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Authors

Huynh, Thanh N
Kleerup, Eric C
Raj, P
[et al.](#)

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THE OPPORTUNITY COST OF FUTILE TREATMENT IN THE INTENSIVE CARE UNIT

Thanh N. Huynh, MD, MSHS,

David Geffen School of Medicine, UCLA, Department of Medicine, Division of Pulmonary and Critical Care Medicine

Eric C. Klerup, MD,

David Geffen School of Medicine, UCLA, Department of Medicine, Division of Pulmonary and Critical Care Medicine

Prince P. Raj, MHA, and

David Geffen School of Medicine, UCLA, Department of Emergency Medicine

Neil S. Wenger, MD, MPH

UCLA Health Ethics Center, David Geffen School of Medicine, UCLA, Department of Medicine, Division of General Internal Medicine and Health Services Research RAND Health

Abstract

Objective—When used to prolong life without achieving a benefit meaningful to the patient, critical care is often considered “futile.” While futile treatment is acknowledged as a misuse of resources by many, no study has evaluated its opportunity cost, that is, how it affects care for others. Our objective was to evaluate delays in care when futile treatment is provided.

Design—For 3 months, we surveyed critical care physicians in 5 intensive care units (ICUs) to identify patients that clinicians identified as receiving futile treatment. We identified days when an ICU was full and contained at least one patient who was receiving futile treatment. For those days, we evaluated the number of patients waiting for ICU admission more than 4 hours in the emergency department (ED) or more than 1 day at an outside hospital.

Setting—One health system that included a quaternary care medical center and an affiliated community hospital.

Patients—Critically ill patients

Interventions—none

Address correspondence to: Thanh N. Huynh, MD, MSHS, Department of Medicine, Division of Pulmonary and Critical Care Medicine, Box 951690, 37-131 CHS, Los Angeles, CA 90095-1690. Phone number: 310-825-5316, Fax 310-206-8622. thuynh@mednet.ucla.edu.

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Author contributions: Study concept and design: Huynh, Klerup, Wenger. Data collection: Huynh, Raj. Analysis and interpretation of data: Huynh, Klerup, Raj, Wenger. Statistical Analysis: Huynh, Wenger. Drafting of manuscript: Huynh, Wenger. Critical revision of manuscript: Huynh, Klerup, Raj, Wenger. Huynh and Wenger had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

Measurements—Boarding time in the ED and waiting time on the transfer list

Main Results—36 critical care specialists made 6916 assessments on 1136 patients of whom 123 were assessed to receive futile treatment. A full ICU was less likely to contain a patient receiving futile treatment compared to an ICU with available beds (38% v 68%, $p<0.001$). On 72 (16%) days, an ICU was full and contained at least one patient receiving futile treatment. During these days, 33 patients boarded in the ED for >4 hours after admitted to the ICU team, 9 patients waited >1 day to be transferred from an outside hospital, and 15 patients cancelled the transfer request after waiting >1 day. Two patients died while waiting to be transferred.

Conclusions—Futile critical care was associated with delays in care to other patients.

Keywords

futile; opportunity cost; critical care

INTRODUCTION

The intensive care unit (ICU) provides specialized, high-level care to the sickest patients. In an academic medical center, the ICU accepts critically ill patients from the Emergency Department (ED), the hospital ward where they may have decompensated, and from other hospitals when those patients need a higher level of care.¹ The outcome of a critically ill patient depends on timely access to ICU interventions, and a delay in transfer to an ICU is associated with adverse effects.^{2–5} Cardoso *et al* reported that critically ill patients who had to wait for admission to the ICU due to bed unavailability had higher mortality; each hour of waiting in the emergency department (ED) or the general hospital ward was associated with a 1.5% increased risk of ICU death.² Chalfinet *al* reported that critically ill patients boarding longer in the ED had increased hospital length of stay and higher ICU and hospital mortality.³ These studies show that when critical care demand exceeds supply, patient care can be compromised. Thus, critical care is a limited, high intensity resource that requires careful allocation.

The demand for ICU level care has increased dramatically in recent years and a shortage is anticipated in the near future.^{6,7} Nevertheless, critical care is sometimes provided to patients who cannot benefit from it.⁸ While provision of hospice care has increased for dying patients over the past decade in the U.S., so has provision of intensive care in close proximity to death⁹, suggesting that allocation of ICU care to patients who can derive benefit is imperfect. Clinicians commonly consider aggressive treatments that prolong life without achieving an effect that the patient can meaningfully appreciate to be futile treatment. While there is no objective, widely accepted definition of futile treatment and patients and families may not agree with the assessment, studies find physician assessments of futile treatment to be common across critical care settings.^{8,10–12}

Because the supply of critical care is limited, futile critical care may compromise the care received by other patients. Futile treatment may present an *opportunity cost*, defined as the loss of potential gain from other alternatives when one alternative is chosen, if critical care is unavailable for another patient for whom it is indicated. We evaluated the opportunity cost

of futile treatment as perceived by the physician by measuring delays in admission to the ICU from the ED and in ICU transfer from an outside hospital. We hypothesized that providing futile treatment denies critical care access to other patients in need.

METHODS

This study evaluates whether there was an opportunity cost associated with the provision of physician-perceived futile treatment that was quantitated in a comprehensive evaluation of critical care at one healthcare system over a three month period. Details of the definition of futile treatment and the core data collection are described in detail elsewhere¹¹ and summarized here. This study was approved by the UCLA institutional review board (IRB#11-002942-AM-00006).

Setting

This study was performed at a 466-bed quaternary care academic medical center and an academically affiliated 266-bed community hospital. There are five adult ICUs in the quaternary care medical center: a Medical ICU (MICU), a Neurocritical Care Unit (Neuro-ICU), a Cardiac Care Unit (CCU), a Cardiothoracic ICU (CT-ICU) and a Liver Transplant ICU (which declined to participate in the study). The academic community hospital has one mixed use ICU (whose capacity decreased from 22 to 18 when its location moved during the study period). The ED at the quaternary care medical center is a certified level 1 trauma center for the greater Los Angeles area and, on average, sees 130 patients per day, of which 30% are admitted to the hospital and 11% of adult admissions are admitted to the ICU. Due to high occupancy, this ED was in diversion for 731 hours (34%) during our 3 month study period. At the academic community hospital, there are approximately 115 ED visits per day, of which 24% are admitted to the hospital and 6.8% of adult admissions are admitted to the ICU. The studied health system serves as a major referral center for higher level of care in the region.

Assessment of futile critical care

Thirteen clinicians who provide care for critically ill patients were convened for a focus group to discuss whether and to whom they provide futile treatment. During the open-ended discussion, participants were asked to describe patients for whom they provided ICU treatment that they judged to be futile. Audiotapes were transcribed and categories of futile treatment were identified for which there was consensus.

Based on the focus group discussion, a questionnaire was developed to identify patients perceived as receiving futile critical care. For each ICU patient under the physician's care, the attending physician completed a brief paper-and-pencil questionnaire asking whether they perceived the patient was receiving futile treatment, receiving probably futile treatment, or not receiving futile treatment. The definition of "probably futile treatment" was left to the clinician's judgment. Every day from December 15, 2011 through March 15, 2012, research assistants administered the questionnaire to each attending critical care specialist providing treatment in five ICUs in the health system: MICU, Neuro-ICU, CCU, CT-ICU, and academic community hospital mixed use ICU. All clinicians provided informed consent.

Hospital and 6-month outcomes were obtained for all patients and proportions in each futility category were compared using a chi-square test.

Opportunity cost evaluation

Midnight and noon census data were obtained for the five ICU's for the 3-month study period. An ICU was considered "full" and unavailable for new admissions on days when the averaged midnight and noon census of that unit showed less than two available beds (one bed is always reserved as a "code bed"). Census data were merged with daily futility assessments to identify whether there was at least one patient assessed as receiving futile treatment on days when the unit was full. Only actual days of an assessment of futile treatment were included (and not subsequent days if the assessment changed), and assessments of "probably futile treatment" were not considered in the analysis of opportunity cost. The relationship between whether the ICU was full and whether there was a patient in it perceived as receiving futile treatment was evaluated using a chi-square test.

ED boarding time—All ICU admissions from the ED at both hospitals were recorded during the study period. "Boarding time" in the ED was defined as the time between when the ED physician noted the decision to admit the patient (bed control had called the admitting team) and the time of the patient's departure from the ED. While some ED literature suggests that a two hour delay has negative clinical implications¹³, based on critical care clinical experience, boarding time was dichotomized at 4 hours. For each ICU admission from the ED, we computed whether the ED boarding time exceeded four hours. For such patients, we evaluated whether the delayed ICU admission occurred on a day that the ICU was full and whether there was a patient receiving futile treatment in the ICU that day.

Requests for ICU transfer—The number of outside hospital transfer requests, reason for transfer, and ICU requested were collected from the health system transfer center for the 3-month study period. We also collected the number of days between request and transfer, cancellations after transfer request and, when available, the reason why transfer was cancelled. Patients not transferred to the ICU within 1 day of the transfer request were considered "waiting on the transfer list." For each day that a patient waited on the transfer list for ICU admission from an outside hospital, we assessed whether the requested ICU was full and whether there was a patient assessed as receiving futile treatment in that ICU on that day.

RESULTS

During the 3-month study period, 36 critical care clinicians in five ICUs provided care to 1193 patients. After excluding boarders in the ICUs and missed and invalid assessments, 6916 assessments were made on 1136 patients. Of these 1136 patients, 904 (80%) patients never received futile treatment, 98 (8.6%) patients received probably futile treatment, and 123 (11%) patients received futile treatment (11 patients were dropped because they were assessed as receiving futile treatment on the day they were transitioned to comfort

care). These 123 patients received 464 days of futile treatment. Futile treatment assessments accounted for 6.7% of all assessments during the study.

The mortality of patients who were perceived to receive futile treatment was significantly higher than those of patients who were not. For patients who never received futile treatment, the in-hospital mortality was 4.6% and the 6-month mortality was 7.3%. On the contrary, 68% of the patients who were perceived to receive futile ICU treatment died before hospital discharge, 85% died within 6 months and survivors remained in severely compromised health states¹¹.

ICU capacity and whether the ICU contained a patient receiving futile treatment

Over the 92 day study period, there was at least one patient perceived as receiving futile treatment in the ICU on 255 (55%) of the 460 cumulative ICU days. This ranged from 88 of 92 days in the MICU to 15 of 92 days in the CCU. The ICUs were full on 191 (42%) of 460 days, ranging from 18 (20%) days at the Community hospital ICU to 55 (60%) days at the CT-ICU. Overall, ICUs were full and contained a patient receiving futile treatment on 72 of 191 (38%) full days, ranging from 19 of 22 (86%) full days in the MICU to 6 of 52 (11%) full days in the CCU. ICUs were significantly more likely to contain a patient receiving futile treatment on days when they were not full compared to days when they were full (68% versus 38%, $p < 0.001$). (Table 1)

Delayed ICU admission from the ED

During the study period, patients admitted from the ED to the ICU were more likely to wait 4 or more hours in the ED if the target ICU was full compared to not full (61% versus 35%, $p = 0.05$). Median time waiting for ICU admission among the group waiting 4 or more hours was 339 minutes (interquartile range 284–495 minutes). Eighty-one patients were admitted from the ED to the ICU on days when the unit was at capacity and there was a patient receiving futile treatment in that unit (Table 2). Thirty-three of these patients boarded in the ED for over 4 hours after they were officially admitted to the ICU.

Delay of ICU transfer from outside hospitals

There were 163 transfer requests to the 5 study ICUs from outside hospitals during the study period. Of these, 104 patients were transferred within 1 day of the request, 22 patients were transferred after waiting for more than one day, and 37 requests were cancelled (Table 3). Of the 22 patients who had to wait for more than one day, 9 patients spent 16 days waiting to be transferred when the ICU was full and at least one patient was receiving futile treatment in the unit. Of the 37 patients who never transferred, 15 patients waited (for a total of 30 days) when the ICU was full and at least one patient was receiving futile treatment in the unit. Of these 15 patients who cancelled the transfer request after waiting at least one day when the intended ICU was full and contained at least one patient receiving futile treatment, 5 patients were transferred to other hospitals, 3 patients improved and did not require ICU transfer, 4 patients were lost to follow-up, 1 patient was discharged to a skilled nursing facility, and 2 patients died while awaiting transfer.

DISCUSSION

Physicians are beholden to provide the best possible care for their patients and also to use the tools of medicine for their intended purposes. While the principle of justice is fundamental to the practice of medicine¹⁴, it was recognized more than a quarter century ago that in the fragmented U.S. healthcare system resources saved from one patient will not necessarily justly benefit another.¹⁵ Although the number of patients affected was small, this study demonstrates an association between patients receiving non-beneficial critical care and delays in ICU admission for patients in the ED and delayed or failed inter-hospital ICU transfers. One cannot know whether the two patients who died waiting for an ICU bed would have survived if they had been transferred in a timely fashion or if harm came to the patients with delayed admission from the ED and other facilities. However, these potentially adverse events can be traced to bed unavailability due to critical care units providing treatment that was perceived by the treating physician to be futile. Patients receiving these futile treatments either died or remained in severely adverse health states that the critical care physicians deemed to be inappropriate for critical care.¹¹ Moreover, futile ICU treatment carried opportunity costs that possibly harmed other patients.

While futile ICU treatment violates the “physician’s professional responsibility for appropriate allocation of resources”^{14,16} and inappropriately uses precious healthcare resources, in a healthcare system functioning at capacity it is not clear that providing futile treatment is less expensive than providing non-futile treatment. Futile treatment days in the ICU are less expensive than routine ICU treatment (estimated costs are \$4004 v \$4732), at least at the studied healthcare system¹¹, and patients that would fill these beds are commonly transferred with end-stage organ failure for consideration of expensive procedures such as organ transplants. However, whether less expensive or not, futile critical care is an inappropriate application of specialized treatment for patients who cannot benefit from it.

Our study found that there were more patients receiving futile treatment when the ICU had empty beds. There are several possible explanations for this. Perhaps on busy days, the perception of futile treatment is different than on days when clinicians have more time to view the “full picture.” More likely, a busy ICU forces clinicians to have difficult discussions with patients and families regarding prognosis to shift goals of care. The fact that fewer patients received futile treatment when the ICU was not full suggests that physicians strive harder to minimize non-efficacious treatments when their ICU is full and patients are waiting. This finding is consistent with a study showing that goals of care were more frequently addressed and changed when ICU beds were unavailable.¹⁶

Several studies have shown that critically ill patients have the best chance of survival when care is delivered expeditiously by well-trained intensivists.^{17–19} Most EDs are not designed or staffed to provide extended critical care, and critically ill patients who board in the ED potentially miss a window of opportunity in which the ICU might offer a survival advantage.⁴ The volume of critically ill patients initially evaluated in the ED is increasing²⁰, and delays in medical attention can be especially detrimental. Patients who “board” in the ED not only have higher mortality, but also longer lengths of stay and higher resource

utilization.³ Downstream effects include ED crowding and compromised capability to provide quality and timely care to other patients.^{13,21}

One of the responsibilities of an academic medical center is to provide equitable access to transfer requests from other hospitals, acting as a regional safety net providing specialized advanced healthcare services.¹ Patients who transfer to a tertiary care ICU generally have higher mortality than directly admitted patients, but this difference dissipates after adjusting for severity of illness.²² In a 3 month period, we recorded 2 deaths and a total of 46 days when patients waited to be transferred from a hospital incapable of providing the necessary level of care.

This study is limited because it was performed at a single health system recognized for resource intensive treatment²³; it is unclear whether these results can be generalized to other hospitals. Future multi-center studies will be necessary. One of the ICUs declined to participate, suggesting that the measured futile treatment and perhaps the opportunity costs may be an underestimate.^{24,25} Additionally, missing futility assessments (4.8%) likely occurred when the ICU was busy, making the opportunity cost estimate conservative. Also, “probably futile treatment” (accounting for another 98 patients) was excluded from this analysis. Finally, midnight and noon census snapshots of bed-availability may not reflect bed-availability at other times of the day.

There is no recognized objective method of prospectively defining futile treatment. The assessments by critical care physicians studied here inherently include the clinicians’ subjective judgments. Furthermore, clinician prognostication is never 100% accurate and for some patients the chance, no matter how miniscule, of improvement or continued existence with poor quality of life is acceptable to the family (or rarely, to the patient). Because futile treatment was defined by the critical care physician, it is likely that many patients’ families would not agree with the assessment. Lastly, patients delayed while waiting on the transfer list may not have benefited from transfer to the academic ICU since they may have been too ill to benefit from critical care, or perhaps another waiting patient may have filled the slot vacated by the patient receiving futile treatment.

CONCLUSIONS

It is unjust when a patient is unable to access intensive care because ICU beds are occupied by patients who cannot benefit from such care. Our findings are particularly relevant in the U.S., but are also instructive elsewhere given universal concerns regarding providing treatments that are non-beneficial. The ethic of “first come, first served” is not only inefficient and wasteful, but it is contrary to Medicine’s responsibility to apply healthcare resources to best serve society. In the context of healthcare reform, which aims to more justly distribute medical care to the nation, opportunity cost is one more reason that futile treatment should be minimized.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Characterization of ICU days during 3-month study period by whether the ICU is full and whether there is a patient receiving futile treatment in that ICU, on that day. ICU is considered full when there are 0 or 1 beds available for new admissions.

INTENSIVE CARE UNIT	Overall		ICU Not Full		ICU Full	
	TOTAL DAYS	DAYS with FUTILE PATIENT IN UNIT	DAYS	DAYS UNIT NOT FULL + FUTILE PATIENT IN UNIT	DAYS	DAYS UNIT FULL + FUTILE PATIENT IN UNIT
Medical ICU	92	88 (96%)	70	69 (99%)	22	19 (86%)
Neurocritical Care Unit	92	33 (36%)	48	17 (35%)	44	16 (36%)
Cardiothoracic ICU	92	51 (55%)	37	27 (73%)	55	24 (44%)
Cardiac Care Unit	92	15 (16%)	40	9 (23%)	52	6 (12%)
Academic Community Hospital ICU	92	68 (74%)	74	61 (82%)	18	7 (39%)
Total	460	255 (55%)	269	183 (68%)	191	72 (38%)

ICU = Intensive care unit, Futile patient = Patient receiving treatment in the ICU that is perceived to be futile by the critical care attending.

Table 2
Emergency department admissions

Emergency department patients with delayed admission to the ICU when the ICU was full and a patient was receiving futile treatment in that ICU on that day.

Intensive Care Unit	ICU Beds	Number of admissions from ED	Number of admissions when ICU Full + Futile Patient in ICU	Number of admissions boarding 4 hours in ED when ICU Full + Futile Patient in ICU
Medical ICU	24	130	32	19
Neurocritical Care Unit	24	121	26	7
Cardiothoracic ICU	24	12	3	0
Cardiac Care Unit	12	60	3	0
Academic Community Hospital ICU	22, 18*	140	17	7
TOTAL	106, 102*	463	81	33

* Academic Community Hospital ICU contained 22 beds study days 1–25 and 18 beds study days 26–92.

ED = Emergency department, ICU = Intensive care unit, Futile patient = Patient receiving treatment in the ICU that is perceived to be futile by the critical care attending

Table 3

ICU Transfer Requests from Outside Hospitals

For patients who waited more than 1 day to be transferred or before cancelling the transfer request, this table shows the number of days spent waiting on the transfer list when the ICU was full and contained a patient receiving futile treatment.

INTENSIVE CARE UNIT	TRANSFERRED AFTER WAITING > 1 DAY			TRANSFER REQUESTS CANCELLED AFTER WAITING > 1 DAY		
	PATIENTS TRANSFERRED AFTER >1 DAY	DAYS WAITED WHEN UNIT FULL (patients)	DAYS WAITED WHEN UNIT FULL + FUTILE PATIENT IN UNIT (patients)	TRANSFER REQUESTS CANCELLED	DAYS WAITED WHEN UNIT FULL (patients)	DAYS WAITED WHEN UNIT FULL + FUTILE PATIENT IN UNIT (patients)
Medical ICU	9	4 (3)	4 (3)	12	20 (7)	16 (7)
Neurocritical Care Unit	5	18 (5)	9 (4)	16	15 (12)	6 (6)
Cardiothoracic ICU	2	4 (2)	2 (1)	6	9 (3)	8 (2)
Cardiac Care Unit	6	16 (6)	1 (1)	2	2 (2)	0 (0)
Academic Community Hospital ICU	0	0 (0)	0 (0)	1	0 (0)	0 (0)
Total	22	42 (16)	16 (9)	37	46 (24)	30 (15)

ICU = Intensive care unit, Futile patient = Patient receiving treatment in the ICU that is perceived to be futile by the critical care attending