Intensive Care Med (2013) 39:1574–1583
DOI 10.1007/s00134-013-2977-x

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The ETHICA study (part II): simulation study of determinants and variability of ICU physician decisions in patients aged 80 or over

Received: 30 October 2012
Accepted: 19 May 2013
Published online: 14 June 2013

Part I of the ETHICA study can be found at: doi:10.1007/s00134-013-2976-y; an editorial discussing both parts of the ETHICA study can be found at: doi: 10.1007/s00134-013-2968-y.

On behalf of the ETHICA group; the members of the ETHICA group who acted as co-investigators are listed in the Appendix.

Electronic supplementary material
The online version of this article (doi:10.1007/s00134-013-2977-x) contains supplementary material, which is available to authorized users.

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Abstract *Purpose:* To assess physician decisions about ICU admission for life-sustaining treatments (LSTs).
Methods: Observational simulation study of physician decisions for patients aged ≥80 years. Each patient was allocated at random to four physicians who made decisions based on actual bed availability and existence of an additional bed before and after obtaining information on patient preferences. The simulations involved non-invasive ventilation (NIV), invasive mechanical ventilation (IMV), and renal replacement therapy after a period of IMV (RRT after IMV).
Results: The physician participation rate was 100/217 (46 %); males without religious beliefs predominated, and median ICU experience was 9 years. Among participants, 85.7, 78, and 62 % felt that NIV, IMV, or RRT (after IMV) was warranted, respectively. By logistic regression analysis, factors associated with admission were age <85 years, self-sufficiency, and bed availability for NIV and IMV. Factors associated with IMV were previous ICU stay (OR 0.29, 95 % CI 0.13–0.65, $p = 0.01$) and cancer (OR 0.23, 95 % CI 0.10–0.52, $p = 0.003$), and factors associated with RRT (after IMV) were living spouse (OR 2.03, 95 % CI 1.04–3.97, $p = 0.038$) and respiratory disease (OR 0.42, 95 % CI 0.23–0.76, $p = 0.004$). Agreement among physicians was low for all LSTs. Knowledge of patient preferences changed physician decisions for 39.9, 56, and 57 % of patients who disagreed with the initial physician decisions for NIV, IMV, and RRT (after IMV) respectively. An additional bed increased admissions for NIV and IMV by 38.6 and 13.6 %, respectively. *Conclusions:* Physician decisions for elderly patients had low agreement and varied greatly with bed availability and knowledge of patient preferences.

Keywords Aged · Decision making · Intensive care unit · Triage · Therapy · ETHICA

Introduction

Caring for the growing population of elderly individuals is a major challenge throughout the world. Of 120,000 patients admitted to 57 ICUs in Australia and New Zealand, 13 % were at least 80 years of age, and this age group increased by 5.6 % per year [1]. Intensivists triage patients to admit those who are most likely to benefit from ICU admission. In France, the overall ICU refusal rate in two multicentre cohorts was 24 % [2, 3], similar to that in a single-centre study from the US [4], whereas a far higher rate of 73.3 % was found among patients aged ≥80 years [5].

Triage decisions are part of everyday practice for ICU physicians. In France, patients are admitted after an evaluation by the ICU physician, who decides whether to use life-sustaining treatments (LSTs) based on the clinical situation and on any available information about the patient's wishes regarding LSTs. Patients and families are most often informed of the physician's decision but cannot make LST decisions, except via advance directives, which few individuals have in France. Few triage guidelines are available [6], and when they are used, patients aged ≥80 years are rarely admitted [7]. Triage decisions rest on both patient-related and organisational factors. Age, co-morbidities, and self-sufficiency are the main patient-related factors—together with gender and illness severity in some cases—that affect ICU [3, 8–10] and emergency [11] triage decisions. Organisational factors are bed availability and circumstances of triage. In a simulation study of an elderly patient with end-stage cancer and acute respiratory failure, decisions varied considerably in a heterogeneous population of intensivists, emergency physicians, and ward physicians [12]. A case-vignette study describing an incompetent elderly patient identified differences in decisions among 897 physicians depending on age, experience, and country of exercise [13].

The objective of this study was to assess variability in physician admission decisions based on patient, ICU, and hospital characteristics, with an evaluation of fixed and random variance. We used scenarios describing previously hospitalised elderly outpatients who were interviewed at home about their preferences for LSTs in the event of a future hypothetical critical illness. Having multiple patient profiles based on real patients allowed us to replicate triage conditions in everyday practice.

Methods

Selection of ICU physicians

A random sample of 220 physicians was taken from members of the French Society for Critical Care, with stratification on geographic area (Paris area vs. other). These physicians were invited to participate in the study in May 2011, via e-mail sent through a secure Web site dedicated to the study. For each physician and each ICU, we collected the characteristics listed in Resource 1 and 2 in the online material respectively.

Selection of elderly patients

The selection, characteristics and preferences of the elderly patients are described in the first ETHICA study report [14]. Briefly, 100 consecutive community-dwelling elderly individuals, aged ≥80 years (84.8 ± 3.5 years), previously hospitalised in medical or surgical wards of the 631-bed Saint-Joseph Hospital in Paris, France, and of volunteers residing in nursing homes or assisted-living facilities participated in the study, in a ratio of 70/30 to reflect the overall ratio among elderly individuals in France. Among these individuals, 81 % were independent for instrumental activities [15] and 71 % for activities of daily living [16], i.e., were good candidates for ICU admission. All participants had normal cognitive function. Their quality of life was assessed using the WHOQOL-BREF [17] and WHOQOL-OLD [18]. Participants were interviewed at their place of residence about their preferences for LSTs, using films showing a clinical scenario of cardiogenic oedema requiring non-invasive mechanical ventilation (NIV) and another of bacterial pneumonia requiring invasive mechanical ventilation (IMV) and followed by renal failure in the ICU requiring renal replacement therapy (RRT after IMV). LST preferences were collected after the patients watched both films on a computer. Refusal rates among the patients were 27 % for NIV, 43 % for IMV, and 63 % for RRT (after IMV) [14].

ICU physician decisions

For 1 month (June 2011), each Monday, the ICU physicians received a description of one elderly patient via a link to the website, including demographic features, co-morbidities, and self-sufficiency measured using the Instrumental Activities of Daily Living [15] and Activities of Daily Living [16] scores. Each patient was randomly allocated to four physicians. Each physician indicated whether he or she would admit the patient in the three situations for which patient preferences had been collected. The first situation was NIV (for cardiogenic oedema), the second was IMV (for bacterial pneumonia with acute respiratory failure), and the third was RRT (after IMV) (for acute renal failure complicating the bacterial pneumonia). Physicians made decisions assuming the bed-availability in their units on the day of the decision, then assuming an additional available bed (to ensure that admission would be possible) (Resource 3 in

the on-line data supplement). Finally, they made decisions after reading a description of patient preferences. The website was designed to prevent the physician from changing earlier decisions. The 1-week intervals separating the case descriptions allowed us to explore a range of bed availabilities and working circumstances that mimicked the real-life decision-making process. Physicians not working on a study Monday could answer on the next working day.

The Saint Joseph Hospital Ethics Committee approved the study and waived the need for informed consent for collecting demographics, medical history, quality of life, and preferences of the elderly participants. All physicians and patients participated on a voluntary basis.

Statistical analysis

No sample size calculation was performed, and the number of patients and physicians included in the study was based on feasibility. Characteristics of the hospitals, ICUs, physicians, and elderly were described using mean ± SD or median (interquartile range) for quantitative values and frequency (%) for qualitative values. Logistic mixed models were used to identify patient, ICU physician, hospital, and centre (ICU)-based determinants of decisions to use LSTs. Random effects for patient, ICU physician, hospital, and centre were tested and included to take into account existing correlations linking patients, physicians, ICUs, and hospitals. The estimated co-variance parameters for the patients and physicians illustrate the residual decision variation that is not explained by the model but can be attributed to the patients and/or physicians. Then, multivariate models were built for each LST (NIV, IMV, and RRT after IMV) by entering all the variables yielding p values lower than 0.20 by univariate analysis then performing backward elimination until all variables remaining in the model yielded p values lower than 0.05. Univariate and multivariate analyses were performed once for decisions made without knowledge of patient preferences and quality of life, then again for decisions made with this knowledge. Fleiss's kappa (κ) for multiple raters with 95 % confidence intervals (95 % CIs) was used to test agreement among ICU physicians about LST decisions. However, this test assumes that the same set of ICU physicians evaluated each patient. Values of p lower than 0.05 were considered significant. All statistical analyses were performed using SAS 9.3 (Cary, NC, USA).

Results

Of the 220 invited ICU physicians, 100 (45 %) agreed to participate, and the response rate in these 100 physicians was 100 %. Resources 1 and 2 in the online material report the characteristics of the 100 ICU physicians and their hospitals. There was a predominance of males reporting no religious beliefs, and median ICU experience was 9 years. Most physicians worked in medical-surgical units and half worked in university hospitals.

Physician decisions

We analysed 400 sets of ICU admission decisions (100 patients each evaluated by 4 physicians). LSTs were indicated according to the physicians in 343/400 (85.7 %) cases for NIV, 312/400 (78 %) for IMV, and 249/400 (62 %) for RRT (after IMV). Resource 4 (online supplement) and Table 1 report the results of the univariate and multivariate analyses, respectively, for each LST. Age <85 years and self-sufficiency were independently associated with decisions to use all LSTs. Location in the Paris area was the only significant hospital-related variable associated with the decision to use NIV [odds ratio (OR) 2.91, 95 % CI 1.30–6.52, $p = 0.01$). Previous ICU admission and cancer were associated with lower rates of IMV decisions (OR 0.29, 95 % CI 0.13–0.65, $p = 0.01$ and OR 0.23, 95 % CI 0.10–0.52, $p = 0.003$), respectively. A decision to use RRT (after IMV) (in patients already in the ICU) was made more often for patients having a living spouse (OR 2.03, 95 % CI 1.04–3.97, $p = 0.038$) and less often for those having respiratory comorbidities (OR 0.42, 95 % CI 0.23–0.76, $p = 0.004$). Finally, ICU bed availability was strongly associated with decisions to admit patients for NIV or IMV (Table 1). Random effects for the physicians were significant only for RRT (after IMV) (Table 1).

Resource 5 (online supplement) and Table 2 reports the results of the univariate and multivariate analyses, respectively, of physician decisions made with knowledge of patient preferences and quality of life. Factors associated with deciding to use LSTs were age <85 years; good quality of life, especially in the environment domain; no previous hospitalisation in the last year; and patient preference for using LSTs. Patient preferences strongly influenced the physician decision for IMV (OR 10.6, 95 % CI 6.17–18.4, $p < 0.001$) and RRT (after IMV) (OR 10.29, 95 % CI 4.97–21.3, $p < 0.0001$). For NIV, physicians felt that admission was warranted regardless of patient preferences (Table 2).

Variability in physician decisions

Figure 1 reports the level of agreement among the decisions made by four different physicians for the same patient. Agreement was extremely low for all three LSTs: NIV ($\kappa = 0.11$, 95 % CI −0.11 to 0.31), IMV ($\kappa = 0.24$, 95 % CI 0.08–0.41), and RRT (after IMV) ($\kappa = 0.22$;

Table 1 Factors associated with decisions to use life-sustaining treatments (multivariate analysis)

Variables	OR for performing LST	95 % CI	*p* value
Non-invasive ventilation			
Patient factors			
Age ≥85 years	0.45	0.20–0.98	0.04
IADL score (1–4) vs. 0	0.32	0.14–0.76	0.01
Centre factors			
Paris area vs. other	2.91	1.30–6.52	0.01
1 available bed vs. 0	8.20	3.22–20.85	<0.0001
2 available beds vs. 0	26.63	8.32–85.23	
>2 available beds vs. 0	17.61	6.03–51.41	
Co-variance parameters	Estimate (SE)		
Elderly		0.42 (0.40)	0.3
Physician		0.65 (0.44)	0.14
Invasive mechanical ventilation			
Patient factors			
Age ≥85 years	0.30	0.14–0.64	0.002
IADL score (1–4) vs. 0	0.23	0.10–0.52	0.0006
Previous ICU admission	0.29	0.13–0.65	0.01
Cancer	0.23	0.10–0.52	0.003
Centre factors			
1 available bed vs. 0	4.89	1.99–12	<0.0001
2 available beds vs. 0	7.92	3.09–20.30	
>2 available beds vs. 0	12.41	4.49–34.26	
Co-variance parameters	Estimate (SE)		
Elderly		0.71 (0.40)	0.08
Physician		0.74 (0.41)	0.07
Renal replacement therapy after invasive mechanical ventilation			
Patient factors			
Age ≥85 years	0.24	0.13–0.43	<0.0001
Married vs. single/ widowed	2.03	1.04–3.97	0.038
Previous ICU admission	0.44	0.22–0.88	0.02
Respiratory co-morbidities	0.42	0.23–0.76	0.004
IADL score (1–4) vs. 0	0.25	0.12–0.51	0.0002
Co-variance parameters	Estimate (SE)		
Elderly		0.18 (0.25)	0.5
Physician		1.16 (0.40)	0.003

OR odds ratio, *95 % CI* 95 % confidence interval, *LST* life-sustaining treatment, *IADL* Instrumental Activities of Daily Living score [15], *ICU* intensive care unit

Table 2 Factors associated with decisions to use life-sustaining treatments after information about patient preferences and quality of life (multivariate analysis)

Variables	OR for performing LST	95 % CI	*p* value
Non-invasive ventilation			
Patient factors			
Age ≥85 years	0.43	0.19–0.93	0.03
IADL score (1–4) vs. 0	0.25	0.12–0.53	0.0003
Previous hospitalisation in the last year	0.40	0.17–0.93	0.03
WHO QOL-BREF environment >75	3.38	1.41–8.09	0.006
Patient preferences			<0.0001
"I don't know", I let the physician decide vs. "I refuse"	10.05	2.44–41.3	
"I accept vs. I refuse"	15.9	7.1–35.5	
Centre factors			
1 available bed vs. 0	2.52	0.95–6.6	0.0004
2 available beds vs. 0	8.68	2.9–25.7	
>2 available beds vs. 0	6.15	2.1–17.5	
Invasive mechanical ventilation			
Patient factors			
Age ≥85 years	0.45	0.26–0.78	0.004
Previous hospitalisation in the last year	0.51	0.30–0.85	0.01
WHO QOL-BREF environment >75	2.14	1.25–3.67	0.006
Patient preferences			<0.0001
"I don't know", I let the physician decide vs. I refuse"	0.70	0.14–3.44	
"I accept vs. I refuse"	10.6	6.17–18.4	
Renal replacement therapy after invasive mechanical ventilation			
Patient factors			
Age ≥85 years	0.52	0.31–0.89	0.018
IADL score (1–4) vs. 0	0.18	0.07–0.42	<0.001
WHO QOL-BREF environment >75	1.71	1.02–2.85	0.039
WHO QOL-BREF psychological health >65	1.87	1.12–3.14	0.017
Patient preferences			<0.001
"I don't know", I let the physician decide vs. I refuse"	0.84	0.09–7.7	
"I accept vs. I refuse"	10.29	4.97–21.3	
12-h shifts for nurses	0.52	0.30–0.88	0.0016
Patient-to-nurse ratio >2.5	2.45	1.49–4.04	0.0004

OR odds ratio, *95 % CI* 95 % confidence interval, *LST* life-sustaining treatment, *IADL* Instrumental Activities of Daily Living score [15], *WHO QOL-BREF* World Health Organisation Quality Of Life Scale (with 26 items covering four domains: physical health, psychological health, social relationships, and the environment [17])

95 % CI 0.11–0.34). Table 3 reports changes in physician decisions after obtaining knowledge of patient preferences. Changes occurred for 53/400 (13.2 %) NIV decisions, 100/400 (25 %) IMV decisions, and 118/400 (29.5 %) RRT (after IMV) decisions. When the initial physician decision was not in agreement with patient preferences, changes occurred for 53/133 (39.9 %), 100/176 (56.8 %), and 118/207 (57 %) NIV, IMV, and RRT (after IMV) decisions, respectively. The change was a switch from using to not using the LST in order to comply with patient preferences for 32/53 (60 %), 84/100 (84 %), and 105/118 (88.9 %) NIV, IMV, and RRT (after IMV) decisions, respectively. In the subgroup of physicians who changed their decisions, none went against patient preferences regarding LST use. When availability of an additional bed was assumed, regardless of the number of available beds in their ICUs, 22/57 (38.6 %) and 12/88 (13.6 %) physicians who had refused admission for NIV and IMV, respectively, changed their decision.

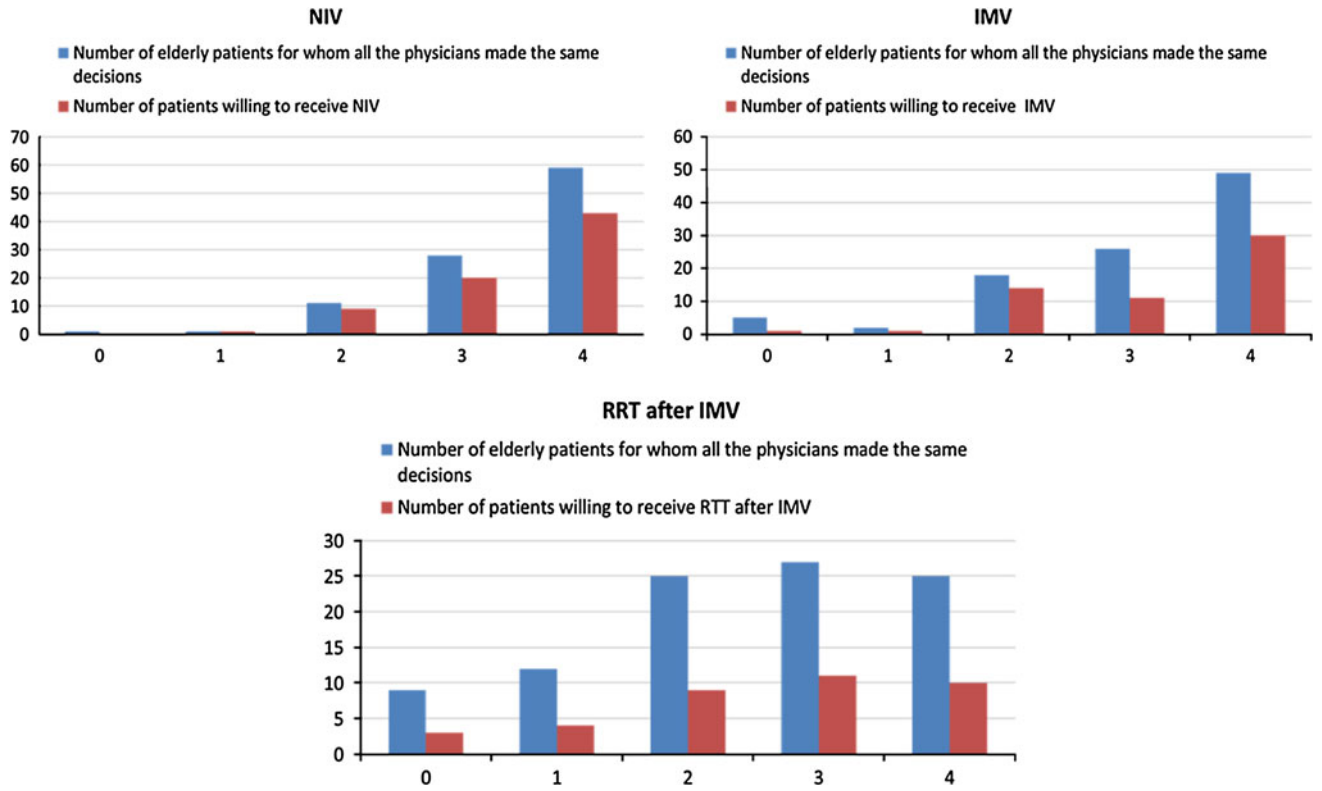

Fig. 1 Agreement among physicians for the same elderly patient when the physicians were not aware of patient preferences. *NIV* non-invasive ventilation, *IMV* invasive mechanical ventilation, *RRT* renal replacement therapy, *LST* life-sustaining treatment. Kappa coefficient for NIV among physicians, 0.11; 95 % CI −0.10 to 0.31. Kappa coefficient for IMV among physicians, 0.24; 95 % CI 0.08–0.41. Kappa coefficient for RRT (after IMV) between physicians, 0.22; 95 % CI 0.11–0.34. Example: all 4 physicians agreed to admit 59 patients for NIV. Among these patients, 43/59 (73 %) said during the home interview that they would consent to NIV

Discussion

This simulation study was designed to collect information on the triage of patients aged ≥80 years by ICU physicians in France. Patient preferences about LST were collected in a previous study: among potentially good candidates for ICU admission, refusal rates were 27 % for NIV, 43 % for IMV, and 63 % for RRT (after IMV) [14]. When ICU physicians were asked to evaluate scenarios involving similar patients, refusal rates were considerably lower, i.e., 14.3 % for NIV, 22 % for IMV, and 38 % for RRT (after IMV). Factors independently associated with deciding to use LSTs were age <85 years, good self-sufficiency, absence of previous ICU admission, and absence of cancer. For renal failure developing in the ICU, having a living spouse and being free of respiratory disease were independently associated with accepting RRT (after IMV). When decisions made by the four physicians who assessed each patient were compared, considerable variability was found. Knowledge of patient preferences strongly influenced decisions to use IMV and RRT (after IMV).

Numerous studies have described the triage process [19–22], and several of them focused on patients aged ≥80 years [5, 7, 21, 23, 24]. Two large recently published multicentre studies [21, 23] may have modified physicians' opinions about the benefits of ICU admission in the elderly. A European study compared 28-day mortality across age groups and found that ICU admission was associated with lower mortality in patients older than 84 years compared to refusal of ICU admission, despite similar severity of illness. The benefit was particularly large when the comparison group was composed of patients deemed too well to benefit from ICU admission [21]. In contrast, in the French ICE-CUB multicentre study of 6-month outcomes [23], ICU admission was associated with no benefits after adjustment for patient characteristics and heterogeneity across centres [25]. This discrepancy may lead physicians to perceive triaging of patients aged 80 years as particularly challenging. Our study adds information about the triage process. The physicians were generally in favour of using NIV and IMV, and to a lesser degree RRT (after IMV), in patients <85 years. The impact of age on healthcare rationing

Table 3 Changes in physician decisions ($n = 400$) induced by receiving information on patient

NIV	Physician decisions before and after information on patient preferences	*N* (%)	Patients willing to receive the LST *N* (%) ($n = 292$)	Patients unwilling to receive the LST *N* (%) ($n = 108$)
	Yes/yes	311 (77.8)	251 (85.9)	60 (55.6)
	No/no	36 (9.0)	20 (6.9)	16 (14.8)
	Yes/no	32 (8.0)	0 (0)	32 (29.6)
	No/yes	21 (5.3)	21 (7.2)	0 (0)
IMV			Patients willing to receive the LST *N* (%) ($n = 228$)	Patients unwilling to receive the LST *N* (%) ($n = 172$)
	Yes/yes	228 (57.0)	182 (79.8)	46 (26.7)
	No/no	72 (18.0)	30 (13.2)	42 (24.4)
	Yes/no	84 (21.0)	0 (0)	84 (48.8)
	No/yes	16 (4.0)	16 (7.0)	0 (0)
RRT after IMV			Patients willing to receive the LST *N* (%) ($n = 148$)	Patients unwilling to receive the LST *N* (%) ($n = 252$)
	Yes/yes	144 (36.0)	95 (64.2)	49 (19.4)
	No/no	138 (34.5)	40 (27.0)	98 (38.9)
	Yes/no	105 (26.3)	0 (0)	105 (41.7)
	No/yes	13 (3.3)	13 (8.8)	0 (0)

NIV non-invasive ventilation, *IMV* invasive mechanical ventilation, *RRT* renal replacement therapy

confirmed the results of our previous single-centre study [5]. Many studies have established that age alone is not a sufficient criterion on which to base decisions [26–28]. That older age independently influences healthcare resource allocation is of considerable ethical concern [29]. Outcome research is crucial to ensure that decisions are based on likely effects of healthcare use and not on beliefs regarding age [30].

Decisions to use LSTs were largely influenced by factors unrelated to the patient, most notably bed availability and a random physician effect. Bed availability was a major independent factor influencing ICU admission in several studies [2, 3, 5, 20, 31]. Similarly, we found that having an additional available bed increased NIV and IMV decisions by 38 and 13 %, respectively. LST decisions for the same elderly patient varied across physicians. The significant residual physician effect found in our study for RRT (after IMV) might be due to unmeasured confounders such as likelihood of benefit (e.g., prognosis) or personal views about the social value of the expenditure. Ethical principles mandate that physician's decisions be independent from a patient's personal and behavioural characteristics. In a Swiss national questionnaire survey of ICU physicians involving vignettes of hypothetical scenarios, triage was significantly influenced by factors such as personality traits and social commitment, in contradiction to ethical rules [32]. In the ICE-CUB study, [23], the proportion of patients deemed by ICU physicians to be eligible for ICU admission ranged across centres from 5.6 to 38.8 %, and patient and ICU characteristics explained only 28 and 18 % of this variability, respectively [23]. The authors of the study suggested an influence of physician beliefs [23].

The physicians in our study often changed their decisions after learning of patient preferences, in 39, 56, and 57 % of cases for NIV, IMV, and RRT (after IMV), respectively. The change usually consisted in deciding not to use an LST that the patient did not want to receive, particularly for the more invasive LSTs (IMV and RRT after IMV), whose use is associated with greater prognostic uncertainty. For NIV, in contrast, which is used in less severe illnesses, the physicians attached limited importance to patient preferences. Unfortunately, knowledge of patient preferences is rarely available at ICU admission in emergencies, and few individuals in France have advance directives, which have not been promoted by healthcare authorities. Achieving the best balance in patient care that takes into account the evidence, recommendations, and patient preferences [33] is a difficult task that requires communication skills and specific training. The applicability of our findings varies with the decision-making process used in each country. The FAMIREA research group in France has reported that 91 % of ICU physicians support family participation but rarely involve families [34], that 50 % of families are unwilling to share

in medical decisions [34], and that post-traumatic stress symptoms are more common in families having participated in end-of-life decisions [35]. Our results may not apply to countries such as the US where a high level of patient autonomy is the rule.

Our study has several limitations. First, decisions made by physicians in a simulation study may differ from those made in everyday practice. However, the validity of our study design is supported by the finding that pre-admission factors substantially influence elderly patient triage to ICU admission [2, 5, 20]. Second, the patient sample is small and may not be representative of the overall elderly population in France. Third, the ICU physician sample was small and the 45 % participation rate may have introduced selection bias. However, the response rate among physicians who agreed to participate was 100 %, probably thanks to the use of vignettes describing real patients, the limited time needed to participate via the website, and the e-mails or personal phone calls used to support participation. Nevertheless, even in this small sample we found significant variability. Fourth, patient preferences were collected during a single interview. Patient preferences regarding healthcare can change over time. However, the method used to collect patient preferences for advance directives is similar to that used in our study.

In conclusion, decisions about ICU admission of elderly patients for LSTs varied widely across ICU physicians. Knowledge of patient preferences led the ICU physicians to change their decision in 39–57 % of cases in order to comply with patient wishes. The change was usually a switch from using to not using the LST. Patient preferences had the largest effect on decisions. Older age and limited bed availability were strongly associated with refusing ICU admission. Our study findings indicate a need for discussing advance directives with patients aged $\geq$80.

Acknowledgments We thank A. Wolfe, MD, for her assistance in preparing the manuscript and Alexis Tabah for building and managing the study website. We thank all ICU physicians of the ETHICA group who participated in the study. This study was supported by the French Society for Critical Care (SRLF) and the Fondation de France. These organisations had no role in the design or conducting of the study; in data collection, management, or interpretation; or in the writing of the manuscript.

Appendix

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References

1. Bagshaw SM, Webb SA, Delaney A, George C, Pilcher D, Hart GK, Bellomo R (2009) Very old patients admitted to intensive care in Australia and New Zealand: a multi-centre cohort analysis. Crit Care 13:R45
2. Garrouste-Orgeas M, Montuclard L, Timsit JF, Reignier J, Desmettre T, Karoubi P, Moreau D, Montesino L, Duguet A, Boussat S, Ede C, Monseau Y, Paule T, Misset B, Carlet J (2005) Predictors of intensive care unit refusal in French intensive care units: a multiple-center study. Crit Care Med 33:750–755
3. Azoulay E, Pochard F, Chevret S, Vinsonneau C, Garrouste-Orgeas M, Cohen Y, Thuong M, Paugam C, Apperre C, De Cagny B, Brun F, Bornstain C, Parrot A, Thamion F, Lacherade JC, Bouffard Y, Le Gall JR, Herve C, Grassin M, Zittoun R, Schlemmer B, Dhainaut JF (2001) Compliance with triage to intensive care recommendations. Crit Care Med 29:2132–2136
4. Vanhecke TE, Gandhi M, McCullough PA, Lazar MH, Ravikrishnan KP, Kadaj P, Begle RL (2008) Outcomes of patients considered for, but not admitted to, the intensive care unit. Crit Care Med 36:812–817
5. Garrouste-Orgeas M, Timsit JF, Montuclard L, Colvez A, Gattolliat O, Philippart F, Rigal G, Misset B, Carlet J (2006) Decision-making process, outcome, and 1-year quality of life of octogenarians referred for intensive care unit admission. Intensive Care Med 32:1045–1051
6. Task Force of the American College of Critical Care Medicine, Society of Critical Care Medicine (1999) Guidelines for intensive care unit admission, discharge, and triage. Crit Care Med 27:633–638
7. Garrouste-Orgeas M, Boumendil A, Pateron D, Aergerter P, Somme D, Simon T, Guidet B (2009) Selection of intensive care unit admission criteria for patients aged 80 years and over and compliance of emergency and intensive care unit physicians with the selected criteria: an observational, multicenter, prospective study. Crit Care Med 37:2919–2928
8. Frost DW, Cook DJ, Heyland DK, Fowler RA (2011) Patient and healthcare professional factors influencing end-of-life decision-making during critical illness: a systematic review. Crit Care Med 39:1174–1189
9. Joynt GM, Gomersall CD, Tan P, Lee A, Cheng CA, Wong EL (2001) Prospective evaluation of patients refused admission to an intensive care unit: triage, futility and outcome. Intensive Care Med 27:1459–1465
10. Reignier J, Dumont R, Katsahian S, Martin-Lefevre L, Renard B, Fiancette M, Lebert C, Clementi E, Bontemps F (2008) Patient-related factors and circumstances surrounding decisions to forego life-sustaining treatment, including intensive care unit admission refusal. Crit Care Med 36:2076–2083
11. Le Conte P, Riochet D, Batard E, Volteau C, Giraudeau B, Arnaudet I, Labastire L, Levraut J, Thys F, Lauque D, Piva C, Schmidt J, Trewick D, Potel G (2010) Death in emergency departments: a multicenter cross-sectional survey with analysis of withholding and withdrawing life support. Intensive Care Med 36:765–772
12. Barnato AE, Hsu HE, Bryce CL, Lave JR, Emlet LL, Angus DC, Arnold RM (2008) Using simulation to isolate physician variation in intensive care unit admission decision making for critically ill elders with end-stage cancer: a pilot feasibility study. Crit Care Med 36:3156–3163
13. Alemayehu E, Molloy DW, Guyatt GH, Singer J, Penington G, Basile J, Eisemann M, Finucane P, McMurdo ME, Powell C (1991) Variability in physicians' decisions on caring for chronically ill elderly patients: an international study. CMAJ 144:1133–1138
14. Philippart F, Vesin A, Bruel C, Kpodji A, Durand-Gassellin B, Garçon P, Levy-Soussan M, Jagot J, Calvo-Verjat N, Timsit JF, Misset B, Garrouste Orgeas M (2013) The ETHICA study (part I): elderly thoughts about intensive care unit admission for life-sustaining treatments: on behalf of the ETHICA group. Intensive Care Med. doi: 10.1007/s00134-013-2976-y
15. Lawton MP, Brody EM (1969) Assessment of older people: self-maintaining and instrumental activities of daily living. Gerontologist 9:179–186
16. Katz S (1983) Assessing self-maintenance: activities of daily living, mobility, and instrumental activities of daily living. J Am Geriatr Soc 31:721–727

17. Skevington SM, Lotfy M, O'Connell KA (2004) The World Health Organization's WHOQOL-BREF quality of life assessment: psychometric properties and results of the international field trial. A report from the WHOQOL Group. Qual Life Res 13:299–310
18. Power M, Quinn K, Schmidt S (2005) Development of the WHOQOL-old module. Qual Life Res 14:2197–2214
19. Edbrooke DL, Minelli C, Mills GH, Iapichino G, Pezzi A, Corbella D, Jacobs P, Lippert A, Wiis J, Pesenti A, Patroniti N, Pirracchio R, Payen D, Gurman G, Bakker J, Kesecioglu J, Hargreaves C, Cohen SL, Baras M, Artigas A, Sprung CL (2011) Implications of ICU triage decisions on patient mortality: a cost-effectiveness analysis. Crit Care 15:R56
20. Garrouste-Orgeas M, Montuclard L, Timsit JF, Misset B, Christias M, Carlet J (2003) Triaging patients to the ICU: a pilot study of factors influencing admission decisions and patient outcomes. Intensive Care Med 29:774–781
21. Sprung CL, Artigas A, Kesecioglu J, Pezzi A, Wiis J, Pirracchio R, Baras M, Edbrooke DL, Pesenti A, Bakker J, Hargreaves C, Gurman G, Cohen SL, Lippert A, Payen D, Corbella D, Iapichino G (2012) The Eldicus prospective, observational study of triage decision making in European intensive care units. Part II: intensive care benefit for the elderly. Crit Care Med 40:132–138
22. Sprung CL, Geber D, Eidelman LA, Baras M, Pizov R, Nimrod A, Oppenheim A, Epstein L, Cotev S (1999) Evaluation of triage decisions for intensive care admission. Crit Care Med 27:1073–1079
23. Boumendil A, Angus DC, Guitonneau AL, Menn AM, Ginsburg C, Takun K, Davido A, Masmoudi R, Doumenc B, Pateron D, Garrouste-Orgeas M, Somme D, Simon T, Aegerter P, Guidet B (2012) Variability of intensive care admission decisions for the very elderly. PLoS One 7:e34387
24. Sprung CL, Baras M, Iapichino G, Kesecioglu J, Lippert A, Hargreaves C, Pezzi A, Pirracchio R, Edbrooke DL, Pesenti A, Bakker J, Gurman G, Cohen SL, Wiis J, Payen D, Artigas A (2012) The Eldicus prospective, observational study of triage decision making in European intensive care units: part I-European Intensive Care Admission Triage Scores. Crit Care Med 40:125–131
25. Boumendil A, Latouche A, Guidet B (2011) On the benefit of intensive care for very old patients. Arch Intern Med 171:1116–1117
26. De Rooij SE, Govers AC, Korevaar JC, Giesbers AW, Levi M, De Jonge E (2008) Cognitive, functional, and quality-of-life outcomes of patients aged 80 and older who survived at least 1 year after planned or unplanned surgery or medical intensive care treatment. J Am Geriatr Soc 56:816–822
27. Somme D, Maillet JM, Gisselbrecht M, Novara A, Ract C, Fagon JY (2003) Critically ill old and the oldest-old patients in intensive care: short- and long-term outcomes. Intensive Care Med 29:2137–2143
28. Martin GS, Mannino DM, Moss M (2006) The effect of age on the development and outcome of adult sepsis. Crit Care Med 34:15–21
29. Loewy EH (2005) Age discrimination at its best: should chronological age be a prime factor in medical decision making? Health Care Anal 13:101–117
30. Mick DJ, Ackerman MH (1997) Neutralizing ageism in critical care via outcomes research. AACN Clin Issues 8:597–608
31. Iapichino G, Corbella D, Minelli C, Mills GH, Artigas A, Edbooke DL, Pezzi A, Kesecioglu J, Patroniti N, Baras M, Sprung CL (2010) Reasons for refusal of admission to intensive care and impact on mortality. Intensive Care Med 36:1772–1779
32. Escher M, Perneger TV, Chevrolet JC (2004) National questionnaire survey on what influences doctors' decisions about admission to intensive care. BMJ 329:425
33. Quill TE, Holloway RG (2012) Evidence, preferences, recommendations–finding the right balance in patient care. N Engl J Med 366:1653–1655
34. Azoulay E, Pochard F, Chevret S, Adrie C, Annane D, Bleichner G, Bornstain C, Bouffard Y, Cohen Y, Feissel M, Goldgran-Toledano D, Guitton C, Hayon J, Iglesias E, Joly LM, Jourdain M, Laplace C, Lebert C, Pingat J, Poisson C, Renault A, Sanchez O, Selcer D, Timsit JF, Le Gall JR, Schlemmer B (2004) Half the family members of intensive care unit patients do not want to share in the decision-making process: a study in 78 French intensive care units. Crit Care Med 32:1832–1838
35. Azoulay E, Pochard F, Kentish-Barnes N, Chevret S, Aboab J, Adrie C, Annane D, Bleichner G, Bollaert PE, Darmon M, Fassier T, Galliot R, Garrouste-Orgeas M, Goulenok C, Goldgran-Toledano D, Hayon J, Jourdain M, Kaidomar M, Laplace C, Larche J (2005) Risk of posttraumatic stress symptoms in family members of intensive care unit patients. Am J Respir Crit Care Med 171:987–994