Duration of Withdrawal of Life Support in the Intensive Care Unit and Association with Family Satisfaction

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Rationale: **Most deaths in the intensive care unit (ICU) involve withholding or withdrawing multiple life-sustaining therapies, but little is known about how to proceed practically and how this process affects family satisfaction.**

Objectives: **To examine the duration of life-support withdrawal and its association with overall family satisfaction with care in the ICU.**

Methods: **We studied family members of 584 patients who died in an ICU at 1 of 14 hospitals after withdrawal of life support and for whom complete medical chart and family questionnaires were available.**

Measurements and Main Results: **Data concerning six life-sustaining interventions administered during the last 5 days of life were collected. Families were asked to rate their satisfaction with care using the Family Satisfaction in the ICU questionnaire. For nearly half of the patients (271/584), withdrawal of all life-sustaining interventions took more than 1 day. Patients with a prolonged (>1 d) life-support withdrawal were younger, stayed longer in the ICU, had more life-sustaining interventions, had less often a diagnosis of cancer, and had more decision makers involved. Among patients with longer ICU stays, a longer duration in life-support withdrawal was associated with an increase in family satisfaction with care ($P = 0.037$). Extubation before death was associated with higher family satisfaction with care ($P = 0.009$).**

Conclusions: **Withdrawal of life support is a complex process that depends on patient and family characteristics. Stuttering withdrawal is a frequent phenomenon that seems to be associated with family satisfaction. Extubation before death should be encouraged if possible.**

Keywords: critical care; withdrawal of life support; end-of-life care; palliative care

Because of the severity of illness of patients who enter the intensive care unit (ICU), it represents a setting where death is common. Approximately one-fifth of all deaths in the United States occur in or soon after a stay in the ICU (1–3) and half of the patients who die in a hospital were in an ICU during their last 3 days of life (1). Nevertheless, dying in this setting is not what most people say they would prefer when asked about preferences for end-of-life (EOL) care (4), and death in the ICU is considered by most as impersonal, invasive, and unnecessarily prolonging life by technological means (4–6). Moreover, because the "culture of the ICU" is oriented toward saving lives and not toward helping patients die, excellent palliative care may be particularly difficult to achieve in this setting (7–9).

Studying patient-assessed outcomes about end of life in the ICU is challenging. Symptoms, treatment preferences, and satisfaction with care cannot be easily evaluated from the patient's perspective because of the patient's critical condition (10, 11). Therefore, family and clinicians are important evaluators, and their assessments and satisfaction are an integral part of the complex process of improving EOL care (12). Moreover, achieving higher family satisfaction with EOL care in the ICU is important, because satisfaction and mental health of relatives can be affected by the quality of a loved one's EOL care (13).

Many investigators have shown that most deaths in the ICU involve withholding or withdrawing multiple life-sustaining therapies (14–22). Decisions concerning withdrawal of life support encompass difficult emotional and ethical questions that affect patients, family members, and care providers (23). Even though critical care clinicians are frequently confronted with these decisions, there is little empirical research that provides evidence about how to proceed practically (24, 25). In particular, few studies have addressed the issue of the time sequence of withdrawal of life support in the ICU (14, 26, 27). Clinicians sometimes decide to withdraw a life-sustaining therapy while continuing other active life-sustaining therapies (24); this partial approach to withdrawing life support may suggest some lack of certainty or consistency in the approach to EOL treatment (14, 24). There is little evidence of the frequency of this phenomenon currently, although this method of incremental withdrawal of life-sustaining therapies, also called stuttering withdrawal, has been considered by some authors as a marker of suboptimal quality of care (14, 24).

We sought to describe the time sequence and the duration of withdrawal of life support at the end of life and its association with overall family satisfaction, as measured by the Family Satisfaction in the ICU (FS-ICU) survey (28). We hypothesized that prolonged (stuttering) withdrawal is associated with a lower level of overall satisfaction with care among families. In addition, we hypothesized that extubation after withdrawal of ventilation would be associated with increased family satisfaction (25).

AT A GLANCE COMMENTARY

Scientific Knowledge on the Subject

No prior studies have examined the association between the timing of withdrawal of life support and indicators of quality of care.

What This Study Adds to the Field

This study demonstrates that "stuttering withdrawal" is common in the intensive care unit and associated with family satisfaction with care.

METHODS

Population and Setting

We used data from an ongoing cluster randomized trial aimed at improving EOL care for ICU patients in 15 hospitals in Seattle or

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Tacoma, Washington. Data consisted of baseline assessments (before the intervention) at 14 of the hospitals (2 university-affiliated teaching hospitals, 3 community-based teaching hospitals, and 9 community-based, nonteaching hospitals) for which chart abstraction and questionnaire data were available at the time of this analysis. The study protocol was approved by institutional review boards at the University of Washington and each participating hospital.

All patients dying in the ICU or within 24 hours of discharge from the ICU were screened for eligibility. Patients who died in full life support were excluded from this analysis, because the aim was to focus on patients for whom a decision about withdrawal of life support was made. Potential patients were identified using ICU admission and discharge logs, and enrollment took place between August 2003 and May 2006. Patient medical records were reviewed by trained chart abstractors using a standardized chart abstraction protocol. Throughout the study, 5% of charts were randomly coreviewed to ensure greater than 95% agreement on the abstracted data elements. Information about the time (nearest day) of withdrawal of six life-support therapies or interventions during the last 5 days of life as well as data on patient demographics, clinical variables, and EOL care processes were collected from medical records. These interventions were only considered as withdrawn if there was documentation in the medical record that the intervention was withdrawn with the expectation that the patient would die. Interventions that were stopped because the indication for the intervention had resolved were not considered withdrawn for purposes of this analysis. Duration of withdrawal of life support was computed by calculating the number of days between when the first life-sustaining intervention was withdrawn to the day on which the last life-sustaining intervention was withdrawn.

Analysis of Sequence and Duration of Withdrawal of Life Support

First, the time sequence of withdrawal of life support was described by comparing the last day of each intervention (measured as days before death or transfer) with the last day of all life-sustaining interventions using multiple Wilcoxon signed rank tests for paired data. Bootstrap analysis was used to obtain a confidence interval of the mean number of days before death that an intervention was last used because it required no assumptions about the underlying distribution. Second, linear regression was used to test for the association between mean duration of withdrawal of life support and patient and family characteristics. Wilcoxon signed rank tests and Mann-Whitney *U* tests were used to confirm the results obtained if the distribution of the outcome variable was not approximately normal.

Analysis of Family Satisfaction with Care

One to two months after the patient's death, family members were asked to rate their satisfaction using the FS-ICU questionnaire, a 34-item validated questionnaire (6, 28–30). The instrument has been used in several Canadian and U.S. studies (31–35), and recently we developed a validated scoring method for the FS-ICU (30). The associations between duration of withdrawal of life support and family satisfaction scores, as well as associations between whether the patient was intubated or extubated at the time of death and family satisfaction scores, were explored using a multivariate adjusted linear regression model. We also examined whether the use of noninvasive positive-pressure ventilation in the last week of life was associated with family satisfaction using the same linear regression approach. Finally, a multivariate logistic regression model was used to explore the factors associated with extubation before death. Analyses were conducted using Stata version 9.0 (StataCorp, College Station, TX), and statistical significance was defined as a $P \leqslant 0.05$.

Additional details on methods concerning study design, survey instruments, chart abstraction, and statistical analyses are available in the online supplement.

RESULTS

During the observation period, 2,003 consecutive patients who died in the ICU or within 24 hours of discharge from the ICU were screened for eligibility, and among those, 824 family questionnaires were available (41% response rate), representing 824 patients. Both chart abstractions and family questionnaires were available for 774 patients. Five hundred and eighty-four patients' families were included after excluding patients who died in the setting of full support.

Table 1 summarizes patients' demographics and characteristics. Mean age was 72.4 years (SD, 14.0; range, 19–99 yr) with a predominance of whites (90.6%) and males (61.0%). The median length of stay in the ICU was 4 days (interquartile range [IQR], 2–8; range, 1–75 d) and most of the patients died in the ICU (90.7%) rather than after a transfer out of the ICU. During the last 5 days of life, the median number of life-support therapies/interventions was four (IQR, 3–4; range, 1–6); most of the patients received laboratory services (98.5%), mechanical ventilation (82.5%), and intravenous hydration (75.5%), and, less frequently, vasopressors (52.2%), tube feeding (32.7%), or renal replacement therapy (9.3%).

The average time sequence of withdrawal of life support at the end of life is shown in Figure 1, which represents the mean

TABLE 1. CHARACTERISTICS OF STUDY POPULATION

Patient Characteristics	n	% or Mean (Range)
Total sample	584	
Age, mean yr (SD, range)		72.4 (14.0, 19–99)
Female	223	39.0
Race/ethnicity		
White	444	90.6
Asian/Pacific Islander	22	4.5
Native American/Alaskan	1	0.2
Black/African American	16	3.3
Hispanic	2	0.4
Multiple	5	1.0
Missing	94	—
Insurance status		
Private/commercial	168	32.9
Government (VA)	73	14.3
Medicare	228	44.7
Medicaid	30	5.9
None	11	2.2
Missing	74	—
Hospital LOS, median in days (IQR, range)	584	6 (3–12; 1–157)
ICU LOS, median in days (IQR, range)	584	4 (2–8; 1–75)
Primary diagnosis		
Cardiovascular	112	19.7
Infectious	83	14.6
Respiratory	128	22.5
Gastrointestinal and hepatic	42	7.4
Neurologic	72	12.7
Trauma	42	7.4
Cancer	42	7.4
Miscellaneous	47	8.3
Missing	16	—
Died in the ICU	529	90.7
Life-sustaining therapies/interventions during last 5 days of life		
Ventilation	482	82.5
Laboratory tests	575	98.5
Vasopressors	305	52.2
Tube feeding	191	32.7
Hydration	441	75.5
Renal replacement therapy	54	9.3
Ventilation last week of life		
Intubated, not extubated	72	13.5
Intubated, extubated, no NIPPV	281	52.7
Intubated, extubated, NIPPV	27	5.1
Not intubated, NIPPV	53	9.9
Not ventilated	100	18.8
Missing	51	—

Definition of abbreviations: ICU = intensive care unit; IQR = interquartile range; LOS = length of stay; NIPPV = noninvasive positive-pressure ventilation.

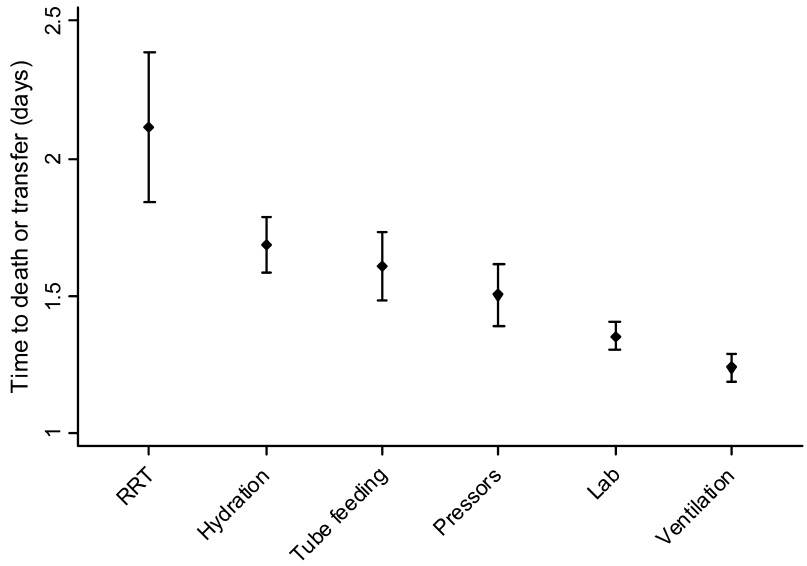

Figure 1. Time sequence of life-sustaining therapies/interventions withdrawal. Mean and 95% confidence intervals of the mean of duration between therapy/intervention interruption and death or transfer (confidence intervals obtained by bootstrap analysis). RRT = renal replacement therapy.

duration between withdrawal of a therapy or intervention and death or transfer. A matrix of *P* values from Wilcoxon matched-pairs signed rank tests (Table 2) confirmed that ventilation was withdrawn significantly later than any other intervention, preceded in order from last to first by laboratory tests, vasopressors, tube feeding, hydration, and renal replacement therapy. Considerable variability existed concerning the timing of withdrawal of vasopressors.

Slightly more than half of the patients (313/584) had all life-sustaining interventions withdrawn the same day, indicating that for the remaining half of the patients, life support was withdrawn over a period of at least 2 days. Risk factors associated with longer duration of withdrawal of life support are described in Table 3 (patient characteristics) and Table 4 (family characteristics and spirituality). Older patients, in particular those who were 85 years and older, had a shorter withdrawal duration than younger patients ($P = 0.022$). No significant association was found between duration of withdrawal of life support and race or insurance status, although patients on Medicaid tended to have a slightly longer withdrawal of life support ($P = 0.054$). Patients with a primary diagnosis of neurologic, respiratory, and cancer disease tended to have a shorter duration of withdrawal of life support, whereas trauma patients experienced longer withdrawal duration. In addition, the presence of more life-sustaining interventions in the last 5 days of life was strongly associated with a longer duration of withdrawal of life support ($P < 0.001$), as was intubation during the last week of life ($P = 0.004$). Patients who were noted as being alert during some part of their last day of life had a shorter withdrawal of life support ($P = 0.003$). Symptoms of pain noted during the last day of life tended to be associated with a shorter withdrawal process ($P = 0.034$), which was not the case for those with dyspnea ($P = 0.56$). The presence of a patient's living will did not influence duration of withdrawal of life support.

Among family factors, the number of decision makers was associated with duration of the withdrawal process: when more members were involved, duration of withdrawal of life support was longer ($P = 0.001$). A family conference occurred in most of the cases in the last week of life (95.2%). However, the timing of the family conference did not seem to have significantly affected duration of withdrawal of life support. Finally, when a spiritual care advisor was involved in care, duration of withdrawal of life support tended to be longer, although it did not achieve statistical significance ($P = 0.075$).

An association was present between the duration of withdrawal of life support and FS-ICU scores in an adjusted model (Table 5). A significant interaction was found between the duration of withdrawal of life support and duration of stay in the ICU and was included in the model: for each additional day in duration of withdrawal of life support, family satisfaction decreased for shorter-stay patients and increased for longer-stay patients. Overall, FS-ICU scores were inversely associated with length of stay in this model (adjusted change in mean total FS-ICU score for each additional day of stay for patients withdrawn from life support on the same day was −2.4%; 95% confidence interval [CI], −3.8 to −1.0%; $P = 0.001$). Analyses were based on a continuous variable for duration and, for descriptive purposes, results of adjusted change in scores are presented at 50th, 75th, and 90th percentiles of duration of stay in the ICU.

During the last week of life, 74% (431/584) of the patients were intubated, and among them, 83% (351/423, 8 missing) were ultimately extubated; only 13% (72/576, 8 missing) of the patients were intubated when they died. Table 6 shows factors associated with extubation before death based on a fully adjusted logistic regression model. Younger age, longer stay in the ICU, and multiple life-sustaining therapies decreased the chance that the patient was extubated. Table 7 summarizes the association between ventilation mode at the end of life and FS-ICU scores in an adjusted model. Intubation during the last week of life did not seem to be associated with any of the satisfaction scores. Among intubated patients, extubation be-

TABLE 2. *P* VALUES FOR THE COMPARISON OF ORDER OF WITHDRAWAL (USING WILCOXON MATCHED-PAIRS SIGNED RANK TESTS)

	P Value*				
	RRT	Hydration	Tube Feeding	Pressors	Lab
Hydration	0.32†				
Tube feeding	0.14†	0.0007			
Pressors	0.0079	0.63	0.89		
Lab	<0.0001	<0.0001	0.0001	0.042	
Ventilation	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

Definition of abbreviation: lab = laboratory tests; RRT = renal replacement therapy.

* Corresponds to H_0: median of the differences is zero. A significant *P* value (<0.01) signifies that the therapy in column was interrupted more often earlier than the corresponding row therapy.

† Sample size for the comparison <30.

TABLE 3. ASSOCIATION BETWEEN PATIENT CHARACTERISTICS AND DURATION OF WITHDRAWAL OF LIFE-SUSTAINING THERAPIES

Associated Factors	n	Withdrawal Duration (*d*) Mean	SD	*P* Value
Total sample	584	1.84	1.13	
Age, yr				0.022
<65	161	1.97	1.28	
65–74	114	1.94	1.16	
75–84	184	1.82	1.07	
⩾85	125	1.62	1.00	
Race/ethnicity				0.73
White	444	1.81	1.16	
Nonwhite	47	1.81	1.14	
Insurance status				0.21
Private/commercial	168	1.80	1.10	
Government/public	73	1.96	1.26	
Medicare	228	1.76	1.06	
Medicaid	30	2.23	1.57	
None	11	2.00	1.10	
LOS in the ICU before withdrawal of life support, d				<0.001
0–4	375	1.71	1.04	
5–9	115	1.98	1.22	
10–14	30	2.20	1.37	
>14	64	2.20	1.27	
Primary diagnosis category				0.066
Cardiovascular	112	1.95	1.16	
Infectious	83	1.89	1.15	
Gastrointestinal and hepatic	42	1.86	1.20	
Neurologic	72	1.63	1.01	
Trauma	42	2.29	1.50	
Respiratory	128	1.70	1.02	
Cancer	42	1.69	1.00	
Miscellaneous	47	1.96	1.16	
No. of therapies/interventions				<0.001
1	20	1.00	—	
2	69	1.36	0.71	
3	185	1.56	0.86	
4	222	1.94	1.21	
5	81	2.73	1.28	
6	7	3.00	1.29	
Ventilation				
Intubated last week of life				0.004
Yes	431	1.92	1.20	
No	153	1.61	0.90	
Extubated before death				0.42
Yes	351	1.90	1.22	
No	72	2.03	1.13	
Mental status and presence of symptoms in the patient's last 24 h				
Alert/oriented				0.003
Yes	183	1.64	1.02	
No	371	1.96	1.20	
Pain				0.034
Yes	190	1.75	1.10	
No	307	1.94	1.17	
Dyspnea				0.56
Yes	182	1.77	1.09	
No	121	1.85	1.18	
Living will				0.91
Yes	272	1.83	1.06	
No	156	1.81	1.19	

Definition of abbreviations: ICU = intensive care unit; LOS = length of stay.

fore death was strongly associated with higher FS-ICU satisfaction with care ($P = 0.009$), decision making ($P = 0.012$), and total scores ($P = 0.008$). An interaction was found between patient age and extubation and included in the model. The change in satisfaction scores was positive in all age groups, with a larger deviation for the 65–84-yr age group (adjusted change in mean FS-ICU satisfaction with care was +62%; 95% CI, 35 to 78%). No significant difference in family satisfaction was seen among patients who underwent noninvasive positive-pressure ventilation during the last week of life.

TABLE 4. ASSOCIATION BETWEEN FAMILY CHARACTERISTICS, FAMILY CONFERENCES, AND SPIRITUAL SERVICES AND DURATION OF WITHDRAWAL OF LIFE-SUSTAINING THERAPIES

Associated Factors	n	Withdrawal Duration Mean	SD	*P* Value
No. of family decision makers				0.001
1	36	1.58	1.05	
2–3	434	1.77	1.06	
>3	111	2.16	1.35	
Documentation of family conference				
Prognosis discussed				0.16
Yes	362	1.89	1.15	
No	222	1.76	1.11	
Family wishes to WD/WH				0.18
Yes	519	1.86	1.15	
No	65	1.66	1.00	
Patient wishes to WD/WH				0.97
Yes	107	1.83	1.09	
No	476	1.84	1.14	
Decision to WD/WH				0.84
Yes	366	1.83	1.14	
No	217	1.85	1.14	
Patient's wishes expressed				0.36
Yes	258	1.79	1.08	
No	325	1.87	1.17	
Family discord				0.092
Yes	18	2.28	1.45	
No	565	1.82	1.11	
Family present at death				0.17
Yes	476	1.82	1.13	
No	73	2.01	1.25	
Spiritual advisor involved				0.075
Yes	293	1.92	1.20	
No	289	1.75	1.05	

Definition of abbreviations: WD = withdrawal; WH = withhold.

DISCUSSION

Our study shows that sequential withdrawal of life support, also called stuttering withdrawal, is not (as previously believed)

TABLE 5. ASSOCIATION BETWEEN WITHDRAWAL DURATION OF LIFE-SUSTAINING THERAPIES AND FAMILY SATISFACTION

Satisfaction Score	Duration of Stay in the ICU (*d*)	Effect on Satisfaction* (*% change*†)	95% CI	*P* Value
Family satisfaction with care domain score (14 items)	3	−2.0	−12.3 to 7.4	0.037
	8	3.5	−5.7 to 11.8	
	16	11.6	0.4 to 21.5	
Family satisfaction with decision making domain score (10 items)	3	−0.3	−11.1 to 9.4	0.007
	8	6.3	−3.3 to 14.9	
	16	15.9	4.6 to 25.9	
Family satisfaction total score (24 items)	3	−0.9	−10.2 to 7.7	0.004
	8	5.3	−2.8 to 12.9	
	16	14.5	4.7 to 23.2	

Definition of abbreviations: CI = confidence interval; ICU = intensive care unit.

* Model adjusted for age, sex, race, number of life-sustaining therapies, intubation status, and including an interaction term with duration of stay.

† Change in mean satisfaction score for each day increase in duration of withdrawal (a positive value corresponds to an increase in mean satisfaction score).

TABLE 6. ASSOCIATION BETWEEN PATIENT CHARACTERISTICS AND EXTUBATION BEFORE DEATH

Risk Factors	Variable Detail	Adjusted OR*	95% CI	*P* Value
Age	Per 10-yr increase in age	1.42	1.15–1.75	0.001
LOS in the ICU	Per additional day of stay	0.94	0.91–0.97	<0.001
No. of life-sustaining therapies	Per additional therapy	0.68	0.47–0.98	0.040
Alertness	Yes	0.57	0.27–1.21	0.142

Definition of abbreviations: CI = confidence interval; ICU = intensive care unit; LOS = length of stay.

* Model adjusted for age, sex, race, duration of stay, number of life-sustaining therapies, and alertness status.

a rare phenomenon and occurred in nearly half of the patients we studied who died during or shortly after a stay in the ICU. As shown by other authors, a specific time sequence in life-support withdrawal was found (14, 26, 27). However, such sequences may be determined, in part, by the differing average duration of survival after withdrawal of a specific life-sustaining therapy. For example, sequences that include the withholding of ventilation support first, which tends to be more determinant in patients' immediate survival, are by nature shorter and do not allow as much variability in the interruption of other therapies. However, if the sequence we observed in this study was only determined by this selection phenomenon, we would not have found a significant difference in the timing of withdrawal of less supportive therapies, such as tube feeding or hydration. In particular, the early withdrawal of renal replacement therapy, an expensive intervention usually more determinant in immediate survival than tube feeding or hydration, may have been driven by economic and practical issues. Therefore, the sequence of withdrawal of life support is likely the consequence of a complex and active process that involves clinical, emotional, ethical, and economic issues (27, 36).

In our study, several factors were associated with a longer duration of the withdrawal of life support process. These associations were presented in a univariate analysis, because little was known or hypothesized about these associations *a priori*. Our findings suggest that duration of withdrawal was affected by several patient characteristics. The fact that the duration of withdrawal of life support was increased among patients who stayed longer in the ICU or who were dependent on a higher number of life-support therapies may indicate that this process was influenced by the investment in care before the decision to withdraw. Patients' long-term prognoses may also have affected the withdrawal process, as shown by the trend in shorter withdrawal duration among older patients or those with a diagnosis of cancer. These findings may indirectly support the hypothesis that stuttering withdrawal is a manifestation of clinicians' ambivalence about the decisions to withdraw life support; when a poor prognosis was more clearly defined, the decision to withdraw may have been easier and less protracted. Family characteristics were also associated with the duration of the withdrawal of life support process, as shown by an increase in its duration when more members were involved in the decision. This may reflect a delay in the duration of withdrawal of life support to accommodate the time it takes to get more people to come to agreement or simply to be able to travel to the bedside of the patient to be in attendance at the patient's death.

TABLE 7. ASSOCIATION BETWEEN VENTILATION MODE AT THE END OF LIFE AND FAMILY SATISFACTION

Satisfaction Score*	Ventilation Mode	Effect on Satisfaction (*% change*)†	95% CI	*P* Value
Family satisfaction with care domain score (14 items)	Intubation	2.9	−48.1 to 36.3	0.89
	Extubation‡	62.2	35.3 to 77.9	0.009
	NIPPV	−12.4	−55.0 to 18.5	0.47
Family satisfaction with decision-making domain score (10 items)	Intubation	20.4	−18.7 to 46.7	0.262
	Extubation‡	65.3	35.7 to 81.2	0.012
	NIPPV	−13.7	−60.4 to 19.3	0.46
Family satisfaction total score (24 items)	Intubation	8.0	−32.9 to 36.3	0.66
	Extubation‡	60.9	34.6 to 76.7	0.008
	NIPPV	−10.6	−47.4 to 17.0	0.49

Definition of abbreviations: CI = confidence interval; NIPPV = noninvasive positive-pressure ventilation.

* Model adjusted for age, sex, race, duration of stay, and number of life-sustaining therapies.

† Change in mean satisfaction score (a positive value corresponds to an increase in mean satisfaction score).

‡ Model adjusted to alertness status in addition to other covariates and including an interaction term with age group. Results are presented for 65–84-year age group.

Families tended to be less satisfied with care when their loved one died after a long stay in the ICU. This finding may be due to the fact that dying in the ICU is not what most people would prefer and is often considered as impersonal, invasive, and unnecessarily prolonging life by technological means (4–6). A prolonged ICU stay before death may magnify this effect. However, our results suggest that EOL care is an important part of patients' care in the ICU and that the duration of withdrawal of life support is associated with family satisfaction, particularly among those staying longer in the ICU. In this study, family satisfaction with care in the ICU, as measured by the FS-ICU questionnaire, was associated with the process of withdrawal of life support at the end of life: among patients who stayed longer in the ICU, families seemed to be more satisfied when the process of withdrawal was longer. This finding is in the opposite direction to our original hypothesis. A longer duration of withdrawal of life support seems unlikely to be beneficial for the patient, because it represents the prolongation of non-beneficial and sometimes painful therapies in a situation in which life-sustaining therapies are being withdrawn in anticipation of death. Moreover, the cost induced by the extra days in the ICU is not insignificant in a time when cost-effectiveness is an important issue for any health care setting. Nevertheless, we found that a longer withdrawal of life support was associated with increased family satisfaction for some family members, in particular for those who were in the ICU longer.

One potential explanation for these findings is that families may need time to move from a situation of maximum support and hope to a process of EOL care, particularly for longer-stay patients. It seems likely that, if insufficient communication or support is offered concerning prognosis and decision making, family members may not be ready to accept withdrawal of life support when the decision is made. In such cases, withholding all therapies the same day, often followed by a quick death, could be experienced as abandonment, and some additional days may help family members cope with and accept the process (37). Therefore, higher satisfaction for a longer duration of withdrawal of life support could be viewed as a surrogate indicator of insufficient preparation or support of families concerning EOL care. Furthermore, longer length of stay for patients who die may also be indicative of less effective communication (38). Our hypothesis is that stuttering withdrawal happens as the result of incomplete decision-making processes, but that it can also serve as a way to compensate for the existing gap between physicians' decisions and family expectations: when physicians make a decision to withdraw support, they may not have prepared the family sufficiently and consequently physicians may stop more expensive therapies first

and may maintain the most "life supportive" ones to have more time to prepare and support the family. If this hypothesis is correct, the solution for improving family experience will not be to prolong the withdrawal of life-support process but rather to prepare the family adequately before this process.

Another potential explanation for why patients with a shorter length of stay had a shorter duration of withdrawal could be that, for short-stay patients, the course of the illness was more quickly evolving and that, consequently, there was less opportunity for a longer duration of the withdrawal of life support. However, because we considered the time in the ICU not as the total time but as the duration of stay in the ICU before the withdrawal process started, it seems less likely that time before the decision to withdraw would have limited the duration of withdrawal itself. Nonetheless, this is a potential explanation for these findings.

In this study, extubation before death was associated with higher family satisfaction with care. The high extubation rate before death in our sample suggests that most the patients can be extubated before death and that this practice should be encouraged when possible (25).

This study has several important limitations. First, given the predominance of white patients, the results may not be generalizable to other populations, and our ability to adjust for factors such as minority race is limited. Second, the low response rate to the family questionnaire, which was comparable to other studies of families after the death of a patient (29, 39), could also limit the generalizability of our findings. Third, the study was limited to the information derived from the abstraction of patients' chart and surveys completed by the family members, which may not have captured some subtle factors related to the patient's condition or to the interaction between families and clinicians. Finally, because this is an observational study, we cannot exclude the possibility of associations due to unmeasured confounders and we cannot determine causality for the associations identified.

In summary, this study suggests that stuttering withdrawal of life support is common, does not occur at random among patients dying in the ICU, and, at least in some circumstances, is associated with higher overall family satisfaction with care after a patient's death. Nevertheless, we believe stuttering withdrawal is a suboptimal way of withdrawing life support in most circumstances, because the goals of care are likely less clear or not clearly communicated to the team and/or family. Unfortunately, in the context of our current standard of care, which may include poor communication with inadequate emotional support for family members (13, 40), stuttering withdrawal is occasionally associated with increased family satisfaction, perhaps because it gives the family more time to come to terms with the patient's dying. However, we believe these results should not be taken to mean that withdrawal should be drawn out over days in these longer ICU stays. Rather, the goals of care should be communicated clearly and readdressed throughout the ICU stay, and the family should be provided with emotional support to ensure that they have the opportunity to come to terms with the patient's dying. In addition, our findings support, in most cases, extubating intubated patients before death, because it was associated with higher family satisfaction with care scores.

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References

1. The SUPPORT Principal Investigators. A controlled trial to improve care for seriously ill hospitalized patients: the Study to Understand Prognoses and Preferences for Outcomes and Risks of Treatments (SUPPORT). *JAMA* 1995;274:1591–1598.
2. National Health Center for Statistics. Deaths by place of death, age, race, and sex: United States [Internet] [accessed September 8, 2008]. Available from: www.cdc.gov/nchs/data/data/dvs/MortFinal2004_Worktable309.pdf
3. Angus DC, Barnato AE, Linde-Zwirble WT, Weissfeld LA, Watson RS, Rickert T, Rubenfeld GD; Robert Wood Johnson Foundation ICU End-Of-Life Peer Group. Use of intensive care at the end of life in the United States: an epidemiologic study. *Crit Care Med* 2004;32:638–643.
4. Fein EB. Talking around death: chronicling the end for 20: hard choices are harder when wishes go unsaid. *New York Times* March 5, 1997; B5.
5. Curtis JR, Rubenfeld GD. Introducing the concept of managing death in the ICU. In: Curtis JR, Rubenfeld GD, editors. Managing death in the intensive care unit: the transition from cure to comfort. New York: Oxford University Press; 2001. p. 3.
6. Critical Care Connections. Family Satisfaction in the Intensive Care Unit (FS-ICU) survey [Internet] [accessed June 27, 2007]. Available from: http://www.criticalcareconnections.com
7. Caswell D, Omrey A. The dying patient in the intensive care unit: making the critical difference. *AACN Clin Issues Crit Care Nurs* 1990;1:178–186.
8. Nelson JE. Saving lives and saving deaths. *Ann Intern Med* 1999;130: 776–777.
9. Danis M, Federman D, Fins JJ, Fox E, Kastenbaum B, Lanken PN, Long K, Lowenstein E, Lynn J, Rouse F, *et al*. Incorporating palliative care into critical care education: principles, challenges, and opportunities. *Crit Care Med* 1999;27:2005–2013.
10. Prendergast TJ, Luce JM. Increasing incidence of withholding and withdrawal of life support from the critically ill. *Am J Respir Crit Care Med* 1997;155:15–20.
11. Nelson JE, Meier D, Oei EJ, Nierman DM, Senzel RS, Manfredi PL, Davis SM, Morrison RS. Self-reported symptom experience of critically ill cancer patients receiving intensive care. *Crit Care Med* 2001;29:277–282.
12. Singer PA, Martin DK, Kelner M. Quality end-of-life care: patients' perspectives. *JAMA* 1999;281:163–168.
13. Lautrette A, Darmon M, Megarbane B, Joly LM, Chevret S, Adrie C, Barnoud D, Bleichner G, Bruel C, Choukroun G, *et al*. A communication strategy and brochure for relatives of patients dying in the ICU. *N Engl J Med* 2007;356:469–478.
14. Faber-Langendoen K. A multi-institutional study of care given to patients dying in hospitals: ethical practices and implications. *Arch Intern Med* 1996;156:2130–2136.
15. Smedira NG, Evans BH, Grais LS, Cohen NH, Lo B, Cooke M, Schecter WP, Fink C, Epstein-Jaffe E, May C, *et al*. Withholding and withdrawal of life support from the critically ill. *N Engl J Med* 1990;322:309–315.
16. Vincent JL, Parquier JN, Preiser JC, Brimioulle S, Kahn RJ. Terminal events in the intensive care unit: review of 258 fatal cases in one year. *Crit Care Med* 1989;17:530–533.
17. Eidelman LA, Jakobson DJ, Pizov R, Geber D, Leibovitz L, Sprung CL. Foregoing life-sustaining treatment in an Israeli ICU. *Intensive Care Med* 1998;24:162–166.
18. Keenan SP, Busche KD, Chen LM, McCarthy L, Inman KJ, Sibbald WJ. A retrospective review of a large cohort of patients undergoing the process of withholding or withdrawal of life support. *Crit Care Med* 1997;22:1020–1025.
19. Koch K. Changing patterns of terminal care management in an intensive care unit. *Crit Care Med* 1994;22:233–243.
20. Vernon DD, Dean JM, Timmons OD, Banner W, Allen-Webb EM. Modes of death in the pediatric intensive care unit: withdrawal and limitation of supportive care. *Crit Care Med* 1993;21:1798–1802.
21. Youngner SJ, Lewandowski W, McClish DK, Juknialis BW, Coulton C, Bartlett ET. Do Not Resuscitate orders: incidence and implications in a medical intensive care unit. *JAMA* 1985;253:54–57.
22. Bedell SE, Pelle D, Maher PL, Cleary PD. Do Not Resuscitate orders for critically ill patients in the hospital: how are they used and what is their impact? *JAMA* 1986;256:233–237.
23. Cook DJ, Giacomini M, Johnson N, Willms D. Life support in the intensive care unit: a qualitative investigation of technological purposes. Canadian Critical Care Trials Group. *CMAJ* 1999;161:1109–1113.
24. Rubenfeld GD, Crawford SW. Principles and practice of withdrawing life-support treatment in the ICU. In: Curtis JR, Rubenfeld GD, editors. Managing death in the intensive care unit: the transition from cure to comfort. New York: Oxford University Press; 2001. pp. 127–147.
25. Campbell ML. How to withdraw mechanical ventilation: a systematic review of the literature. *AACN Adv Crit Care*. 2007;18:397–403. [Quiz, pp. 344–345.]
26. Rocker GM, Heyland DK, Cook DJ, Dodek PM, Kutsogiannis DJ, O'Callaghan CJ. Most critically ill patients are perceived to die in comfort during withdrawal of life support: a Canadian multicentre study. *Can J Anaesth* 2004;51:623–630.

27. Asch DA, Faber-Langendoen K, Shea JA, Christakis NA. The sequence of withdrawing life-sustaining treatment from patients. *Am J Med* 1999;107:153–156.
28. Heyland DK, Tranmer JE. Measuring family satisfaction with care in the intensive care unit: the development of a questionnaire and preliminary results. *J Crit Care* 2001;16:142–149.
29. Heyland DK, Rocker GM, Dodek PM, Kutsogiannis DJ, Konopad E, Cook DJ, Peters S, Tranmer JE, O'Callaghan CJ. Family satisfaction with care in the intensive care unit: results of a multiple center study. *Crit Care Med* 2002;30:1413–1418.
30. Wall RJ, Engelberg RA, Downey L, Heyland D, Curtis JR. Refinement, scoring, and validation of the Family Satisfaction in the Intensive Care Unit (FS-ICU) survey. *Crit Care Med* 2007;35:271–279.
31. Dodek PM, Heyland DK, Rocker GM, Cook DJ. Translating family satisfaction data into quality improvement. *Crit Care Med* 2004;32:1922–1927.
32. Cook D, Rocker G, Heyland D. Dying in the ICU: strategies that may improve end-of-life care. *Can J Anaesth* 2004;51:266–272.
33. Dowling J, Vender J, Guilianelli S, Wang B. A model of family-centered care and satisfaction predictors: the Critical Care Family Assistance Program. *Chest* 2005;128(3, Suppl):81S–92S.
34. Dowling J, Wang B. Impact on family satisfaction: the Critical Care Family Assistance Program. *Chest* 2005;128(3, Suppl):76S–80S.
35. Lederer MA, Goode T, Dowling J. Origins and development: the Critical Care Family Assistance Program. *Chest* 2005;128(3, Suppl):65S–75S.
36. Luce JM, White DB. The pressure to withhold or withdraw life-sustaining therapy from critically ill patients in the United States. *Am J Respir Crit Care Med* 2007;175:1104–1108.
37. West HF, Engelberg RA, Wenrich MD, Curtis JR. Expressions of nonabandonment during the intensive care unit family conference. *J Palliat Med* 2005;8:797–807.
38. Lilly CM, De Meo DL, Sonna LA, Haley KJ, Massaro AF, Wallace RF, Cody S. An intensive communication intervention for the critically ill. *Am J Med* 2000;109:469–475.
39. Casarett DJ, Crowley R, Hirschman KB. Surveys to assess satisfaction with end-of-life care: does timing matter? *J Pain Symptom Manage* 2003;25:128–132.
40. Curtis JR, Engelberg RA, Wenrich MD, Shannon SE, Treece PD, Rubenfeld GD. Missed opportunities during family conferences about end-of-life care in the intensive care unit. *Am J Respir Crit Care Med* 2005;171:803–804.