VANDERBILT UNIVERSITY
MEDICAL CENTER

The Brain in Critical Illness: ICU Liberation & ABCDEFs

E. Wesley Ely, MD, MPH
Professor of Medicine and Critical Care
Vanderbilt University, Nashville, TN
VA TN Valley Health Care System GRECC

VANDERBILT UNIVERSITY
MEDICAL CENTER

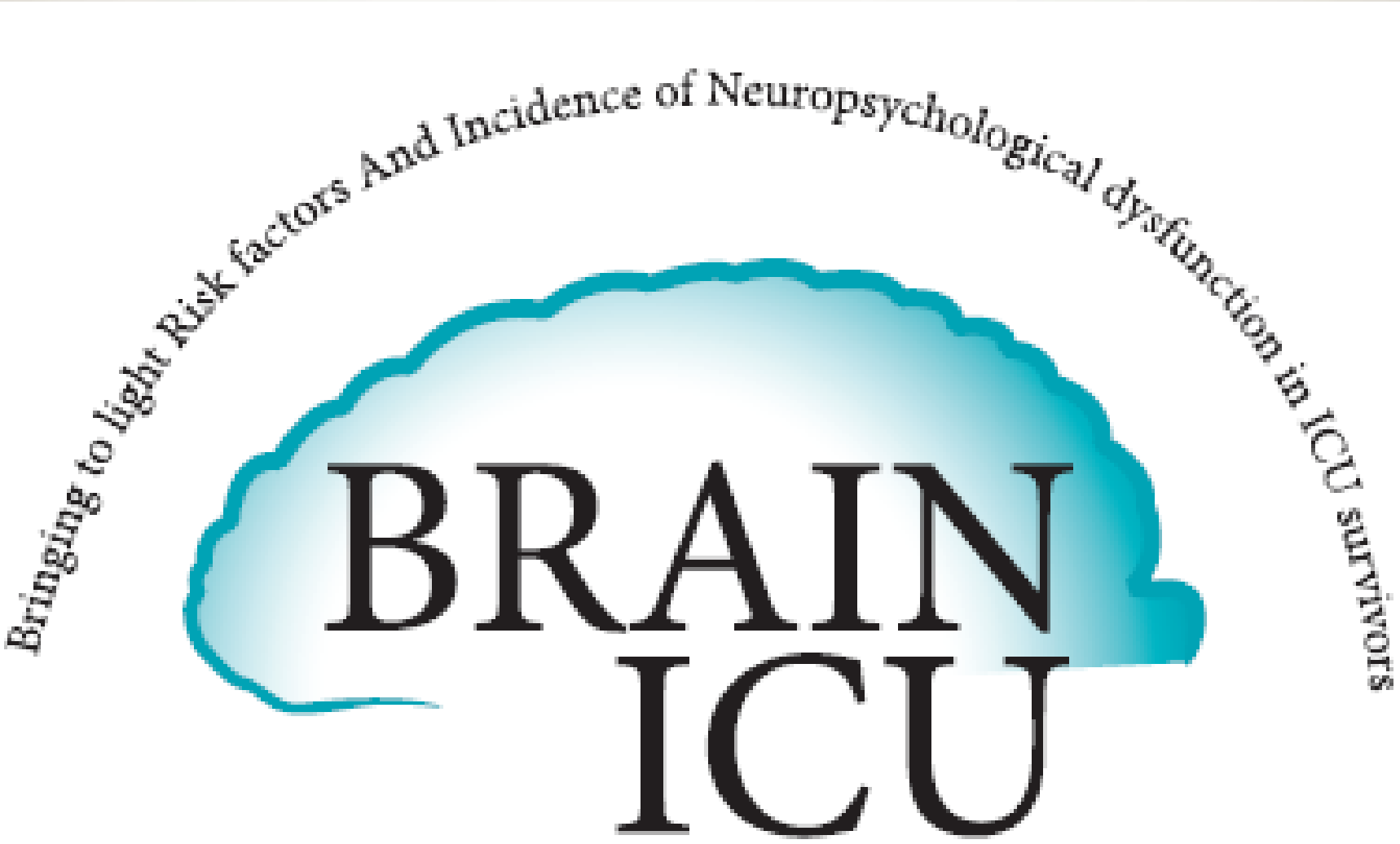
Disclosures: Physician-Scientist

- Honoraria from Abbott, Pfizer, Orion for CME Activities
- NIH and VA U.S. Federal Funding

"Medicine is more than a profession…It is not an occupation for those to whom career is more precious than humanity or for those who value comfort and serenity above service to others."

Abraham Joshua Heschel

1964 AMA Convention


Bringing to light Risk factors And Incidence of Neuropsychological dysfunction in ICU survivors
BRAIN
ICU

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Long-Term Cognitive Impairment after Critical Illness

P.P. Pandharipande, T.D. Girard, J.C. Jackson, A. Morandi, J.L. Thompson, B.T. Pun, N.E. Brummel, C.G. Hughes, E.E. Vasilevskis, A.K. Shintani, K.G. Moons, S.K. Geevarghese, A. Canonico, R.O. Hopkins, G.R. Bernard, R.S. Dittus, and E.W. Ely, for the BRAIN-ICU Study Investigators*

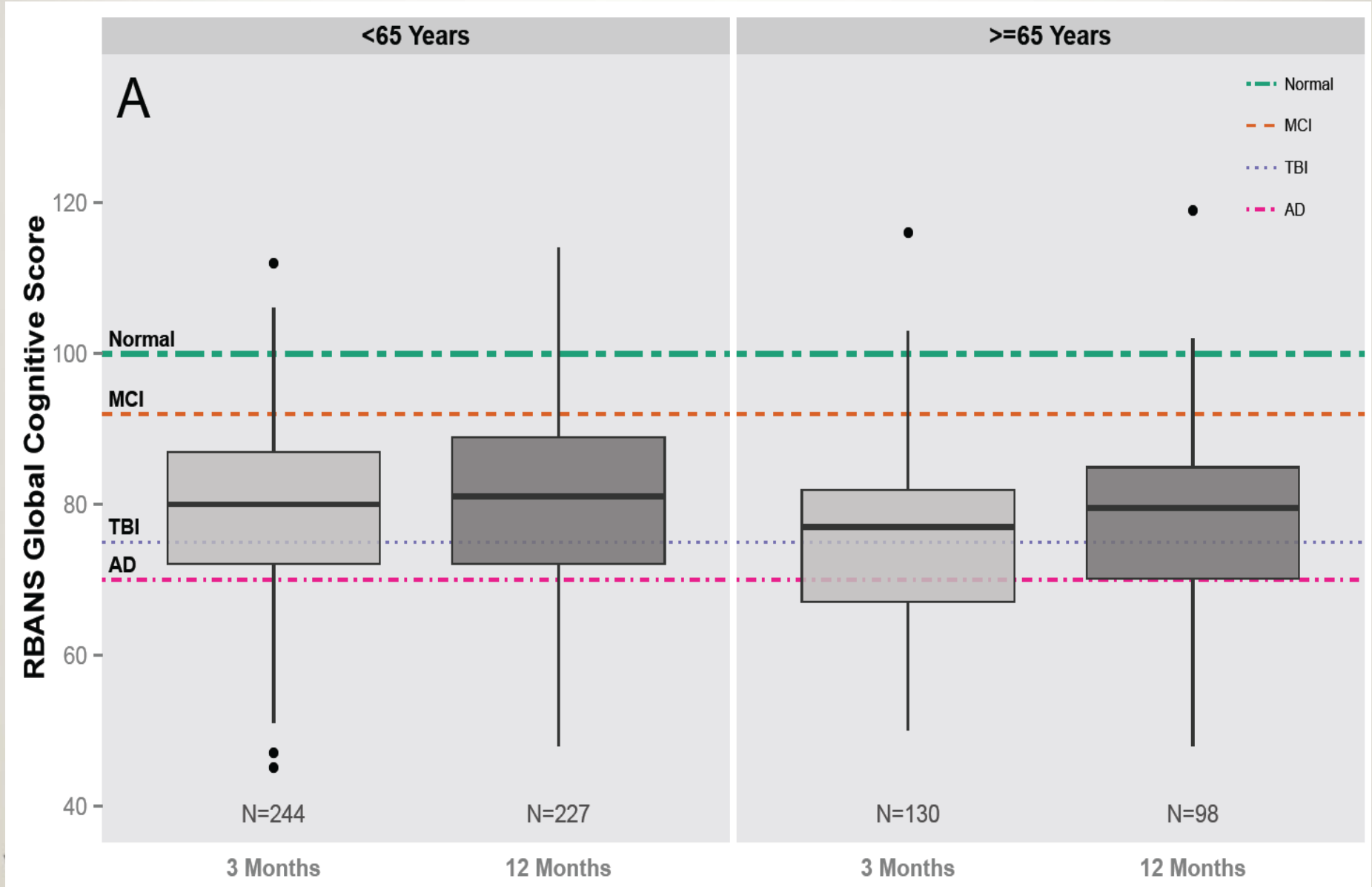
ABSTRACT

BACKGROUND

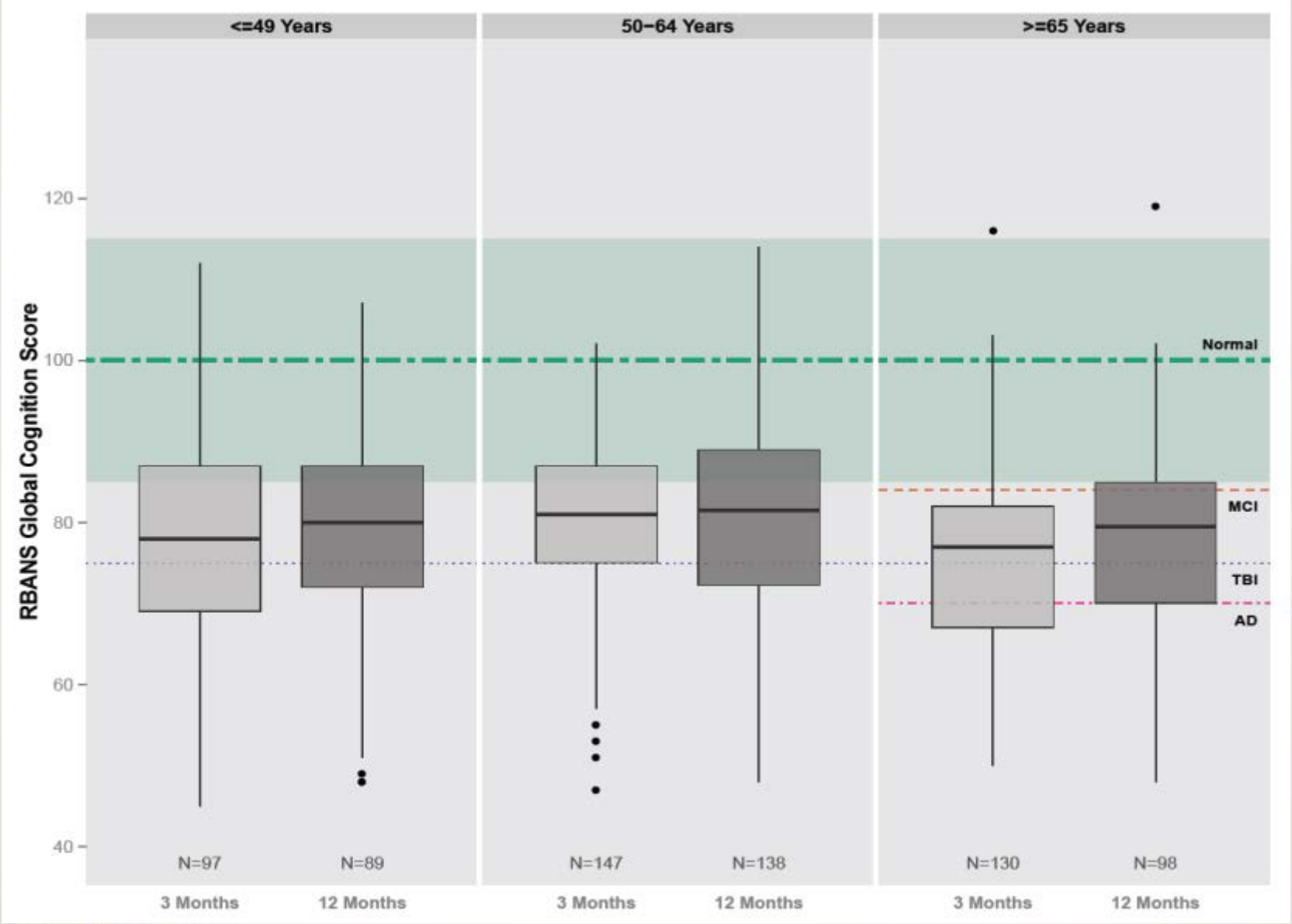
Survivors of critical illness often have a prolonged and disabling form of cognitive impairment that remains inadequately characterized.

NEJM 2013;369:1306-16
Editorial by M. Herridge

The Picture of Dementia Following ICU Care



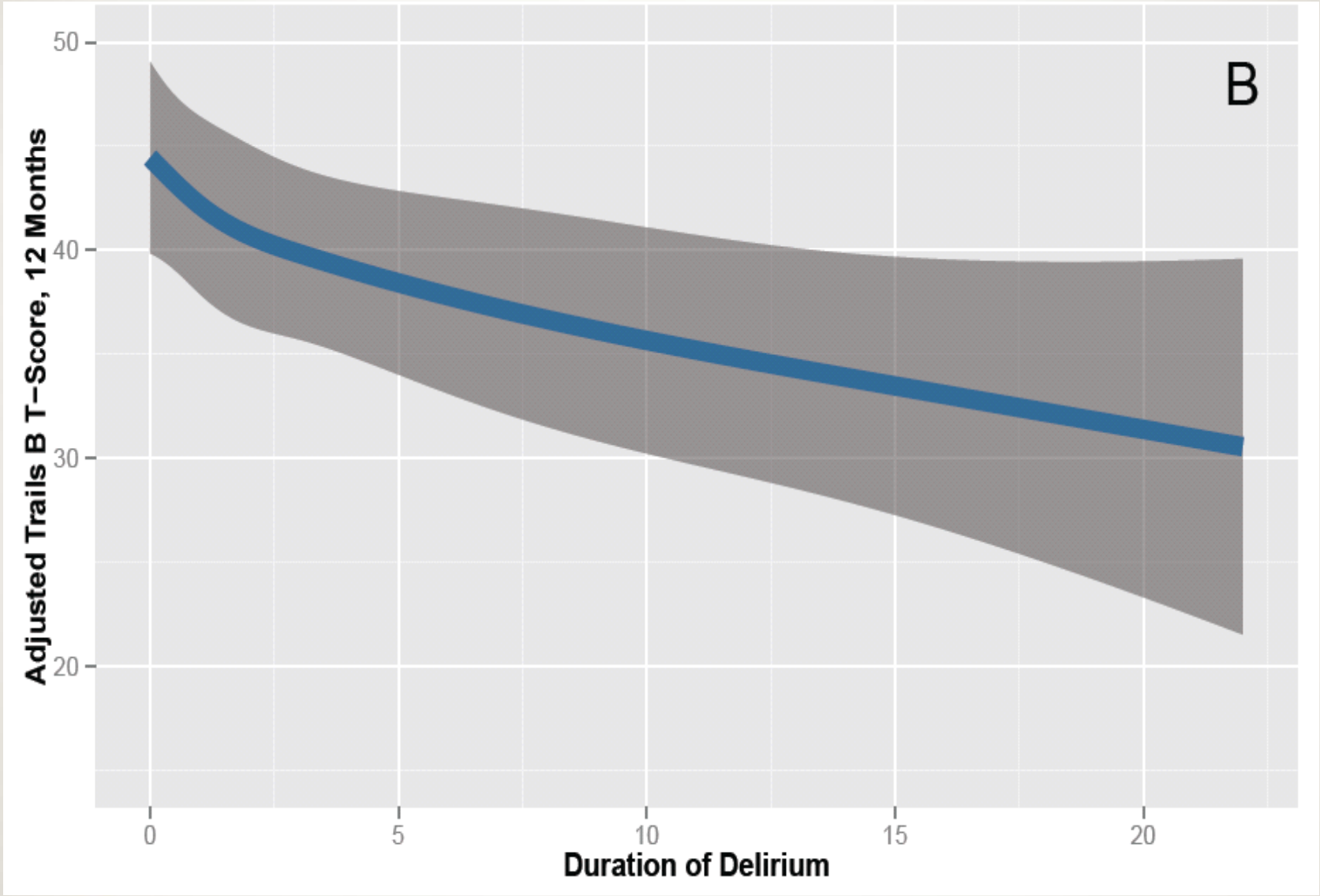
Global Cognitive Scores by Age



VANDERBILT UNIVERSITY MEDICAL CENTER

NEJM 2013;369:1306-16

Delirium and Executive Function



VANDERBILT UNIVERSITY MEDICAL CENTER

NEJM 2013;369:1306-16

Confirmed: Delirium Risk Factor for Long-Term Cognitive Problems after ICU Stay

- 1,101 survivors of critical illness, 37% with delirium
- Studied only survivors and used self report
- Multivariable analysis with adjustment for gender, admission dx, severity of illness (both APACHE IV and cumulative SOFA)
- Delirium independent predictor of mild (O.R. 2.41, C.I. 1.57-3.69) and severe (3.1, 1.1-8.74) LTCI 1 year

Wolters AE, Crit Care 2014;18:R125

Cognitive Outcomes:
Identical Cognitive Testing & Threshold*

Prevalence of cognitive impairment	6 Months	12 Months	P-Value (6 vs 12 mo.)
EDEN/OMEGA – ARDS (2008-2012) N=173	36%	25%	0.001
SAILS – SEPSIS-ARDS (2010-2014) N=172	37%	29%	0.167

*1 cognitive test score ≥2 standard deviations (SD) below population norm or at least 2 test scores ≥1.5 SD below norm

Needham D (ALTOS) AJRCCM 2013;188:567-76
Needham D (ALTOS) Lancet Resp Med 2016;4:203-12

Strictly Surgical Patients & POCD

- Famous cohorts have advocated cognitive decline post-surgery (e.g. CABG & Pump-Head) [1]
- Trials have refuted that the cognitive decline had to do with bypass itself (OCTOPUS) [2]
- And now others have posited that the term POCD is a fallacy [3-5]

[1] Newman M, NEJM 2001;344:395-402 (n=261)
[2] Van Dijk D, JAMA 2002;287:1405-12 (n=281)
[3] Avidan M, Anesthesiol 2009;111:964-70 (n=575)
[4] Avidan M, Anesthesiol 2010;113:1246-8
[5] Avidan M, Anesthesiol 2016;124;255-8

ANNALS OF
SURGERY

A Monthly Review of Surgical
Science and Practice Since 1885

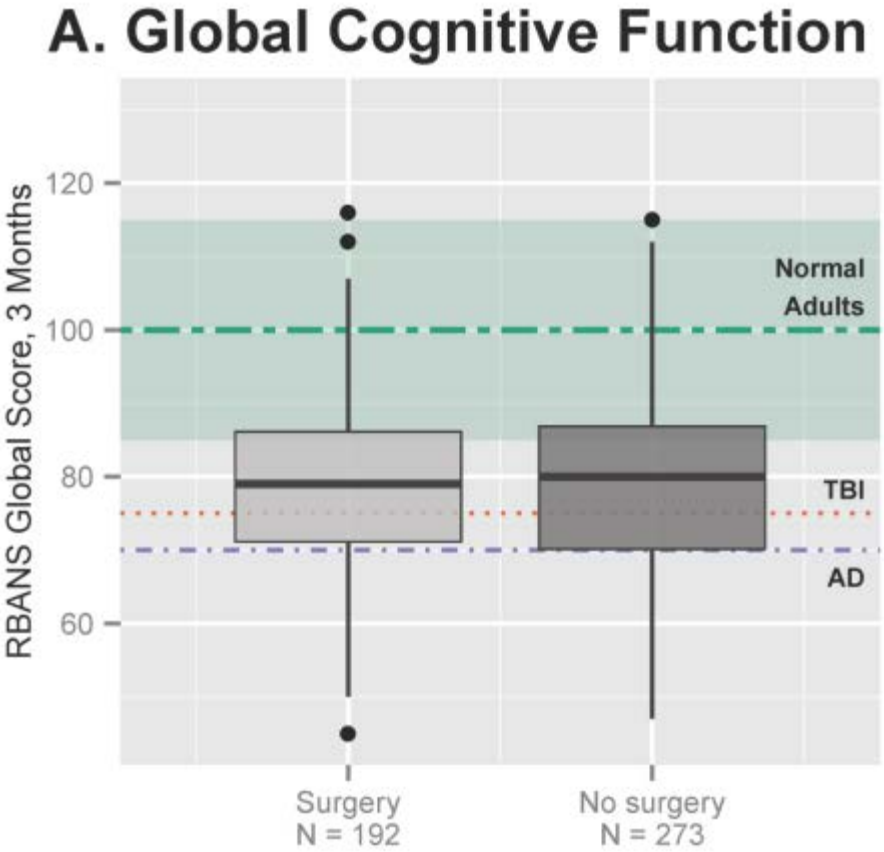
ORIGINAL ARTICLE

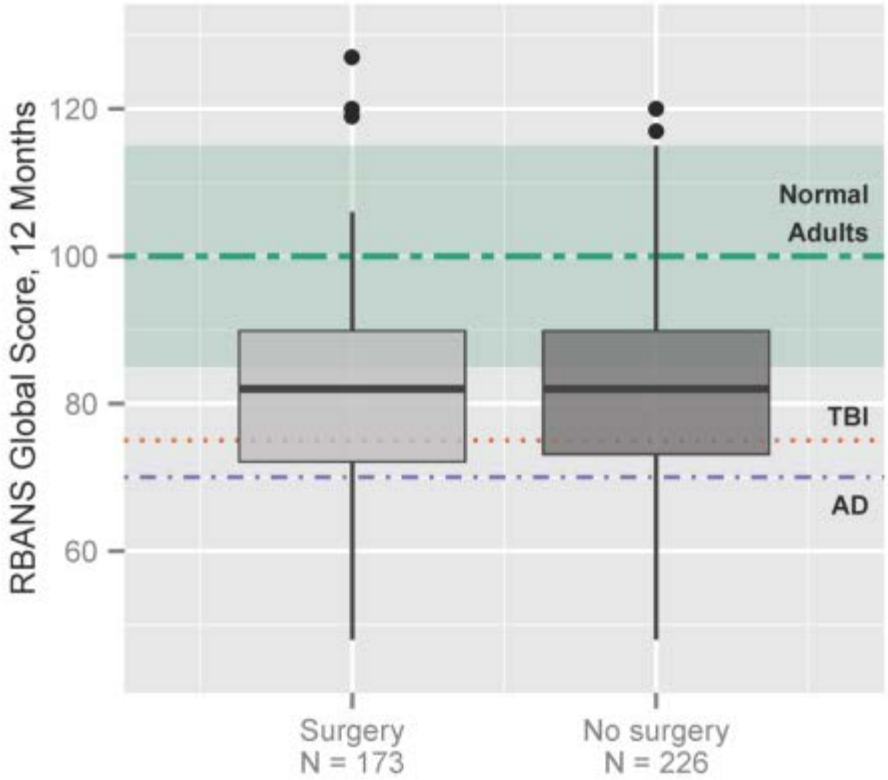
Surgery and Anesthesia Exposure Is Not a Risk Factor for Cognitive Impairment After Major Noncardiac Surgery and Critical Illness

Christopher G. Hughes, MD,[*] Mayur B. Patel, MD, MPH,[†] James C. Jackson, Psy.D,[‡] Timothy D. Girard, MD, MSCI,[§] Sunil K. Geevarghese, MD,[¶] Brett C. Norman, MD, MPH,[||] Jennifer L. Thompson, MPH,[**] Rameela Chandrasekhar, PhD,[**] Nathan E. Brummel, MD, MSCI,[††] Addison K. May, MD,[‡‡] Mark R. Elstad, MD,[§§] Mitzi L. Wasserstein, MD,[¶¶] Richard B. Goodman, MD,[||||] Karel G. Moons, PhD,[***] Robert S. Dittus, MD, MPH,[§] E. Wesley Ely, MD, MPH,[§] and Pratik P. Pandharipande, MD, MSCI[†††], for the MIND-ICU, BRAIN-ICU investigators

Global Cognition and Surgery Exposure

n=1,040



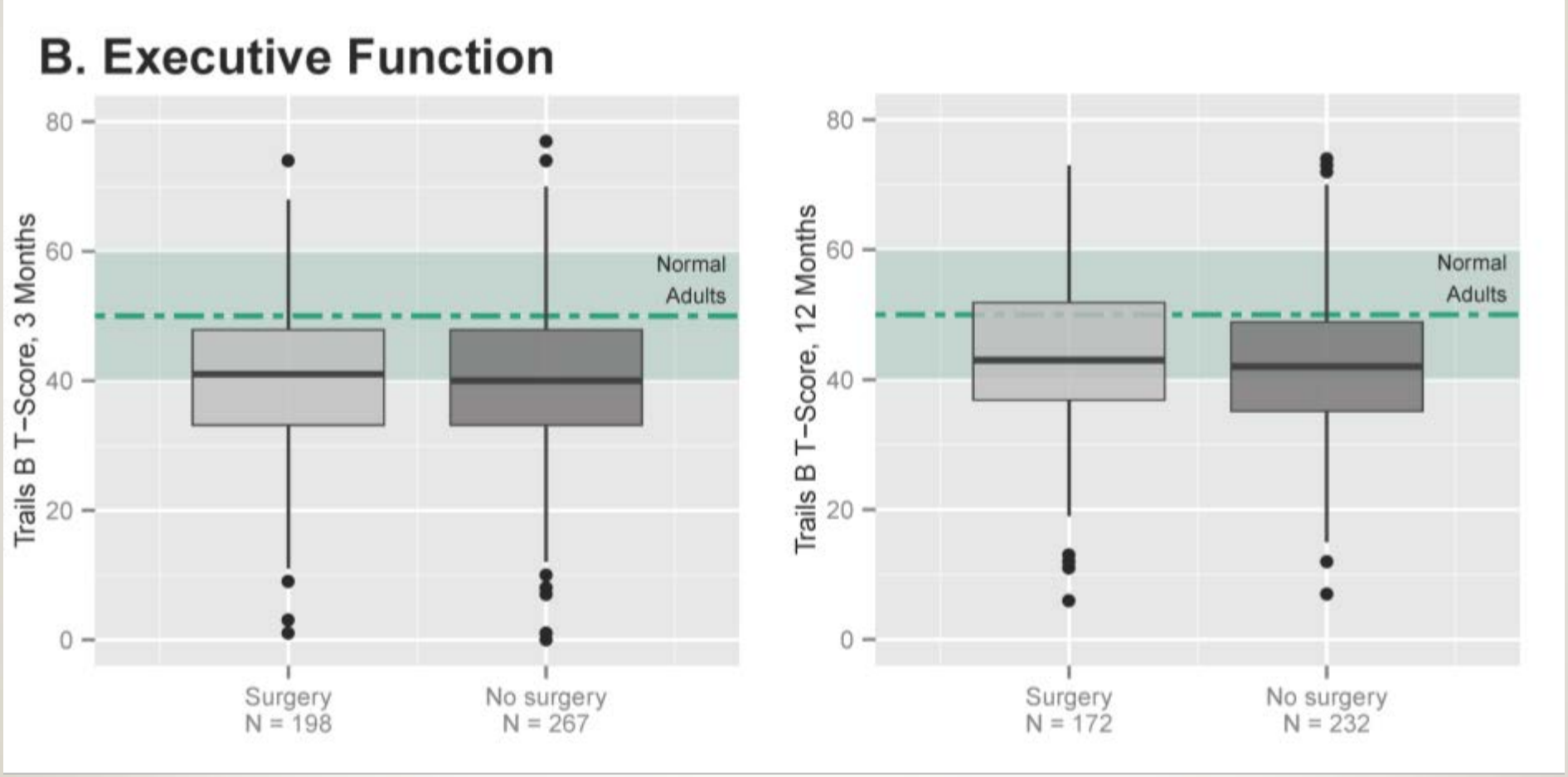


VANDERBILT UNIVERSITY MEDICAL CENTER

Hughes CG et al. *Ann Surg* 2016; Epub

Executive Function and Surgery Exposure

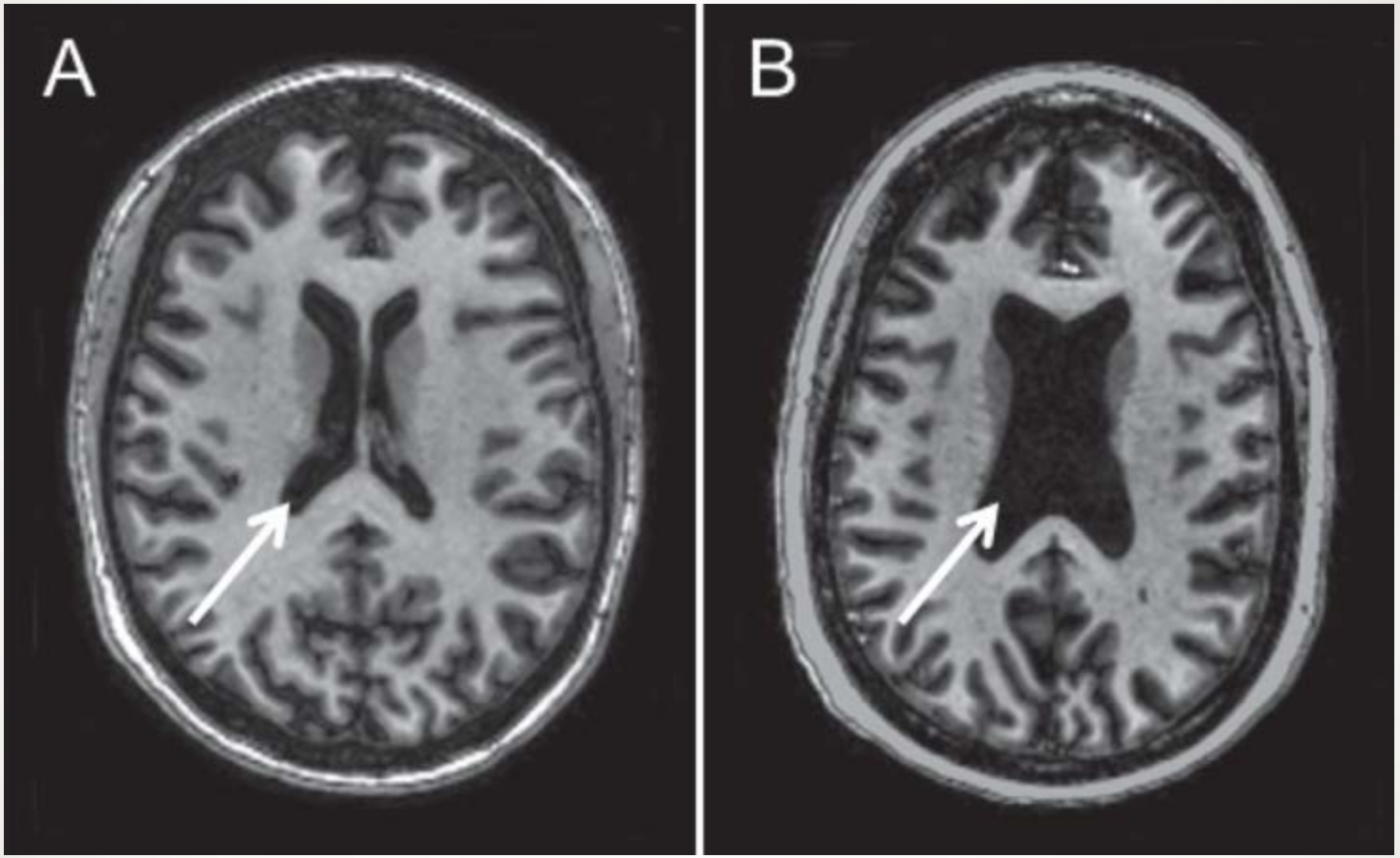
n=1,040



VANDERBILT UNIVERSITY MEDICAL CENTER

Hughes CG et al. *Ann Surg* 2016; Epub

Delirium and Brain Atrophy



(A) 46 year old, no delirium

(B) 42 year old, 12 days of delirium

VANDERBILT UNIVERSITY MEDICAL CENTER

Gunther M et al. CCM 2012;40:2022-32

INSIGHT-ICU Study

Illuminating

Neuropsychological dysfunction and

Systemic

Inflammatory mechanisms

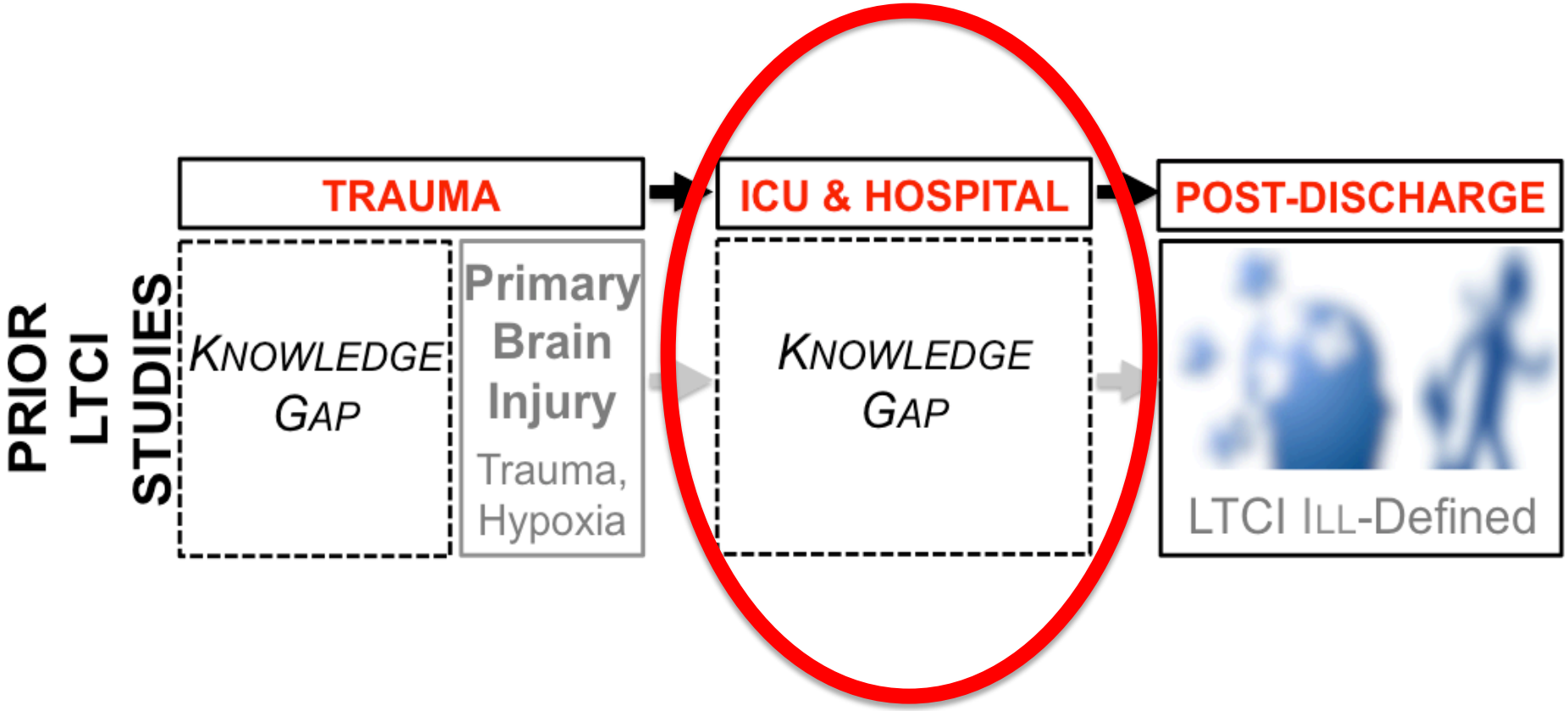
Gleaned after

Hospitalization in

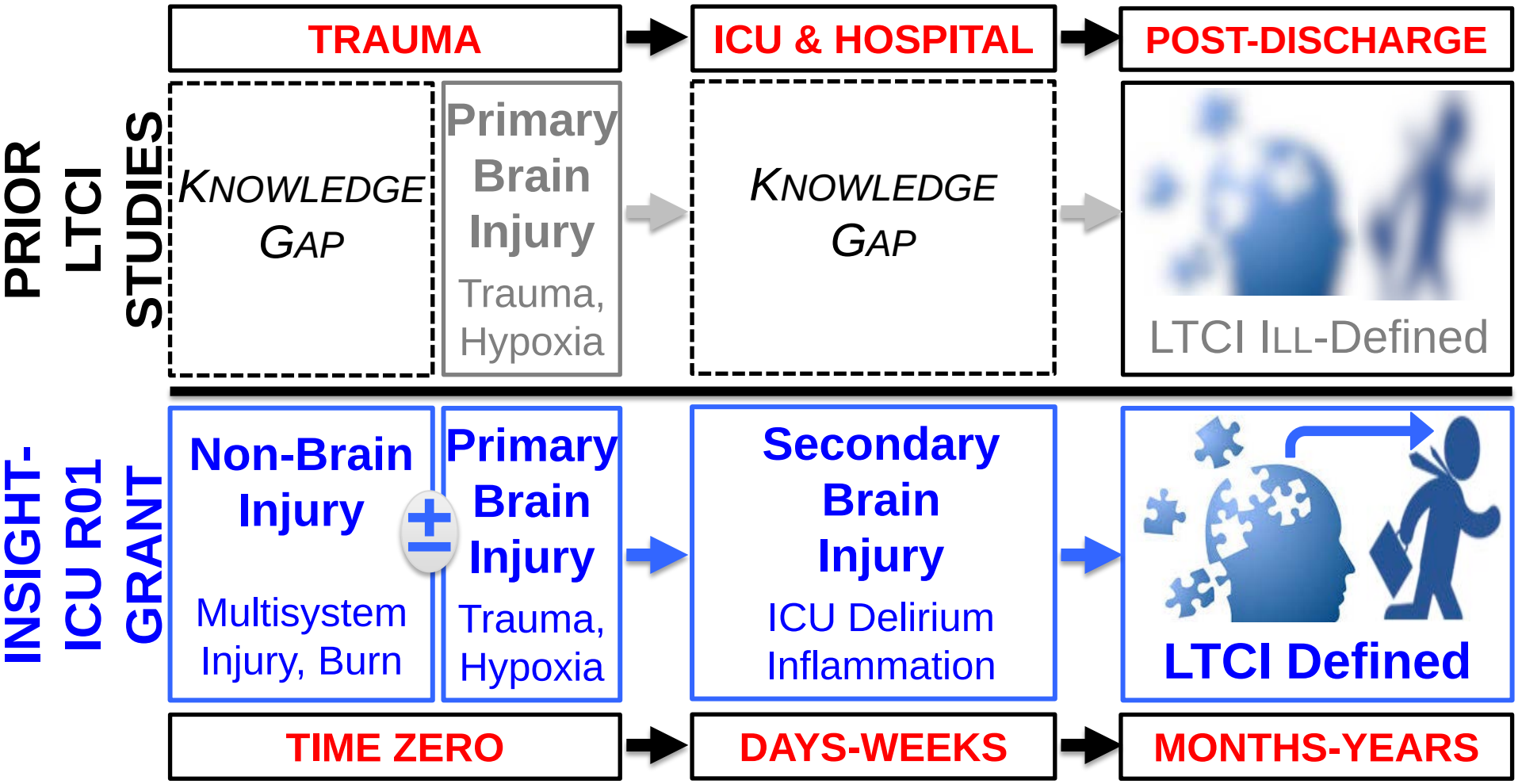
Trauma

ICU Study

LTCI is Not Well-Defined after Primary Brain Injury



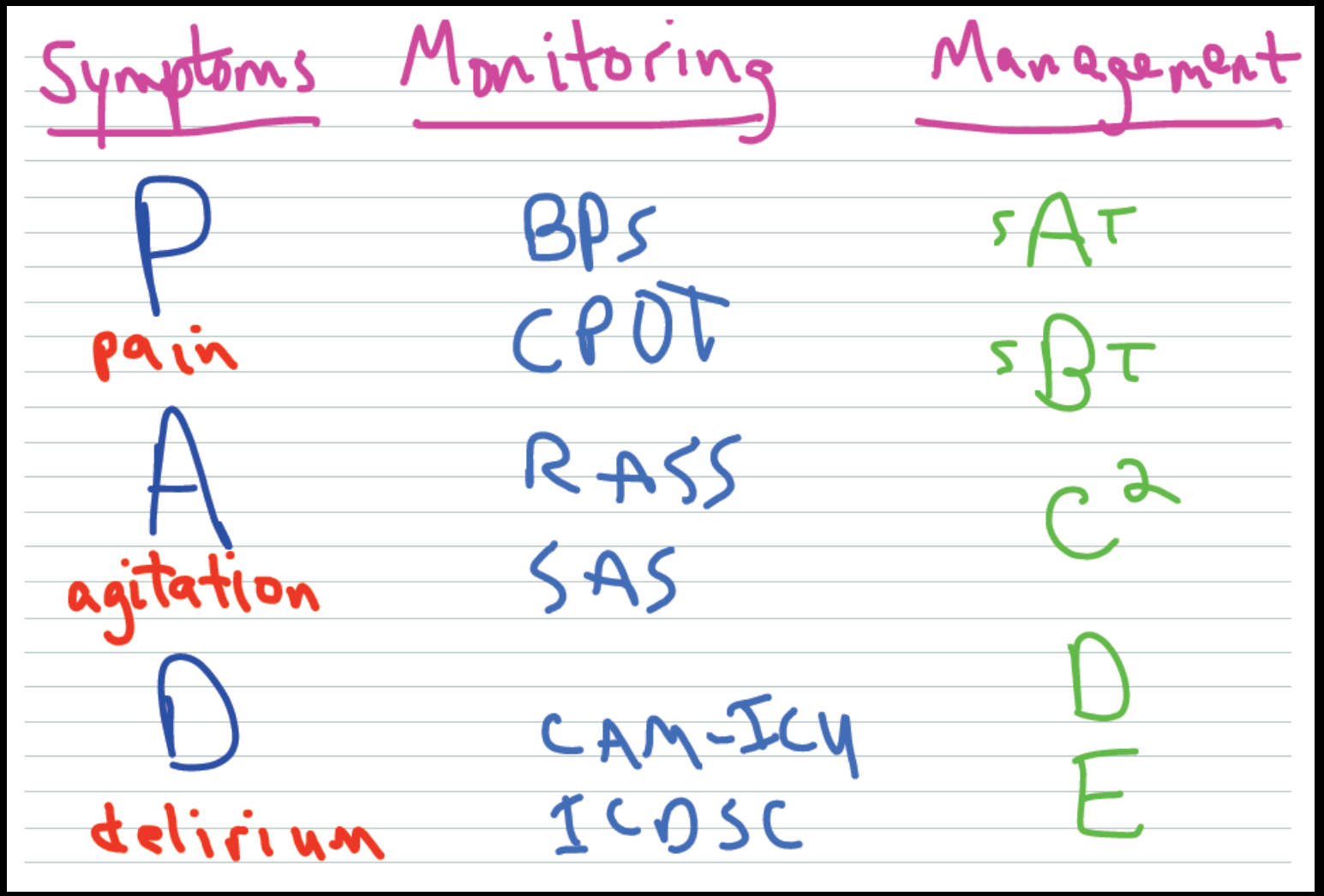
LONG-TERM COGNITIVE IMPAIRMENT (LTCI) OF TRAUMA ICU SURVIVORS ?



NIH R01, FOA PA13-302, 1R01GM120484 NIGMS (pending) The INSIGHT-ICU Study: Illuminating Neuropsychological dysfunction and Systemic Inflammatory mechanisms Gleaned after Hospitalization in Trauma-ICU Study

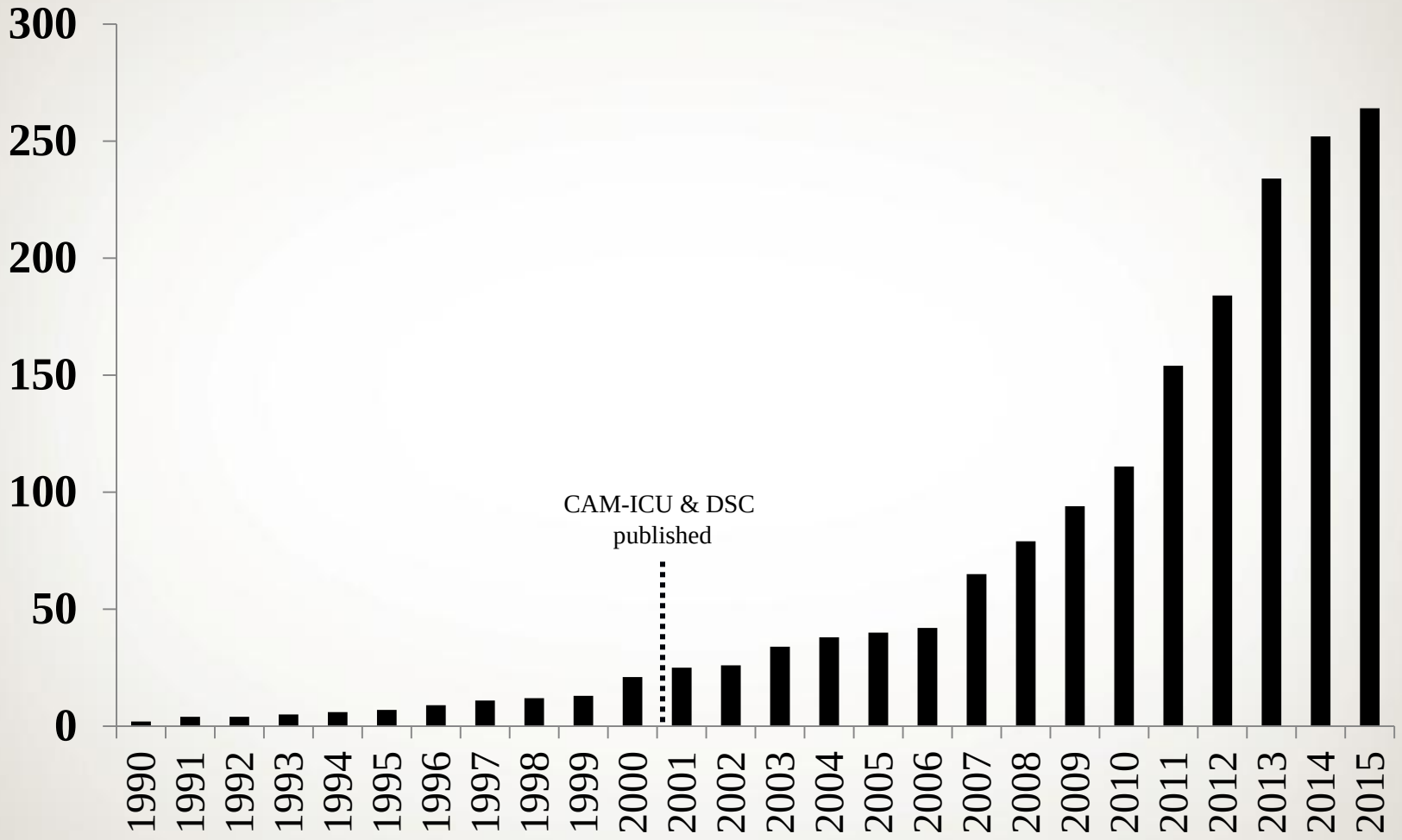
Barr J et al. **PAD Guidelines**. *Crit Care Med.* 2013;41:263-306
Baron R et al. **German PAD Guidelines**, GMS e-journal 2015;13:Doc19

Airplane Draft
ICU Liberation - 3 Columns



VANDERBILT UNIVERSITY
MEDICAL CENTER

Articles on ICU Delirium



Unrecognized Delirium

Study	Setting	Provider	Miss Rate
Francis et al. 1990	Medical	Physicians	84%
Elie et al. 2000	Emergency	Physician	65%
Inouye et al. 2001	Med-Surg	Nurses	81%
Han et al. 2009	Emergency	Physician	76%
Van Eijk et al. 2009	ICU	Physician	81%
Spronk et al. 2009	ICU	Phys/Nurses	70%
Grossmann et al. 2014	Emergency	Nurses	73%
Rice et al. 2014	Med-Surg	Nurses	77%

Early Intensive Care Sedation Predicts Long-Term Mortality in Ventilated Critically Ill Patients

Yahya Shehabi[1,2], Rinaldo Bellomo[3,4,5,6], Michael C. Reade[7,8], Michael Bailey[5], Frances Bass[2], Belinda Howe[5], Colin McArthur[9], Ian M. Seppelt[10], Steve Webb[11,12], and Leonie Weisbrodt[13]; Sedation Practice in Intensive Care Evaluation (SPICE) Study Investigators and the ANZICS Clinical Trials Group*

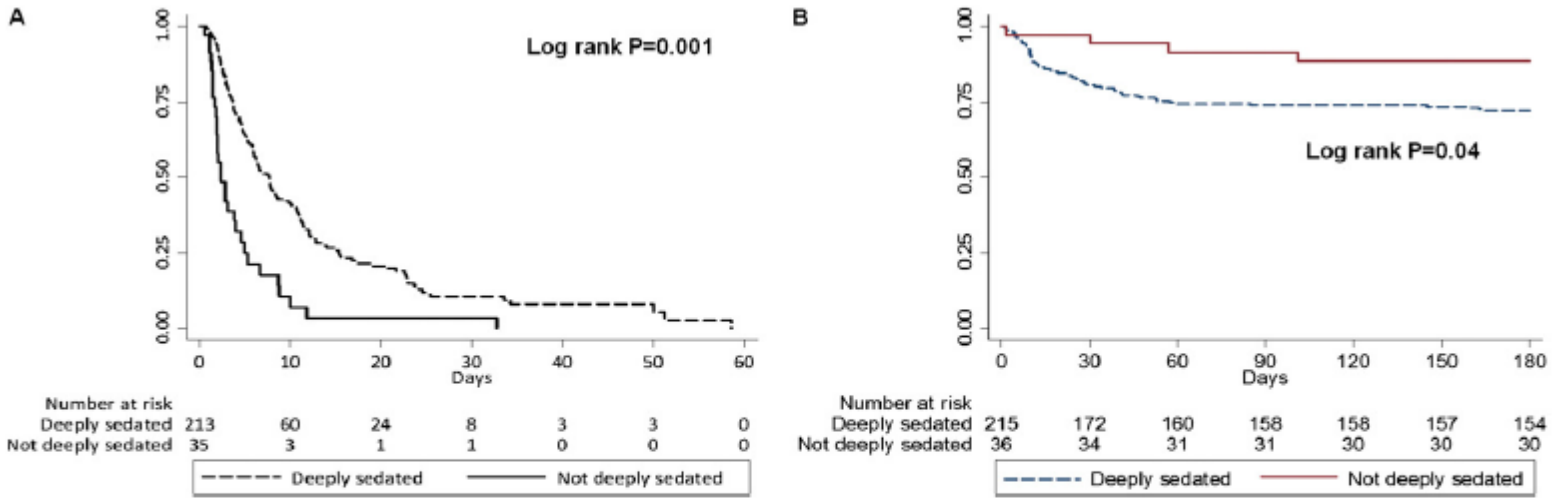
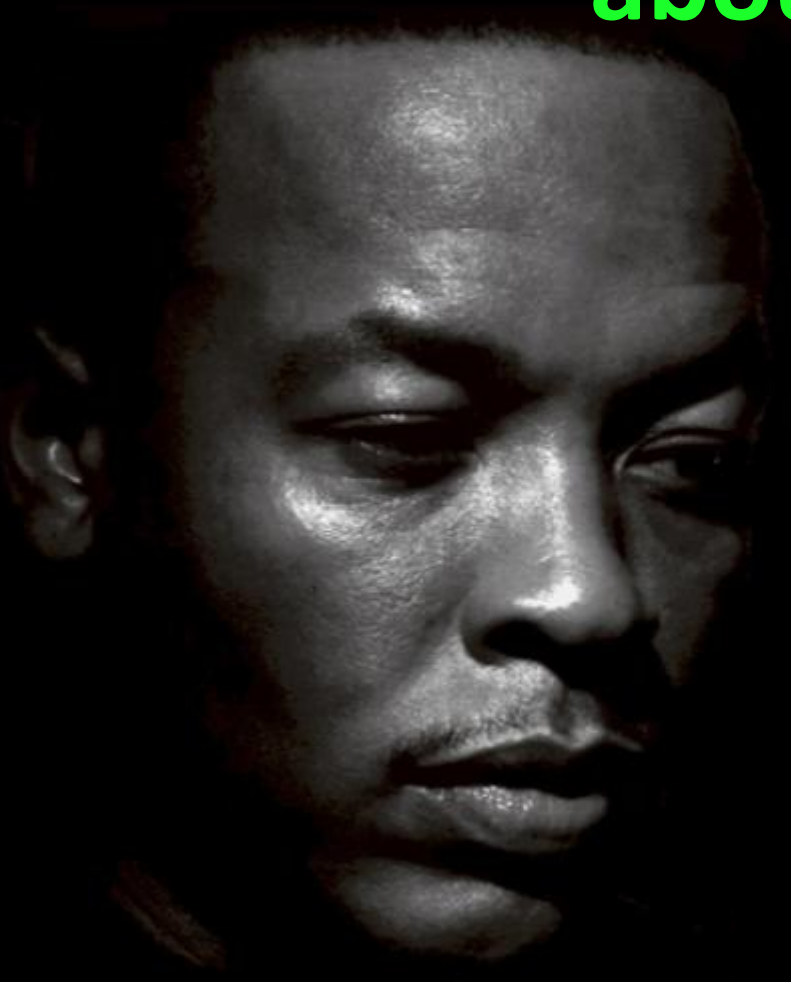


Figure 4. Kaplan-Meier curves for time to extubation and mortality at 180 days. (*A*) Time to extubation was significantly longer among patients who were deeply sedated early in the intensive care unit compared with those who were not. Median (interquartile range), 7.7 (6.0–8.6) vs. 2.4 (1.9–4.0) days (log-rank, $P < 0.001$). (*B*) Those who were deeply sedated early (first 48 h) showed significantly reduced survival (log-rank $P = 0.048$) compared with patients who were not deeply sedated.

Shehabi Y, SPICE, AJRCCM 2010;186:724-31

When Delirium strikes, don't forget about Dr. DRE



Disease **r**emediation

Sepsis, COPD, CHF

Drug **R**emoval

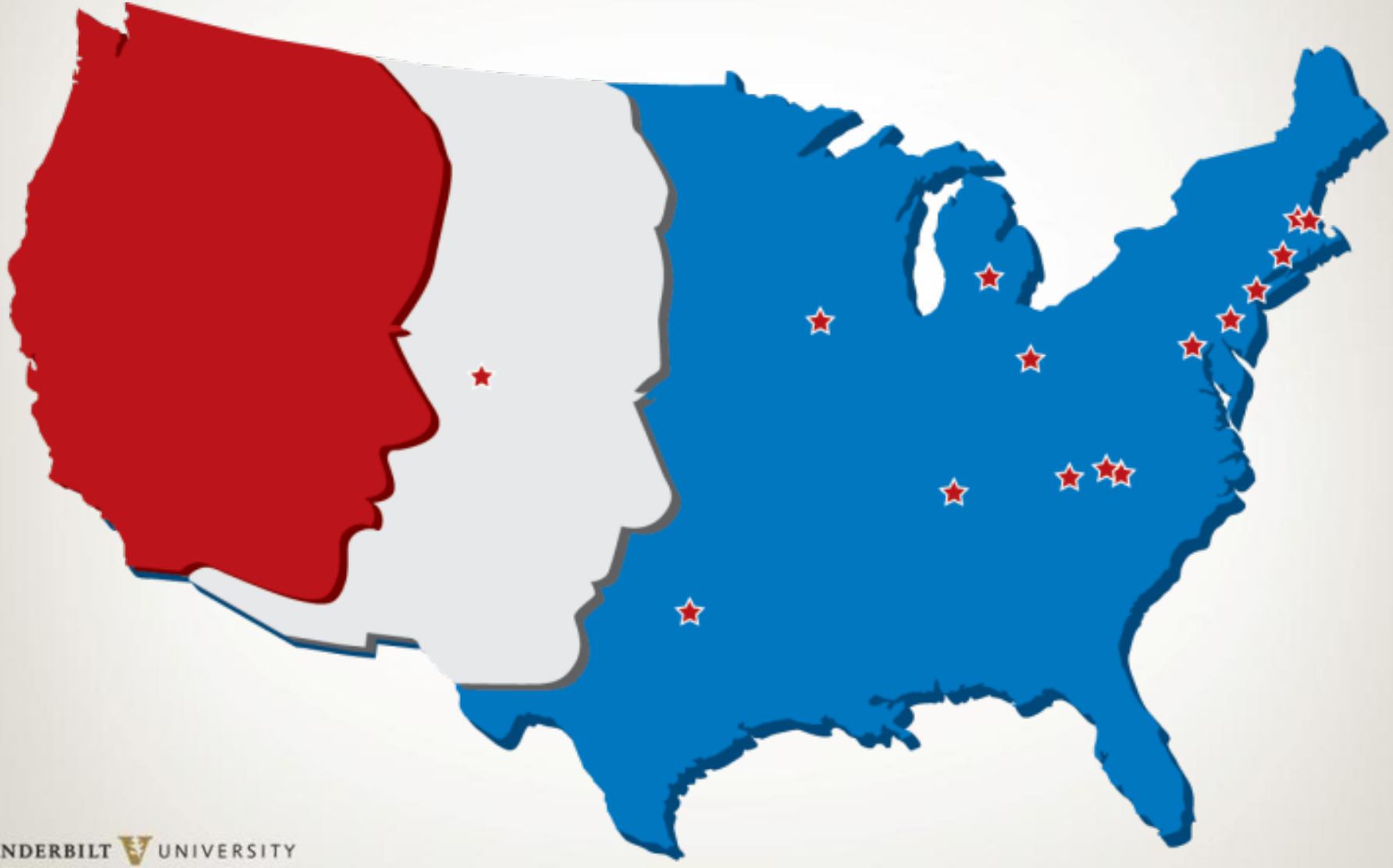
SATs and stopping benzodiazepines/ narcotics

Environment

Immobilization, sleep and day/night, hearing aids, glasses, noise

MIND-USA

Modifying the Impact of ICU-Associated Neurological Dysfunction



VANDERBILT UNIVERSITY
MEDICAL CENTER

Barr J et al. **PAD Guidelines**. *Crit Care Med.* 2013;41:263-306
Baron R et al. **German PAD Guidelines**, GMS e-journal 2015;13:Doc19

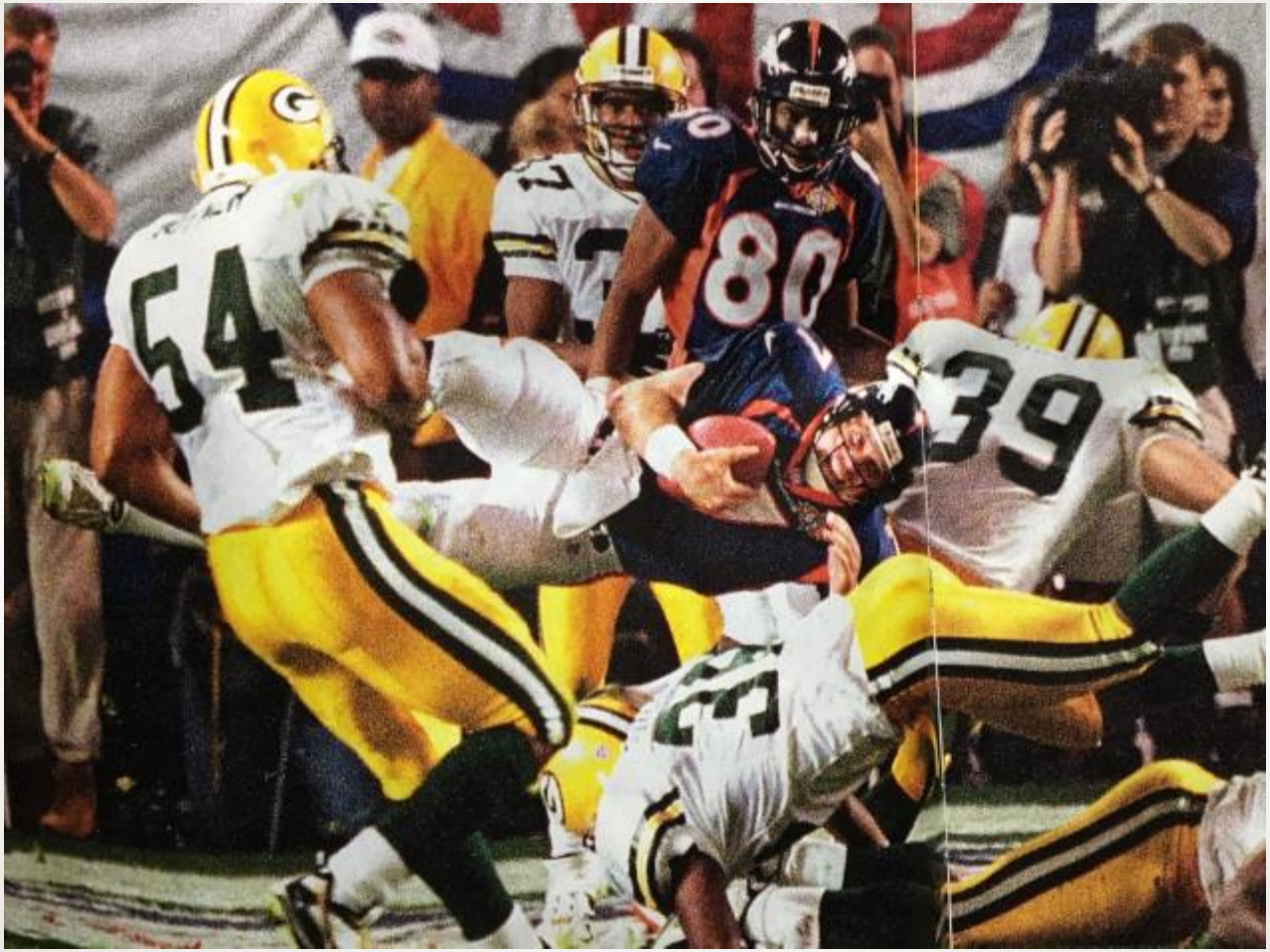
From Canadian Authors of SLEAP…

n=712 and 3,620 patient-days

"We found that nearly all patients were managed with continuous-infusion opioids and sedatives. We also found that actual practice was different from what we expected because the available clinical tools – such as protocols and assessment scales – were not necessarily applied at the bedside."

Burry LD, Can J Anesth May 2014 epub
Data collected 2008-2009

Feeling “Sideways”



Teamwork – Brady's Patriots

Regarding **delirium and sedation**, let's focus on teamwork and potentially modifiable aspects of care …

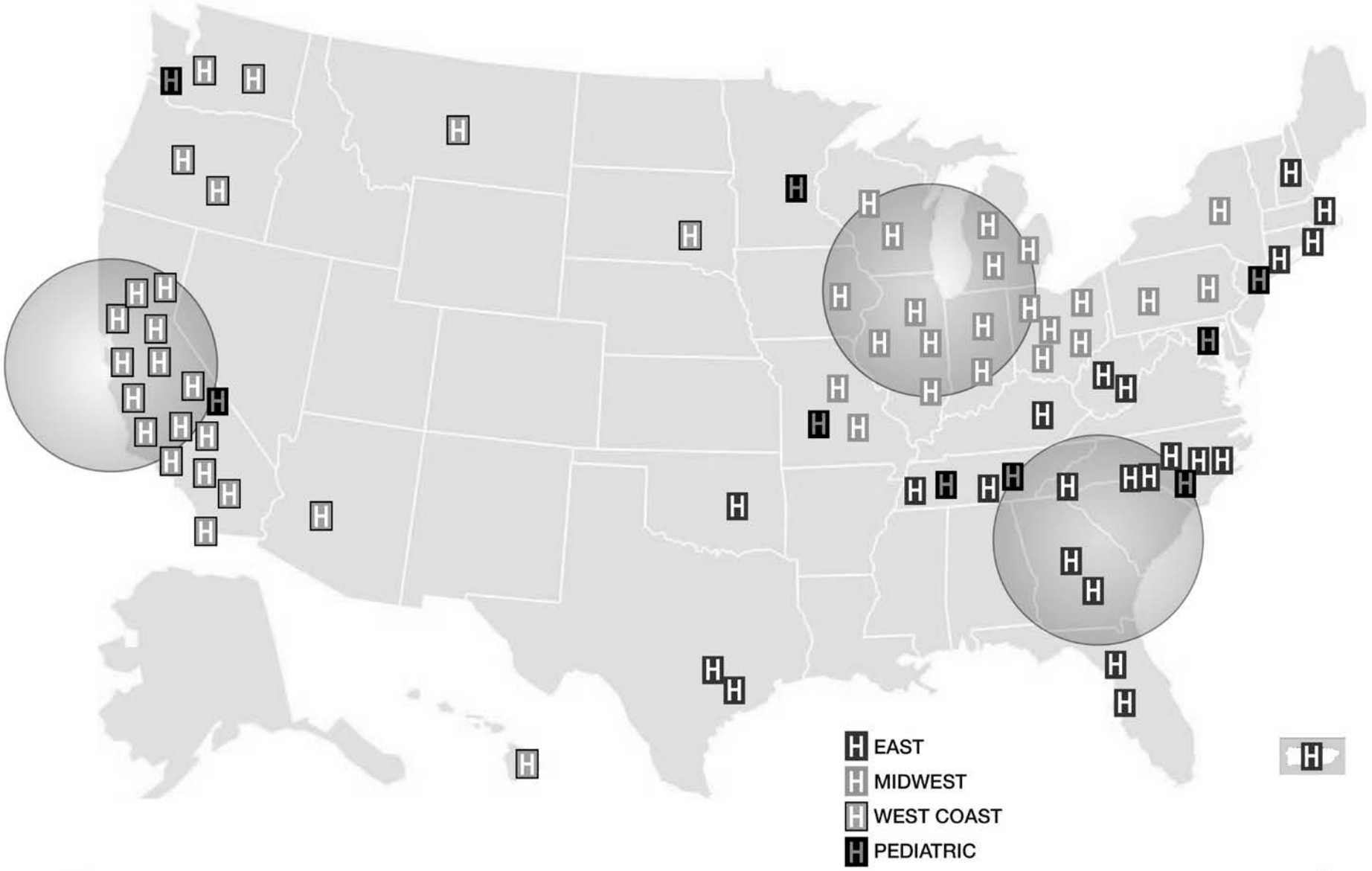
Tipping Point - Malcolm Gladwell with Brooke and Blair Ely

ICU PAD Guidelines
ABCDEF Bundle Checklist*

- A – Assess, Prevent and Manage Pain
- B – Both SATs and SBTs
- C – Choice of Sedation
- D – Delirium: Assess, Prevent and Manage
- E – Early Mobility and Exercise
- F – Family Engagement and Empowerment

***www.icudelirium.org**
***www.iculiberation.org**

ICU Liberation Hospitals and Regions



ICU LIBERATION

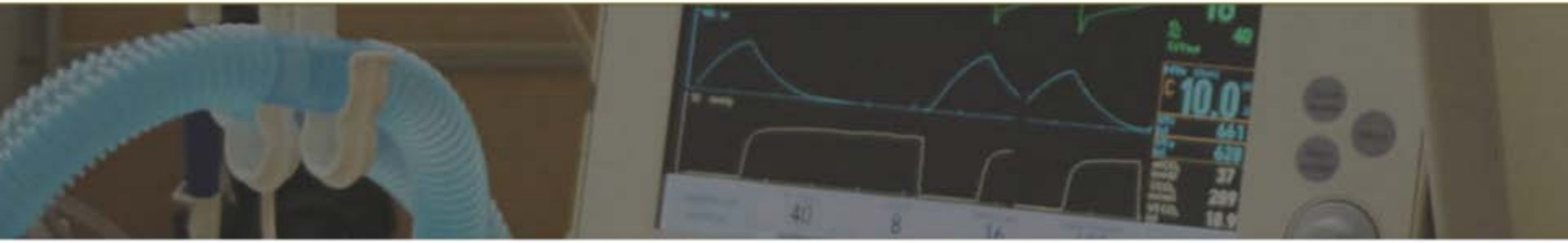
Society of Critical Care Medicine
The Intensive Care Professionals

ICU Delirium
and Cognitive Impairment Study Group

Vanderbilt University Medical Center

Monroe Carell Jr. Children's Hospital at Vanderbilt

Department of Veterans Affairs



for Medical Professionals

ABCDEF's of Prevention and Safety

- Assess, Prevent, and Manage Pain
- Both SAT and SBT
- Choice of Analgesia and Sedation
- Delirium: Assess, Prevent and Manage
- Early Mobility and Exercise
- Family Engagement and Empowerment

Additional Resources

- All Resources

Delirium Prevention and Safety: Starting with the ABCDEF's

It is essential to consider delirium management in the broader picture of ICU patient care as a major piece of the current guidelines for Pain, Agitation, and Delirium (PAD) of the Society of Critical Care Medicine (SCCM). Advancements in research and technology are resulting in higher acuity and increased complexity of care, which is resulting in drastic increases in workload and demands on staff. More than ever, there is a great need to develop simpler ways of implementing safer and better care into practice for our sickest patients.

The ABCDEF bundle is one way to align and coordinate care, which includes specific focus on delirium as a component of the overall care patients receive including sedation and pain medications, breathing machines, and mobilization.

What are the components of the ABCDEF

Scientific Foundation for ICU Liberation and the ABCDEF Bundle…

B: Both SATs and SBTs

1. Ely E. **N Engl J Med.** 1996;335:1864-9
2. Kress J. **N Engl J Med.** 2000;342:1471-7
3. Girard T. **Lancet**. 2008;371:126-34
4. Mehta G. **JAMA** 2012;308:1985-92

C: Choice of Sedation and Analgesia

5. Pandharipande P. **JAMA**. 2007;298:2644-53
6. Riker R. **JAMA**. 2009;301:489-9
7. Strøm T. **Lancet**. 2010;375:475-80
8. Jakob S. **JAMA**. 2012;307:1151-60
9. Reade M **JAMA** 2016;315:1460-1468
10. Su X. **Lancet** 2016; epub ahead of print

ICU LIBERATION

Society of Critical Care Medicine

Scientific Foundation for ICU Liberation and the ABCDEF Bundle…

D: Delirium

11. Ely E**. JAMA.** 2001;286:2703-10
12. Ely E. **JAMA**. 2003;289:2983-91
13. Ely E. **JAMA.** 2004;291:1753-62
14. Schweickert W. **Lancet.** 2009;373:1874-82

E: Early Mobility

15. Herridge M. **N Engl J Med.** 2003;348:683-93
16. Levine S. **N Engl J Med**. 2008;358:1327-35
17. Puthucheary Z. **JAMA.** 2013;310:1591-1600
18. Kress J. **N Engl J Med**. 2014;370:1626-35
19. Morris P. **JAMA** 2016;315:2694-2702

ICU LIBERATION

Society of Critical Care Medicine

Scientific Foundation for ICU Liberation and the ABCDEF Bundle…

F: Family Engagement

20. Schneiderman L. **JAMA**. 2003;290:1166-72
21. Lautrette A. **N Engl J Med**. 2007;356:469-78
22. Jabre P. **N Engl J Med**. 2013;368:1008-18
23. Cameron J. **N Engl J Med** 2016;374:1831-41

PICS: Post-Intensive Care Syndrome

24. Iwashyna TJ. **JAMA**. 2010;304:1787-94
25. Ehlenbach W. **JAMA**. 2010;303:763-70
26. Herridge MS. **N Engl J Med**. 2011;364:1293-04
27. Pandharipande PP. **N Engl J Med**. 2013;369:1306-16

ICU LIBERATION

Society of Critical Care Medicine

ABCDEF Bundle Objectives

- *Optimize pain management.*
- *Break the cycle of deep sedation and prolonged mechanical ventilation.*
- *Reduce the incidence, duration of ICU delirium.*
- *Improve short, long-term ICU patient outcomes.*
- *Reduce health care costs!*

Morandi et al Curr Opin Crit Care 2011;17:43-9
Vasilevskis et al Crit Care Med 2010;38:S683-91
Zaal et al, ICM 2013;39:481-88
Colombo et al, Minerva Anest 1012;78:1026-33

Liberation from…

- Public Health Problem
- Iatrogenic ignorance
- Acquisition of new injury (neck-up & neck-down)

How? By self-sacrifice, commitment, devotion to the truth of service to others, truth of these new data, and generation of a new way…

Improving Hospital Survival and Reducing Brain Dysfunction at Seven California Community Hospitals: Implementing PAD Guidelines Via the ABCDEF Bundle in 6,064 Patients*

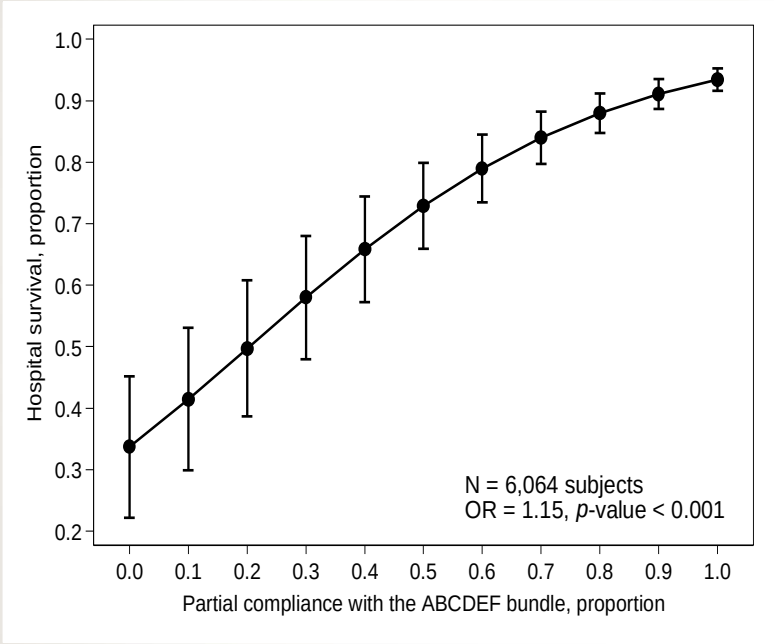
Mary Ann Barnes-Daly, MS, RN, CCRN, DC[1]; Gary Phillips, MAS[2]; E. Wesley Ely, MD, MPH, FCCM[3,4]

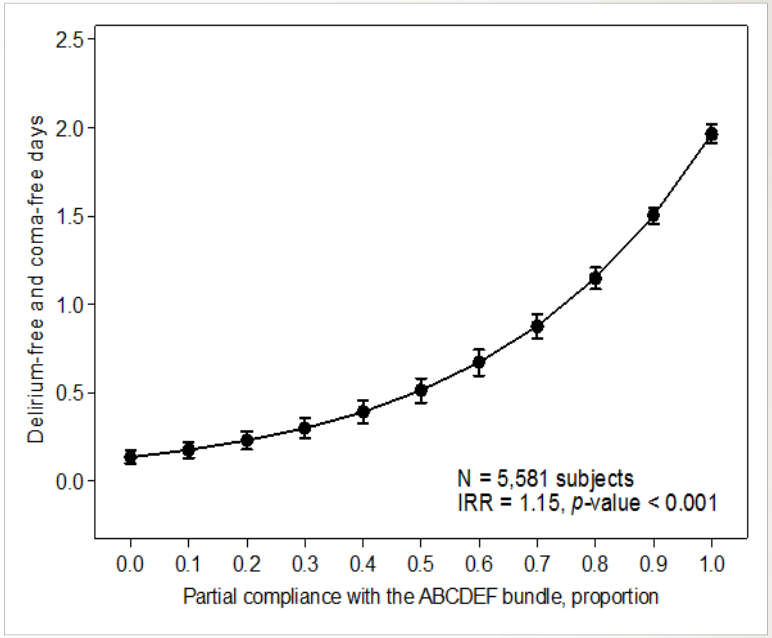
The ABCDEF Bundle: Science and Philosophy of How ICU Liberation Serves Patients and Families

E. Wesley Ely, MD, MPH, FCCM

Crit Care Med, Feb 2017

Survival and Delirium/Coma Improved after Implementing PAD Guidelines via ABCDEF Bundle in ≥6,000 patients





Mortality Improvement

Delirium and Coma Freedom

NOTE: Adjusted for age, APACHE III, and mechanical ventilation
7 California Hospitals, Interprofessional QI Implementation project

VANDERBILT UNIVERSITY MEDICAL CENTER

Barnes-Daly MA, CCM 2017;45:171-8
Ely EW CCM 2014;45:321-30

ICU LIBERATION
LIBERATION, ANIMATION, RESTORATION

ICU Liberation: ABCDEF Bundle

Symptoms Pain, Agitation, Delirium Guidelines	Monitoring Tools	Care ABCDEF Bundle	Done
Pain	Critical-Care Pain Observation Tool (CPOT) NRS Numeric Rating Scale BPS Behavioral Pain Scale	**A:** Assess, Prevent and Manage Pain	☐
Agitation	Richmond Agitation-Sedation Scale (RASS) Sedation-Agitation Scale (SAS)	**B:** Both Spontaneous Awakening Trials (SAT) and Spontaneous Breathing Trials (SBT) **C:** Choice of Analgesia and Sedation	☐ ☐
Delirium	Confusion Assessment Method for the Intensive Care Unit (CAM-ICU) Intensive Care Delirium Screening Checklist (ICDSC)	**D:** Delirium: Assess, Prevent and Manage **E:** Early Mobility and Exercise **F:** Family Engagement and Empowerment	☐ ☐ ☐


PLANAR

San Francisco

1970

2015

Ely EW CCM 2014;45:321-30

ABCDEF…Early Mobility and Family in Poland:

Ventilated Patient and Her Husband with Shopping Cart

Ely EW CCM 2014;45:321-30

Courtesy of Dr. Kasia Kotfis in Szczecin, Poland

A Doctor's (ICU Team's) Touch…

Verghese TED Talk

https://www.ted.com/talks/abraham_verghese_a_doctor_s_touch#t-937949

Start at 15:50 minutes (watch 2.5 min)

Liberated…?

Liberated…

Liberated…texting while on vent

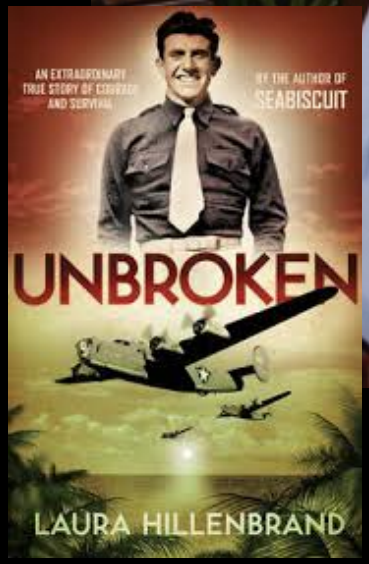
Liberated…
ventilated patient and nurse “talking”





Author's note: "At its heart, this story is not at all about any specific belief system, but rather about making the ICU a place where EOL wishes and resolutions are respected by the ICU team and achieved by the patient and family."

Swimming Pool in the ICU:
Ely WSJ Op-Ed on June 17, 2016
Ely EW, ICM 2016 Sep;42:1502-3



Louis Zamperini


;IGY6

Vanderbilt/VA ICU Delirium & Cognitive Impairment Study Group