Respiratory Review of 2017: Critical Care Medicine

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- Sepsis – SSC international guideline ***ICM & CCM***
- ARDS – LIPS Trial ***JAMA***
- ECLS
  - Long-term ECMO result ***CCM***
  - ECCO2R for AE-COPD ***ICM***
- Tracheostomy ***ICM***
- Intubation & Video laryngoscope ***CCM, JAMA***
- Palliative Care
  - Patient Caregivers ***NEJM***
  - Proactive Rounding ***ICM, JAMA***

Surviving Sepsis Campaign

CONFERENCE REPORTS AND EXPERT PANEL

Surviving Sepsis Campaign: International Guidelines for Management of Sepsis and Septic Shock: 2016

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Society of Critical Care Medicine

ESICM

Intensive Care Med (2017) 43:304–377.

Crit Care Med 2017; 45:486–552.

Recommendations and Best Practice Statements

A. Initial Resuscitation
B. Screening for Sepsis and Performance improvement
C. Diagnosis
D. Antimicrobial Therapy
E. Source control
F. Fluid therapy
G. Vasoactive medications
H. Corticosteroids
I. Blood products
J. Immunoglobulins
K. Blood purification
L. Anticoagulants
M. Mechanical ventilation
N. Sedation and Analgesia
O. Glucose control
P. Renal replacement therapy
Q. Bicarbonate therapy
R. Venous thromboembolism prophylaxis
S. Stress ulcer prophylaxis
T. Nutrition
U. Setting goals of care

Best Practice Statements

TABLE 3. Comparison of 2016 Grading Terminology with Previous Alphanumeric Descriptors

	2016 Descriptor	2012 Descriptor
Strength	Strong	1
	Weak	2
Quality	High	A
	Moderate	B
	Low	C
	Very Low	D
Ungraded strong recommendation	Best Practice Statement	Ungraded

Surviving Sepsis Campaign

Best Practice Statements

- Strong but ungraded statements
- Use defined criteria

Criteria for Best Practice Statements
Is the statement clear and actionable?
Is the message necessary?
Is the net benefit (or harm) unequivocal?
Is the evidence difficult to collect and summarize?
Is the rationale explicit?
Is the statement better if formally GRADEd?

Guyatt GH, Schünemann HJ, Djulbegovic B, et al: *Clin Epidemiol* 2015; 68:597–600

Comparison from 2012 to 2016

F. FLUID THERAPY

1. Crystalloids as the initial fluid of choice in the resuscitation of severe sepsis and septic shock (grade 1B).
2. Against the use of hydroxyethyl starches for fluid resuscitation of severe sepsis and septic shock (grade 1B).
3. Albumin in the fluid resuscitation of severe sepsis and septic shock when patients require substantial amounts of crystalloids (grade 2C).
4. Initial fluid challenge in patients with sepsis-induced tissue hypoperfusion with suspicion of hypovolemia to achieve a minimum of 30 mL/kg of crystalloids (a portion of this may be albumin equivalent). More rapid administration and greater amounts of fluid may be needed in some patients (grade 1C).
5. Fluid challenge technique be applied wherein fluid administration is continued as long as there is hemodynamic improvement either based on dynamic (e.g., change in pulse pressure, stroke volume variation) or static (e.g., arterial pressure, heart rate) variables (UG).

F. FLUID THERAPY

1. We recommend that a fluid challenge technique be applied where fluid administration is continued as long as hemodynamic factors continue to improve (BPS).
2. We recommend crystalloids as the fluid of choice for initial resuscitation and subsequent intravascular volume replacement in patients with sepsis and septic shock (strong recommendation, moderate quality of evidence).
3. We suggest using either balanced crystalloids or saline for fluid resuscitation of patients with sepsis or septic shock (weak recommendation, low quality of evidence).
4. We suggest using albumin in addition to crystalloids for initial resuscitation and subsequent intravascular volume replacement in patients with sepsis and septic shock, when patients require substantial amounts of crystalloids (weak recommendation, low quality of evidence).
5. We recommend against using hydroxyethyl starches for intravascular volume replacement in patients with sepsis or septic shock (strong recommendation, high quality of evidence).
6. We suggest using crystalloids over gelatins when resuscitating patients with sepsis or septic shock (weak recommendation, low quality of evidence).

G. VASOACTIVE MEDICATIONS

1. Vasopressor therapy initially to target a mean arterial pressure (MAP) of 65 mm Hg (grade 1C).
2. Norepinephrine as the first-choice vasopressor (grade 1B).
3. Epinephrine (added to and potentially substituted for norepinephrine) when an additional agent is needed to maintain adequate blood pressure (grade 2B).
4. Vasopressin, 0.03 units/minute, can be added to norepinephrine with intent of either raising MAP or decreasing norepinephrine dosage (UG).
5. Low-dose vasopressin is not recommended as the single initial vasopressor for treatment of sepsis-induced hypotension, and vasopressin doses higher than 0.03–0.04 units/minute should be reserved for salvage therapy (failure to achieve adequate MAP with other vasopressor agents) (UG).
6. Dopamine as an alternative vasopressor agent to norepinephrine only in highly selected patients (e.g., patients with low risk of tachyarrhythmias and absolute or relative bradycardia) (grade 2C).
7. Phenylephrine is not recommended in the treatment of septic shock except in circumstances where (a) norepinephrine is associated with serious arrhythmias, (b) cardiac output is known to be high and blood pressure persistently low, or (c) as salvage therapy when combined inotrope/vasopressor drugs and low-dose vasopressin have failed to achieve MAP target (grade 1C).
8. Low-dose dopamine should not be used for renal protection (grade 1A).
9. All patients requiring vasopressors have an arterial catheter placed as soon as practical if resources are available (UG).

G. VASOACTIVE MEDICATIONS

1. We recommend norepinephrine as the first-choice vasopressor (strong recommendation, moderate quality of evidence).
2. We suggest adding either vasopressin (up to 0.03 U/min) (weak recommendation, moderate quality of evidence) or epinephrine (weak recommendation, low quality of evidence) to norepinephrine with the intent of raising mean arterial pressure to target, or adding vasopressin (up to 0.03 U/min) (weak recommendation, moderate quality of evidence) to decrease norepinephrine dosage.
3. We suggest using dopamine as an alternative vasopressor agent to norepinephrine only in highly selected patients (e.g., patients with low risk of tachyarrhythmias and absolute or relative bradycardia) (weak recommendation, low quality of evidence).
4. We recommend against using low-dose dopamine for renal protection (strong recommendation, high quality of evidence).
5. We suggest using dobutamine in patients who show evidence of persistent hypoperfusion despite adequate fluid loading and the use of vasopressor agents (weak recommendation, low quality of evidence).

Remarks: If initiated, dosing should be titrated to an end point reflecting perfusion, and the agent reduced or discontinued in the face of worsening hypotension or arrhythmias.

6. We suggest that all patients requiring vasopressors have an arterial catheter placed as soon as practical if resources are available (weak recommendation, very low quality of evidence).

H. CORTICOSTEROIDS	**H. CORTICOSTEROIDS**
1. Not using IV hydrocortisone to treat adult septic shock patients if adequate fluid resuscitation and vasopressor therapy are able to restore hemodynamic stability (see goals for Initial Resuscitation). In case this is not achievable, we suggest IV hydrocortisone alone at a dose of 200 mg/day (grade 2C). 2. Not using the adrenocorticotropic hormone stimulation test to identify adults with septic shock who should receive hydrocortisone (grade 2B). 3. In treated patients, hydrocortisone tapered when vasopressors are no longer required (grade 2D). 4. Corticosteroids not be administered for the treatment of sepsis in the absence of shock (grade 1D). 5. When hydrocortisone is given, use continuous flow (grade 2D).	1. We suggest against using IV hydrocortisone to treat septic shock patients if adequate fluid resuscitation and vasopressor therapy are able to restore hemodynamic stability. If this is not achievable, we suggest IV hydrocortisone at a dose of 200 mg per day (weak recommendation, low quality of evidence).

J. IMMUNOGLOBULINS	**J. IMMUNOGLOBULINS**
1. Not using IV immunoglobulins in adult patients with severe sepsis or septic shock (grade 2B).	1. We suggest against the use of IV immunoglobulins in patients with sepsis or septic shock (weak recommendation, low quality of evidence).
K. BLOOD PURIFICATION	**K. BLOOD PURIFICATION**
Not applicable.	1. We make no recommendation regarding the use of blood purification techniques.
L. ANTICOAGULANTS	**L. ANTICOAGULANTS**
Not applicable.	1. We recommend against the use of antithrombin for the treatment of sepsis and septic shock (strong recommendation, moderate quality of evidence). 2. We make no recommendation regarding the use of thrombomodulin or heparin for the treatment of sepsis or septic shock.

T. NUTRITION

1. Administer oral or enteral (if necessary) feedings, as tolerated, rather than either complete fasting or provision of only IV glucose within the first 48 hours after a diagnosis of severe sepsis or septic shock (grade 2C).
2. Avoid mandatory full caloric feeding in the first week but rather suggest low-dose feeding (e.g., up to 500 calories per day), advancing only as tolerated (grade 2B).
3. Use IV glucose and enteral nutrition rather than total parenteral nutrition alone or parenteral nutrition in conjunction with enteral feeding in the first 7 days after a diagnosis of severe sepsis or septic shock (grade 2B).
4. Use nutrition with no specific immunomodulating supplementation rather than nutrition providing specific immunomodulating supplementation in patients with severe sepsis (grade 2C).
5. Not using IV selenium for the treatment of severe sepsis (grade 2C).

T. NUTRITION

1. We recommend against the administration of early parenteral nutrition alone or parenteral nutrition in combination with enteral feedings (but rather initiate early enteral nutrition) in critically ill patients with sepsis or septic shock who can be fed enterally (strong recommendation, moderate quality of evidence).
2. We recommend against the administration of parenteral nutrition alone or in combination with enteral feeds (but rather to initiate IV glucose and advance enteral feeds as tolerated) over the first 7 days in critically ill patients with sepsis or septic shock for whom early enteral feeding is not feasible (strong recommendation, moderate quality of evidence).
3. We suggest the early initiation of enteral feeding rather than a complete fast or only IV glucose in critically ill patients with sepsis or septic shock who can be fed enterally (weak recommendation, low quality of evidence).
4. We suggest either early trophic/hypocaloric or early full enteral feeding in critically ill patients with sepsis or septic shock; if trophic/hypocaloric feeding is the initial strategy, then feeds should be advanced according to patient tolerance (weak recommendation, moderate quality of evidence).

2012 RECOMMENDATIONS	2016 RECOMMENDATIONS

5. We recommend against the use of omega-3 fatty acids as an immune supplement in critically ill patients with sepsis or septic shock (strong recommendation, low quality of evidence).
6. We suggest against routinely monitoring gastric residual volumes in critically ill patients with sepsis or septic shock (weak recommendation, low quality of evidence). However, we suggest measurement of gastric residuals in patients

2012 RECOMMENDATIONS	2016 RECOMMENDATIONS
	5. We recommend against the use of omega-3 fatty acids as an immune supplement in critically ill patients with sepsis or septic shock (strong recommendation, low quality of evidence). 6. We suggest against routinely monitoring gastric residual volumes in critically ill patients with sepsis or septic shock (weak recommendation, low quality of evidence). However, we suggest measurement of gastric residuals in patients with feeding intolerance or who are considered to be at high risk of aspiration (weak recommendation, very low quality of evidence). Remarks: This recommendation refers to nonsurgical critically ill patients with sepsis or septic shock. 7. We suggest the use of prokinetic agents in critically ill patients with sepsis or septic shock and feeding intolerance (weak recommendation, low quality of evidence). 8. We suggest placement of post-pyloric feeding tubes in critically ill patients with sepsis or septic shock with feeding intolerance or who are considered to be at high risk of aspiration (weak recommendation, low quality of evidence). 9. We recommend against the use of IV selenium to treat sepsis and septic shock (strong recommendation, moderate quality of evidence). 10. We suggest against the use of arginine to treat sepsis and septic shock (weak recommendation, low quality of evidence). 11. We recommend against the use of glutamine to treat sepsis and septic shock (strong recommendation, moderate quality of evidence). 12. We make no recommendation about the use of carnitine for sepsis and septic shock.

Research

Original Investigation | CARING FOR THE CRITICALLY ILL PATIENT

Effect of Aspirin on Development of ARDS in At-Risk Patients Presenting to the Emergency Department

The LIPS-A Randomized Clinical Trial

Daryl J. Kor, MD, MSc; Rickey E. Carter, PhD; Pauline K. Park, MD; Emir Festic, MD, MSc; Valerie M. Banner-Goodspeed, ALB, MPH; Richard Hinds, MS, RRT; Daniel Talmor, MD, MPH; Ognjen Gajic, MD, MSc; Lorraine B. Ware, MD; Michelle Ng Gong, MD, MS; for the US Critical Illness and Injury Trials Group: Lung Injury Prevention with Aspirin Study Group (USCIITG: LIPS-A)

JAMA. 2016;315(22):2406-2414.

Can early intervention prevent development of ARDS?

- Multicenter, double-blind, placebo-controlled, randomized clinical trial
- 16 US academic hospitals
- Patients at risk for ARDS (Lung Injury Prediction Score4) in the emergency department were screened
- 1º outcome: the development of ARDS

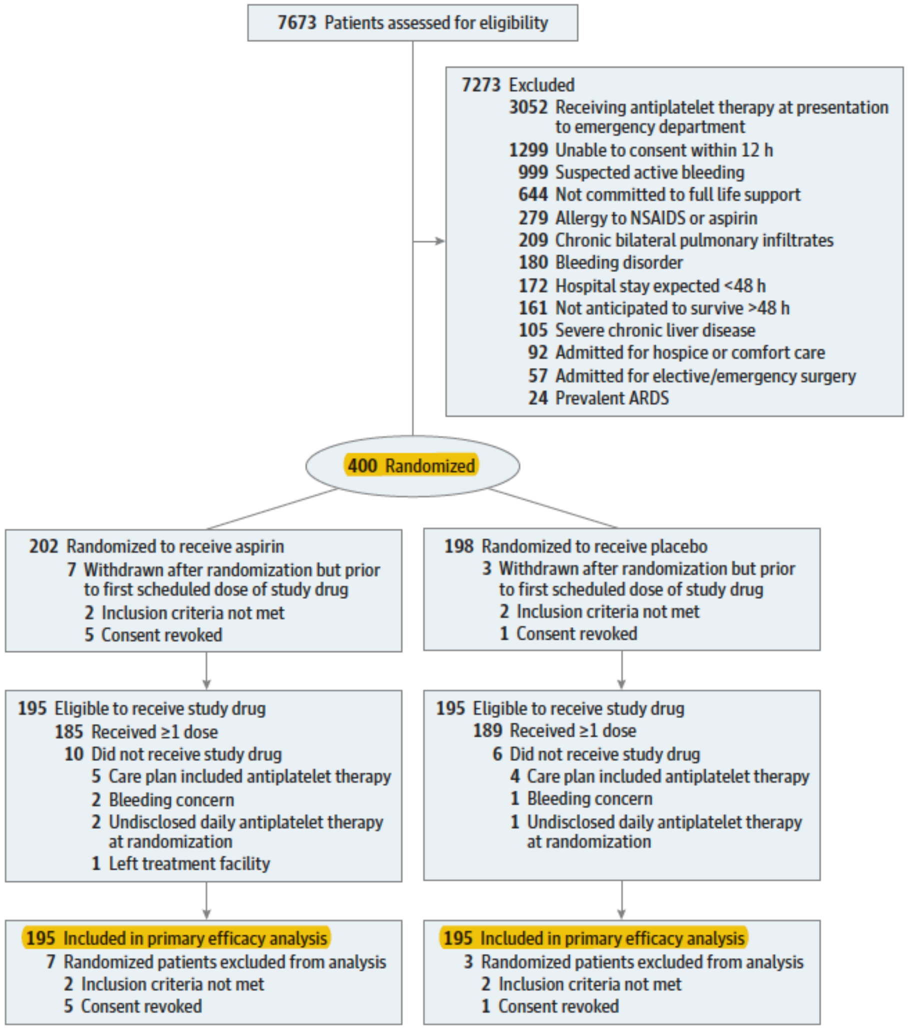
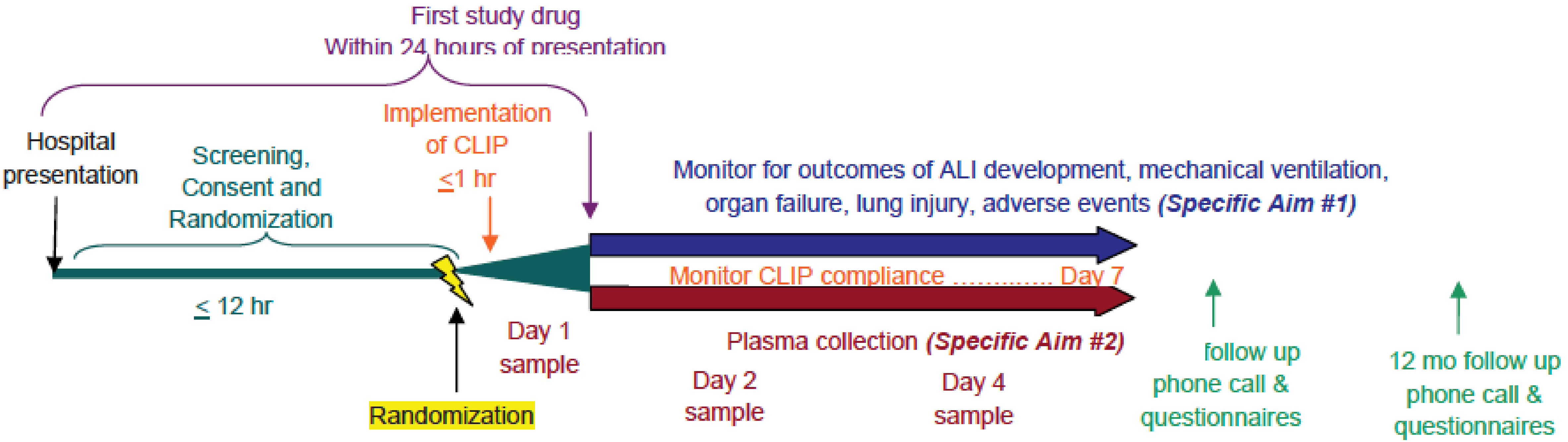
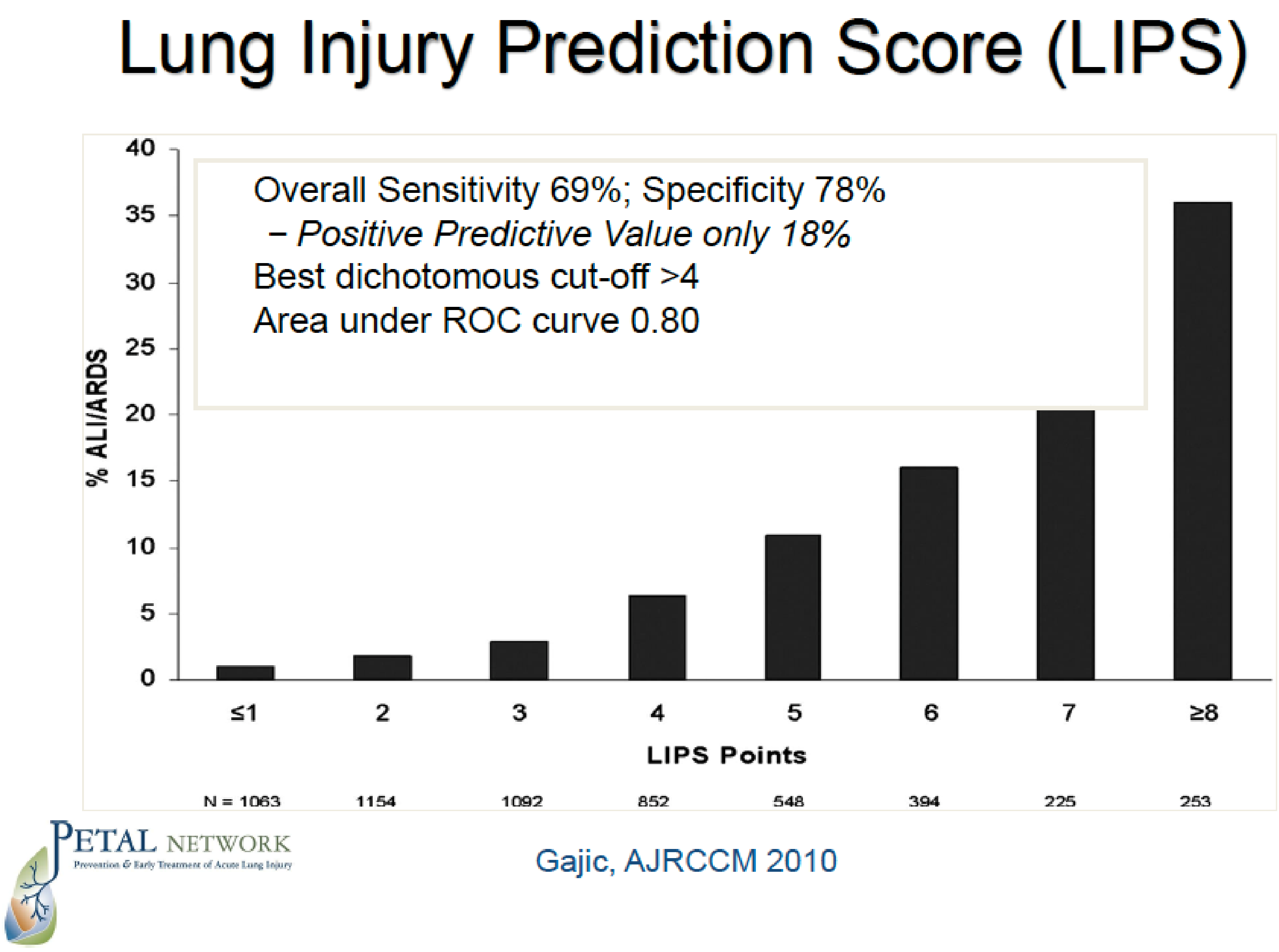


Figure 3: Schematic of study



Appendix F. Lung Injury Prediction Scoring Schema

Predisposing Conditions	LIPS Points
Shock	2
Aspiration	2
Sepsis	1
Pneumonia	1.5
High risk surgery*	
Orthopedic spine	1
Acute abdomen	2
Cardiac	2.5
Aortic vascular	3.5
High risk trauma	
Traumatic brain injury	2
Smoke inhalation	2
Near drowning	2
Lung contusion	1.5
Multiple fractures	1.5
Risk modifiers	
Alcohol abuse**	1
Obesity (BMI >30)	1
Hypoalbuminemia	1
Chemotherapy	1
FiO_2 >0.35 (>4 L/min)	2
Tachypnea (RR >30)	1.5
SpO2 <95%	1
Acidosis (pH <7.35)	1.5
Diabetes mellitus**	-1



* Add 1.5 points if emergency surgery.

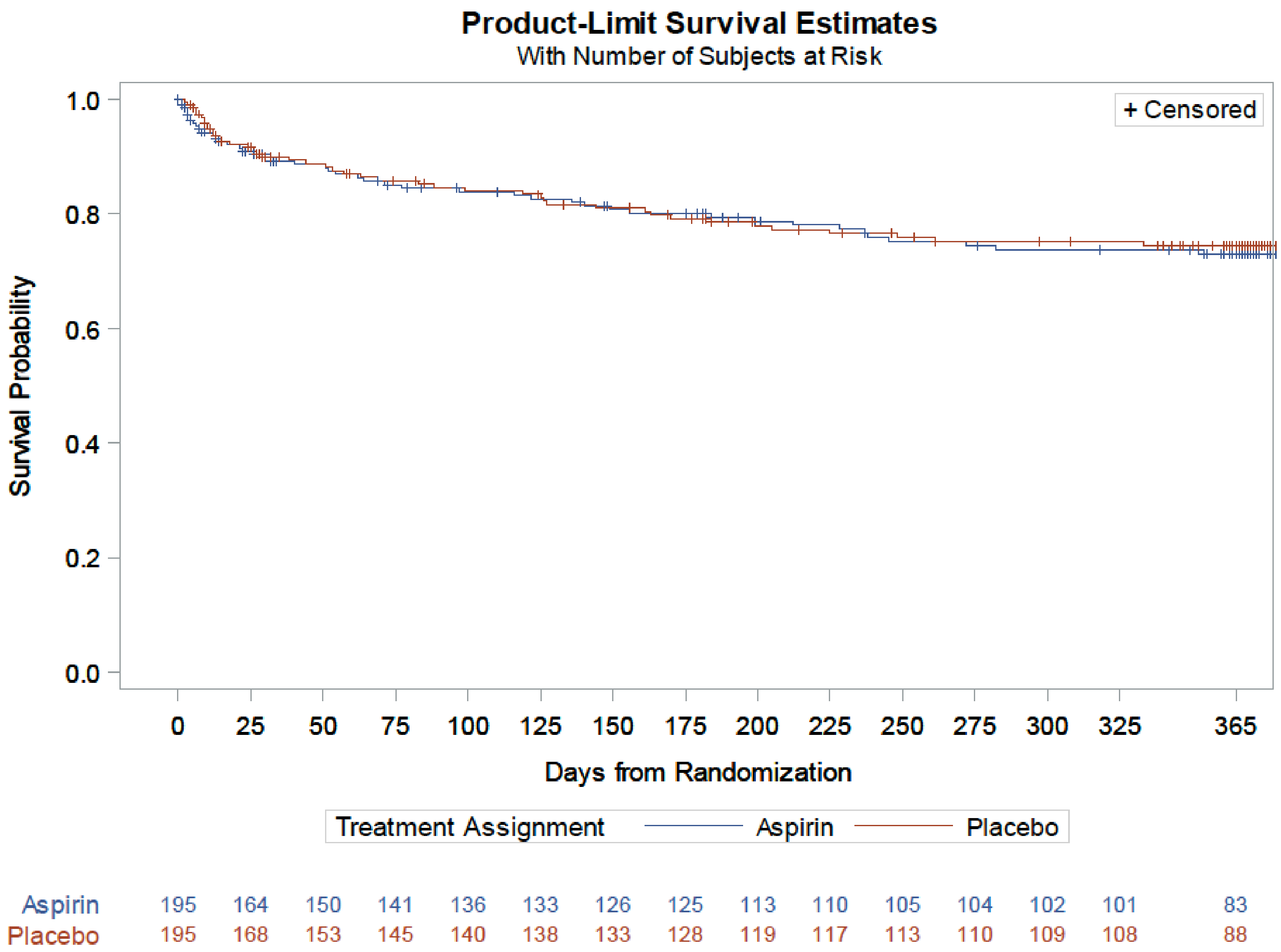
** Known diagnosis of chronic alcoholism or a previous admission for alcohol detoxification or alcohol withdrawal; daily alcohol consumption of >14 drinks a week; or >5 drinks binges1

*** Only if sepsis.

Aspirin vs. Placebo
(325mg loading → 81mg/d)

	Aspirin (n = 195)	Placebo (n = 195)	Mean Difference (90% CI)	P Value
Primary outcome				
ARDS within 7 d, No. (%)	20 (10.3)	17 (8.7)	1.5 (−3.8 to 6.8)	.53
Secondary outcomes				
Ventilator-free days to day 28, mean (SD)	24.9 (7.4)	25.2 (7.0)	−0.26 (−1.46 to 0.94)	.72
ICU length of stay, mean (SD), d	5.2 (7.0)	5.4 (7.0)	−0.16 (−1.75 to 1.43)	.87
Hospital length of stay, mean (SD), d	8.8 (10.3)	9.0 (9.9)	−0.27 (−1.96 to 1.42)	.79
28-Day survival, % (90% CI)	90 (86 to 93)	90 (86 to 93)	HR, 1.03 (90% CI, 0.60 to 1.79)	.92
1-Year estimated survival, % (90% CI)	73 (67 to 78)	75 (69 to 80)	HR, 1.06 (90% CI, 0.75 to 1.50)	.79
Bleeding-related adverse events, No. (%)	11 (5.6)	5 (2.6)	OR, 2.27 (90% CI, 0.92 to 5.61)	.13

Figure S2: Survival outcomes. The estimated one-year survival by treatment group is shown by the Kaplan-Meier product limit estimator. There were no differences in survival as measured by the logrank test statistic (Logrank p= 0.7891).



Biomarker analysis

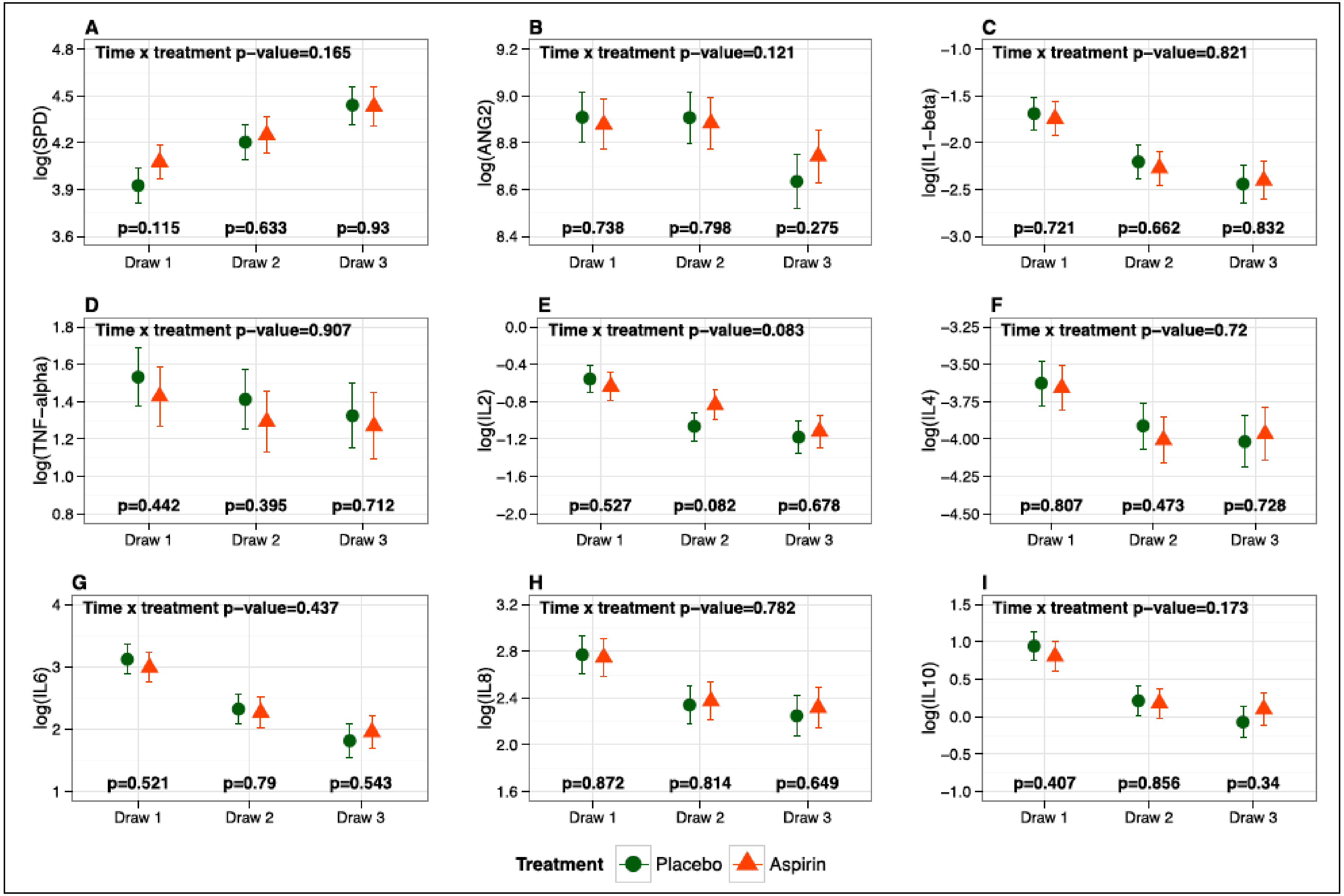


Table 3. Safety Outcomes by Treatment Assignment

	Aspirin (n = 195)	Placebo (n = 195)	Difference (90% CI)[b]	Odds Ratio (90% CI)	P Value
Adverse event summary, No. (%)[a]					
Any adverse event	17 (8.7)	13 (6.7)	2.1 (−2.4 to 6.5)	1.34 (0.71 to 2.51)	.45
Bleeding-related adverse event					
Any severity	11 (5.6)	5 (2.6)	3.1 (−0.2 to 6.4)	2.27 (0.92 to 5.61)	.13
Moderate or severe	8 (4.1)	4 (2.1)	2.1 (−0.8 to 4.9)	2.04 (0.74 to 5.67)	.24
Renal function[c]					
RIFLE classification, No. (%)					
Risk	28 (17.0)	20 (11.2)	5.8 (−0.4 to 12.0)	1.61 (0.96 to 2.71)	.13
Injury	5 (3.0)	6 (3.4)	−0.3 (−3.5 to 2.8)	1.12 (0.41 to 3.07)	.86
Failure	0	0			>.99
Change in creatinine, median (Q1-Q3), mg/dL	0.0 (−0.2 to 0.1)	−0.1 (−0.2 to 0.1)			.29
Mean (SD), mg/dL	0.04 (0.76)	−0.19 (1.08)	0.2 (0.1 to 0.4)[d]		.03
% Change in creatinine	0.0 (−20.0 to 15.4)	−5.2 (−18.8 to 8.6)			.36
Mean (SD), %	5.7 (59.4)	1.1 (51.8)	4.6 (−5.3 to 14.5)		.44
Change GFR, median (Q1-Q3), mL/min/BSA	0.0 (−20.5 to 7.2)	−0.7 (−15.4 to 4.1)			.70
Mean (SD)	0.2 (63.8)	−5.1 (42.8)	5.3 (−4.3 to 14.9)		.37
% Change in GFR, median (Q1-Q3)	0.0 (−29.4 to 15.2)	−6.3 (−27.1 to 9.1)			.36
Mean (SD), %	−10.1 (41.0)	−32.9 (186.2)	4.3 (−3.7 to 12.4)[e]		.13

Table S2. Number of patients experiencing adverse events by treatment group.

Adverse Event	Frequency Reported Aspirin (N=195)	Placebo (N=195)	Total (N=390)
Anemia due to upper GI Bleeding	0	1	1
Bleeding, gastrointestinal	3	2	5
Bleeding, NOS	2	0	2
Bleeding, nose	1	0	1
Bleeding, rectal	1	0	1
Bleeding, stress ulcers	1	0	1
Cerebral hemorrhage	1	0	1
Chest pain	1	0	1
Elevated blood pressure	1	0	1
Hematoma	2	1	3
Hemoptysis	0	1	1
Low Hemoglobin	0	2	2
Mild Indigestion	1	0	1
NSTEMI	1	0	1
Pleural effusion	1	0	1
Pneumonia	0	2	2
Pulseless Electrical Activity	0	1	1
Renal Failure requiring dialysis	0	1	1
Right hip resection	1	0	1
Thrombocytopenia	2	0	2
Urosepsis	1	0	1
UTI, Hydrocephalus, Skin Infection	0	1	1
Vomiting	0	1	1
Total	20	13	33

Conclusions

- Among at-risk patients presenting to the ED, the use of aspirin compared with placebo did not reduce the risk of ARDS at 7 days.
- The findings of this phase 2b trial do not support continuation to a larger phase 3 trial.

12 PETAL Clinical Sites and CCC

~ 40 hospitals
LA, OR, ME, VA, MS

PETAL NETWORK
Prevention & Early Treatment of Acute Lung Injury

Long-Term Survival in Adults Treated With Extracorporeal Membrane Oxygenation for Respiratory Failure and Sepsis*

Viktor von Bahr, MD[1]; Jan Hultman, MD, PhD[1,2]; Staffan Eksborg, PhD[3]; Björn Frenckner MD, PhD[2,4]; Håkan Kalzén MD[1,2]

Crit Care Med 2017; 45:164–170.

5-year survival rates and causes of late death in adults with respiratory failure and sepsis under ECMO support

- Single-center retrospective cohort study
- Karolinska Universty Hospital, Sweden
- Adult patients treated with extracorporeal membrane oxygenation for respiratory failure and sepsis
- Survival status and Causes of Death

TABLE 2. Comparison of Demographics and Baseline Clinical Characteristics by Diagnostic Group

Variable	Total	Pneumonia, Bacterial	Pneumonia, Viral	Pneumonia, Aspiration	Nonpulmonary Infection	Severe Inflammatory Response[a]	Traumatic Chest/ Lung Contusion	Other Respiratory Etiology[b]
N	255[c]	134	31	19	24	23	9	15
Age at treatment (yr)	46 (33–58)	49 (37–59)	44 (29–53)	46 (32–57)	55 (23–66)	34 (24–46)	38 (23–51)	44 (33–63)
Sex, male, *n* (%)	166 (65)	83 (62)	19 (61)	11 (58)	18 (75)	16 (70)	9 (100)	10 (67)
Time on extracorporeal membrane oxygenation ICU[d] (d)	8 (4–17)	9 (4–17)	15 (7–34)	5 (3–15)	4 (3–8)	6 (2–19)	7 (4–10)	7 (4–12)
Cannulation, VV,[e] *n* (%)	135 (53)	78 (58)	14 (45)	10 (53)	9 (38)	9 (39)	5 (56)	10 (67)
Cannulation, VA, *n* (%)	70 (27)	29 (22)	10 (32)	5 (26)	12 (50)	6 (26)	3 (33)	5 (33)
Converted to VV,[f] *n* (%)	13 (5)	7 (5)	3 (10)	0 (0)	0 (0)	3 (13)	0 (0)	0 (0)
Converted to VA, *n* (%)	37 (15)	20 (15)	4 (13)	4 (21)	3 (13)	5 (22)	1 (11)	0 (0)
Pao_2:Fio_2 ratio[g] at referral (mmHg)	54 (47–60)	54 (47–60)	51 (44–58)	56 (48–62)	52 (49–56)	52 (38–59)	56 (34–66)	61 (51–67)
Follow-up time in survivors (yr)	4.4 (2.1–9.3)	5.2 (2.2–10.7)	4.2 (1.4–4.4)	5.4 (4.4–6.8)	2.0 (1.3–6.2)	10.4 (1.3–10.6)	10.3 (6.8–12.8)	6.1 (3.6–11.9)
Follow-up time in diseased[h] (d)	48 (14–427)	56 (33–544)	*4/502* (*n* = 2)	*21/157/ 334/727* (*n* = 4)	*5/14/15/60* (*n* = 4)	*1/3/15/870* (*n* = 4)	*173/427* (*n* = 2)	12 (11–55)

TABLE 3. Survival Estimates by Diagnostic Group, Age, and Cannulation

Variable	*n*	Survives Treatment	Survives to Discharge	Survives 90 d	1-yr Survival[a]	5-yr Survival[a]	1-yr Conditional[b] Survival (%)	5-yr Conditional[b] Survival (%)
Total	255	168 (66%)	163 (64%)	139 (55%)	52% NAR 125	47% NAR 53	96	87
Pneumonia, bacterial	134	92 (69%)	89 (66%)	78 (58%)	56% NAR 70	51% NAR 36	96	88
Pneumonia, viral	31	20 (65%)	20 (65%)	19 (61%)	61% NAR 19	57% (3 yr)[c]	100	3 yr: 93§
Pneumonia, aspiration	19	12 (63%)	12 (63%)	11 (58%)	47% NAR 9	41% NAR 5	82	72
Nonpulmonary infection	24	17 (71%)	17 (71%)	13 (54%)	54% NAR 11	*54% NAR 4*	100	100
Severe inflammatory response	23	10 (43%)	9 (39%)	6 (26%)	26% NAR 5	*20% NAR 3*	100	75
Traumatic chest/ lung contusion	9	6 (67%)	5 (56%)	5 (56%)	*44% NAR 4*	*33% NAR 2*	80	60
Other respiratory etiology	15	11 (73%)	11 (73%)	7 (47%)	47% NAR 7	*40% NAR 3*	100	86
Survival based on cannulation and age								
Age ≥ 65 yr	26	17 (65%)	17 (65%)	14 (54%)	54% NAR 13	*54% NAR 2*	100	100
VV-ECMO	135	103 (76%)	99 (73%)	84 (62%)	60% NAR 76	56% NAR 39	96	90
VA-ECMO	70	46 (66%)	45 (64%)	38 (54%)	51% NAR 34	44% NAR 10	97	84
Converted to VV[d]	13	10 (77%)	10 (77%)	9 (69%)	69% NAR 8	41% (3 yr)[e]	100	60
Converted to VA	37	9 (24%)	9 (24%)	8 (22%)	19% NAR 7	*19% NAR 4*	88	88

NAR = number at risk, VA = veno arterial cannulation, VV = veno venous cannulation.

[a]Survival calculated by means of the Kaplan-Meier method.

[b]Survival for patients that were alive 90 days after treatment.

[c]Follow-up time was 4.6 years, in median 3.6 years. Number at risk (NAR) (3 yr) = 12.

[d]Includes veno arterial cannulation (VA)-veno venous cannulation (VV) (i.e., patients converted from an initial VA cannulation to VV) and VV-VA-VV.

[e] Follow-up time was 4.5 years, in median 2.3 years. NAR (3 yr) = 3.

Table showing survival estimates based on diagnostic group, old age and cannulation. Groups with fewer than five patients are written in italic. A statistical analysis is provided in Supplemental Digital Content 1 (http://links.lww.com/CCM/C154). Results are presented as number (percentage).

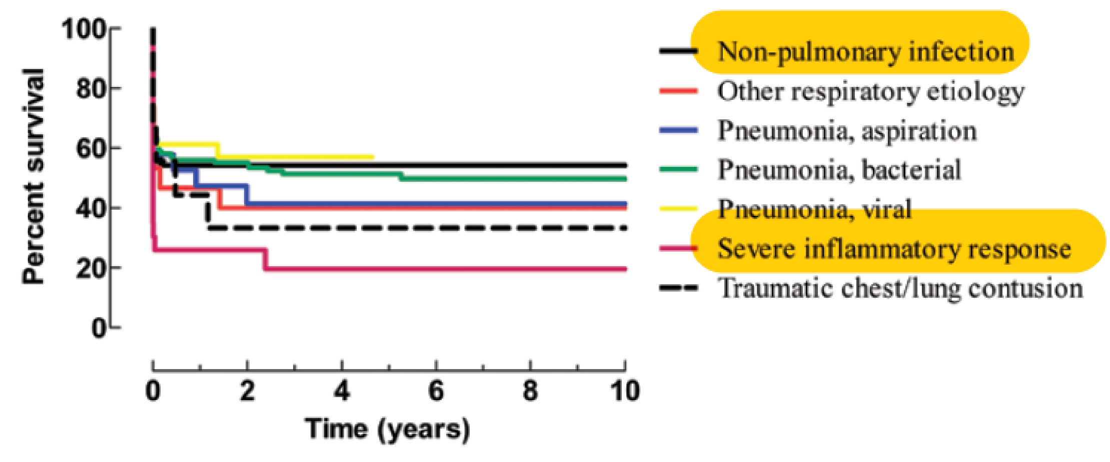


Figure 1. Kaplan-Meier graph to show survival estimates in years for all ECMO-treated patients ($n = 255$) based on diagnostic group. The initial descending part represents deaths during treatment. Numbers at risk after 1 and 5 years are shown in Table 3. Statistical analyses were used for the comparison of the survival curves, with $p = 0.15$, i.e., not statistically significant (additional information about statistical analyses can be found in, **Table E2**, Supplemental Digital Content 1, http://links.lww.com/CCM/C154).

Conclusions

- Outcome after ECMO treatment is highly variable.
- It is suggested that **survival to discharge** is a **poor estimate** of survival because many deaths occur in the first 90 days after weaning from ECMO.
- For the patients **who survive the initial critical time** after ECMO treatment, survival in the coming years seems **good**, especially if treated for an infectious disease.

ORIGINAL

The feasibility and safety of extracorporeal carbon dioxide removal to avoid intubation in patients with COPD unresponsive to noninvasive ventilation for acute hypercapnic respiratory failure (ECLAIR study): multicentre case–control study

Stephan Braune[1], Annekatrin Sieweke[1], Franz Brettner[2], Thomas Staudinger[3], Michael Joannidis[4], Serge Verbrugge[5], Daniel Frings[1], Axel Nierhaus[1], Karl Wegscheider[6] and Stefan Kluge[1*]

Intensive Care Med (2016) 42:1437–1444.

Is it feasible and safe that avoiding iMV by using $ECCO_2R$?

- Case–control study (matched, historical controls)
- 5 Euro ICUs
- Patients with acute hypercapnic respiratory failure refractory to NIV being treated with a pump-driven veno-venous ECCO2 R system
- Outcomes: intubation, AEs, mortality

Table 1 Baseline patient characteristics

Patients characteristics	$ECCO_2R$ group (*n* = 25)	Control group (*n* = 25)	*p* value
Demographic data, BMI and SAPS-II score			
Age (years)	67.3 (51.0–83.0)	68.6 (55.0–82.0)	0.24
Gender (male) *n* (%)	12 (48.0)	13 (52.0)	0.78
BMI	26.6 (17.0–53.4)	24.9 (17.7–34.2)	0.29
SAPS II	40.5 (24.0–63.0)	41.5 (26.0–63.0)	0.23
Arterial blood gases pre-$ECCO_2R$ and IMV			
pH	7.24 (7.06–7.34)	7.23 (7.04–7.37)	0.11
$PaCO_2$ (mmHg)	81.5 (53.8–126.0)	79.5 (48.4–117.0)	0.64
PaO_2/FiO_2 (mmHg)	209.3 (106.2–476.0)	201.0 (58.0–466.0)	0.77
Noninvasive ventilatory parameters pre-$ECCO_2R$ and pre-IMV			
Insp. pressure (mbar)	20.5 (10.0–30.0)	19.7 (10.0–30.0)	0.53
PEEP (mbar)	5.3 (3.0–8.0)	5.8 (3.0–12.0)	0.23
Tidal volume (ml)	474.4 (218.0–822.0)	432.6 (50.0–1034.0)	0.47
Tidal volume/kg PBW (ml/kg)	6.9 (3.1–12.6)	5.9 (0.7–17.2)	0.32
Minute volume (L/min)	12.3 (1.1–29.3)	10.3 (0.2–23.5)	0.23
Respiratory rate (/min)	27.6 (10.0–48.0)	26.5 (17.0–38.0)	0.56
Duration of NIV (h)	21.2 (0.5–67.8)	30.6 (1.0–216.0)	0.36

Table 2 Clinical course and outcomes

Clinical course	$ECCO_2R$ group (*n* = 25)	Control group (*n* = 25)	*p* value
Days on $ECCO_2R$	8.5 (1.0–27.0)	N/A	N/A
Days on IMV	8.3 (0–60.0)	13.7 (1.0–52.0)	0.02*
Tracheotomy	9.0 (36.0)	15.0 (60.0)	0.09*
Days on NIV during $ECCO_2R$	4.6 (0–22.0)	N/A	N/A
Mode of NIV used during $ECCO_2R$	A-NIV 12.0 % C-NIV 8.0 % Mix-NIV 44.0 %	N/A	N/A
Length of stay			
Days in ICU	28.9 (8.0–100.0)	24.0 (2.0–66.0)	0.09*
Days in hospital	36.9 (9.0–100.0)	37.0 (12.0–248.0)	0.49*
Mortality *n* (%)			
28-day mortality	4.0 (16.0)	3.0 (12.0)	0.68
Hospital mortality	6.0 (24.0)	3.0 (12.0)	0.28
90-day mortality	7.0 (28.0)	7.0 (28.0)	1.0

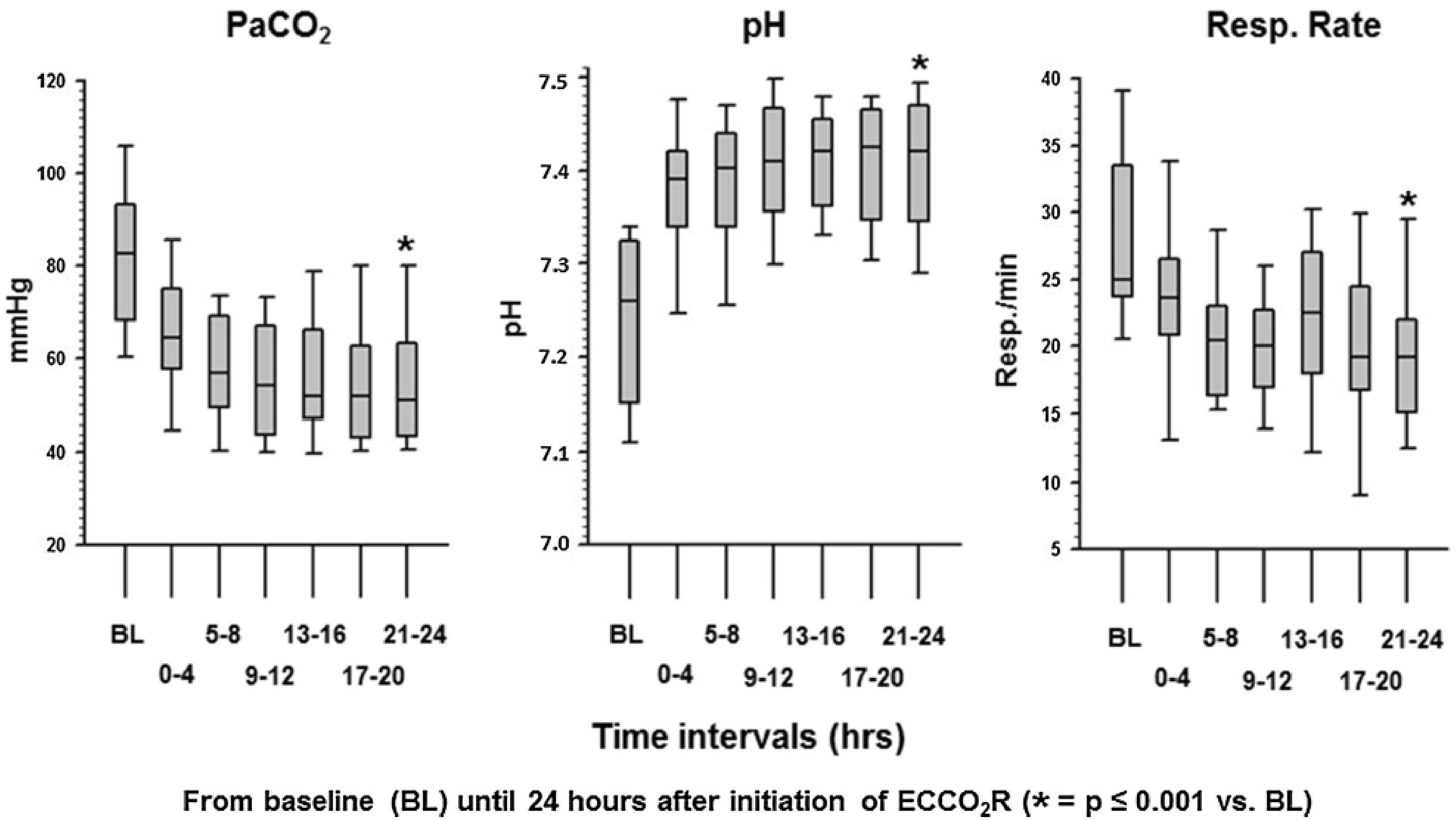


Fig. 1 Sequential changes in arterial partial pressure of carbon dioxide ($PaCO_2$), pH and respiratory rate. *Boxplots* display medians, 10th, 25th, 75th, and 90th percentiles, *$p < 0.001$ baseline (BL) vs. 21–24 h

Table 3 $ECCO_2R$-associated adverse events and bleeding/thromboembolic complications

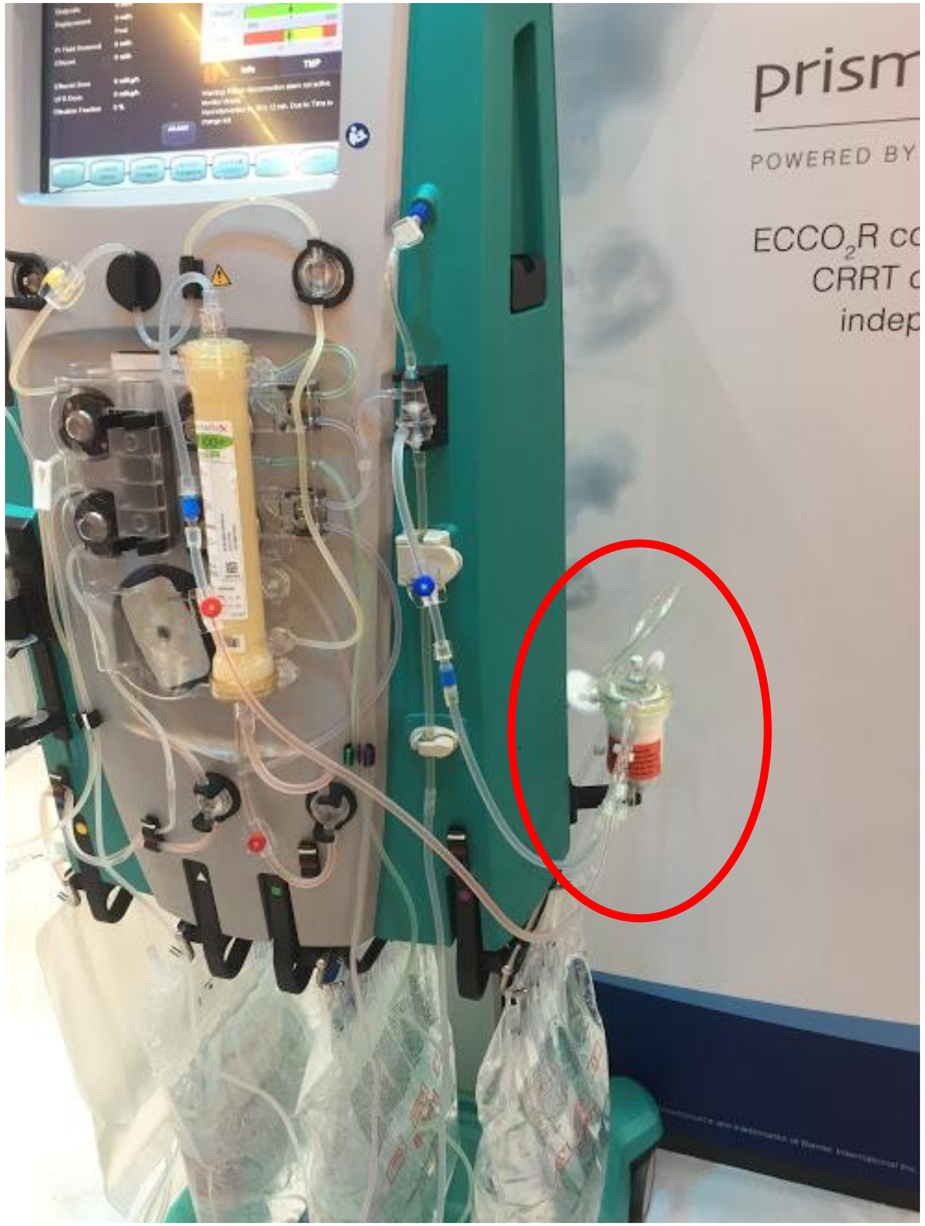
Adverse events (*n*)	$ECCO_2R$ group	Control group
Major $ECCO_2R$-associated adverse events	14	N/A
Major bleeding	11	2*
Pulmonary haemorrhage	2	–
Bleeding from tracheostomy	2	1
Haematothorax	2	–
Bleeding from gastric ulcer	1	–
Bleeding from rectal ulcer	1	–
Bleeding from oesophageal varices	–	1
Retroperitoneal haematoma	1	–
Dislodged sealing cap of DLC	1	–
Cannula insertion site	1	–
Device-related	3	N/A
Air detection in the circuit	1	–
Extracorporeal clotting	2	–
Minor $ECCO_2R$-associated adverse events	11	N/A
Minor bleeding/thrombosis	10	10
Haematuria	3	1
Cannula insertion site	2	–
Intracerebral bleeding (small)	–	1
Epistaxis	2	–
Haemorrhagic pleural effusion	1	–
Tracheobronchial haemorrhage	1	3
Bleeding from ileostomy	1	–
Inguinal haematoma	–	1
Intramuscular bleeding lower limb	–	1
Postoperative wound bleeding	–	1
Bleeding from tracheostomy	–	1
Thrombosis inferior vena cava and renal vein		1
Device-related	1	N/A
Disconnection of sweep gas tubing	1	–

Conclusions

- The use of veno-venous ECCO2 R to avoid invasive mechanical ventilation was successful in just over half of the cases.

- However, relevant ECCO2 R-associated complications occurred in over one-third of cases. Despite the shorter period of IMV in the ECCO2 R group there were no significant differences in length of stay or in 28- and 90-day mortality rates between the two groups.

- Larger, randomised studies are warranted for further assessment of the effectiveness of ECCO2 R.


POWERED BY


NovaPort twin

ESICM TRIALS GROUP

SUPERNOVA: A Strategy of UltraProtective lung ventilation With Extracorporeal CO2 Removal for New-Onset moderate to seVere ARDS

Q&A

Rationale

ARDSnet strategy might not protect against tidal hyperinflation

- When Pplat remains >28-30 cm H2O

Further decrease of Vt

- From 6 to 5, 4 or 3 ml/kg IBW
- To decrease Pplat <25 cm H2O, To decrease delta P
- To further reduce VILI
- With sufficient PEEP to prevent lung derecruitment

Induced hypercapnia controlled by extracorporeal CO2 removal

- "CO2 dialysis"
- Low-flow devices

PILOT trial

Feasibility and safety
100 patients
3 devices (MAQUET, NOVALUNG, ALUNG)
Starting date: Autumn 2015

RCT

The aim is to randomise up to 1500 patients
There will be an adaptive design
The protocol will be finalised according to the results of the pilot trial

Study Objectives

Extracorporeal CO2(ECCO2R) removal devices (PALP, MAQUET; ILA-active, NOVALUNG; Hemolung, ALung) allowVT and plateau pressure reduction in patients with moderate ARDS. This study will assess changes in pH/PaO2 /PaCO2, Respiratory Rate and device CO2 clearance in the first 24 hours of ECCO2R following VT and plateau pressure reduction in patients with moderate ARDS. Safety variables during treatment will also be analysed.

Research protocol

- Study design: We plan to prospectively collect data on 100 patients during usual care in 21 centers.
- Study devices: PALP, MAQUET; ILA-active, NOVALUNG; Hemolung, ALung. All devices are CE-marked in the European Union.

How do I participate?

A selection of ICUs will take part in the pilot study (approx. 20)

ORIGINAL

Ultrasound-guided percutaneous dilational tracheostomy versus bronchoscopy-guided percutaneous dilational tracheostomy in critically ill patients (TRACHUS): a randomized noninferiority controlled trial

André Luiz Nunes Gobatto[1,4*], Bruno A. M. P. Besen[1], Paulo F. G. M. M. Tierno[2], Pedro V. Mendes[1], Filipe Cadamuro[2], Daniel Joelsons[3], Livia Melro[1], Maria J. C. Carmona[4], Gregorio Santori[5], Paolo Pelosi[5,6], Marcelo Park[1] and Luiz M. S. Malbouisson[2,4]

Intensive Care Med (2016) 42:342–351.

Has ultrasound emerged as a potential useful tool to assist PDT?

- Open-label, parallel, non-inferiority randomized controlled trial
- Single center
- Adult patients, intubated, mechanically ventilated, and indicated for a tracheostomy
- 1° outcome: procedure failure

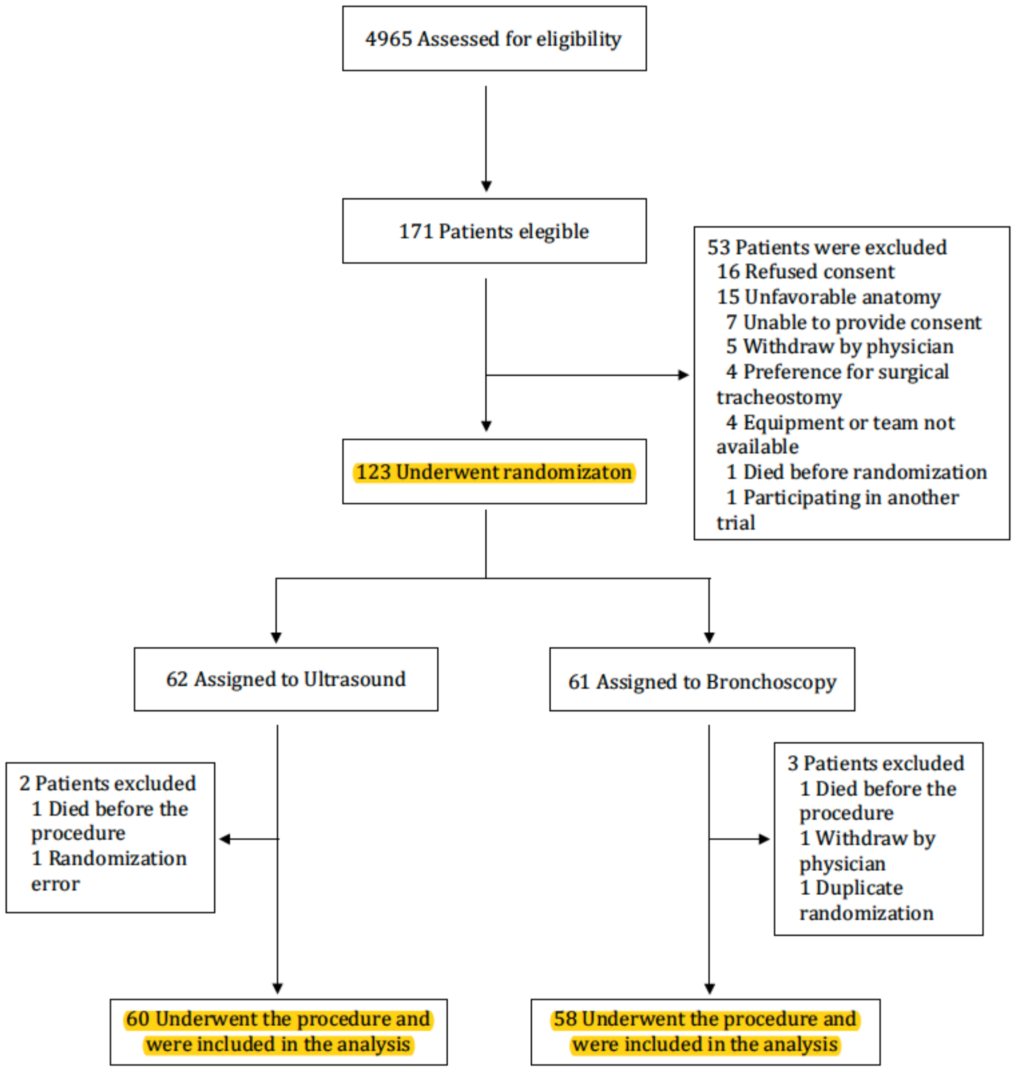
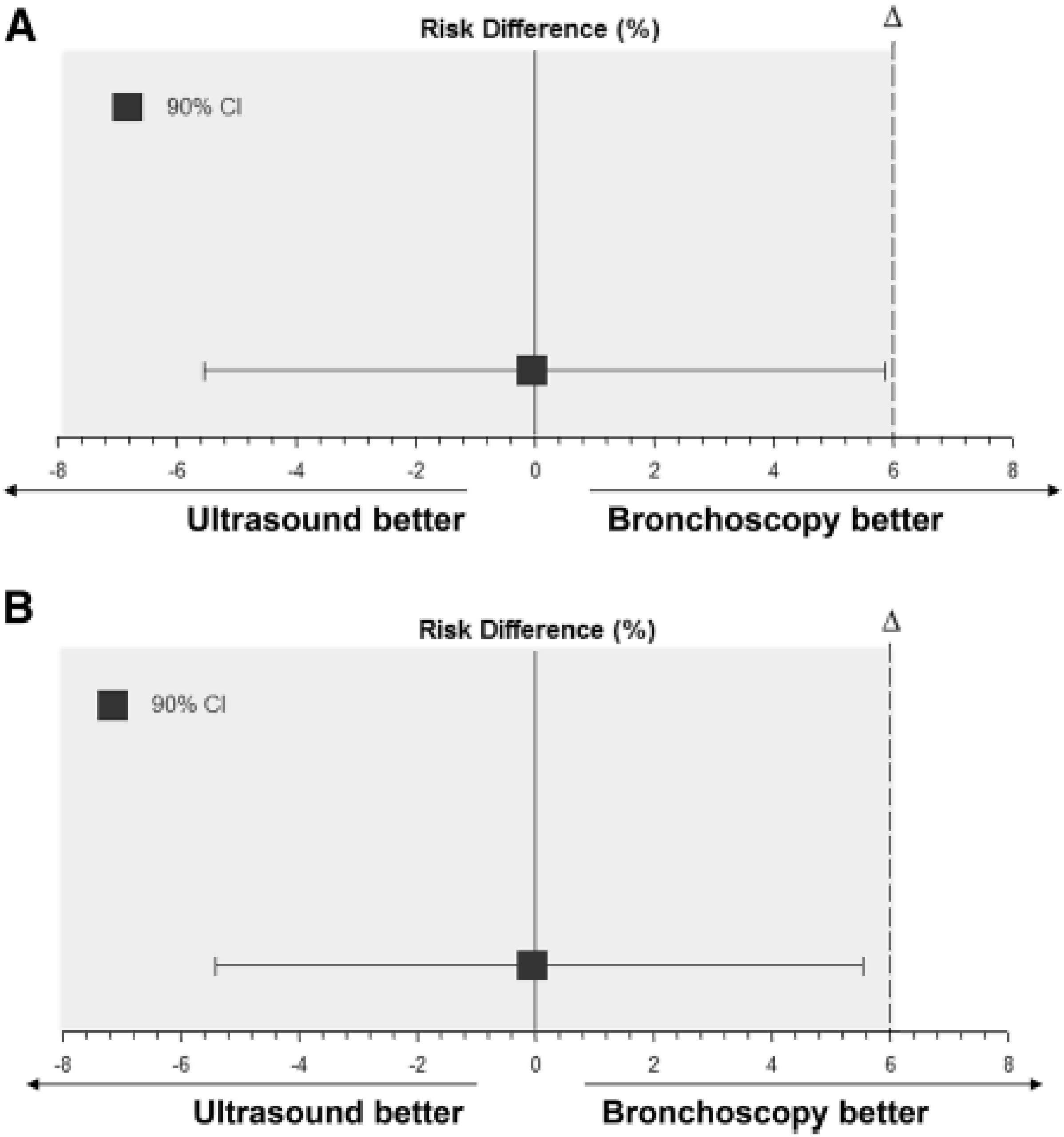


Table 2 Procedure data

	Ultrasound (*n* = 60)	Bronchoscopy (*n* = 58)	*P* value
Procedure difficulty, *n* (%)			0.960
Easy	38 (63.3)	34 (58.6)	
Somewhat difficult	15 (25.0)	16 (27.6)	
Difficult	6 (10)	7 (12.1)	
Very difficult	1 (1.7)	1 (1.7)	
Impossible	0	0	
Tracheal punctures	2 [1–2]	2 [1–2]	0.724
Distance between skin and trachea, mm	8.9 (2.4)	NA	
Tracheal diameter, mm	22.2 (3.9)	NA	
Vessels beneath the puncture site, *n* (%)	10 (16.7)	NA	
Thyroid beneath the puncture site, *n* (%)	18 (30)	NA	
Change in the puncture site after US, *n* (%)	14 (23.3)	NA	
Procedure length (min)	11 [7–19]	13 [8–20]	0.468

Values are expressed as the mean (standard deviation), median [25th–75th percentiles], or a number (percentage)

US ultrasound, *NA* not applicable



- Patients were excluded if they had an unsuitable anatomy to undergo a PDT as judged by the patient attending physician

  (i.e., short neck, tracheal deviation, cervical anatomical anomaly, previous cervical surgery, cervical trauma, cervical tumors, or the inability to perform a neck extension)

Table 3 Complications and clinical outcomes

	Ultrasound ($n = 60$)	Bronchoscopy ($n = 58$)	*P* value
Procedure failure, *n* (%)	1 (1.7)	1 (1.7)	0.981
Transient hypotension, *n* (%)	7 (11.7)	6 (10.3)	0.819
Minor bleeding, *n* (%)	4 (6.7)	5 (8.6)	0.689
Transient acute hypoxemia, *n* (%)	2 (3.3)	0	0.496
Orotracheal cannula puncture, *n* (%)	3 (5.0)	1 (1.7)	0.619
Stoma infection, *n* (%)	2 (3.3)	0	0.496
Accidental decannulation, *n* (%)	1 (1.7)	2 (3.4)	0.615
Atelectasis, *n* (%)	5 (8.3)	1 (1.7)	0.207
Total minor complications, *n* (%)	20 (33.3)	12 (20.7)	0.122
Time to unassisted breathing, days	49 (81.7)	44 (75.9)	0.440
MV time, days	19 [12–28]	19 [13–24]	0.699
Time between tracheostomy and unassisted breathing, days	3 [2–6]	4 [2.5–7]	0.231
Ventilation-free days at day 60, days	38.5 [18–47]	38 [8–45]	0.505
ICU length of stay, days	26 [19–38]	24 [19–34]	0.819
Hospital length of stay, days	48 [29–70]	41 [27–66]	0.272
ICU mortality, *n* (%)	20 (33.3)	21 (36.2)	0.743
Hospital mortality, *n* (%)	26 (44.8)	26 (46.4)	0.864
ICU free days at day 60, *n* (%)	18 [0–36]	25 [0–38]	0.608

Values are expressed as the mean (standard deviation), median [25th–75th percentiles], or number (percentage)

MV mechanical ventilation, *ICU* intensive care unit

Conclusions

- Ultrasound-guided PDT is noninferior to bronchoscopy-guided PDT in mechanically ventilated critically ill patients.

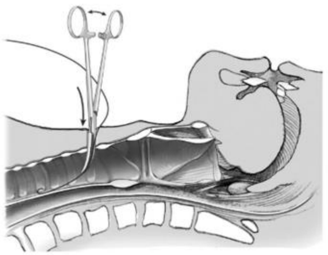
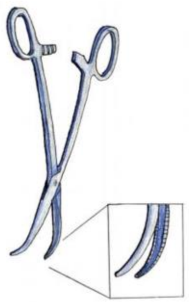


Figure 6 The guidewire dilator forceps jaws now lie longitudinally in the trachea. Dilate the tracheal wall by opening the forceps arms with both hands.



- Griggs clamp
- Exclusion Criteria
  - Patients were excluded if they had an unsuitable anatomy to undergo a PDT as judged by the patient attending physician (i.e., short neck, tracheal deviation, cervical anatomical anomaly, previous cervical surgery, cervical trauma, cervical tumors, or the inability to perform a neck extension)

Randomized Trial of Video Laryngoscopy for Endotracheal Intubation of Critically Ill Adults*

David R. Janz, MD, MSc[1]; Matthew W. Semler, MD[2]; Robert J. Lentz, MD[2]; Daniel T. Matthews, MD[2]; Tufik R. Assad, MD[2]; Brett C. Norman, MD[2]; Raj D. Keriwala, MD, MPH[2]; Benjamin A. Ferrell, MD[2]; Michael J. Noto, MD, PhD[2]; Ciara M. Shaver, MD, PhD[2]; Bradley W. Richmond, MD[2]; Jeannette Zinggeler Berg, MD, PhD[2]; Todd W. Rice, MD, MSc[2]; for the Facilitating EndotracheaL intubation by Laryngoscopy technique and apneic Oxygenation Within the ICU Investigators and the Pragmatic Critical Care Research Group

JAMA | Original Investigation | CARING FOR THE CRITICALLY ILL PATIENT

Video Laryngoscopy vs Direct Laryngoscopy on Successful First-Pass Orotracheal Intubation Among ICU Patients
A Randomized Clinical Trial

Jean Baptiste Lascarrou, MD; Julie Boisrame-Helms, MD, PhD; Arthur Bailly, MD; Aurelie Le Thuaut, MSc; Toufik Kamel, MD; Emmanuelle Mercier, MD; Jean-Damien Ricard, MD, PhD; Virginie Lemiale, MD; Gwenhael Colin, MD; Jean Paul Mira, MD, PhD; Ferhat Meziani, MD, PhD; Jonathan Messika, MD; Pierre Francois Dequin, MD, PhD; Thierry Boulain, MD; Elie Azoulay, MD, PhD; Benoit Champigneulle, MD; Jean Reignier, MD, PhD; for the Clinical Research in Intensive Care and Sepsis (CRICS) Group

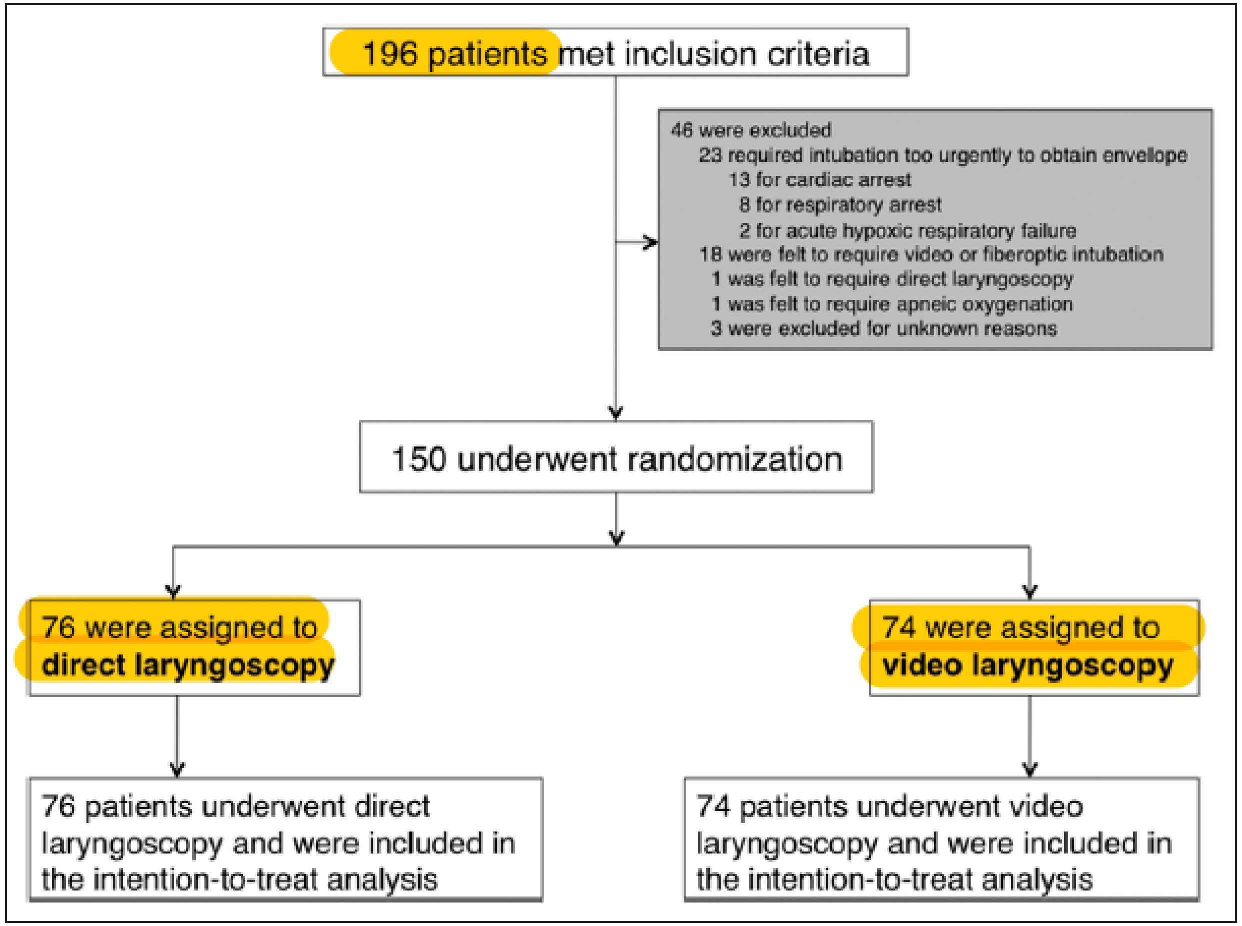
Crit Care Med 2016; 44:1980–1987.

JAMA. 2017;317(5):483-493.

Which is better between VL vs. DL ?

- Randomized, parallel-group, pragmatic trial
- A medical ICU in a tertiary, academic medical center (Vanderbilt)

- PCCM fellow
- Outcome: the rate of intubation on first attempt



Crit Care Med 2016; 44:1980–1987

Clinical Outcomes	Video Laryngoscopy ($n = 74$)	Direct Laryngoscopy ($n = 76$)	p
Intubation on first laryngoscopy attempt, n (%)	51 (68.9)	50 (65.8)	0.68
No. of laryngoscopy attempts, median (IQR)	1 (1)	1 (1–2)	0.24
Time from induction to intubation, median (IQR) (s)	126 (89–197)	153 (93–253)	0.13
Time to intubation when only one attempt, median (IQR), seconds ($n = 101$)	105 (75–150)	112 (86–156)	0.45
Lowest arterial oxygen saturation, median (IQR) (%)	91% (82–98)	90% (82–97)	0.75
Change in arterial oxygen saturation from baseline, median (IQR) (%)	−4% (−14.5 to −1)	−4% (−11 to 0)	0.39
Best Cormack-Lehane view obtained on first attempt*, n (%)			
Grade I	57 (77)	38 (50)	0.001
Grade II	15 (20.3)	23 (30.3)	
Grade III	1 (1.4)	9 (11.8)	
Grade IV	1 (1.4)	6 (7.9)	
Difficulty of intubation*, n (%)			
Easy	64 (86.5)	54 (71.1)	0.051
Moderate	9 (12.2)	17 (22.4)	
Difficult	1 (1.4)	5 (6.6)	
Procedural complications*, total n (%)	26 (35.1)	29 (38.1)	0.73
Aspiration	1 (1.4)	1 (1.3)	1
Esophageal intubation	1 (1.4)	4 (5.3)	0.36
Systolic blood pressure < 80 mm Hg	8 (10.8)	7 (9.2)	0.79
Arterial oxygen saturation < 80%	14 (19.4)	16 (21.1)	0.84
Cardiac arrest	1 (1.4)	1 (1.3)	1
Airway trauma	1 (1.4)	0	0.49
Duration of mechanical ventilation, median (IQR) (d)	3 (1–11)	3 (1–8)	0.69
ICU length of Stay, median (IQR) (d)	6 (2–11)	4 (3–9)	0.41
In-hospital mortality, n (%)	31 (41)	32 (42)	1

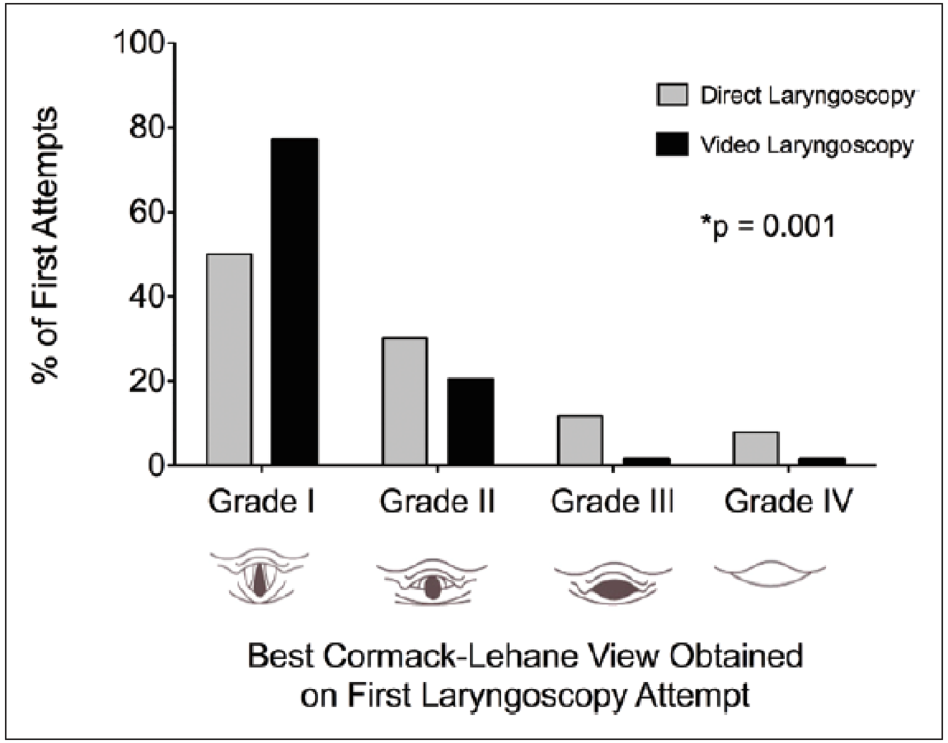
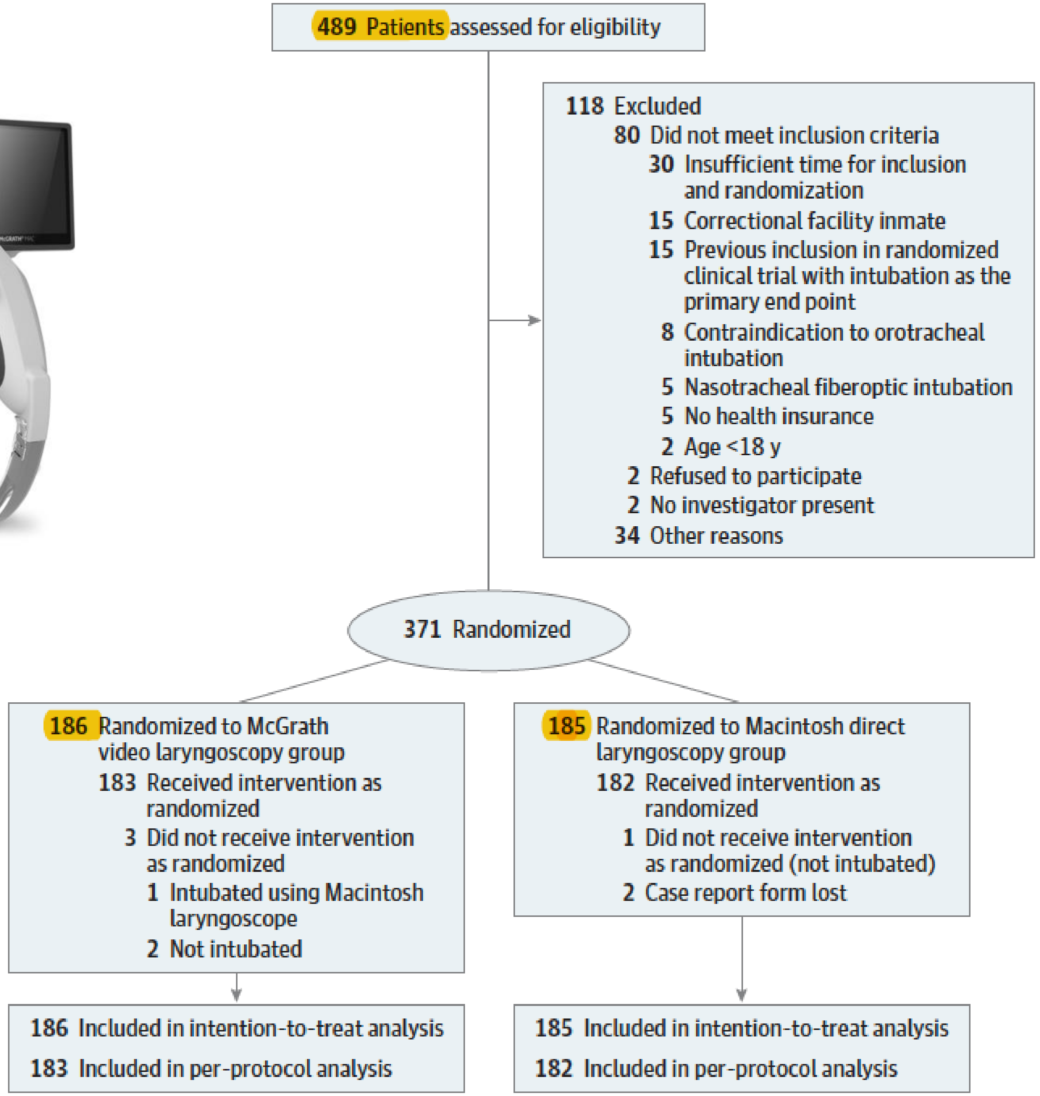


Figure 2. Cormack-Lehane glottic views obtained on the first laryngoscopy attempt. Video laryngoscopy results in better glottic views during the first laryngoscopy attempt compared with direct laryngoscopy ($p = 0.001$, chi-square for a trend).

French study

- Randomized clinical trial
- 7 ICUs in France

- Stratified by center and expert or non-expert status
- Outcomes: the proportion of patients with successful first-pass intubation.



JAMA. 2017;317(5):483-493.

Table 2. Intubation Characteristics and Outcomes of Patients

	No./Total (%) of Patients[a]			
	Video Laryngoscopy	Direct Laryngoscopy	Absolute Difference (95% CI), %	P Value
Primary Outcome: Successful First-Pass Intubation				
Intention-to-treat analysis	126/186 (67.7)	130/185 (70.3)	−2.5 (−11.9 to 6.9)	.60
Per-protocol analysis	126/183 (68.9)	130/182 (71.4)	−2.5 (−12.3 to 6.4)	.54
Secondary Outcomes				
Cormack-Lehane grade[b]				
1	133/176 (75.6)	93/177 (52.5)	23.1 (13.3 to 32.7)	<.001
2	25/176 (14.2)	51/177 (28.8)	−14.6 (−23.0 to −6.2)	
3	10/176 (5.7)	20/177 (11.3)	−5.6 (−11.4 to 0.2)	
4	8/176 (4.5)	13/177 (7.3)	−2.8 (−7.7 to 2.1)	
Percentage of glottic opening score, median (IQR)[c]	100 (80 to 100)	80 (50 to 100)	20 (0 to 20)	<.001

Table 2. Intubation Characteristics and Outcomes of Patients

	No./Total (%) of Patients[a]			
	Video Laryngoscopy	Direct Laryngoscopy	Absolute Difference (95% CI), %	P Value
Reason for intubation failure[f]				
Glottis not seen	13/58 (22.4)	36/51 (70.6)	−48.2 (−64.6 to −31.7)	<.001
Failure of tracheal catheterization	41/58 (70.7)	12/51 (23.5)	47.2 (30.6 to 63.7)	
Adverse event[g]	1/58 (1.7)	2/51 (3.9)	−2.2 (−8.5 to 4.1)	
Laryngeal obstruction	1/58 (1.7)	1/51 (2.0)	−0.3 (−5.3 to 4.8)	
Technical failure (battery, other)	2/58 (3.4)	0	3.4 (−1.2 to 8.1)	
Type of complication				
Death	1/184 (0.5)	0/181	0.5 (−0.5 to 1.6)	.99
Cardiac arrest	4/184 (2.2)	0/181	2.2 (0.07 to 4.3)	.12
Arrhythmia	3/184 (1.6)	4/181 (2.2)	−0.6 (−3.4 to 2.2)	.69
Esophageal intubation	3/184 (1.6)	6/181 (3.3)	−1.7 (−4.9 to 1.5)	.33
Aspiration	4/184 (2.2)	4/181 (2.2)	0 (−3.0 to 3.0)	.99
Tooth injury	0/184	1/181 (0.6)	−0.6 (−1.6 to 0.5)	.50
Hypoxemia[i]	14/173 (8.1)	19/174 (10.9)	−2.8 (−9.0 to 3.3)	.37
Severe hypoxemia[j]	6/176 (3.4)	1/181 (0.5)	2.9 (−0.03 to 5.7)	.06
Hypotension[k]	8/180 (4.4)	4/179 (2.2)	2.2 (−1.5 to 5.9)	.24
≥1 Life-threatening complication	24/180 (13.3)	17/179 (9.5)	3.8 (−2.7 to 10.4)	.25
Type of life-threatening complication[l]				
Mild to moderate[m]	10/181 (5.4)	14/181 (7.7)	−2.3 (−7.4 to 2.8)	.37
Severe[n]	17/179 (9.5)	5/179 (2.8)	6.7 (1.8 to 11.6)	.01

Conclusions

- CCM
  - Among critically ill adults undergoing endotracheal intubation by PCCM fellows, VL does not improve the rate of intubation on first attempt. These results do not support the routine use of VL for all ICU intubations.

- JAMA
  - Among patients in the ICU requiring intubation, video laryngoscopy compared with direct laryngoscopy did not improve first-pass orotracheal intubation rates and was associated with higher rates of severe life-threatening complications.

Evidence & lived experience must support any theory

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

One-Year Outcomes in Caregivers of Critically Ill Patients

Jill I. Cameron, Ph.D., Leslie M. Chu, B.Sc., Andrea Matte, B.Sc.,
George Tomlinson, Ph.D., Linda Chan, B.A.Sc., Claire Thomas, R.N.,
Jan O. Friedrich, M.D., D.Phil., Sangeeta Mehta, M.D.,
Francois Lamontagne, M.D., Melanie Levasseur, M.D., Niall D. Ferguson, M.D.,
Neill K.J. Adhikari, M.D., Jill C. Rudkowski, M.D., Hilary Meggison, M.D.,
Yoanna Skrobik, M.D., John Flannery, M.D., Mark Bayley, M.D., Jane Batt, M.D.,
Claudia dos Santos, M.D., Susan E. Abbey, M.D., Adrienne Tan, M.D.,
Vincent Lo, P.T., B.Sc., Sunita Mathur, P.T., Ph.D., Matteo Parotto, M.D.,
Denise Morris, R.N., Linda Flockhart, R.N., Eddy Fan, M.D., Ph.D.,
Christie M. Lee, M.D., M. Elizabeth Wilcox, M.D., Najib Ayas, M.D.,
Karen Choong, M.D., Robert Fowler, M.D., Damon C. Scales, M.D.,
Tasnim Sinuff, M.D., Brian H. Cuthbertson, M.D., Louise Rose, R.N., Ph.D.,
Priscila Robles, P.T., Ph.D., Stacey Burns, R.N., Marcelo Cypel, M.D.,
Lianne Singer, M.D., Cecilia Chaparro, M.D., Chung-Wai Chow, M.D.,
Shaf Keshavjee, M.D., Laurent Brochard, M.D., Paul Hébert, M.D.,
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(Phase 1: towards RECOVER) and the Canadian Critical Care Trials Group

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Which characteristics were associated with caregivers' health outcomes after patient discharge from ICU?

- Multicenter, longitudinal observational study
- 10 university-affiliated hospitals in Canada

- Caregivers of patients who had received 7 or more days of mechanical ventilation in an ICU
- RECOVER program

- Caregiver Outcomes: CES-D, PANAS, PCS and MCS in SF-36

Table 1. Characteristics of the Caregivers at Baseline.*

Characteristic	All Caregivers (N=238)	Caregivers Whose Depressive Symptoms Decreased over Time (N=199)	Caregivers Whose Depressive Symptoms Remained High (N=39)	P Value†
Age — yr	53.2±13.4	53.4±13.8	52.3±11.2	0.54
Female sex — no. (%)	166 (70)	137 (69)	29 (74)	0.57
Caring for spouse — no. (%)	144 (61)	119 (60)	25 (64)	1.00
Married or in common-law relationship — no./total no. (%)	195/234 (83)	164/196 (84)	31/38 (82)	0.77
Completed postsecondary education or more — no./total no. (%)	121/236 (51)	102/198 (52)	19/38 (50)	0.22
Annual income >$70,000 in Canadian $ — no. (%)	90 (38)	78 (39)	12 (31)	0.59
Living with care recipient full time — no./total no. (%)	164/237 (69)	139/198 (70)	25/39 (64)	0.11
Employment status — no. (%)				0.25
Working for pay	141 (59)	115 (58)	26 (67)	
Retired, volunteer, unemployed, or receiving disability	69 (29)	62 (31)	7 (18)	
Homemaker or caregiving as primary daily activity	28 (12)	22 (11)	6 (15)	
Parent of children <16 yr of age — no. (%)	25 (11)	21 (11)	4 (10)	0.40
Assessments				
Score on PANAS Positive Affect Scale‡	31.1±8.8	31.6±8.6	28.9±9.5	0.10
Score on SF-36 Mental Component Summary§	33.4±13.9	35.5±13.7	22.5±9.6	<0.001
Score on SF-36 Physical Component Summary¶	51.8±9.2	52.7±9.0	47.6±9.2	0.003
Score on Mastery Scale‖	19.9±3.8	20.4±3.7	17.4±3.7	<0.001
Score on Caregiver Assistance Scale**	41.7±23.0	40.0±23.0	50.4±21.2	0.006
Score on MOS Social Support Survey††	70.1±23.6	73.2±21.8	53.9±26.7	<0.001
Score on Caregiving Impact Scale‡‡	37.4±22.3	34.4±21.8	52.6±18.5	<0.001

Most caregivers of critically ill patients reported high levels of depressive symptoms, which commonly persisted up to 1 year and did not decrease in some caregivers.

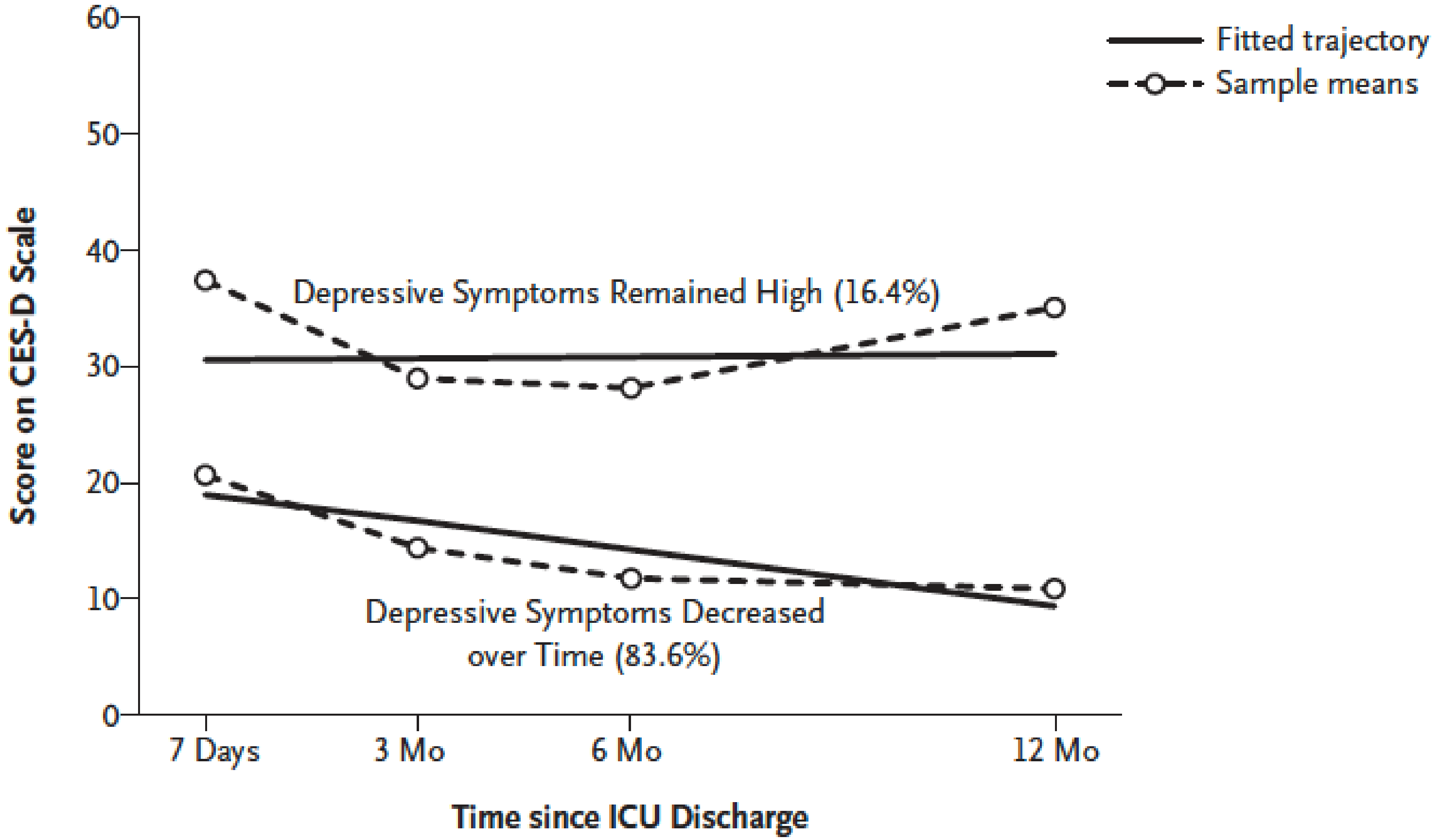

Table 2. Mixed-Effects Modeling for Caregiver Outcome Variables.*

Predictor	Caregiver Outcomes			
	Depressive Symptoms	Psychological Well-Being	Mental Health	Physical Health
	estimated mean difference (95% CI)			
Caregiver baseline variables				
Age	−1.43 (−2.51 to −0.35)§	1.86 (0.95 to 2.77)†	2.86 (1.59 to 4.13)†	−1.96 (−3.20 to −0.72)§
Caring for a spouse	−2.46 (−4.47 to −0.46)¶	0.64 (−1.02 to 2.31)	0.13 (−2.21 to 2.48)	1.98 (−0.19 to 4.16)‡
Provided care previously	0.71 (−1.17 to 2.58)	−0.55 (−2.12 to 1.01)	−0.64 (−2.81 to 1.53)	−1.12 (−3.19 to 0.95)
Male sex	−1.35 (−3.83 to 1.13)	0.28 (−1.81 to 2.36)	2.93 (0.03 to 5.82)¶	0.14 (−2.57 to 2.85)
Employed	0.29 (−1.68 to 2.27)	−0.09 (−1.74 to 1.56)	−0.02 (−2.32 to 2.28)	−0.60 (−2.80 to 1.61)
Education				
Less than secondary	Reference	Reference	Reference	Reference
Postsecondary	−3.98 (−7.07 to −0.88)¶	2.49 (−0.10 to 5.08)‡	3.14 (−0.50 to 6.78)‡	2.68 (−0.88 to 6.24)
Secondary and some postsecondary	−3.91 (−6.98 to −0.83)¶	1.88 (−0.68 to 4.43)	3.55 (−0.03 to 7.13)‡	2.28 (−1.15 to 5.72)
Caregiver income in Canadian $				
<$50,000	Reference	Reference	Reference	Reference
$50,000–70,000	−3.08 (−5.55 to −0.61)¶	0.08 (−1.95 to 2.11)	1.78 (−1.14 to 4.69)	2.66 (−0.22 to 5.55)‡
>$70,000	−0.55 (−2.82 to 1.72)	−0.91 (−2.74 to 0.91)	−0.48 (−3.02 to 2.07)	4.59 (2.04 to 7.13)†

Conclusions

- This multicenter longitudinal study suggests that critical illness affects long-term outcomes not only in patients but also in their caregivers, increasing the effect of critical illness and societal burden.
- Our data also suggest that it is not sufficient to support caregivers of only the sickest patients, and family-centered models that cross the care continuum are needed to address caregivers' unique needs for care and support.

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ORIGINAL

CrossMark

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Prospective study of a proactive palliative care rounding intervention in a medical ICU

- Prospective, before-and-after interventional study
- A 24-bed academic ICU in Wisconsin, USA

- Palliative care clinician interacting with Intensivists on daily rounds for high-risk patients

- Outcomes: hospital LOS

Table 1 Trigger criteria for patients at high risk of mortality or morbidity

Metastatic or otherwise incurable malignancy
Hospital length of stay of 10 days prior to transfer to the ICU
Duration of ongoing invasive mechanical ventilation of 7 days or more
ICU length of stay of 14 days or more
Age 80 years old or older with 2 or more significant chronic diseases (e.g., chronic obstructive pulmonary disease requiring home oxygen therapy, chronic kidney disease requiring renal replacement therapy)
Out-of-hospital or in-hospital cardiac arrest
Cerebral hemorrhage requiring mechanical ventilation
Admission to the ICU from a long-term acute care hospital (LTAC)

Table 2 Demographic and clinical characteristics, by group

	Usual care, $n = 100$	Intervention, $n = 103$	P*
Respondent relationship			
Spouse/partner	35 (56)	24 (42)	0.30
Child	11 (18)	15 (26)	0.26
Parent	6 (10)	8 (14)	0.46
Sibling	8 (13)	4 (7)	0.29
Guardian	2 (3)	1 (2)	0.61
Friend	0 (0)	3 (5)	0.07
Other relative	0 (0)	1 (2)	0.30
Other	0 (0)	1 (2)	0.30

LOS of Hospital and ICU

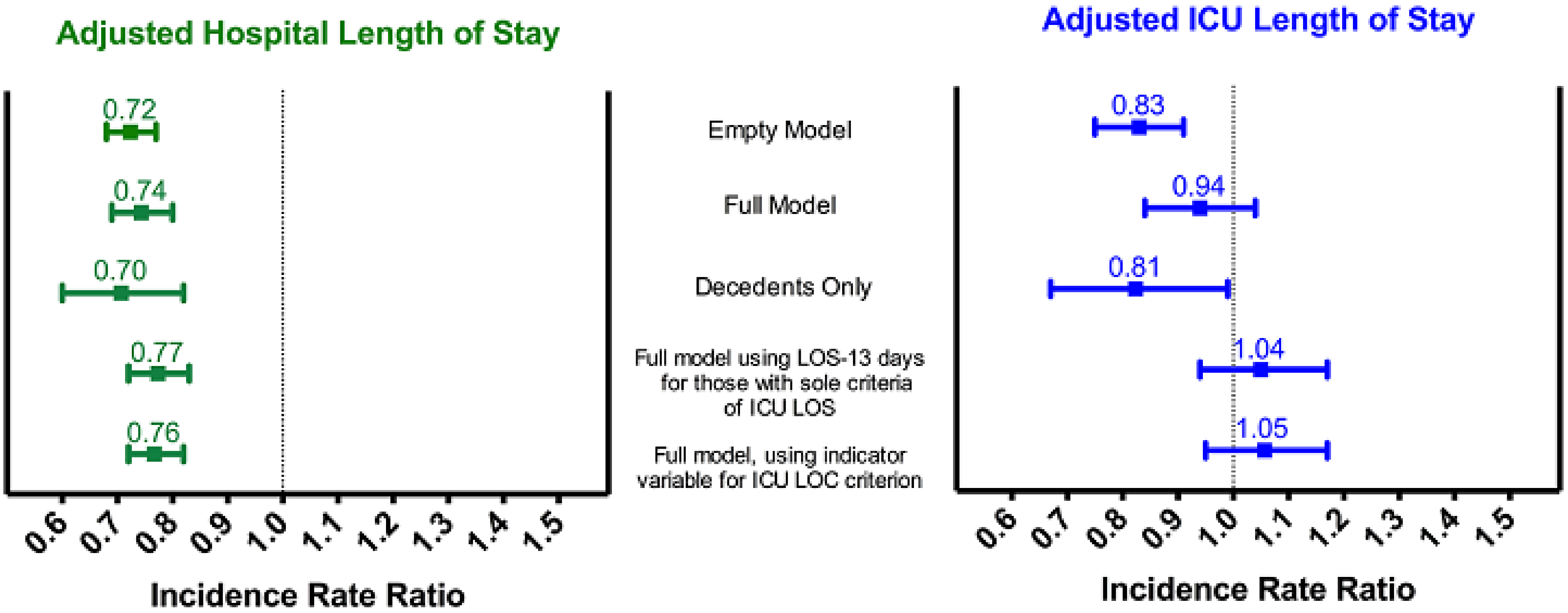
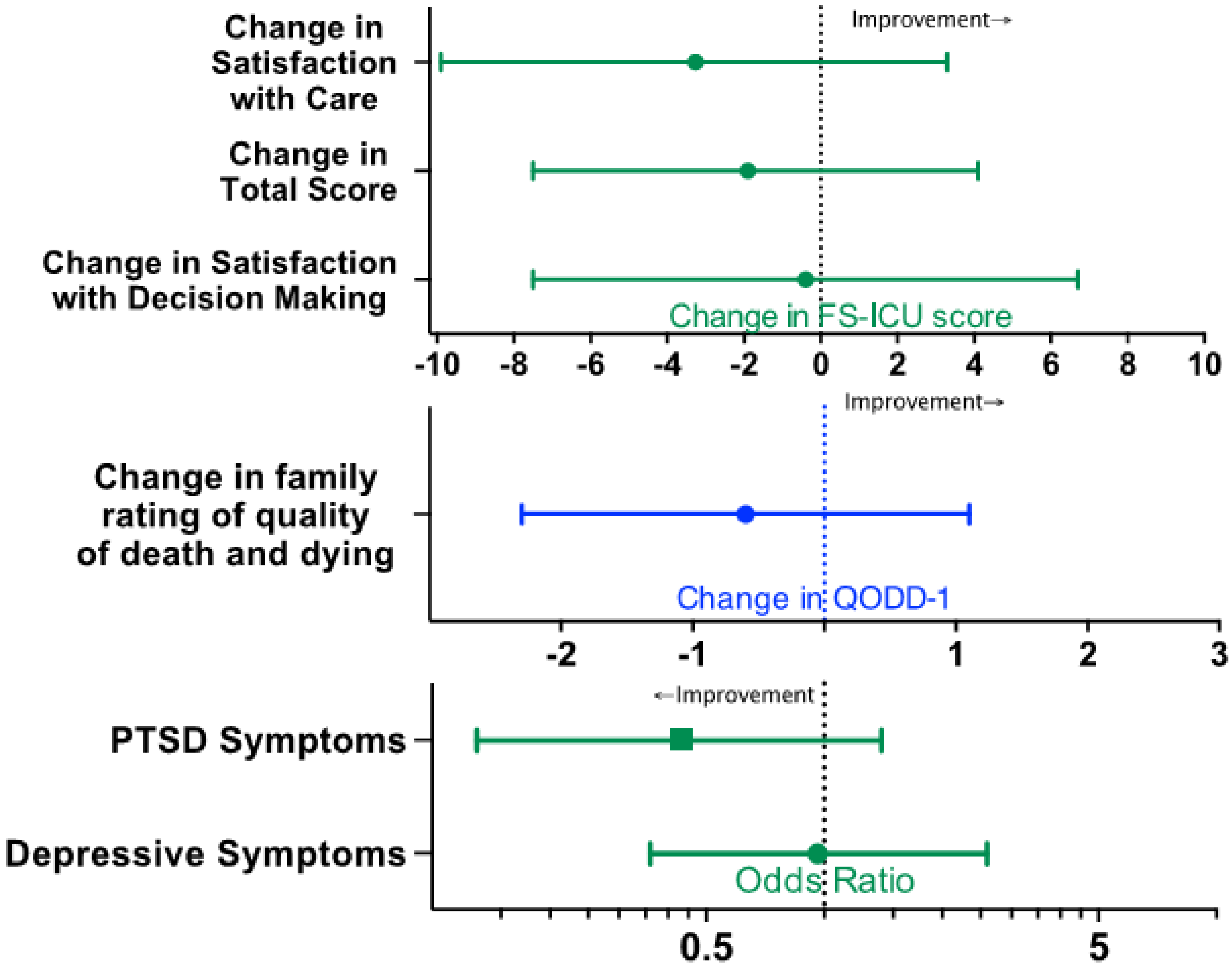


Fig. 2 Adjusted change in family satisfaction scores (by FS-ICU) (*top*) and adjusted change in family assessment of the quality of death and dying (QODD-1) (*middle*, in *blue*), using multivariable linear regression. Adjusted association between the intervention and psychological outcomes (*bottom*). All models were adjusted for patient age, sex, and race, respondent sex, whether the patient and respondent were spouses, the presence of metastatic or incurable cancer, multimorbidity with age over 80, and (except for the QODD-1 model) the occurrence of death in the ICU



Conclusions

- Proactive PC involvement on ICU rounds for high-risk patients to prompt ICU physician attention to PC needs and to nudge the ICU physicians to better address these needs was associated with **more and earlier ICU family meetings and shorter hospital LOS**.

- We did **not** identify differences in family satisfaction, family psychological symptoms, or family-rated quality of dying, but had limited power to detect such differences.

Original Investigation

Effect of Palliative Care–Led Meetings for Families of Patients With Chronic Critical Illness
A Randomized Clinical Trial

Shannon S. Carson, MD; Christopher E. Cox, MD, MPH; Sylvan Wallenstein, PhD; Laura C. Hanson, MD, MPH; Marion Danis, MD; James A Tulsky, MD; Emily Chai, MD; Judith E. Nelson, MD, JD

JAMA. 2016;316(1):51-62.

DESIGN, SETTING, AND PARTICIPANTS A multicenter randomized clinical trial conducted from October 2010 through November 2014 in 4 medical intensive care units (ICUs). Adult patients (aged ≥21 years) requiring 7 days of mechanical ventilation were randomized and their family surrogate decision makers were enrolled in the study. Observers were blinded to group allocation for the measurement of the primary outcomes.

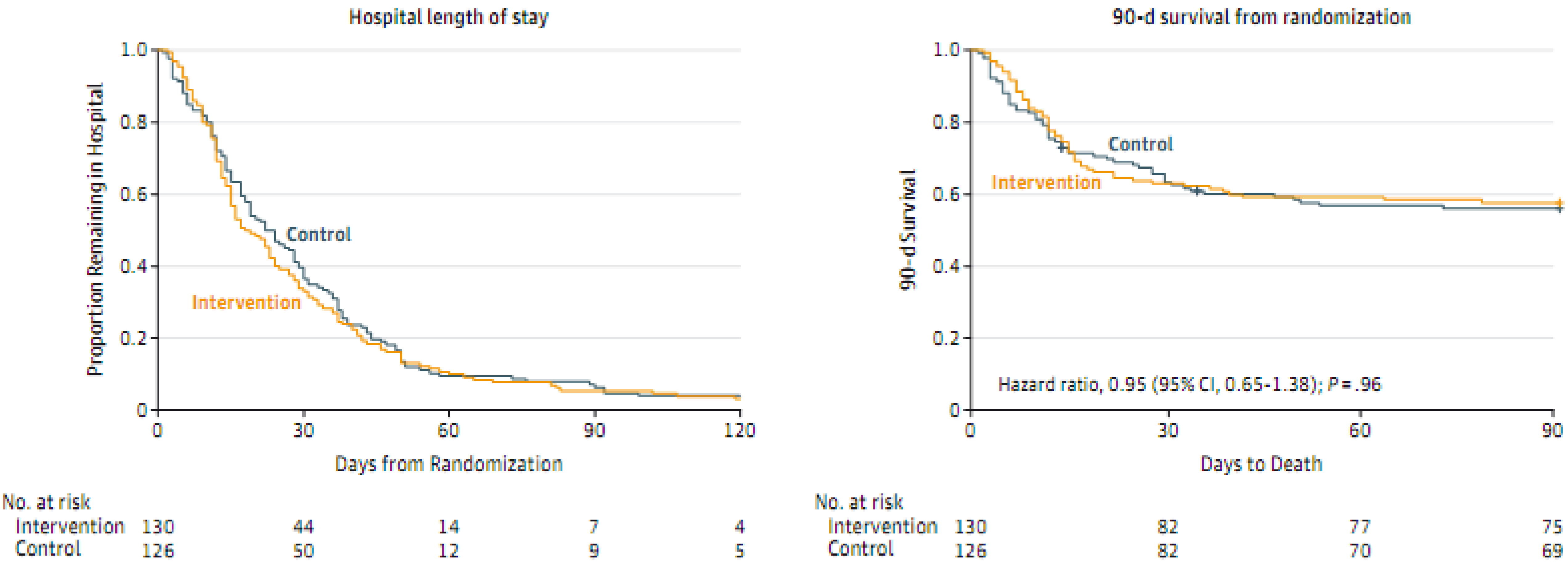
INTERVENTIONS At least 2 structured family meetings led by palliative care specialists and provision of an informational brochure (intervention) compared with provision of an informational brochure and routine family meetings conducted by ICU teams (control). There were 130 patients with 184 family surrogate decision makers in the intervention group and 126 patients with 181 family surrogate decision makers in the control group.

MAIN OUTCOMES AND MEASURES The primary outcome was Hospital Anxiety and Depression Scale symptom score (HADS; score range, 0 [best] to 42 [worst]; minimal clinically important difference, 1.5) obtained during 3-month follow-up interviews with the surrogate decision makers. Secondary outcomes included posttraumatic stress disorder experienced by the family and measured by the Impact of Events Scale-Revised (IES-R; total score range, 0 [best] to 88 [worst]), discussion of patient preferences, hospital length of stay, and 90-day survival.

RESULTS Among 365 family surrogate decision makers (mean age, 51 years; 71% female), 312 completed the study. At 3 months, there was no significant difference in anxiety and depression symptoms between surrogate decision makers in the intervention group and the control group (adjusted mean HADS score, 12.2 vs 11.4, respectively; between-group difference, 0.8 [95% CI, −0.9 to 2.6]; *P* = .34). Posttraumatic stress disorder symptoms were higher in the intervention group (adjusted mean IES-R score, 25.9) compared with the control group (adjusted mean IES-R score, 21.3) (between-group difference, 4.60 [95% CI, 0.01 to 9.10]; *P* = .0495). There was no difference between groups regarding the discussion of patient preferences (intervention, 75%; control, 83%; odds ratio, 0.63 [95% CI, 0.34 to 1.16; *P* = .14]). The median number of hospital days for patients in the intervention vs the control group (19 days vs 23 days, respectively; between-group difference, −4 days [95% CI, −6 to 3 days]; *P* = .51) and 90-day survival (hazard ratio, 0.95 [95% CI, 0.65 to 1.38], *P* = .96) were not significantly different.

CONCLUSIONS AND RELEVANCE Among families of patients with chronic critical illness, the use of palliative care–led informational and emotional support meetings compared with usual care did not reduce anxiety or depression symptoms and may have increased posttraumatic stress disorder symptoms. These findings do not support routine or mandatory palliative care–led discussion of goals of care for all families of patients with chronic critical illness.

Figure 2. Kaplan-Meier Plot of Patient Hospital Length of Stay After Randomization and 90-Day Survival



Critical Care Congress

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Family Centered Care: Translating Research Into Practice

Special Article

Guidelines for Family-Centered Care in the Neonatal, Pediatric, and Adult ICU

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Extremis
A Documentary Look at End-of-Life Decisions in the ICU

Mara Buchbinder, PhD

Extremis, an original documentary short released directly to Netflix, follows Jessica Nutik Zitter, MD, MPH, a critical and palliative care physician who works in the intensive care unit (ICU) at Oakland's Highland Hospital. The opening scene and

JAMA. 2017;317(3):240–241.

Thank you for your attention!