Intensive Care Med (2012) 38:1169–1176
DOI 10.1007/s00134-012-2510-7

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Increased nonbeneficial care in patients spending their birthday in the ICU

Received: 28 July 2011
Accepted: 23 January 2012
Published online: 10 February 2012

This study was performed on behalf of the Outcomerea Study Group. Contributors and the 12 intensive care units where the study was performed are listed in the Appendix.

Electronic supplementary material The online version of this article (doi:10.1007/s00134-012-2510-7) contains supplementary material, which is available to authorized users.

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Abstract *Objective:* End-of-life decisions are based on objective and subjective criteria. Previous studies identified substantial subjective biases during end-of-life decision-making. We evaluated whether in-ICU patient's birthday influenced management decisions. *Design:* We used a case–control design in which patients spending their birthday in the ICU (cases) were matched to controls on center, gender, age, severity, type of admission, and length of ICU stay before birthday. *Setting:* 12 ICUs in French hospitals. *Patients:* The cases and controls were patients with ICU admissions >48 h over a 10-year period. *Interventions:* None. *Measurements and main results:* Compared with the 1,042 controls, the 223 cases were more often trauma patients and received a larger number and longer durations of life-sustaining interventions. This increased intensity of life support occurred after, but not before, the birthday. The cases had longer ICU stay lengths. ICU and hospital mortality were not different between the two groups. End-of-life decisions were made in 22% and 24% of cases and controls, respectively. However, these decisions were made later in the cases than in the controls (18 [5–33] versus 9 [3–19] days). *Conclusions:* Our finding that patients who spent their birthday in the ICU received a higher intensity of life-sustaining care and had longer ICU stays but did not have significantly different mortality rates compared with the controls suggests the use of nonbeneficial interventions. Staff members caring for patients whose birthdays fall during the ICU stay should be aware that this feature can bias end-of-life decisions, leading to an inappropriate level of care.

Keywords Withholding treatment · Intensive care units · Decision-making · Matched case–control study · Medical futility

Introduction

Most ICU deaths follow decisions to forgo life-sustaining treatments (DFLSTs) [1–5]. DFLSTs are usually taken within 3 days after ICU admission, and the patient usually dies within the next 24 h [4]. Among patients discharged alive from the ICU, those who had DFLSTs taken in the ICU are less likely to survive to hospital discharge than are patients without such decisions [6]. DFLSTs are taken in the sickest ICU patients, most notably those with terminal diseases and those not responding to a trial of intensive care without preset limits [6–8]. Independent predictors of DFLSTs include not only disease severity, patient comorbidities, expected quality of life, and post-ICU cognitive dysfunction, but also partly subjective variables such as the clinician's prediction of post-ICU cognitive dysfunction or quality-of-life alterations [9].

Over the last two decades, studies have identified substantial biases in the end-of-life decision-making process [9–13]. These biases may account for considerable practice differences that cannot be explained by routinely collected information. Sources of bias may be patient related (e.g., patient unwilling to receive life support or be dependent on vasopressors), family related (e.g., cultural factors, religion, and religiosity [4, 14, 15]), and clinician related (e.g., gender, role, specialty, and time working in ICUs [16–20]). In addition, treatments are more likely to be withdrawn if they are expensive or scarce or if they support noniatrogenic events. Last, discrepancies have been reported across countries in the incidence of death after DFLSTs, characteristics of patients who die after DFLSTs, and weight given to the patient's and family's opinion [4, 7, 8]. In addition to cultural specificities, legislation may substantially affect practices regarding end-of-life decisions [2, 12, 16, 21–23].

Several studies have identified significant associations between the risk of severe disease or death and ceremonial events such as birthdays and anniversaries [24]; For instance, in famous baseball players, death was more common shortly after birthdays than expected by chance [25], suggesting that the occurrence of one's birthday might have powerful effects on health.

Here, we hypothesized that staff members might be influenced by the knowledge that their patients are spending their birthday in the ICU. Staff members may perceive patients spending their birthday in the ICU as deserving of special care, and this perception may affect their management decisions in ways they are not aware. Such an effect may be either direct, related to staff members' feelings about birthdays, or indirect, occurring as a reaction to the family's expressions of painful feelings in response to the circumstances in which the birthday is taking place. To assess this hypothesis, we performed a multicenter case–control study comparing patients spending their birthday in the ICU (cases) with other patients admitted during the same period (controls). We compared these two groups regarding treatment intensity, rate of DFLSTs, time to DFLST implementation, ICU stay length, and mortality.

Patients and methods

This study was approved by the institutional review board of the Rhône-Alpes-Auvergne Clinical Investigation Centers.

Study design

Outcomerea is a prospective observational study that includes detailed clinical and outcome data on patients admitted to participating French ICUs [26]. Data included in the Outcomerea database have been collected by senior physicians with the collaboration of trained study monitors in the participating ICUs. For each patient, the data were entered into electronic case-report forms using VIGIREA™ and RHEA™ data-capture software (OUTCOMEREA™, Rosny-sous-Bois, France), and all case-report forms were then entered into the OUTCOMEREA™ data warehouse. The data-capture software automatically conducts multiple checks for internal consistency of most of the variables at entry into the database. Queries generated by these checks were resolved with the source ICU before incorporation of the new data into the database. At each participating ICU, data quality was controlled by having a senior physician from another participating ICU check a 2% random sample of the study data. A 1-day coding course is organized annually with the study investigators and research organization monitors.

Study population

The cases were all patients whose birthday fell between the ICU admission date and the ICU discharge date. Controls were all patients whose birthday fell outside the time spent in the ICU. To be in the same stratum as a case, a control had to be from the same center, gender, and age in class (<45, 45–58, 59–69, 70–77, ≥78 years). Control patients were also matched based on severity at admission in class [Sequential Organ Failure Assessment (SOFA) max in the first 48 h: 2, 3–5, 6–8, 9–12, ≥13)] [27] and on type of ICU admission (medical versus surgical). Lastly, control patients needed to have a length of ICU stay at least equal to the time in the ICU before birthday for cases.

Infections were defined as reported elsewhere [28, 29]. ICU and hospital stay lengths were computed from day of ICU admission. Severe sepsis was defined as infection with two or more criteria for systemic inflammatory response syndrome and at least one criterion for organ dysfunction. Criteria for systemic inflammatory response syndrome included core temperature ≥38°C or ≤36°C, heart rate ≥90 beats/min, respiratory rate ≥20 breaths/min, PCO_2 ≤32 mmHg or use of mechanical ventilation, and peripheral leukocyte count ≥12,000/µL or ≤4,000/µL. Organ dysfunction was defined as follows: (1) cardiovascular system failure with need for vasopressors and/or inotropic drugs, and/or systolic blood pressure <90 mmHg, and/or systolic blood pressure drop >40 mmHg from baseline, (2) renal dysfunction as urinary output ≤700 mL/day in a patient not previously receiving hemodialysis for chronic renal failure, (3) respiratory dysfunction as PaO_2 <70 mmHg or mechanical ventilation or a PaO_2/fraction of inspired oxygen ratio ≤250 (or <200 in patients with pneumonia), (4) bone marrow failure as platelet count <80,000/µL, and (5) metabolic acidosis as plasma lactate level ≥3 mmol/L.

Endpoints and analysis

Comparisons between cases and matched controls focused on five points: ICU stay length; treatment intensity, as reflected by the type and duration of life-sustaining treatments; DFLST rate; time from ICU admission to DFLSTs; and ICU and hospital mortality rates.

Statistical analysis

Results are expressed as numbers and percentages for categorical variables and as medians and first and third quartiles for continuous variables. Cases–controls comparisons in the overall cohort were based on conditional logistic regression controlling for matched groups.

A time proportional Cox model stratified on matching clusters was performed to assess the effect of having birthday during ICU stay on the risk to take DFLST. Birthday was introduced as a time-dependent covariate that occurs at the exact day of the ICU stay which corresponds to the patient's birthday. The effect of birthday was tested either as univariate or in the multivariate context thus adjusted on risk factors of DFLST known from literature [9].

Analyses were run using SAS 9.13 software (SAS Institute; Cary, NC, USA) and R software (R foundation, Vienna, Austria).

Results

As shown in Fig. 1, among the 7,899 patients admitted to the 12 participating ICUs over the 10-year study period (1997–2007), 256 (3.2%) spent their birthday in the ICU. Among them, 223 could be matched to 1,042 controls.

As reported in Table 1, the cases were more often admitted for trauma and had higher rates of use of intravascular catheters (central venous and arterial lines). A larger proportion of cases than controls were receiving antibiotics at ICU admission.

ICU length of stay was significantly greater in the cases than in the controls (13 [6–29] versus 9 [interquartile range (IQR) 5–19] days) (Table 2). The cases had longer durations of use for antibiotic therapy, mechanical ventilation, vasoactive agents, central venous and arterial lines, and nutrition. The rate of ICU-acquired infection was higher in the cases than in the controls. Of note, the use of life-sustaining interventions was greater in the cases than in the controls after, but not before, the birthday.

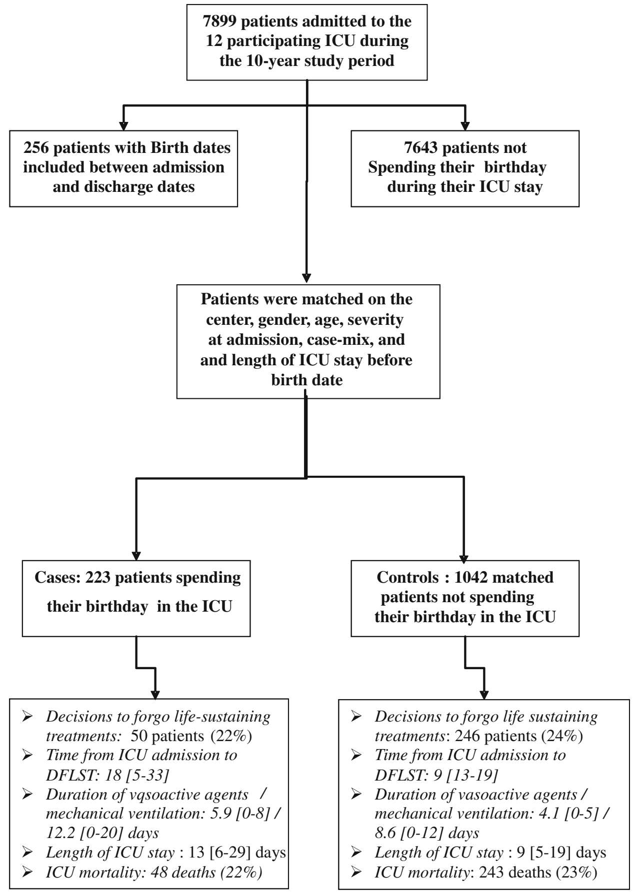

Fig. 1 Outcomes in patients spending their birthday in the ICU and in matched controls

The crude DFLST rate was not significantly different between the cases and controls (22% and 24%, respectively). However, the median time from ICU admission to DFLSTs was significantly longer in the cases (19 versus 10 days). Using survival models we found that the speed of making DFLSTs was lower among cases than among controls [Fig. 2; hazards ratio, 0.47; 95% confidence interval (CI), 0.28–0.78; $P = 0.004$]. This association remained significant after adjustment on risk factors of DFLST (hazards ratio, 0.45; 95% CI, 0.27–0.77; $P = 0.003$). Moreover, time between birthday and DFLST was 11 (3–24) days in the 50 patients (cases) in whom a DFLST was made.

ICU mortality was not significantly different between cases and controls. On multivariate analysis, independent risk factors for ICU mortality were comorbidities such as

Table 1 Patient characteristics at ICU admission in the 223 cases (patients spending their birthday in the ICU) and 1,042 matched controls

Numbers (%) or median (IQR)	Controls (n = 1,042)	Cases (n = 223)	P value[a]
Demographics			
Male gender	714 (68.5)	149 (66.8)	–
Age (years)	67 to [54–78]	67 to [55–78]	0.33
Patient location before ICU admission			
Ward	516 (49.5)	112 (50.2)	0.81
Type of ICU admission			
Medical	788 (75.6)	157 (70.4)	0.47
Emergency surgery	171 (16.4)	42 (18.8)	
Scheduled surgery	83 (8)	24 (10.8)	
Duration of hospital stay before ICU admission (days)	0 to [0–5]	0 to [0–5]	0.34
DNR order at admission	56 (5.4)	12 (5.4)	0.67
Comorbidities			
COPD	218 (20.9)	49 (22)	0.94
Cardiovascular	163 (15.6)	37 (16.6)	0.94
Immunocompromised	160 (15.4)	37 (16.6)	0.57
Cirrhosis	65 (6.2)	7 (3.1)	0.08
Diabetes mellitus	89 (8.5)	16 (7.2)	0.4
Metastatic cancer	63 (6)	10 (4.5)	0.25
Hematological malignancy	48 (4.6)	12 (5.4)	0.26
HIV infection	40 (3.9)	9 (4)	0.31
Chronic renal insufficiency	41 (3.9)	11 (4.9)	0.43
At least one comorbidity	528 (50.7)	110 (49.3)	0.68
Reasons for ICU admission			
Shock	233 (22.4)	53 (23.7)	0.57
Acute respiratory failure	296 (28.4)	66 (29.6)	0.72
Sepsis	124 (11.9)	38 (17)	0.07
Coma	166 (15.9)	25 (11.2)	0.19
Acute kidney injury	61 (5.9)	9 (4)	0.27
Trauma	6 (0.6)	7 (3.1)	0.004
SAPSII score at ICU admission	40 to [31–52]	39 to [29–53]	0.65
SOFA score at ICU admission	7 to [4–9]	7 to [4–10]	0.92
Treatments received within 24 h after ICU admission			
Antibiotics	671 (64.4)	166 (74.4)	0.006
Broad-spectrum antibiotic at admission	565 (54.2)	140 (62.8)	0.03
Mechanical ventilation	594 (57)	136 (61)	0.66
Vasoactive agents	454 (43.6)	104 (46.6)	0.72
Central venous catheter at admission	470 (45.1)	122 (54.7)	0.03
Arterial catheter at admission	253 (24.3)	77 (34.5)	0.01
Renal replacement therapy	86 (8.3)	21 (9.4)	0.87

DNR do-not-resuscitate, *SAPSII* Simplified Acute Physiology Score version II, *SOFA* Sequential Organ Failure Assessment score, *ICU* intensive care unit, *HIV* human immunodeficiency virus, *COPD* chronic obstructive pulmonary disease, *IQR* interquartile range

[a] Conditional logistic regression

malignancies or immunosuppression, admission for stroke, mechanical ventilation, and worse SOFA or SAPSII score at ICU admission. Having one's birthday fall during the ICU stay did not independently influence mortality.

In the 12 participating ICUs, 155 nurses and physicians were interviewed about their knowledge of patients' birthdays. When birthdays were within 30 days from the interview day, 75% of nurses and 30% of physicians remembered being aware that the patient was spending his or her birthday in the ICU. These proportions fell to 40% and 15%, respectively, when the time between the birthday and the interview day was 30 days or longer.

Discussion

Compared with the 1,042 controls, the 256 patients spending their birthday in the ICU had the same proportion of DFLSTs but longer times to DFLSTs. This decrease translated into greater treatment intensity and longer length of ICU stay.

Previous studies identified substantial biases during the end-of-life decision-making process [4, 11, 14, 15]. These biases were related to the patients, the family, or the ICU physicians. However, no previous study investigated whether patients spending their birthday in the ICU were managed differently compared with other patients.

Table 2 ICU management and outcomes in the 223 cases (patients spending their birthday in the ICU) and 1,042 matched controls

Numbers (%) or median (IQR)	Controls (n = 1,042)	Cases (n = 223)	P value[a]
ICU stay length (days)	9 (5–19)	13 (6–29)	0.0005
SOFA on day 3	6 (3–8)	5 (3–8)	0.25
SOFA on day 7	5 (3–8)	5 (3–7)	0.04
Duration (days) of use [median (IQR)]			
Antibiotics	6 (2–13)	9 (4–21)	<0.0001
Mechanical ventilation	4 (0–12)	6 (0–20)	0.008
Vasopressors	1 (0–5)	3 (0–8)	0.02
Renal replacement therapy	0 (0–0)	0 (0–0)	0.75
Central vein catheter	3 (0–11)	7 (0–16)	0.006
Arterial catheter	0 (0–2)	0 (0–4)	0.03
Enteral nutrition	0 (0–8)	4 (0–16)	0.0004
ICU-acquired events			
Unplanned extubation	123 (11.8)	36 (16.1)	0.17
Nosocomial infection	353 (33.9)	103 (46.2)	0.01
DFLST	246 (23.6)	50 (22.4)	0.54
Time from ICU admission to DFLST (days)	10 (4–20)	19 (6-34)	0.02
ICU mortality	243 (23.3)	48 (21.5)	0.35
Post-ICU events			
In-hospital days after ICU stay	9 (0–20)	8 (0–19)	0.92
Overall hospital stay length (days)	26 (15–47)	31 (16–61)	0.07
Hospital mortality	331 (31.8)	64 (28.7)	0.26

ICU intensive care unit, *SOFA* Sequential Organ Failure Assessment score, *DFLST* decision to forgo life-sustaining treatment
[a] Conditional logistic regression controlling for matched groups

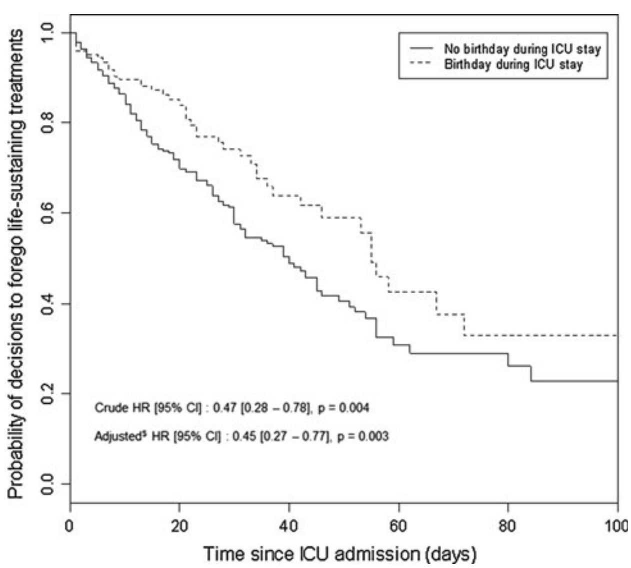

Fig. 2 Kaplan–Meier estimates of decisions to forgo life-sustaining treatments in patients spending their birthday in the ICU and in matched controls**.** *Dollar symbol* after adjustment on age, SOFA in the first 24 h, presence of chronic diseases, transfer from another ward, hematological malignancy, metastatic cancer, and HIV

One's birthday is traditionally a day of joy, a celebration of life, and an opportunity to share a good time with family and friends. The person having his or her birthday is honored and feted with gifts, flowers, food, and other manifestations used by others to signify their love. The atmosphere of celebration that usually surrounds people spending their birthday at home is in stark contrast to the situation of ICU patients, who experience physical and emotional suffering as they receive care for life-threatening illnesses. Conceivably, this contrast may be perceived by family members and ICU staff as an injustice that requires correction. Such correction may manifest as the family members' staying longer at the patient's bedside, trying particularly hard to convey their love and commitment to the patient, or insisting in their communications with the ICU staff that emphasis be placed on hope for survival and therefore on a high intensity of care. Among ICU staff, awareness of the birthday may, either directly or via a response to the family's behavior, produce a feeling of being obligated to keep death at bay by using all the interventions at their disposal. Although this mechanism is speculative, it is consistent with our finding of fewer and later DFLSTs in patients spending their birthday in the ICU. Further studies would be of interest to assess the perceptions of patients' birthdays among ICU staff.

Despite the greater treatment intensity in cases than in controls in our study, ICU and hospital mortality rates were not significantly different between the two groups. This finding suggests that the cases may have received nonbeneficial care [30]. Thus, birthday falling during the ICU stay may be among the factors that prolonged the dying process by impairing the ability of ICU staff to make optimal management decisions. For the ICU staff, even though this had not been directly investigated, the birthday effect may be an unwanted factor that diminishes their compliance with ethical principles. However, one could advocate that providing nonbeneficial care to a patient because of her/his birthday would be ethically appropriate. For the family, the high level of care delivered after the birthday may be an obstacle to the realization that death is inevitable, which may adversely affect the grieving process [31]. However, a family begging a physician not to let a patient die on his or her birthday seems along the line of keeping a patient alive until family members arrive from long distances. Addressing family needs and requests at end of life is consistent with the concept of family-centered care that has been developed over the last few years [32]. Further exploration is needed to better understand how birthdays influence decision-making, which might occur in either conscious or unconscious ways.

Our study has several limitations. First, we only report a statistical association between the birthday falling during the ICU stay and a decrease in the proportion of patients dying after DFLSTs. We did not demonstrate a causal link between the higher level of care in the cases and occurrence of the birthday during the ICU stay. Moreover, the 4-day difference in ICU length of stay between cases and controls could have accounted for a methodological bias (the longer the ICU stay, the higher the probability of having one's birthday in the ICU). Even after careful matching, and the use of an appropriate marginal Cox model with time-dependent variables, we still demonstrate a significant association between DFLST and birthday. The temporal relationship suggests that having birthday in the ICU delays DFLST. Second, we did not collect clinical observations from the patients, relatives, or ICU staff. A few studies suggest that patients may be able to briefly delay their death in order to participate in a celebratory event, although one such study found no such effects in patients with cancer [33–35]. Third, ICU physicians may not be aware of the birthdays of their patients. Our survey in the participating ICUs indicates that nurses usually know the birthdays of their patients. A previous study established that participants had better recall of birthdays close to their own birthday and of those of newly introduced individuals [36], two factors that may have been present in the ICUs. Strengths of our study include the case–control design, which is well suited to the study hypothesis; the fairly large number of cases and controls; and the matching on several variables to correct for disease severity, case mix, and time in the ICU before the birthday.

In summary, patients spending their birthday in the ICU were chiefly admitted after unscheduled events and sudden illnesses (e.g., trauma or sepsis), and they had greater disease severity than did the other patients. DFLSTs were made later in patients spending their birthday in the ICU, who received greater treatment intensity and had longer ICU stays than their matched controls. Since these differences did not translate into better survival, they suggest nonbeneficial or futile care. Clinicians must be aware that patients spending their birthday in the ICU are at risk for an inappropriate level of care. Studies assessing the impact of this bias on post-ICU burden and family grief are warranted.

Acknowledgments Financial support was provided by French Ministry of Health.

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Study monitors

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