explore how we can increase the percentage of patients with code-status in the group of patients that expire during their stay.

Usually a code-status is preceded by a discussion between the patient or her kin and the initiating physician. EoL discussions are difficult and stressful for providers, and the utility of a code-status must overcome the provider's inhibition and discomfort to initiate the discussion. Successful EoL decision making may vary based on gender, race, or ethnicity of both patient and provider. Gender,<sup>11</sup> race, and ethnic<sup>12</sup> biases have been reported in the past. An implicit ethnic bias could be the language barrier. In both the adult and

pediatric patient cohorts, Hispanic patients were less likely to have a code-status documented (Table 4).

Distance of residence from the hospital was associated with documented code-status. We suspect that the utility for providers to initiate discussions for patients whose next of kin would have to travel longer distances in the event of an arrest may be higher, thus leading to more provider initiated discussions (Table 4). A selection bias is another possibility. Patients traveling longer distances may have higher severity of illness, necessitating a referral to a tertiary medical center.

In our study, gender, race, and ethnicity were significantly associated with the presence of a code-status (Table 4) in adult patients. This was not the case in pediatric patients. However, analysis of a limited subset of pediatric patients with only 'Black' and 'White' race attributes indicated statistically significant association of race with the outcome.

#### 4.1. Limitations

For the 12 months' study period, the proportion of pediatric patients with a documented code-status was relatively small compared to the adult population. The small numbers may have affected statistical significance of some comparisons.

We limited the scope of this study to the basic analysis of the code-status by patient demographics, preventing a complex cross-section of multiple attributes such as nature of illness. Subsequent studies may be planned for specific combination of attributes of interest, including multivariate logistic models.

The ease of accessibility during the handovers of an electronic code-status, rather than in paper format, is an empirical observation and a logical deduction from the experience with the other electronic health data. With no means to assess the paper-based code-status documentation prior to the introduction of the electronic tool the before-after comparison of the code-status use was not feasible.

An important demographic attribute, the 'Guardianship Status', was not available. Guardianship Status may influence the decision to have code-status recorded especially in the case of very old and pediatric patients. Additionally, we did not analyze LIMITED code-status at individual levels due to the small number of pediatric patients with this status. Another attribute not analyzed was the 'Hospital Service', because it was not available for over 60% of adult (70% for pediatric) patients.

## 5. Conclusion

Availability of advance directives and code-status can be elusive, which can complicate the care delivered to patients during the final moments of life. Absence of a recorded code-status may result in unnecessary interventions. Documenting code-status in electronic records helps to create a ready reference for care providers and facilitates smoother transition of patient care.

To our knowledge, this is the first study attempting to determine the code-status documentation prevalence in electronic health records of a large university hospital system. Reviewing the code-status for all inpatient admissions to our adult and children's hospitals for a year, we observed that for adult patients, age, severity of illness, gender, race, and ethnicity were associated with documented code-status. For the pediatric patients the decision to provide a code-status was associated with the severity of illness and not significantly associated with age.

With the introduction of the code-status tool, 71% of adult patients and 30% of pediatric patients who died had a documented code-status reducing uncertainty and potentially reducing pain, suffering, and cost. Continued efforts are underway to identify

measures that will increase documentation of code-status in populations at highest mortality risk.

### Conflict of interest statement

Author Christoph U. Lehmann receives honoraria for Pediatric Informatics and royalties from Objective Arts.

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