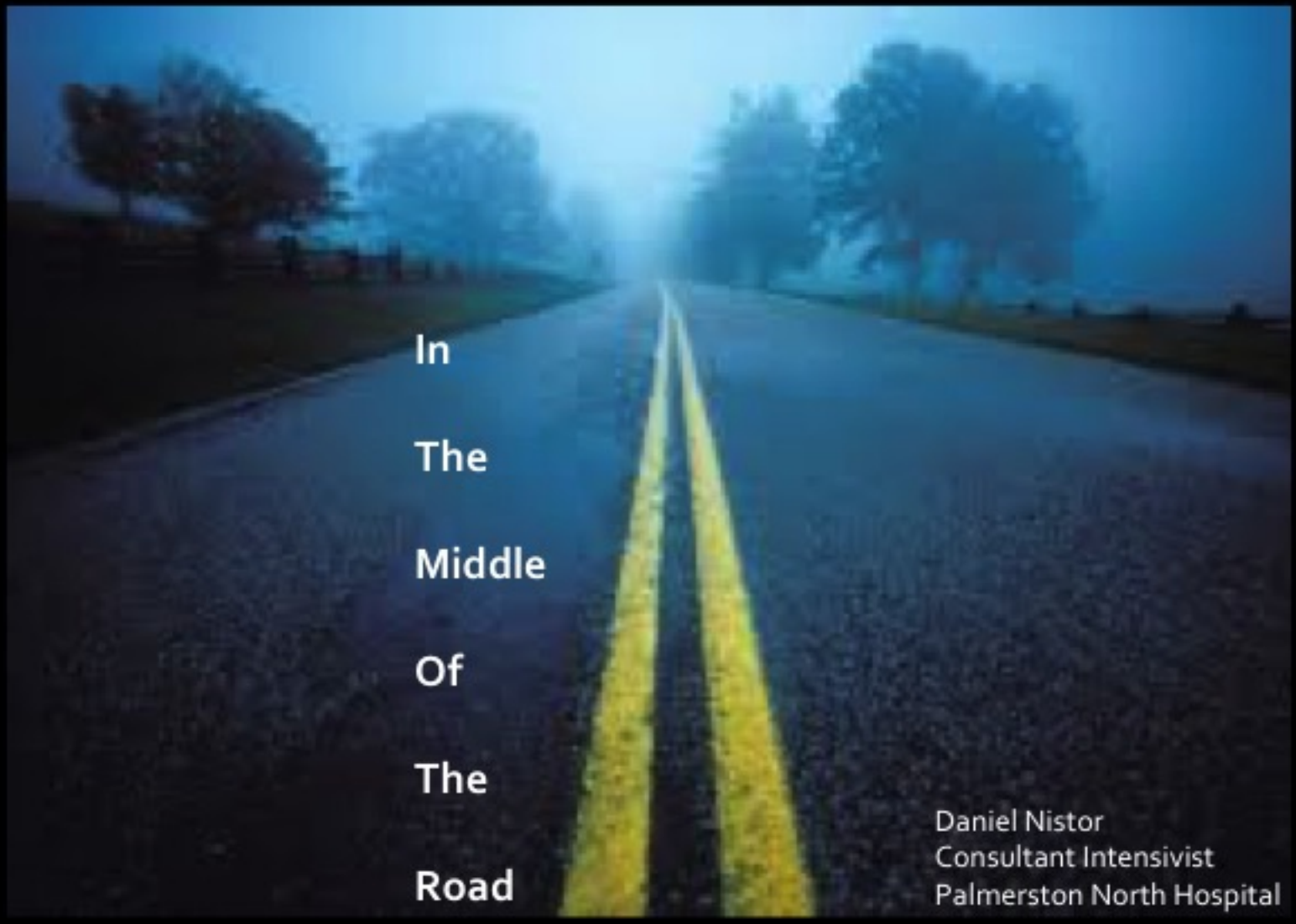
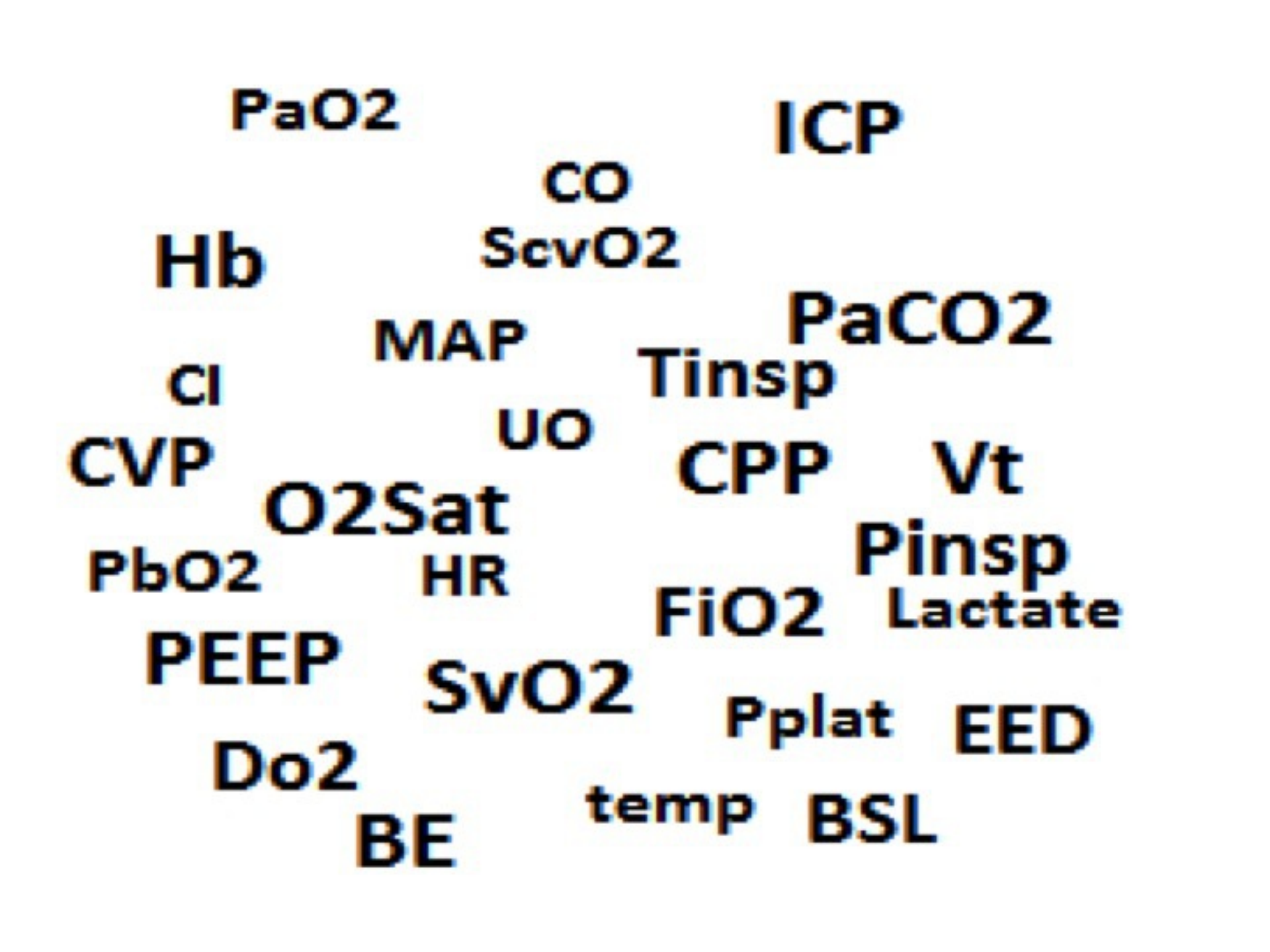


Daniel Nistor
Consultant Intensivist
Palmerston North Hospital


PaO2
ICP
CO
Hb
ScvO2
PaCO2
MAP
Tinsp
Cl
UO
CVP
CPP
Vt
O2Sat
Pinsp
PbO2
HR
FiO2
Lactate
PEEP
SvO2
Pplat
EED
Do2
temp
BSL
BE

$$DO_2 = CO \times [(1.34 \times Hb \times SaO_2) + 0.003 \times PaO_2]$$

"Physiological" model

- Basis for assessment and Rx
- Abnormal numbers indicate severity
- Normalization of numbers parallels disease resolution

Normalizing physiology

- Normalization → therapeutic end-point
- Certain variables (supra-normal parameters) linked with survival → "survivor levels" targeted

Optimizing physiology

- Survivor levels
- CI > 4.5 L/min/sqm
- Do2 > 600 mls/min/sqm

Normalizing/Optimizing

- What is "normal"?
- Demonstration of benefit required
- Potential for harm

"EBM" model (RCTs & beyond)

- Physiological model tested for > 20 years
- RCTs compared "normal"&"supra-normal" targets; intensive vs. less intensive Rx

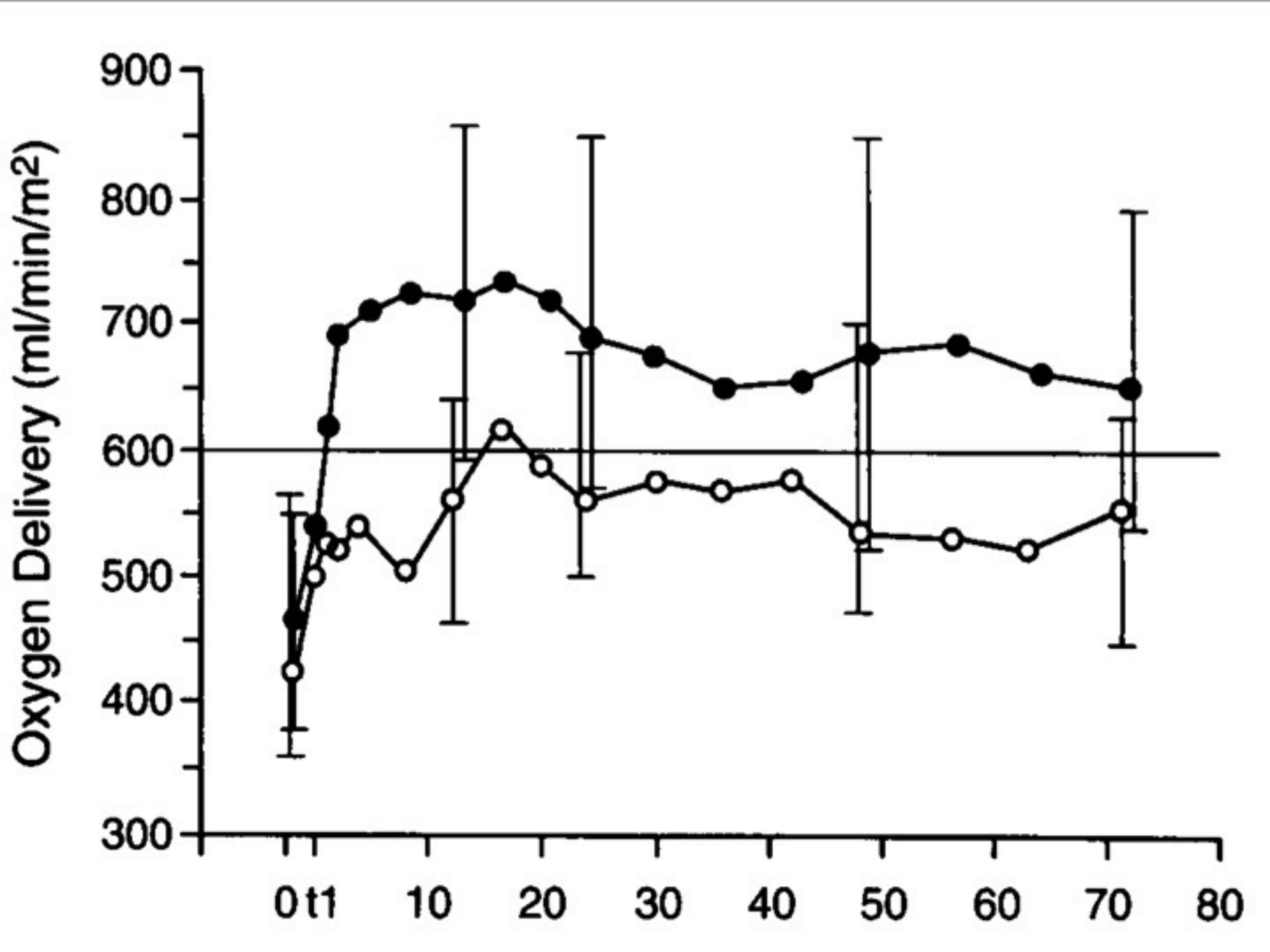
→No difference in mortality
→ Higher mortality

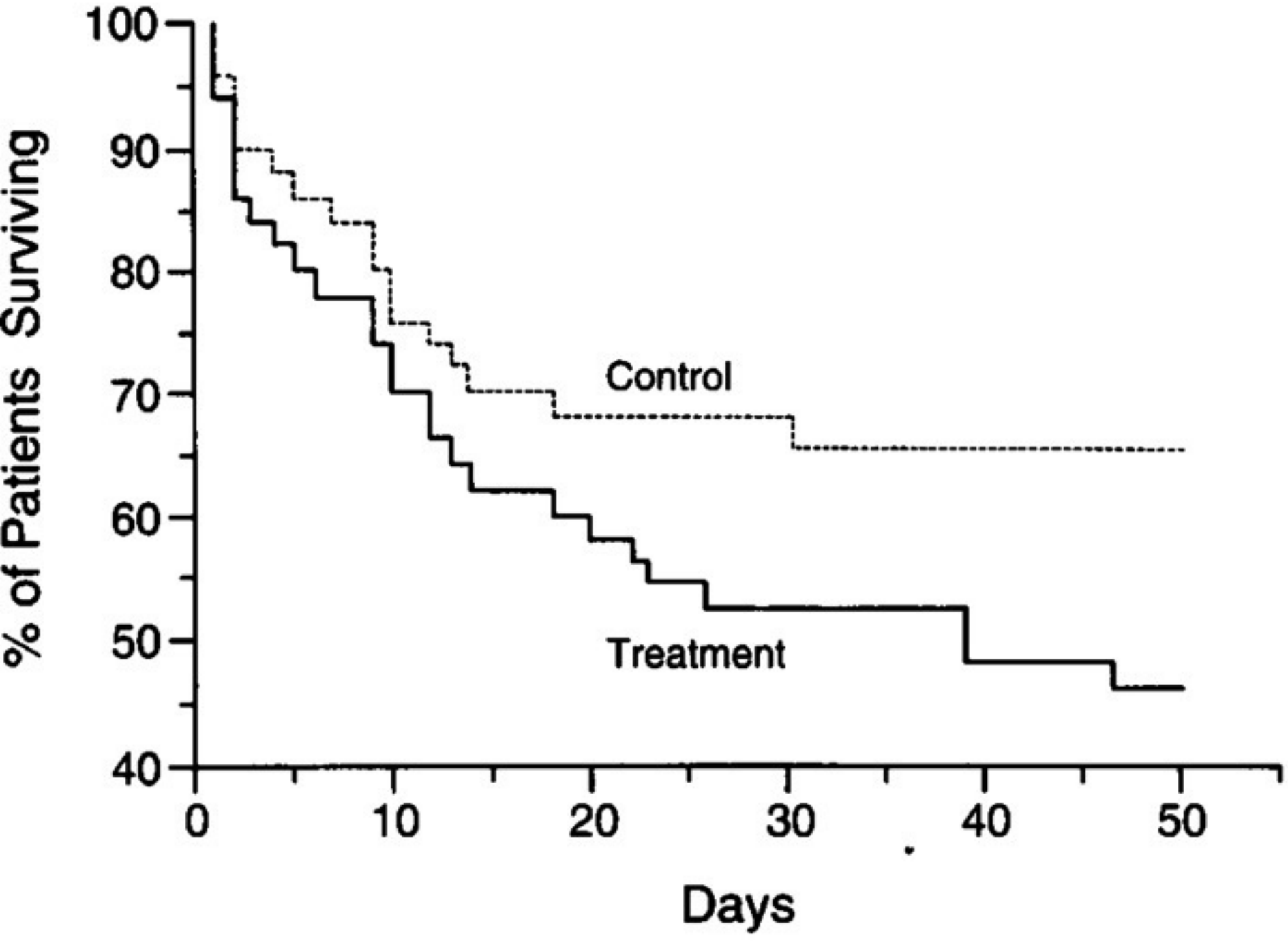
The NEW ENGLAND JOURNAL of MEDICINE

ELEVATION OF SYSTEMIC OXYGEN DELIVERY IN THE TREATMENT OF CRITICALLY ILL PATIENTS

MICHELLE A. HAYES, F.R.C.A., ANDREW C. TIMMINS, F.R.C.A., ERNEST H.S. YAU, F.R.C.A., MARK PALAZZO, F.R.C.A., CHARLES J. HINDS, F.R.C.A., AND DAVID WATSON, F.R.C.A.

Conclusions. The use of dobutamine to boost the cardiac index and systemic oxygen delivery failed to improve the outcome in this heterogeneous group of critically ill patients. Contrary to what might have been expected, our results suggest that in some cases aggressive efforts to increase oxygen consumption may have been detrimental. (N Engl J Med 1994;330:1717-22.)


Oxygen Delivery (ml/min/m²)
900
800
700
600
500
400
300
0
t1
10
20
30
40
50
60
70
80


100
90
80
70
60
50
40
% of Patients Surviving
Control
Treatment
0
10
20
30
40
50
Days

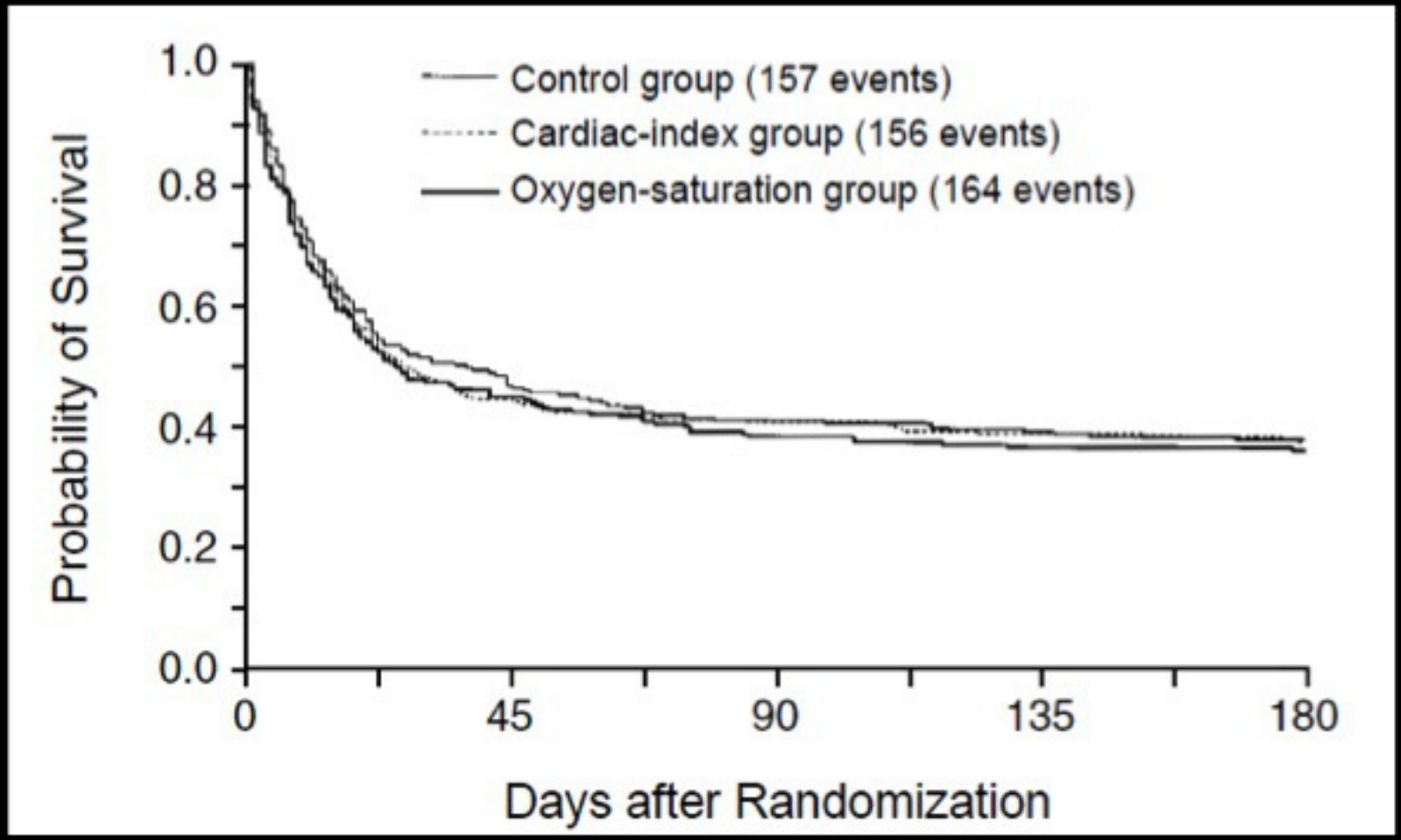
The NEW ENGLAND JOURNAL of MEDICINE

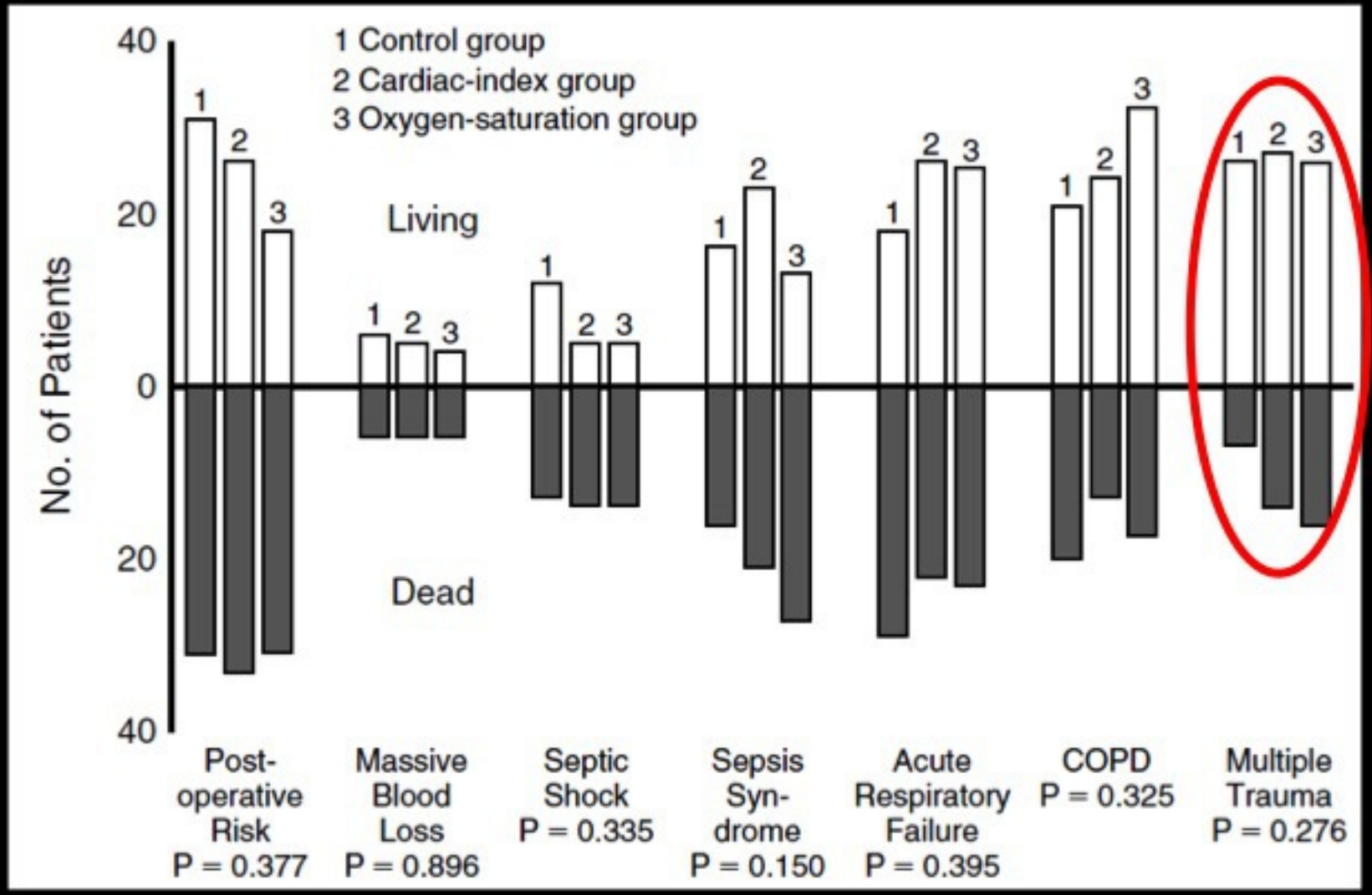
Volume 333 OCTOBER 19, 1995 Number 16

A TRIAL OF GOAL-ORIENTED HEMODYNAMIC THERAPY IN CRITICALLY ILL PATIENTS

LUCIANO GATTINONI, M.D., LUCA BRAZZI, M.D., PAOLO PELOSI, M.D., ROBERTO LATINI, M.D., GIANNI TOGNONI, M.D., ANTONIO PESENTI, M.D., AND ROBERTO FUMAGALLI, M.D., FOR THE SvO_2 COLLABORATIVE GROUP*

Conclusions. Hemodynamic therapy aimed at achieving supranormal values for the cardiac index or normal values for mixed venous oxygen saturation does not reduce morbidity or mortality among critically ill patients. (N Engl J Med 1995;333:1025-32.)


Control group (157 events)
Cardiac-index group (156 events)
Oxygen-saturation group (164 events)
Probability of Survival
1.0
0.8
0.6
0.4
0.2
0.0
0
45
90
135
180
Days after Randomization


1 Control group
2 Cardiac-index group
3 Oxygen-saturation group
Living
Dead
No. of Patients
40
20
0
20
40
Post-operative Risk P = 0.377
Massive Blood Loss P = 0.896
Septic Shock P = 0.335
Sepsis Syn-drome P = 0.150
Acute Respiratory Failure P = 0.395
COPD P = 0.325
Multiple Trauma P = 0.276

ANNALS OF SURGERY
A Monthly Review of Surgical Science Since 1885

Endpoints of Resuscitation of Critically Injured Patients: Normal or Supranormal?

A Prospective Randomized Trial

George C. Velmahos, MD, PhD,* Demetrios Demetriades, MD, PhD,* William C. Shoemaker, MD,* Linda S. Chan, PhD,† Raymond Tatevossian, BS,* Charles C.J. Wo, BS,* Pantelis Vassiliu, MD,* Edward E. Cornwell III, MD,* James A. Murray, MD,* Bradley Roth, MD,* Howard Belzberg, MD,* Juan A. Asensio, MD,* and Thomas V. Berne, MD*

*From the *Department of Surgery, Division of Trauma and Critical Care, and the †Department of Biostatistics and Outcomes Research, University of Southern California, and the Los Angeles County+USC Medical Center, Los Angeles, California*

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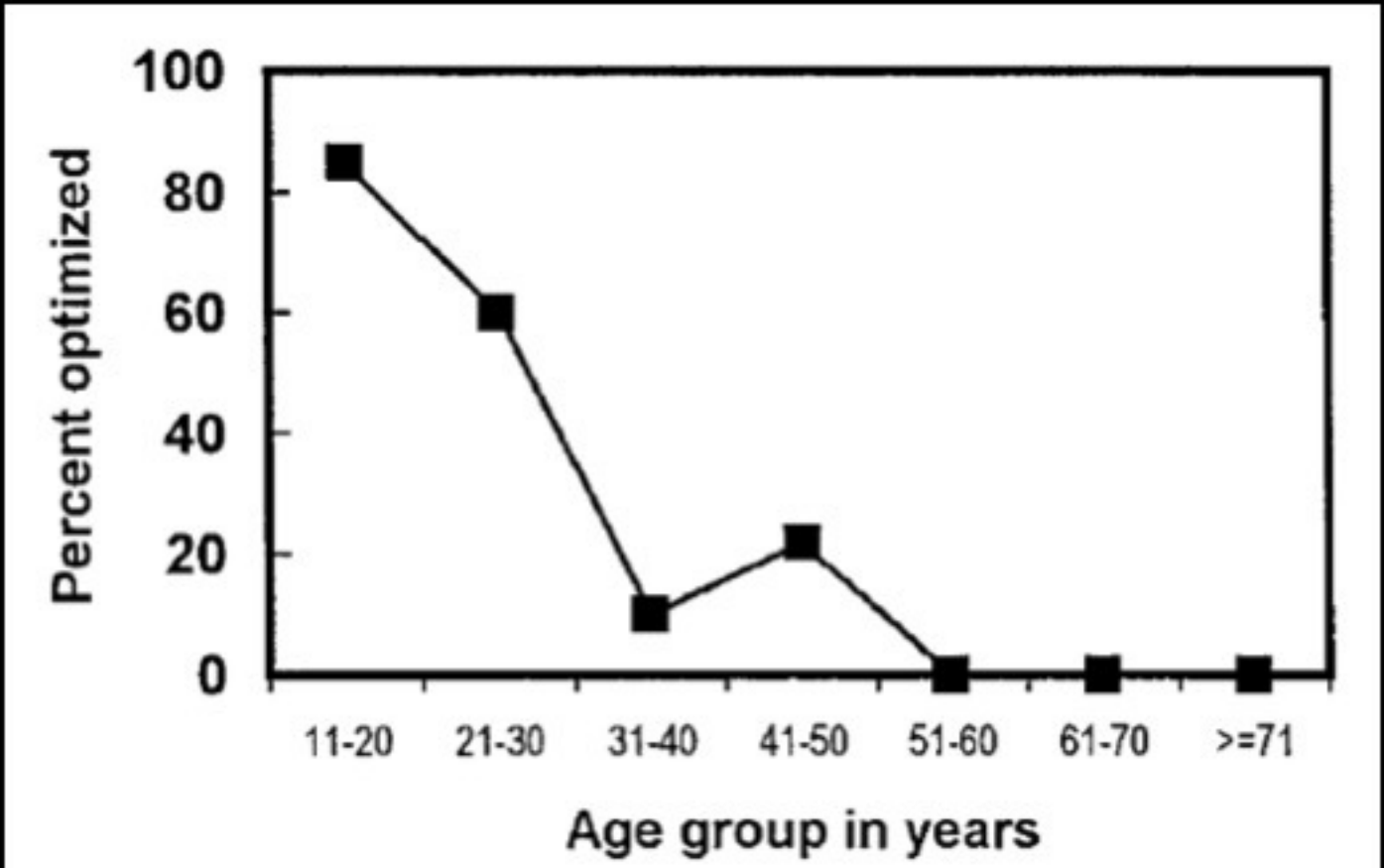


Figure 1. Effect of age on the ability to achieve optimal hemodynamic values.

Results

- No survival benefit overall
- Survivors achieved optimal values → values indicate better physiologic reserve
- In the treatment group, if optimal values not achieved → higher mortality (50% vs. 19%) → aggressive attempts to optimize patients with no physiological reserve are harmful

$$DO_2 = CO \times [(1.34 \times Hb \times SaO_2) + 0.003 \times PaO_2]$$

Critical Care Medicine

Society of Critical Care Medicine
The Intensive Care Professionals

Clinical practice guideline: Red blood cell transfusion in adult trauma and critical care*

Lena M. Napolitano, MD; Stanley Kurek, DO; Fred A. Luchette, MD; Howard L. Corwin, MD; Philip S. Barie, MD; Samuel A. Tisherman, MD; Paul C. Hebert, MD, MHSc; Gary L. Anderson, DO; Michael R. Bard, MD; William Bromberg, MD; William C. Chiu, MD; Mark D. Cipolle, MD; PhD; Keith D. Clancy, MD; Lawrence Diebel, MD; William S. Hoff, MD; K. Michael Hughes, DO; Imtiaz Munshi, MD; Donna Nayduch, RN, MSN, ACNP; Rovinder Sandhu, MD; Jay A. Yelon, MD; for the American College of Critical Care Medicine of the Society of Critical Care Medicine and the Eastern Association for the Surgery of Trauma Practice Management Workgroup

Conclusions: **Evidence-based recommendations regarding the use of RBC transfusion in adult trauma and critical care will provide important information to critical care practitioners. (Crit Care Med 2009; 37:3124–3157)**

Table 5. Studies examining oxygen delivery, oxygen consumption and lactate before and after

Author and Year	Study Population	n	Amount Transfused (units)	Changes in Measurements of Posttransfusion			
				↑ Hb	↑ Do_2	↑ Vo_2	↓ Lactate
Shah et al (123)	Posttrauma critically ill patients	8	1 or 2 units	Yes	No	No	NA
Kahn et al (124)	Acute respiratory failure	15	7–10 mL/kg	Yes	No	No	NA
Gilbert et al (113)	Septic adults	54	Δ 20 g/L	Yes	Yes	No	No
Dietrich et al (125)	Medical shock (septic/cardiac)	32	577 mL	Yes	Yes	No	No
Conrad et al (116)	Septic shock	19	Δ 3 g/dL	Yes	Yes	No	No
Ronco et al (126)	PCP pneumonia	5	1.5 units	Yes	Yes	Yes	NA
Fenwick et al (127)	ARDS	24	1.5 units	Yes	Yes	No	No
Mink et al (114)	Septic shock 2 mo–6 yrs	8	8–10 mL/kg × 1–2 hrs	Yes	Yes	No	NA
Lucking et al (115)	Septic shock 4 mos–15 yrs	7	10–15 mL/kg × 1–3 hrs	Yes	Yes	Yes	NA
Ronco et al (128)	ARDS	17	1.5 units	Yes	Yes	No	NA
Steffes et al (117)	Postoperative and posttrauma	21	1–2 units	Yes	Yes	Yes	No
Babineau et al (129)	Postoperative	31	328 ± 9 mL	Yes	Yes	No	No
Silverman et al (118)	Septic shock 21–88 yrs	21	2 units	Yes	Yes	No	No
Marik et al (119)	Septic adults	23	3 units	Yes	Yes	No	No
Lorente et al (120)	Septic adults	16	2 units	Yes	Yes	No	NA
Gramm et al (131)	Septic shock 46 ± 3 yrs	19	2 units	Yes	No	No	NA
Casutt et al (132)	Postoperative 32–81 yrs	67	368 ± 10 mL	Yes	Yes	No	NA
Fernandes et al (50)	Septic shock 18–80 yrs	10	1 units	Yes	No	No	No
Walsh et al (133)	Euvolemic anemic critically ill patients without ongoing hemorrhage	22	2 units	Yes	NA	NA	No
Suttner et al (47)	Volume-resuscitated mechanically ventilated patients	51	1 or 2 units vs. 100% Fio_2 (n = 17 each)	Yes	Yes	No	NA
Mazza et al (134)	SIRS/Sepsis	29	1–3 units	Yes	NA	NA	No

D_{O_2}

&

PRBC

~~tissue oxygenation~~
~~oxygen extraction~~

1. RBC transfusion is indicated for patients with evidence of hemorrhagic shock. (Level 1)

3. A "restrictive" strategy of RBC transfusion (transfuse when Hb < 7 g/dL) is as effective as a "liberal" transfusion strategy (transfusion when Hb < 10 g/dL) in critically ill patients with hemodynamically stable anemia, except possibly in patients with acute myocardial ischemia. (Level 1)

7. Consider transfusion if Hb < 7 g/dL in resuscitated critically ill trauma patients. There is no benefit of a "liberal" transfusion strategy (transfusion when Hb < 10 g/dL) in resuscitated critically ill trauma patients. (Level 2)

9. RBC transfusion should not be considered as an absolute method to improve tissue oxygen consumption in critically ill patients. (Level 2)

"Middle of the road"

- Less is more
- Less aggressive manipulation of physiology

→ better outcomes

Middle of the road – less is more

- **Ventilation**: 6 mls/kg vs. 12 mls/kg
- **Sedation**: less/daily interruption/no sedation
- **CPP**: 60 mmHg vs. 70, DECRA
- **Fluids**: negative balance
- **Dialysis**: 25 mls/kg/hr vs. 40 mls/kg/hr
- **Glucose**: tight control kills

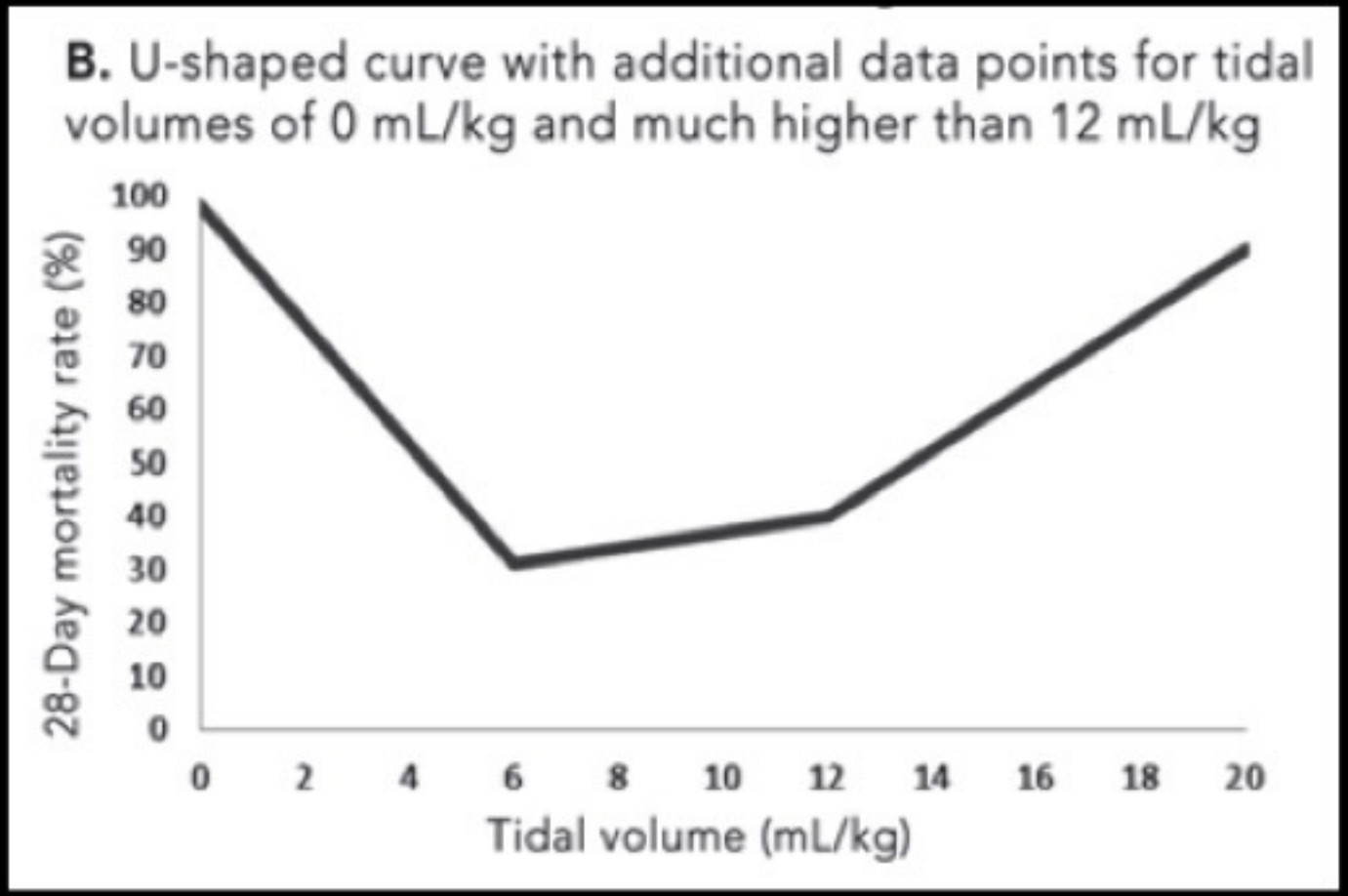
Critical Care and Resuscitation

The "sweet spot" for physiological targets in critically ill patients

Steve A R Webb, Paul J Young and Rinaldo Bellomo

Titrating various therapies to achieve a target range or a threshold level of a physiological variable is an integral component of managing critically ill patients in the intensive care unit. There are many examples of this type of titration.

poorer survival.[4-10] Indeed, with the possible exception of early goal-directed therapy in sepsis (an unblinded single centre study[11]), there are no studies in which either of these approaches have improved patient-centred outcomes such as


B. U-shaped curve with additional data points for tidal volumes of 0 mL/kg and much higher than 12 mL/kg
28-Day mortality rate (%)
100
90
80
70
60
50
40
30
20
10
0
0
2
4
6
8
10
12
14
16
18
20
Tidal volume (mL/kg)


UNDER-RESUSCITATION
OVER-RESUSCITATION
SUPRANORMAL
NORMAL

He who walks in the middle of the road gets hit from both sides