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Physicians' predictions of long-term survival and functional outcomes do not influence the decision to admit patients with advanced disease to intensive care: A prospective study

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Abstract

Background: Long-term survival and functional outcomes should influence admission decisions to intensive care, especially for patients with advanced disease.

Aim: To determine whether physicians' predictions of long-term prognosis influenced admission decisions for patients with and without advanced disease.

Design: A prospective study was conducted. Physicians estimated patient survival with intensive care and with care on the ward, and the probability of 4 long-term outcomes: leaving hospital alive, survival at 6 months, recovery of functional status, and recovery of cognitive status. Patient mortality at 28 days was recorded. We built multivariate logistic regression models using admission to the intensive care unit (ICU) as the dependent variable.

Setting/participants: ICU consultations for medical inpatients at a Swiss tertiary care hospital were included.

Results: Of 201 evaluated patients, 105 (52.2%) had an advanced disease and 140 (69.7%) were admitted to the ICU. The probability of admission was strongly associated with the expected short-term survival benefit for patients with or without advanced disease. In contrast, the predicted likelihood that the patient would leave the hospital alive, would be alive 6 months later, would recover functional status, and would recover initial cognitive capacity was not associated with the decision to admit a patient to the ICU. Even for patients with advanced disease, none of these estimated outcomes influenced the admission decision.

Conclusions: ICU admissions of patients with advanced disease were determined by short-term survival benefit, and not by long-term prognosis. Advance care planning and developing decision-aid tools for triage could help limit potentially inappropriate admissions to intensive care.

Keywords

Palliative care, intensive care, prognosis, patient admission, decision making, end of life, prospective study

Key statements

What is already known about the topic?

- ICU use for patients near the end of life can be high and may only prolong unnecessary suffering.
- It is recommended that patients' long-term prognosis and functional outcomes be taken into account when admission to intensive care is considered.
- Available data show that physicians' admission decisions are influenced by patients' expected short-term survival benefit.

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What this paper adds?

- This study demonstrates that ICU admissions for patients with advanced disease are determined by expected short-term survival benefit, and not by expected long-term mortality, functional or cognitive outcomes
- Nevertheless, physicians are capable of identifying patients with the most severe disease, who are at increased risk of death.

Implications for practice, theory or policy

- Patients with advanced disease and a limited prognosis are at risk of receiving potentially inappropriate intensive care.
- Various interventions, such as fostering advance care planning, improving goals of care documentation, and developing decision-aid tools for triage, may be required to limit potentially inappropriate intensive care for patients at the end of their life.

Background

The decision to admit or not a patient to the intensive care unit (ICU) is often based on a combination of criteria. Guidelines recommend that factors such as patient long-term prognosis and prehospital functional status be considered along the patient's need for life-sustaining therapies.[1] However, ICU use for patients near the end of life can be high[2,3] and this trend has increased over the years.[4–6] In the United States, the proportion of Medicare decedents receiving intensive care in the last month of life increased from 24.3% in 2000 to 29.0% in 2009 and 2015.[7] Variations among countries exist: 27.2% of US cancer patients were admitted to the ICU in the last month of life compared to 11% in Belgium and 3.5% in Germany.[8] Available evidence shows that physicians' admission decisions are influenced by the expected probability of improving patient survival in the short term.[9] This suggests that long-term prognosis may be insufficiently used in making ICU admission decisions.

Intensive care does not only provide benefits. The ICU stay can be burdensome for patients.[10,11] ICU survivors often develop persistent mental, cognitive, and physical impairments such as anxiety, posttraumatic stress disorder, impaired memory, decreased mental processing speed, and neuromuscular weakness, which impact their quality of life.[12] Interventions to prevent or to treat this post-ICU syndrome had limited efficacy.[13–18]

While long-term survival and long-term quality of life are of concern to patients, families, and physicians, whether and how these considerations influence the ICU admission decision is unclear. Patients with advanced oncological or non-oncological disease have a limited life expectancy and their quality of life may be poor. It is however uncertain if the presence of advanced disease influences admission decisions. In this study, we examined the associations between physicians' predictions of patient survival and functional status at 6 months, and the decision to admit a patient with and without advanced disease to intensive care, while accounting for short-term survival benefit.

Methods

Setting

We conducted a study at the Geneva University Hospitals, a tertiary care hospital of 1,741 beds, including 156 internal medicine beds and 34 adult ICU beds, between August 2014 and August 2015.[9] The study was approved by the Geneva Research Ethics Committee on 10 April 2012 (protocol no. 12-042).

In our institution internists routinely define and document goals of care and code status in the patient's electronic medical record. If a patient becomes acutely ill and the ward physician deems that intensive may be appropriate, the patient's situation is assessed by an ICU physician.[19] Whenever possible and appropriate, the patient's and/or family's opinion is sought before a decision about admitting the patient or not is made.

Participants

All consecutive ICU consultations for inpatients staying in the Division of General Internal Medicine were identified. The internist and the ICU physician directly involved in the admission decision were eligible. The physicians gave written consent for participation and socio-demographic data were collected (Supplemental Table).

Data collection

A questionnaire was developed to determine the factors influencing ICU admission decisions in patients with and without advanced disease. It was pilot tested by five ICU physicians and five internists not involved in the study. Internists and ICU physicians were contacted by phone within 12 h of the ICU consultation and were asked to complete the questionnaire. Questionnaires were administered by phone or by email, according to the physician's preference. Reminders were sent 3 days later if necessary. Physicians were asked to predict patient survival if admitted in the ICU and if staying on

the ward, using five categories of probabilities (<10%, 10%–40%, 41%–60%, 61%–90%, >90%). Physicians also estimated the probability of four long-term outcomes on a Likert scale ranging from 1 (most probably not) to 4 (most probably yes): leaving hospital alive, being alive at 6 months, recovery of functional status, and recovery of cognitive function. We chose to ask about patient survival at 6 months because long-term survival is typically measured at 6 months or more.[20,21] Recovery of functionality and cognitive status was defined as return to pre-hospitalization status. Data were used only if the two involved physicians completed the questionnaire. Patient data (gender, age, comorbidities) and mortality at 28 days were collected from the electronic patient file. Advanced disease was defined as the presence of any of the following: metastatic cancer, active hematologic malignancy, chronic heart failure of NYHA stage III or IV and/or LVEF ⩽ 20%, severe chronic obstructive pulmonary disease (FEV ⩽ 50% or non invasive ventilation or oxygenotherapy), severe chronic kidney disease (glomerular filtration rate <30mL/min), liver cirrhosis Child B or C.

Sample size and statistical analysis

Sample size was driven by the main objective of the study, that is, modeling of the decision to admit a patient to intensive care. Assuming eight potential predictors of the decision to admit the patient, we intended to enroll 80 patients in the smaller of the two groups (admitted or not), and aimed for 160 patients if the admission rate was 50%. As the observed admission rate was 70%, the sample size was increased to 200; despite this the smaller group reached a total of only 61.

To capture the expected short-term survival benefit of an ICU admission, we computed the difference, in survival categories, between predicted survival in the ICU and on the ward, for each physician (thus 0 indicated the same survival category in both locations, and 4 a survival >90% in the ICU and <10% on the ward). The accuracy of short-term survival predictions of the two physicians, and their association with admission to the ICU, have been reported previously.[9] Following exploratory analysis, the responses to the long-term prognosis items (leaving hospital alive, being alive at 6 months, recovery of functional status, recovery of cognitive function) were dichotomized as Yes (most probably, or probably) versus No (most probably not, or probably not).

We cross-tabulated patient characteristics, that is, gender, age (in four age-groups), presence of advanced disease, and the eight long-term prognosis ratings (four by each physician) across the decision to admit the patient. Then we built two multivariate logistic regression models (one for assessments made by internists, the other for ICU physicians) that used admission to the ICU as the dependent variable, and patient gender, age, presence of advanced disease, short-term survival benefit, and the four long-term prognostic ratings as independent variables. Finally we selected patients with advanced disease ($n = 105$) and ran the same models (only omitting the "advanced disease" variable as independent variable).

To assess the construct validity of physicians' long-term outcome predictions, we also examined prognostic ratings across observed mortality at 28 days (patient outcomes at 6 months were not available).

Statistical significance was set at $p < 0.05$. We used SPSS version 24 software.

Results

Of 219 patients assessed for intensive care admission, 18 were excluded because of missing physician data, and 201 were included. Among them, 128 were men and 73 were women. Mean age was 64.9 years (SD 14.3). About half the patients ($n = 105$; 52.2%) had an advanced disease: 38 had COPD, 37 had an oncological disease, 20 had cirrhosis, 18 had chronic kidney disease, and seven had heart failure (total exceeds 105 due to multiple diagnoses). The most common reasons for calling the ICU was respiratory failure ($n = 111$; 55.2%) and heart failure or shock ($n = 55$; 27.4%).

Thirty ICU physicians (1 to 14 assessments per physician) and 97 internists (1 to 11 assessments per physician) participated in the study. Among ICU physicians, 20 (67%) were men, and among internists, 38 (39%). The mean age was 38 years for ICU physicians and 30 years for internists. ICU physicians and internists completed the questionnaire within 1 day of the admission decision in 63.2% and 71.1% of the cases, respectively.

Of the 201 evaluated patients, 140 (69.7%) were admitted to the ICU. The oldest patients were less likely to be admitted, but there was no difference in the probability of admission for patients with advanced disease (Table 1). Physicians' estimates of patient long-term prognosis, functional recovery, and cognitive recovery were not associated with the admission decision (Table 2). In the multivariate logistic regression models, only predicted short-term survival and older age were associated with admission to the ICU, both for the ICU physicians and the internists (Table 3). The results were the same when only the group of patients with advanced disease was analyzed (Table 4)

Fifty-eight patients (28.9%) had died by day 28. Mortality was higher in men than in women, and in patients with advanced disease (Table 1). All long-term prognostic estimates made by the two physicians were strongly associated with mortality (Table 2). Mortality was similar in patients who were admitted to the ICU (28.6%) and in those who were not (29.5%, $p = 0.89$).

Table 1. Patient characteristics and probability of admission to intensive care, among 201 patients evaluated for admission to the ICU.

	N (%)	Admitted to ICU, row (%)	*P* value	Died by day 28, row (%)	*P* value
Gender			0.22		<0.001
°Men	128 (63.7)	72.7%		37.5%	
°Women	73 (36.3)	64.4%		13.7%	
Age groups			0.032		0.20
°16–59	65 (32.3)	75.4%		23.1%	
°60–69	65 (26.9)	70.4%		31.5%	
°70–79	49 (24.4)	75.5%		24.5%	
°80–94	33 (16.4)	48.5%		42.4%	
Advanced disease			0.97		0.001
°Yes	105 (52.2)	69.5%		39.0%	
°No	96 (47.8)	69.8%		17.7%	

Table 2. Long-term prognosis according to the ICU physician and to the internist, and association with the probability of admission, among 201 patients evaluated for admission to the ICU.

	N (%)	Admitted to ICU, row (%)	*P* value	Died by day 28, row (%)	*P* value
Prognosis according to ICU physician					
Will leave hospital alive			0.72		<0.001
°No*	73 (36.5)	68.5%		53.4%	
°Yes**	127 (63.5)	70.9%		14.2%	
Will be alive at 6 months			0.93		<0.001
°No*	91 (45.5)	70.3%		47.3%	
°Yes**	109 (54.5)	69.7%		12.8%	
Will recover functional status			0.62		<0.001
°No*	112 (56.0)	71.4%		41.1%	
°Yes**	88 (44.0)	68.2%		12.5%	
Will recover cognitive function			0.39		<0.001
°No*	72 (36.2)	66.7%		47.2%	
°Yes**	127 (63.8)	72.4%		18.1%	
Prognosis according to internist					
Will leave hospital alive			0.34		<0.001
°No*	51 (25.5)	64.7%		68.6%	
°Yes**	149 (74.5)	71.8%		14.8%	
Will be alive at 6 months			0.071		<0.001
°No*	69 (34.7)	62.3%		58.0%	
°Yes**	130 (65.3)	74.6%		13.1%	
Will recover functional status			0.58		<0.001
°No*	87 (43.7)	67.8%		48.3%	
°Yes**	112 (56.3)	71.4%		13.4%	
Will recover cognitive function			0.11		<0.001
°No*	54 (27.4)	61.1%		57.4%	
°Yes**	143 (72.6)	72.7%		17.5%	

*Most probably not, or probably not, **Most probably yes, or probably yes.

Discussion

The results of this study show that ICU admissions are determined by expected short-term survival benefit, and old age (⩾80 years), but not by the presence of advanced disease. Expected long-term prognosis, functional outcomes, and cognitive outcomes do not influence the admission decision for patients with advanced disease. This finding contrasts with current guidelines. ICU admissions should be guided by a combination of factors including patient's need for treatments provided in the ICU and potential to benefit from them, but also prognosis of the underlying disease, of recovery and quality of life, and prehospital functional status.[1] Functional status is a determinant of

Table 3. Multivariate logistic regression models for admission to intensive care, according to short-term and long-term prognosis assessed by either the ICU physician or by the internist, and according to patient characteristics.

	Opinion of ICU physician		Opinion of internist	
	Odds ratio (95% CI)	*P* value	Odds ratio (95% CI)	*P* value
Survival benefit of ICU admission*	3.0 (1.9–4.5)	<0.001	2.3 (1.5–3.5)	<0.001
Will leave hospital alive	0.6 (0.2–2.4)	0.51	0.6 (0.2–2.0)	0.41
Will be alive at 6 months	1.2 (0.3–4.8)	0.81	1.5 (0.5–4.2)	0.43
Will recover functional status	0.6 (0.2–1.9)	0.41	0.8 (0.3–2.1)	0.59
Will recover cognitive function	1.3 (0.4–4.2)	0.60	1.6 (0.5–4.6)	0.42
Advanced disease	1.2 (0.5–2.7)	0.72	1.0 (0.4–2.1)	0.94
Male gender	1.3 (0.6–2.6)	0.52	1.5 (0.7–3.1)	0.26
Age groups, years				
°16–59	1.0	–	1.0	–
°60–69	0.9 (0.3–2.5)	0.86	0.6 (0.2–1.6)	0.34
°70–79	1.2 (0.4–3.5)	0.67	0.9 (0.4–2.5)	0.91
°80–94	0.3 (0.1–0.9)	0.026	0.3 (0.1–0.8)	0.012

*Difference in estimated survival if patient cared in the ICU or if patient cared on the ward, both categorized as <10%, 10–40%, 61–60%, 61–90%, >90%, per category of benefit.

Table 4. Multivariate logistic regression models for admission to intensive care among 105 patients with advanced disease, according to short-term and long-term prognosis assessed by either the ICU physician or by the internist, and according to patient characteristics.

	Opinion of ICU physician		Opinion of internist	
	Odds ratio (95% CI)	*P* value	Odds ratio (95% CI)	*P* value
Survival benefit of ICU admission*	4.6 (2.1–10.1)	<0.001	2.5 (1.4–4.6)	0.003
Will leave hospital alive	0.4 (0.1–1.8)	0.21	0.3 (0.1–1.4)	0.13
Will be alive at 6 months	0.8 (0.2–5.8)	0.86	1.5 (0.4–6.1)	0.57
Will recover functional status	2.5 (0.4–15.3)	0.33	1.5 (0.4–5.8)	0. 53
Will recover cognitive function	1.0 (0.4–4.7)	0.98	1.5 (0.4–6.0)	0.54
Male gender	1.4 (0.4–4.2)	0.59	1.2 (0.4–3.4)	0.73
Age groups				
°16–59	1.0	–	1.0	–
°60–69	0.8 (0.2–3.8)	0.79	0.5 (0.1–2.0)	0.30
°70–79	1.2 (0.2–5.8)	0.86	0.6 (0.1–2.9)	0.56
°80–94	0.2 (0.0–1.2)	0.08	0.1 (0.0–0.6)	0.003

*Difference in estimated survival in the ICU and survival on the ward, both categorized as <10%, 10%–40%, 61%–60%, 61%–90%, >90%, per category of benefit.

frailty, which was associated with higher hospital and long-term mortality (i.e. ⩾6 months) following ICU admission.[22] In elderly adults, even minimal cognitive impairment was associated with post-ICU disability and moderate impairment was associated with increased likelihood of being admitted to a nursing home.[23] Our finding is also problematic as the mortality in patients with advanced disease is higher compared to patients without advanced disease. It raises the question of how to limit inappropriate use of intensive care at the end of life[24] and provide high-value patient-centered intensive care.[25]

When assessing prognosis, physicians correctly identified patients with the most severe disease, as all their predictions were associated with mortality at 28 days. This suggests that physicians are capable of making reasonable predictions. The issue is that they do not seem to use these predictions to guide ICU admission decisions for patients with advanced disease. The reason may be that, following professional guidelines, they feel that overtriage is more acceptable than undertriage.[1] It may also be the result of an emotional burden associated with ICU admission decisions on the part of physicians. Intensive care is sometimes perceived as the default option which ensures a patient the best chance of survival.[26] Physicians reported a feeling of making a life-death decision and psychological strain during triage of hospitalized patients and in the emergency department.[19,27]

The eldest patients (⩾80 years) were less likely to be admitted to intensive care. Increasing age and frailty in patients 80 years or above are actually associated with short-term mortality,[28] and the benefit of intensive care for this age group is still a matter of debate.[29,30]

An important issue is to identify and implement strategies to avoid unwarranted intensive care. Considering our results, physicians should be encouraged to rely on their predictive abilities to introduce early palliative care, especially since the performance of existing screening tools is limited.[31] Moreover, to estimate the patient's prognosis explicitly might help admission decision making. In simulation studies, ICU physicians asked to estimate a patient's survival and functional prognosis were more likely to discuss treatment withdrawal or to inform a family member of the patient's high risk of dying.[32,33]

Advance care planning and goals of care discussions are part of comprehensive palliative care and are considered useful in decreasing high intensity care at the end of life, including admission to the ICU.[34–37] Barriers to optimal discussions include physicians' discomfort and lack of skills in addressing end-of-life issues. Training in communication and structured communication tools can help physicians engage in these sensitive discussions.[38–40] In our institution all new internal medicine residents attend a physician-led workshop of 2 h. The content includes the identification of the barriers to discussing goals of care and code status, the teaching of a communication tool, and role plays. When a patient is admitted to an internal medicine ward in our hospital, treatment intensity and the corresponding code status are defined and documented in a dedicated space in the electronic medical record. Documentation of code status and its quality are important for time-pressured decisions such as ICU admissions. According to previous studies incompleteness and inconsistency of documentation are common.[41,42] Such shortcomings are found in our institution. Physicians reported that the absence of code status or poorly substantiated code status were likely to make ICU admission decisions difficult for a patient with advanced disease.[19] Hence inappropriate admissions to intensive care may occur if the decision is made by default.

The designation of a healthcare surrogate is a legally recognized practice in Switzerland and is encouraged in our institution. Early during a hospital stay, patients are asked to identify a surrogate, most often a family member. Family members may be involved in complex decision making about admitting their loved one to the ICU, a demanding and stressful task they are not necessarily prepared to.[19,43] Supporting their capacity to act as surrogates, for example by improving previous communication with the patient,[44,45] might limit the risk of inappropriate intensive care.

There is no validated tool for triage and physicians, like in our study, have to use clinical judgment to make decisions. The development of decision-aid tools for triage could be an interesting option,[46] as is the suggestion to add an assessment of frailty to existing severity scores.[34] Frailty, although more common in elderly patients, is independently associated with adverse outcomes in critically ill patients.[22]

This study has limitations. We did not record patients' survival after 28 days, neither did we assess functional and cognitive recovery. So we could not compare physicians' predictions with actual patient outcomes. Other studies have shown that clinicians are fairly accurate in predicting outcomes of critically ill patients.[9,20] Furthermore, our data reflect what guidelines expect from physicians at the moment of triage, that is, to make an admission decision based on an estimation of the patient's long-term outcomes. The study was conducted at a single site and the results might not be generalizable to all countries and different cultures.

Conclusion

ICU admissions for patients with advanced disease are determined by expected short-term survival benefit, and not by long-term mortality or functional outcomes. Fostering advance care planning and documentation of goals of care, and developing decision-aid tools for triage could help limit the number of potentially inappropriate admissions to intensive care.

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Authors' contributions

M.E. and T.P. contributed to study concepts. M.E., T.P., M.N., S.C. contributed to study design. F.S. collected the data and contributed to quality control of the data. T.P. did the statistical analysis. M.E. drafted the manuscript. All authors contributed to data analysis and interpretation, and to manuscript editing and review.

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Supplemental material

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