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REPORTS OF ORIGINAL INVESTIGATIONS

Outcomes of elderly critically ill medical and surgical patients: a multicentre cohort study

Pronostics des patients âgés et gravement malades en médecine et en chirurgie: une étude de cohorte multicentrique

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Abstract

Purpose *Very elderly (over 80 yr of age) critically ill patients admitted to medical-surgical intensive care units (ICUs) have a high incidence of mortality, prolonged hospital length of stay, and dependent living conditions should they survive. The primary purpose of this study is to describe the outcomes and differences in outcomes between very elderly medical patients and their surgical counterparts admitted to Canadian ICUs, thereby informing decision-making for clinicians and substitute decision-makers.*

Methods *This was a prospective multicentre cohort study of very elderly medical and surgical patients admitted to 22 Canadian academic and non-academic ICUs. Outcome measures included ICU length of stay and mortality, hospital length of stay and mortality, and disposition following hospital discharge.*

Results *There were 1,671 patients evaluated in this study. Patient demographics included a mean age of 84.5 yr, baseline Acute Physiology and Chronic Health Evaluation (APACHE) II score of 22.4, baseline Sequential Organ Failure Assessment (SOFA) score of 5.3, overall ICU mortality of 21.8%, and overall hospital mortality of 35.0%. Medical patient median ICU length of stay was 4.1 days, hospital length of stay was 16.2 days, ICU mortality was 26.5%, and hospital mortality was 41.5%. Surgical patient median ICU length of stay was 3.8 days, hospital length of stay was 20.1 days, ICU mortality was*

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18.7%, and hospital mortality was 31.6%. Only 45.0% of medical patients and 41.6% of surgical emergency patients were able to return home to live.

Conclusions *In this large sample of critically ill medical and surgical patients, the admission SOFA score and hospital lengths of stay were not different between the two groups, but medical patients had longer ICU lengths of stay and higher ICU and hospital mortality than surgical patients.*

Résumé

Objectif *Chez les patients gravement malades et très âgés (plus de 80 ans) admis dans les unités de soins intensifs (USI) médico-chirurgicales, l'incidence de mortalité, de séjour hospitalier prolongé, et de conditions de vie à charge d'autrui en cas de survie est élevée. L'objectif principal de cette étude est de décrire les pronostics et les différences de pronostics entre les patients médicaux très âgés et leurs pendants chirurgicaux admis dans les USI canadiennes, et d'ainsi éclairer la prise de décision des cliniciens et autres décideurs.*

Méthode *Nous avons réalisé une étude de cohorte multicentrique et prospective portant sur des patients médicaux et chirurgicaux très âgés admis dans 22 USI canadiennes situés dans des centres universitaires et non universitaires. Les critères d'évaluation comprenaient la durée de séjour et la mortalité à l'USI, la durée de séjour et la mortalité à l'hôpital, et l'état après le congé de l'hôpital.*

Résultats *Au total, 1671 patients ont été évalués dans cette étude. Voici les données démographiques des patients : âge moyen de 84,5 ans, score APACHE II (Acute Physiology and Chronic Health Evaluation) à l'arrivée de 22,4, score SOFA (Sequential Organ Failure Assessment) à l'arrivée de 5,3, mortalité globale à l'USI de 21,8%, et mortalité globale à l'hôpital de 35,0%. Pour les patients en médecine, la durée de séjour médiane à l'USI était de 4,1 jours, la durée de séjour à l'hôpital de 16,2 jours, la mortalité à l'USI de 26,5% et la mortalité hospitalière de 41,5%. Pour les patients en chirurgie, la durée de séjour médiane à l'USI était de 3,8 jours, la durée de séjour à l'hôpital de 20,1 jours, la mortalité à l'USI de 18,7% et la mortalité hospitalière de 31,6%. Seuls 45,0% des patients en médecine et 41,6% des patients d'urgence chirurgicale ont été capables de rentrer chez eux pour y vivre après avoir reçu leur congé.*

Conclusion *Dans ce vaste échantillon de patients médicaux et chirurgicaux gravement malades, le score SOFA à l'admission et les durées de séjour hospitalier étaient comparables entre les deux groupes, mais les patients médicaux sont restés plus longtemps à l'USI et ont souffert d'une mortalité plus élevée tant à l'USI qu'à l'hôpital par rapport aux patients chirurgicaux.*

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The percentage of the world's population over 80 yr of age is expected to double by 2050.[1–3] Australian data from 2000-2005 show a 6% increase per year in intensive care unit (ICU) admissions for patients over 80 yr of age.[4] The same data suggest that, by 2015, 25% of ICU admissions will be for patients over 80 yr of age. The main causes of death in this demographic are degenerative diseases and cancer.[5] Twenty percent of these deaths occur in Canadian intensive care units (ICUs).[6,7] Reserving ICU beds for elderly patients who wish to receive aggressive life-sustaining therapy and are likely to benefit from such treatment could significantly improve critical care resource allocation and utilization.

Based on survey data from both Canada and abroad, most elderly people would prefer to be cared for and die in their own home.[7–9] A 2006 study by Heyland and other members of our group[10] identified that elderly Canadians value quality over quantity of life and do not want technology-supported life-prolonging measures. Canadian ICUs continue with mechanical ventilation and life-prolonging technology for the elderly, even when there is little chance of meaningful recovery. There is currently a significant disconnect between the wishes of the Canadian population and ground-level clinical practice.[4–7]

A recent study in France found a similar challenge in that 54% of hospitalized patients over 80 yr of age were admitted to ICUs, although 70% wanted comfort care rather than life-prolonging care.[11] Data from other countries confirm a similar discrepancy.[11–13] In the Hospitalized Elderly Longitudinal Project (HELP), although 70% of participants stated a preference for comfort-focused care rather than life-prolonging care and $>$ 80% had a do-not-resuscitate order, 63% of patients received one or more life-sustaining treatments before they died.[14] These discrepancies disrespect patient autonomy and prolong the dying process at significant expense to healthcare systems. The Canadian Critical Care Research Network database of over 200,000 ICU admissions shows an increase in the proportion of octogenarian admissions from 10% in 1994 to 14% in 2005. An Ontario (provincial) critical care database shows that octogenarians comprised 18% of ICU admissions from 2006-2008.[15] Ontario hospital ICU mortality data from 2001-2003 shows that 48% of critically ill octogenarians had died one year after hospitalization compared with a 23% ICU mortality in patients under 80 yr of age.[16] In a single-centre study in France published in 2006, 180 critically ill octogenarians were followed to one year after hospital discharge. The hospital and one-year mortality were 63% and 71%, respectively. Survivors described higher rates of depression, isolation, and lower mobility than an age- and sex-matched community cohort. More concerning was the fact that 57% of respondents stated that they would decline a subsequent life-sustaining ICU admission in the event of a recurrent critical illness.[11]

Canadian data are lacking on outcomes of patients over 80 yr of age admitted to ICUs, and on outcomes of elderly surgical emergency patients *vs* medically ill patients admitted to the ICU. REALISTIC 80 (Realities, Expectations, and Attitudes to Life Support Technologies in Intensive Care for Octogenarians, clinicaltrials.gov, NCT01293708), a multicentre prospective observational cohort study conducted from September 2009 to February 2013, is the largest prospective study of ICU outcomes in elderly patients. Twenty-two Canadian academic and community ICUs participated. Our primary objective was to describe the outcomes of the Realistic 80 cohort, including length of ICU stay, ICU mortality, length of hospital stay, hospital mortality, and ability to return to their pre-ICU admission living environment. Secondary objectives were to describe the types of very old patients typically being admitted to ICUs, including demographics, admission diagnosis, illness severity, and outcome differences between those patients admitted for medical *vs* surgical reasons.

Methods

Design and setting

Each local Research Ethics Board gave permission to waive consent for the REALISTIC 80 study. All patients over 80 yr of age and admitted to the ICU were eligible. The recently published principal manuscript from this study[17] evaluated differences between participants who stayed in the ICU more than seven days *vs* less than seven days, outcome differences based on premorbid frailty scores, and management and outcome differences based on the presence or absence of advanced directives. This companion paper focuses on differences between medical patients and surgical emergency patients as regards processes of care, ICU and hospital lengths of stay, ICU and hospital mortality, and disposition following hospital discharge.

Study population

We included a consecutive sample of all patients 80 yr of age or older who were admitted to participating ICUs. Patients were grouped into three categories: elective surgical patients, emergency (unplanned) surgical patients, and medical patients. Enrolment began in September 2009 and was completed in February 2013. Previously enrolled patients re-admitted to the ICU were not re-enrolled as comprehensive data collection continued for 12 months following the index ICU admission. Routine local practices regarding criteria for ICU admission were maintained.

Baseline data collection

Trained research personnel collected data on the following outcomes for each study participant: age, sex, marital status, living status, APACHE II,[18] SOFA (Sequential Organ Failure Assessment),[19] Functional Comorbidity Index,[20] Charlson Comorbidity Index,[21] admission type (medical, surgical emergency, surgical elective), following acute or chronic illness, length of hospital stay prior to ICU admission, primary ICU diagnosis, number of hospitalizations and emergency department visits in the preceding 12 months, serum albumin, body mass index, number of days in ICU, number of days in hospital, number of days of mechanical ventilation, ICU mortality, and hospital mortality.

The rates of ICU and hospital mortality were endpoints of interest in our dataset, not survival. In this manuscript, survival refers to discharge from hospital to the same/similar type of residence prior to the index admission and within one year of the index ICU admission or alive in hospital one year following the index ICU admission. Early in the recruitment phase, funding allowed for each site to enrol a convenience sample of the first 60 eligible patients into the hospital cohort. Partway through the study, this number was decreased to 30 patients per site as our peer-review funding was insufficient to enroll and carefully follow the 60 patients per site as originally planned.

Data analysis

Length of stay variables are presented as medians, quartiles [IQR], and ranges because of their positive skews, while other continuous variables are presented as means, standard deviations (SD), and ranges. Categorical variables are presented as counts and percentages. All statistical analyses were performed using SAS® Version 9.3 (SAS Inc., Cary, NC, USA).

Results

There were 1,671 patients enrolled in this study. The majority of study participants were critically ill for medical reasons (1,033 patients), while surgical emergencies (418 patients) and elective surgeries (220 patients) formed the remainder of the cohort (Table 1). All enrolled patients were successfully followed until hospital death, 12 months following their index admission, or transfer to a non-study site hospital ward.

The mean age (approximately 84 yr) was consistent across the three groups, and sex was also similarly distributed among the three groups (55% male).

The medical patients received the poorest results on the APACHE II, Charlson, and Functional Comorbidity indices, which were statistically significant outcomes for these three parameters. The SOFA score, however, was highest in surgical emergency patients (Table 1). Regarding the primary ICU diagnosis, medical patients accounted for the majority of respiratory and septic causes for admission, while surgical patients accounted for a disproportionately high number of gastrointestinal causes for their ICU admissions (Table 1).

The percentage of patients requiring vasopressor support was virtually the same in the medical (56.8%) and surgical (54.3%) groups of patients (Table 2). More than twice as many medical patients (19.3%) received noninvasive mechanical ventilation compared with surgical patients (9.8%). (Table 2) This is not surprising, as more medical patients would be expected to have disease processes amenable to noninvasive ventilation management. Moreover, many emergency surgical patients are transferred directly to the ICU from the operating room prior to tracheal extubation, which likely accounts for the higher proportion of surgical patients (85.2%) *vs* medical patients (67.1%) receiving invasive ventilation (Table 2). More medical patients (7.6%) than surgical patients (4.1%) received dialysis during their ICU stay. Medical patients were more likely than surgical patients to have life-sustaining therapies withheld at ICU admission, withheld after ICU admission, or withdrawn after ICU admission (Table 2).

The median total ICU length of stay was 4.1 days for medical patients and 3.8 days for surgical emergency patients. Median index ICU length of stay was 4.0 days for medical patients and 2.1 days for surgical emergency patients (Table 3). Less than seven percent of all patients were readmitted to the ICU. The median total hospital length of stay was 16.4 days and 20.1 days for medical and surgical emergency patients, respectively. The ICU mortality was 26.5% for medical patients and 18.7% for surgical emergency patients. The hospital mortality was 41.5% for medical patients and 31.6% for surgical emergency patients (Tables 3, 4). Of the 1,086 patients who survived to leave the hospital, 45% of medical patients and 41.6% of surgical emergency patients were discharged home. A considerable proportion of the patients (46% of medical patients and 51.4% of surgical patients) who were discharged from their admitting hospital within one year of admission were ultimately transferred to either another hospital or to a long-term care facility.

Discussion

The results of this study are important at this time for several reasons. The proportion of the population over 80 yr of age is growing at a rapid rate, and increasing numbers of elderly patients are becoming critically ill. In order to empower these patients and optimize management of scarce resources, it is more important now than ever to understand their wishes regarding end-of-life care and to engage in evidence informed end-of-life discussions.

A current body of literature attempts to provide data on the outcomes of critically ill elderly patients who are managed aggressively in ICU settings. Boumendil *et al.* performed a single-centre prospective cohort study of 233 octogenarians admitted to an ICU in France over a two-year period.[22] The primary outcome of their study was long-term survival, which was predicted principally by the patient's premorbid condition. De Rooij[23] used patient characteristics available within the first 24 hr of ICU admission, whereas Boumendil used characteristics available within the first 72 hr. Minne's 2011 systematic review evaluated prognostic models for ICU mortality in elderly patients and concluded that, although most of the existing models are methodologically sound, none are ready for implementation into clinical practice.[24]

The lack of robust data about the clinical course of critically ill octogenarians may be a contributing factor to the indecision concerning end-of-life care in general and ICU admissions in particular.

Families commonly ask Canadian acute care physicians to quantify the expected mortality prior to any decision regarding the desired level of medical intervention. When physicians cannot provide an objective evidence-based prediction of the outcome, the family's typical default decision is to opt for aggressive technology-driven life-prolonging treatment. This may be a decision that they later come to regret.[15,25] In addition, clinician judgment has been shown to be poor at predicting when patients will die.[26]

Table 1 Patient demographics categorized by admission diagnosis

*Mean (SD)	Medical (n = 1,033)	Surgical elective (n = 220)	Surgical emergency (n = 418)	All patients (n = 1,671)
Age (yr)* - mean - range	84.6 (3.5) 79.9-100.2	84.0 (3.2) 80.0-95.9	84.4 (3.4) 80.0-96.6	84.5 (3.2) 79.9-100.2
Sex				
Male	568 (55.0%)	123 (55.9%)	224 (53.6%)	915 (54.8%)
Female	465 (45.0%)	97 (44.1%)	194 (46.4%)	756 (45.2%)
Baseline APACHE II*	23.1 (7.9)	19.5 (7.1)	22.1 (7.2)	22.4 (7.7)
Charlson Comorbidity Index*	2.2 (1.8)	1.9 (1.9)	1.9 (1.9)	2.1 (1.8)
Functional Comorbidity Index *	1.9 (1.4)	1.8 (1.3)	1.7 (1.4)	1.8 (1.4)
Pre-ICU Albumin ($g{\cdot}L^{-1}$) *	29.5 (7.2)	32.3 (8.4)	28.7 (6.8)	29.6 (7.3)
Pre-ICU Hemoglobin ($g{\cdot}L^{-1}$) *	114.1 (25.9)	112.4 (26.1)	114.3 (27.0)	114.0 (26.2)
Baseline SOFA score*	5.3 (3.4)	4.8 (2.9)	5.4 (3.3)	5.3 (3.3)
Primary ICU diagnosis				
Cardiovascular/vascular	212 (20.5%)	112 (50.9%)	84 (20.1%)	408 (24.4%)
Respiratory	361 (34.9%)	16 (7.3%)	12 (2.9%)	389 (23.3%)
Gastrointestinal	74 (7.2%)	35 (15.9%)	189 (45.2%)	298 (17.8%)
Neurologic	114 (11.0%)	17 (7.7%)	55 (13.2%)	186 (11.1%)
Sepsis	171 (16.6%)	5 (2.3%)	2 (0.5%)	178 (10.7%)
Trauma	37 (3.6%)	0 (0.0%)	37 (8.9%)	74 (4.4%)
Orthopedic	2 (0.2%)	29 (13.2%)	36 (8.6%)	67 (4.0%)
Hematologic	43 (4.2%)	0 (0.0%)	0 (0.0%)	43 (2.6%)
Metabolic	18 (1.7%)	0 (0.0%)	0 (0.0%)	18 (1.1%)
Renal	1 (0.1%)	5 (2.3%)	3 (0.7%)	9 (0.5%)
Gynecologic	0 (0.0%)	1 (0.5%)	0 (0.0%)	1 (0.1%)
*Mean (SD)	Medical (n = 1,033)	Surgical Elective (n = 220)	Surgical Emergency (n = 418)	All Patients (n = 1,671)
Mean Days* from ICU Admission to First Withhold or Withdrawal Order in ICU	5.1 (7.7)	6.8 (8.6)	4.8 (5.5)	5.2 (7.3)
Mean Days* from First Withhold or Withdrawal Order in ICU to Death	6.5 (9.7)	4.6 (4.9)	6.8 (10.1)	6.5 (9.7)
Received Vasopressors				
Yes (%)	587 (56.8%)	128 (58.2%)	227 (54.3%)	942 (56.4%)
Duration (days)*	3.7 (3.7)	3.5 (4.6)	3.6 (3.1)	3.7 (3.7)
Non-Invasive Ventilation				
Yes (%)	199 (19.3%)	18 (8.2%)	41 (9.8%)	258 (15.4%)
Duration (days)*	3.3 (3.9)	3.1 (2.9)	3.0 (2.9)	3.2 (3.7)
Invasive Ventilation				
Yes (%)	693 (67.1%)	152 (69.1%)	356 (85.2%)	1,201 (71.9%)
Duration (days)*	8.2 (17.3)	4.8 (7.9)	6.0 (7.6)	7.1 (14.1)
Received Dialysis				
Yes (%)	78 (7.6%)	8 (3.6%)	17 (4.1%)	103 (6.2%)
Duration (days)*	12.0 (18.2)	17.0 (16.1)	13.9 (22.6)	12.7 (18.6)
Withheld at ICU Admission				
Vasopressor	28 (2.7%)	2 (0.9%)	4 (1.0%)	34 (2.0%)
Ventilator	73 (7.1%)	4 (1.8%)	9 (2.2%)	86 (5.1%)
Dialysis	29 (2.8%)	1 (0.5%)	8 (1.9%)	38 (2.3%)
CPR	216 (20.9%)	12 (5.5%)	69 (16.5%)	297 (17.8%)

Table 1 continued

*Mean (SD)	Medical (*n* = 1,033)	Surgical elective (*n* = 220)	Surgical emergency (*n* = 418)	All patients (*n* = 1,671)
No life-sustaining therapies withheld	814 (78.8%)	208 (94.5%)	349 (83.5%)	1,371 (82.0%)
Withheld After ICU Admission to ICU Discharge or ICU Death				
Vasopressor	132 (12.8%)	9 (4.1%)	29 (6.9%)	170 (10.2%)
Ventilation	147 (14.2%)	13 (5.9%)	37 (8.9%)	197 (11.8%)
Dialysis	110 (10.6%)	8 (3.6%)	35 (8.4%)	153 (9.2%)
CPR	311 (30.1%)	20 (.1%)	96 (23.0%)	427 (25.6%)
No life-sustaining therapies withheld	672 (65.1%)	195 (88.6%)	309 (73.9%)	1,176 (70.4%)
Withdrawn After ICU Admission to ICU Discharge or ICU Death				
Vasopressor	112 (10.8%)	6 (2.7%)	40 (9.6%)	158 (9.5%)
Ventilation	184 (17.8%)	7 (3.2%)	45 (10.8%)	236 (14.1%)
Dialysis	19 (1.8%)	1 (0.5%)	11 (2.6%)	31 (1.9%)
CPR	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
No life-sustaining therapies withheld	823 (79.7%)	210 (95.5%)	362 (86.6%)	1,395 (83.5%)

CPR = cardiopulmonary resuscitation; ICU = intensive care unit; SOFA = Sequential Organ Failure Assessment.

An expert panel convened by the European Intensive Care Society, the American Thoracic Society, and the Society for Critical Care Medicine has identified late deaths after critical illness as a priority research area.[27] Realistic 80 is the largest study of critically ill elderly patients to date. Strengths of this dataset include the richness of premorbid patient data, its prospective nature, the heterogeneous patient population, and the inclusion of a large number of teaching and non-teaching centres.

There is abundant evidence that ICU mortality worsens with increasing age,[13,15,16,27–30] which is also intuitively obvious. It has also been repeatedly shown that elderly ICU patients can have very good outcomes.[11,16,22–24,27] While our data show a statistically significant difference in age between survivors and non-survivors, the six-month difference does not appear clinically meaningful.

On the first day of ICU stay, the mean (SD) SOFA scores were similar between medical patients and surgical emergency patients [5.4 (3.3) *vs* 5.3 (3.4), respectively]. Despite similar organ dysfunction scores upon ICU admission and similar hospital lengths of stay, very old critically ill medical patients had longer index ICU lengths of stay and much higher ICU and hospital mortalities than their surgical emergency counterparts (Table 4). Nevertheless, a similar percentage of medical and surgical patients who survived to hospital discharge were able to return home. In addition, a similar proportion of both medical and surgical patients who were discharged from their admitting hospital within one year of admission were ultimately transferred to another healthcare institution.

In our view, our data on ICU mortality, hospital mortality, and eventual location of hospital discharge, combined with the mean lengths of stay, will help inform decision- makers regarding ICU admission, either at the time when immediate consideration is required or, ideally, before the necessity arises.

We acknowledge that even the most robust data are not a substitute for a compassionate patient-centred end-of-life discussion with patients and/or their substitute decision-makers. We expect that this information will complement high-quality end-of-life meetings, thereby allowing surrogate decision-makers to make more informed patient-focused end-of-life decisions.

Although this study enrolled a large number of very old critically ill patients across 22 different centres, it still suffers from several important limitations. In particular, the following factors limit the generalizability of this study's findings.

This study enrolled only patients who were admitted to ICUs, thereby systematically excluding all elderly patients who died at home, who were not transferred to hospital from their nursing home, and who previously expressed their wish not to be admitted to ICU or placed on life-sustaining therapy. Many critically ill elderly patients were likely referred to the ICU but were refused admission either because their prognosis was considered too poor or because the conclusion not to admit the patient to the ICU was reached during a pre-ICU admission family meeting.

Table 2 Processes of ICU care

	Medical (*n* = 1,033)	Surgical Elective (*n* = 220)	Surgical Emergency (*n* = 418)	All Patients (*n* = 1,671)
Received Vasopressors				
Yes (%)	587 (56.8%)	128 (58.2%)	227 (54.3%)	942 (56.4%)
Duration [days]*	3 [2-4]	2 [1-4]	3 [2-4]	3 [2-4]
Non-Invasive Ventilation				
Yes (%)	199 (19.3%)	18 (8.2%)	41 (9.8%)	258 (15.4%)
Duration [days]*	0.9 [0.3-2.4]	1.1 [0.5-2.6]	0.7 [0.3-2.6]	0.9 [0.3-2.5]
Invasive Ventilation				
Yes (%)	693 (67.1%)	152 (69.1%)	356 (85.2%)	1,201 (71.9%)
Duration [days]*	3.1 [1.3-7.4]	0.9 [0.4-3.1]	1.9 [0.8-6.0]	2.4 [0.9-6.6]
Withheld at ICU Admission				
Vasopressor	28 (2.7%)	2 (0.9%)	4 (1.0%)	34 (2.0%)
Ventilator	73 (7.1%)	4 (1.8%)	9 (2.2%)	86 (5.1%)
Dialysis	29 (2.8%)	1 (0.5%)	8 (1.9%)	38 (2.3%)
CPR	216 (20.9%)	12 (5.5%)	69 (16.5%)	297 (17.8%)
No life-sustaining therapies withheld	814 (78.8%)	208 (94.5%)	349 (83.5%)	1,371 (82.0%)
Withheld After ICU Admission to ICU Discharge or ICU Death				
Vasopressor	132 (12.8%)	9 (4.1%)	29 (6.9%)	170 (10.2%)
Ventilation	147 (14.2%)	13 (5.9%)	37 (8.9%)	197 (11.8%)
Dialysis	110 (10.6%)	8 (3.6%)	35 (8.4%)	153 (9.2%)
CPR	311 (30.1%)	20 (.1%)	96 (23.0%)	427 (25.6%)
No life-sustaining therapies withheld	672 (65.1%)	195 (88.6%)	309 (73.9%)	1,176 (70.4%)
Withdrawn After ICU Admission to ICU Discharge or ICU Death				
Vasopressor	112 (10.8%)	6 (2.7%)	40 (9.6%)	158 (9.5%)
Ventilation	184 (17.8%)	7 (3.2%)	45 (10.8%)	236 (14.1%)
Dialysis	19 (1.8%)	1 (0.5%)	11 (2.6%)	31 (1.9%)
CPR	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
No life-sustaining therapies withheld	823 (79.7%)	210 (95.5%)	362 (86.6%)	1,395 (83.5%)

*Median [interquartile range]. CPR = cardiopulmonary resuscitation; ICU = intensive care unit.

We assumed patients survived their hospital stay if they survived their ICU admission, were transferred to the ward, and were subsequently transferred out of the study hospital. This is a significant limitation of our data, which affected 288 (26.5%) of the 1,671 patients in the study.

Unfortunately, we did not collect outcome data on patients referred to the ICU but not admitted. For the above reasons, our results are biased towards overly optimistic outcomes. This may explain why the ICU and hospital mortality rates of the study patients do not differ significantly from those of younger ICU patients with similar degrees of illness.[30–34]

In general, the published ICU survival rates in very elderly patients are extremely variable, likely reflecting differences in inclusion criteria and/or patient type (medical *vs* surgical emergency *vs* elective surgical).[23–35]

This study enrolled a very small cohort of critically ill elderly trauma patients, another patient population for which data on long-term outcomes are limited.

Withdrawal of life support occurs earlier in the clinical course of very old patients who are not showing clinical improvement.[26] The decision to withdraw life-sustaining therapy based on medical futility relatively early in the ICU course biases our data, which shortens the expected lengths of stay but does not necessarily affect overall mortality. This bias could potentially make decision-makers view the length of stay data as falsely optimistic.

Some of the previously discussed factors limit the generalizability of our findings to patients who are transferred to hospital and referred for ICU admission. Our vision is to produce data that can inform advance-care

Table 3 Clinical outcomes

*Mean (SD)	Medical (n = 1,033)	Surgical elective (n = 220)	Surgical emergency (n = 418)	All patients (n = 1,671)
Baseline SOFA*	5.3 (3.4)	4.8 (2.9)	5.4 (3.3)	5.3 (3.3)
Maximum SOFA*	6.2 (3.7)	5.6 (3.2)	6.3 (3.6)	6.1 (3.6)
Delta SOFA*	0.8 (1.6)	0.8 (1.6)	1.0 (1.8)	0.9 (1.6)
Index ICU Length of Stay [days]**	4.0 [2.0-7.9]	2.1 [1.2-4.8]	3.8 [1.8-8.1]	3.7 [1.8-7.7]
Total ICU Length of Stay [days]**	4.1 [2.0-8.2]	2.4 [1.2-5.1]	3.8 [1.8-8.5]	3.8 [1.9-7.9]
Patients with at least one ICU readmission (%)	59 (5.7%)	14 (6.4%)	29 (6.9%)	102 (6.1%)
Hospital Length of Stay [days]**	16.4 [7.7-33.3]	13.0 [8.3-23.3]	20.1 [9.8-38.6]	16.6 [8.1-33.0]
ICU mortality (%)	274 (26.5%)	13 (5.9%)	78 (18.7%)	365 (21.8%)
Hospital mortality (%)	429 (41.5%)	24 (10.9%)	132 (31.6%)	585 (35.0%)
Discharged from Hospital to (%of total discharged)				
Ward in another hospital	149 (24.7%)	51 (26.0%)	88 (30.8%)	288 (26.5%)
ICU in another hospital	20 (3.3%)	1 (0.5%)	9 (3.1%)	30 (2.8%)
Long term care facility	136 (22.5%)	21 (10.7%)	59 (20.6%)	216 (19.9%)
Home	272 (45.0%)	113 (57.7%)	119 (41.6%)	504 (46.4%)
Rehab	22 (3.6%)	3 (1.5%)	9 (3.1%)	34 (3.1%)
Palliative Care	4 (0.7%)	2 (1.0%)	1 (0.3%)	7 (0.6%)
Other	1 (0.2%)	5 (2.6%)	1 (0.3%)	7 (0.6%)

*Mean (SD); **Median [interquartile range]. ICU = intensive care unit; SOFA = Sequential Organ Failure Assessment.

Table 4 Differences in most relevant outcomes between medical and surgical emergency patients

	Medical Patients	Surgical Emergency Patients	P value
Baseline SOFA, mean (SD)	5.3 (3.4)	5.4 (3.3)	0.609
ICU Length of Stay**	4.1 [2.0-8.2]	3.7 [1.8-8.5]	0.043
Hospital Length of Stay**	16.4 [7.7-33.2]	20.1 [9.8-38.6]	0.093
Discharge Home	26.3%	28.5%	0.406
ICU Mortality	26.5%	18.7%	0.0016
Hospital Mortality	41.5%	31.6%	0.0004

** Median [interquartile range]. ICU = intensive care unit; SOFA = sequential organ failure assessment.

planning in the healthy elderly outpatient population. Ideally, this planning could involve patients' family members and general practitioners in a non-acute care setting. Our results are still valuable for serving such a function, but they must be interpreted within the previously stipulated contexts.

In addition to informing decision-makers about ICU and hospital mortality, our data also provide practical data on median ICU length of stay, hospital length of stay, and the proportion of critically ill elderly patients who are able to return home following critical illness.

Future studies should provide clinical prediction tools that support more individualized prognoses of likely patient outcomes. Data for these tools can be obtained from patients' premorbid medical status and from their physical examination and laboratory tests obtained prior to ICU admission. This information will help predict low, moderate, or high probability of hospital mortality and/or functional outcomes. Once these individualized prediction tools are prospectively validated, they should provide decision-makers with information which is much more useful than mean cohort data.

Conclusions

Realistic 80 is the largest prospective dataset to evaluate the experiences of critically ill very old patients and to compare the outcomes of medical *vs* surgically treated patients admitted to the ICU. As stand-alone data, our results can inform end-of-life decision-making, not only regarding ICU and hospital mortality but also concerning more practical outcomes such as length of stay, and location of eventual hospital discharge.

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