DELIRIUM

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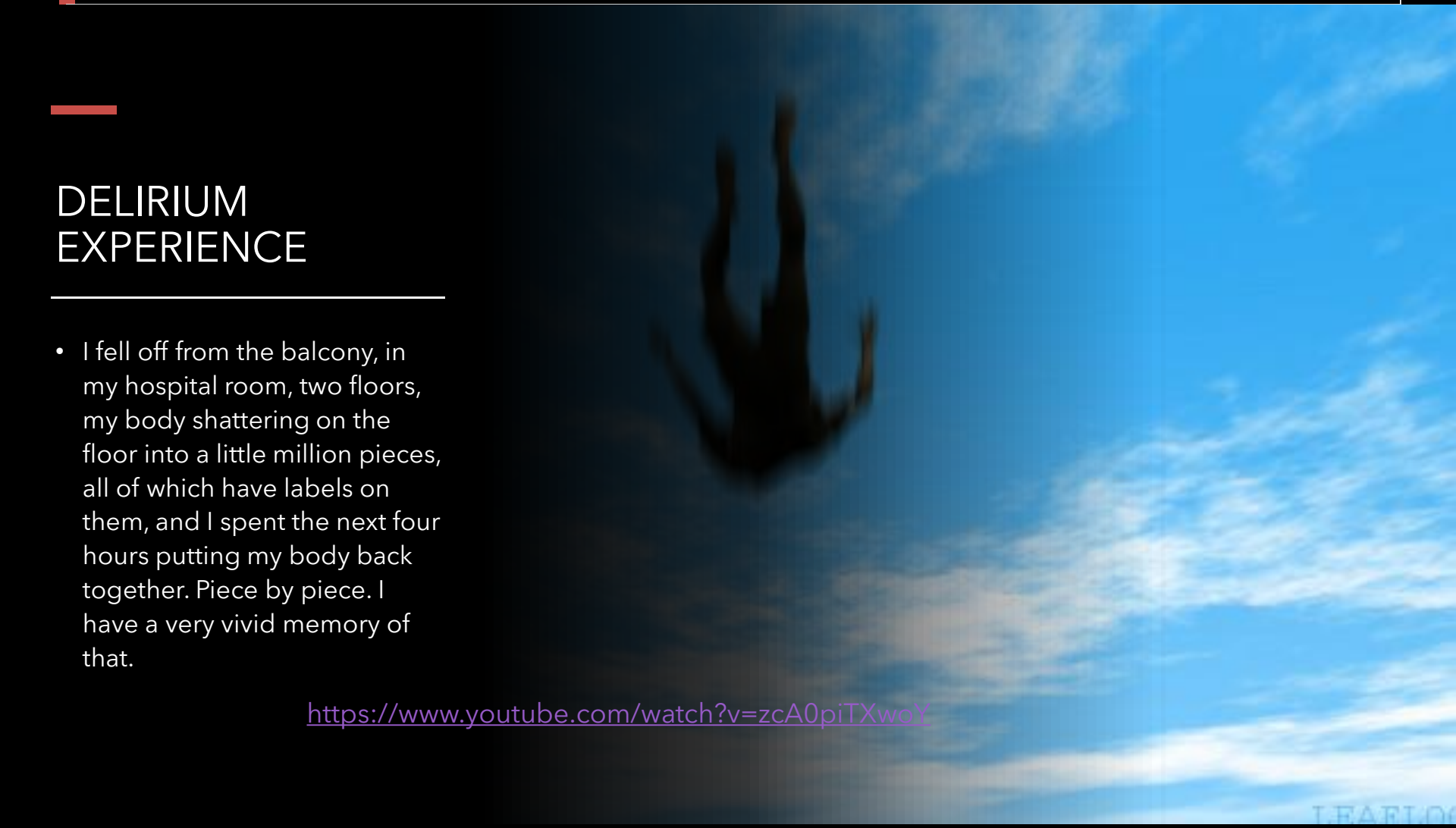
DELIRIUM EXPERIENCE

- Paul Wischmeyer, MD
- University of Duke
- Perioperative Physician

DELIRIUM EXPERIENCE

- I fell off from the balcony, in my hospital room, two floors, my body shattering on the floor into a little million pieces, all of which have labels on them, and I spent the next four hours putting my body back together. Piece by piece. I have a very vivid memory of that.

https://www.youtube.com/watch?v=zcA0piTXwoY



DEFINITION – DSM V

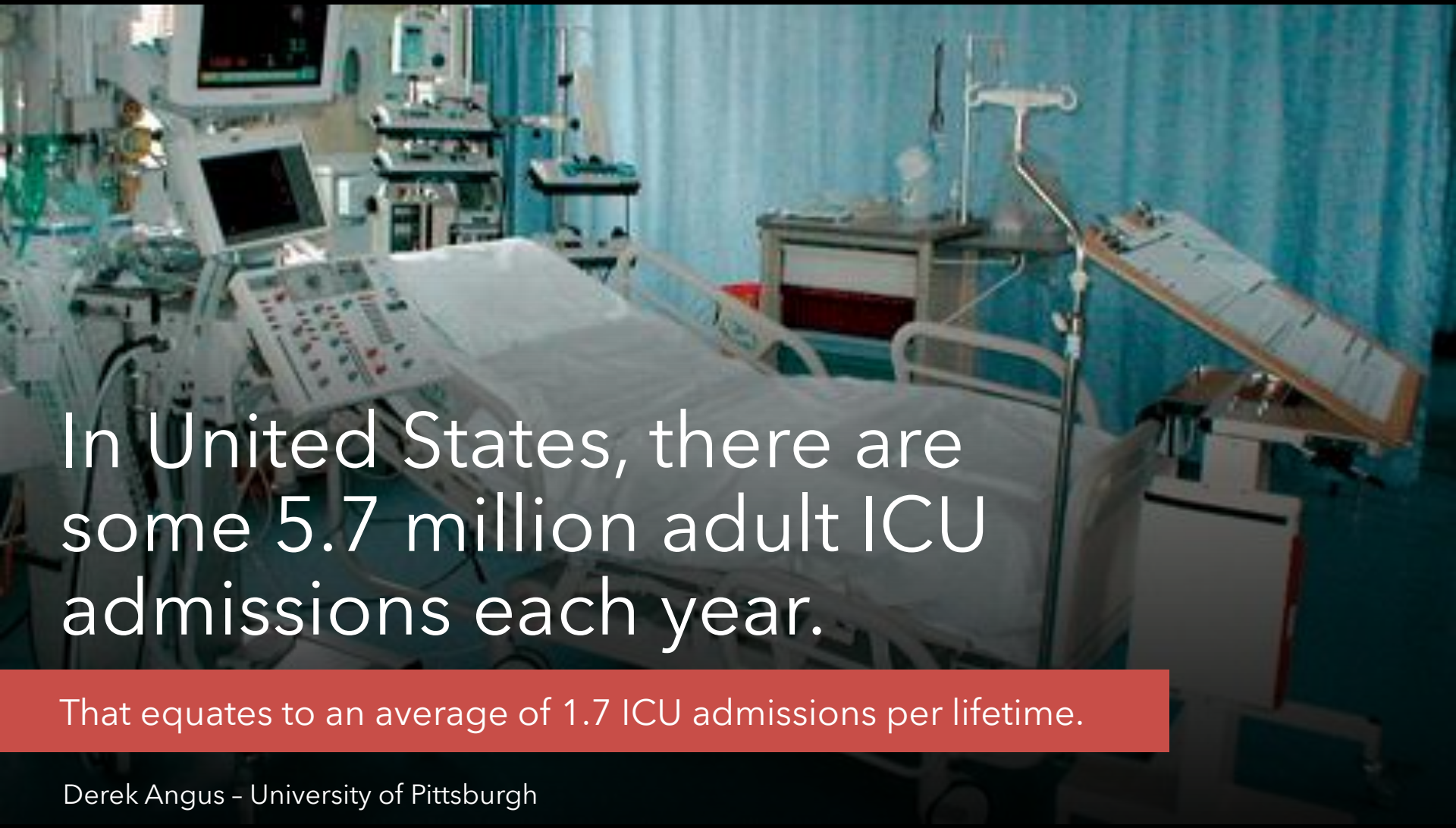
- Consciousness disturbances → Attention and Awareness Disturbances
- Inattention → Any disturbance of arousal that leaves the patient unable to perform cognitive tests, besides coma

DEFINITION – DSM V

Disturbances in attention and awareness

Development over a short time and fluctuation in severity

An additional disturbance in cognition, e.g. a memory deficit or language impairment



In United States, there are some 5.7 million adult ICU admissions each year.

That equates to an average of 1.7 ICU admissions per lifetime.

Derek Angus – University of Pittsburgh

DELIRIUM INCIDENCE

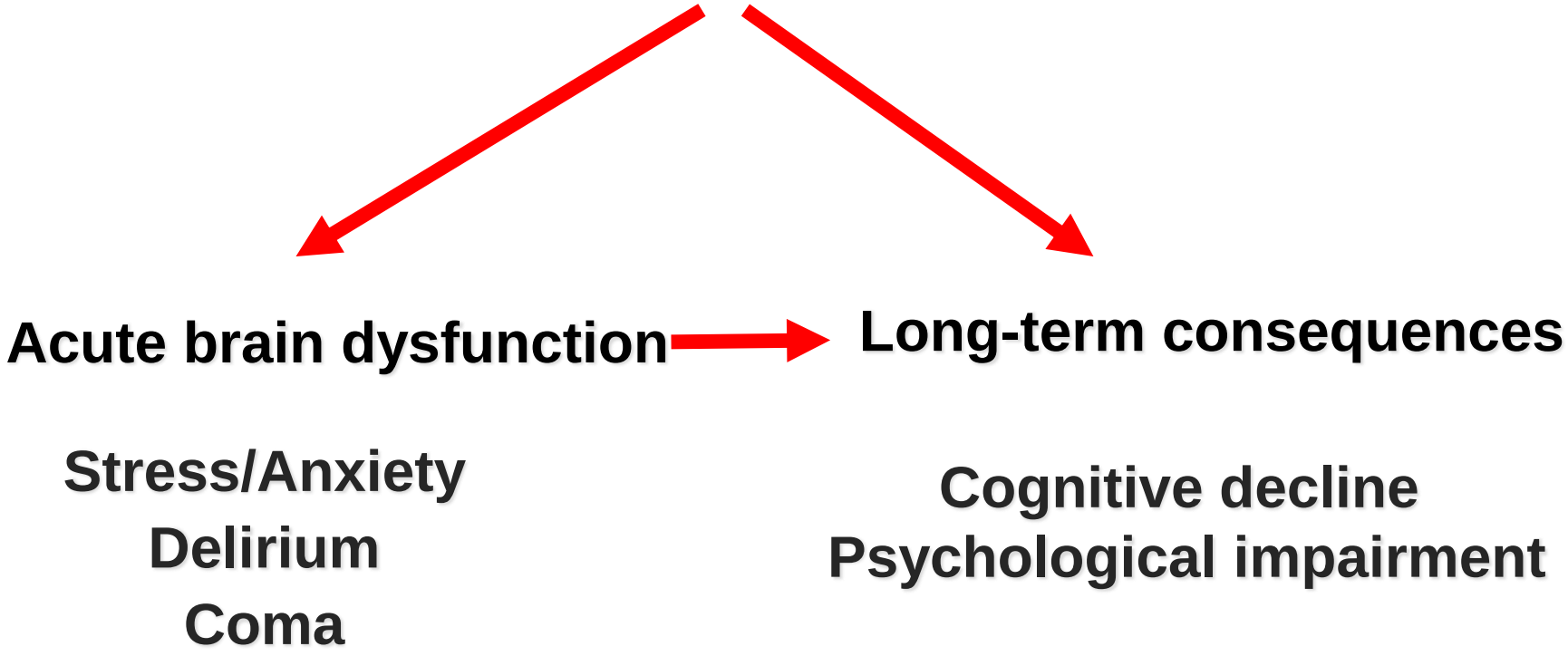
20%

Non-intubated Patients in Critical Care

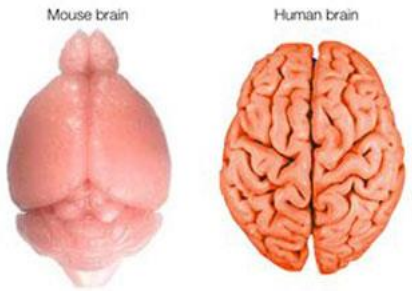
87%

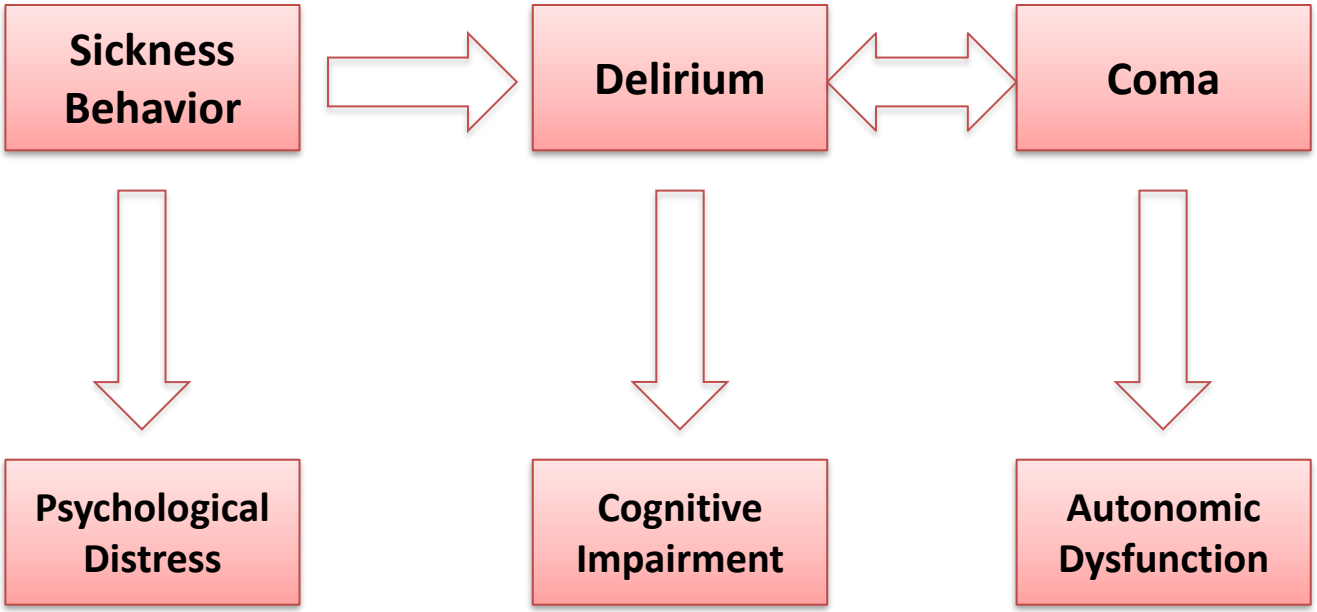
Elderly, mechanically ventilated patients

Neuropsychological consequences of **SEPSIS**



Brain Response to Systemic Inflammation





CONSEQUÊNCIAS DELIRIUM

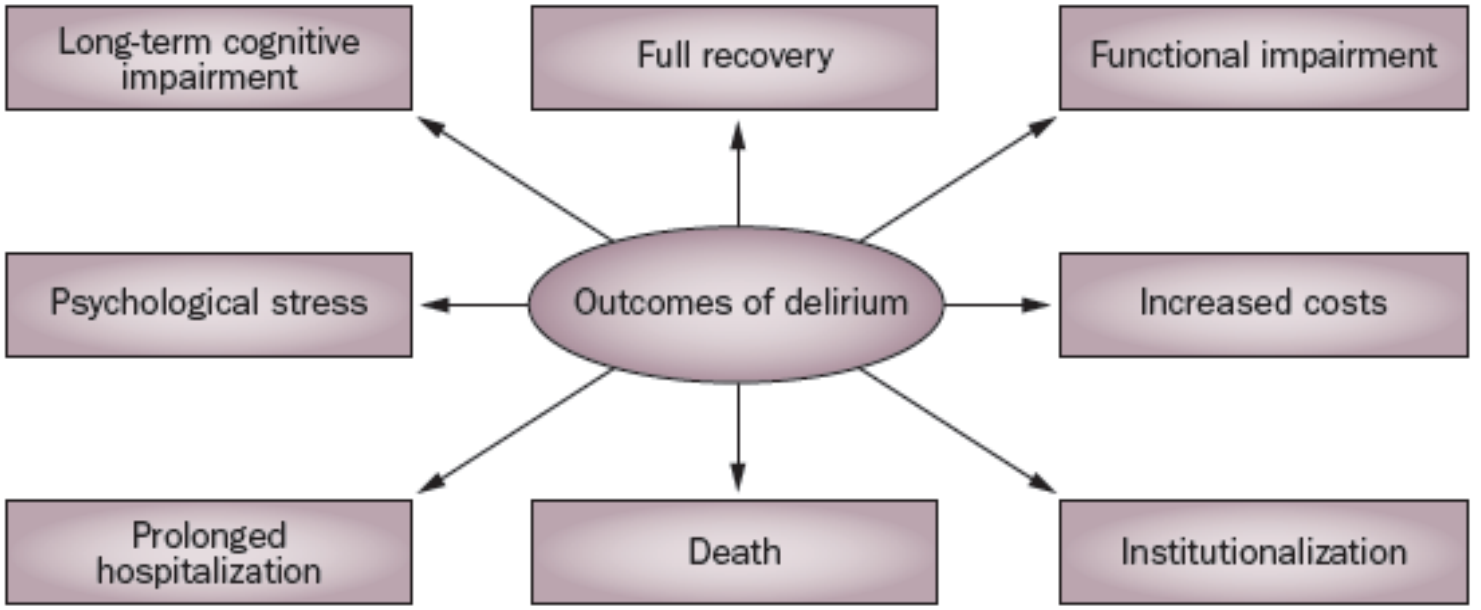
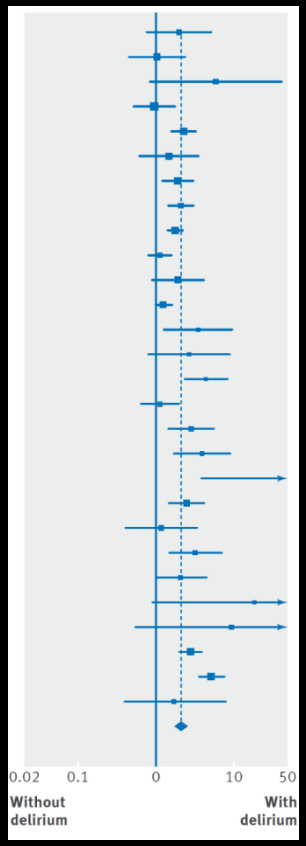


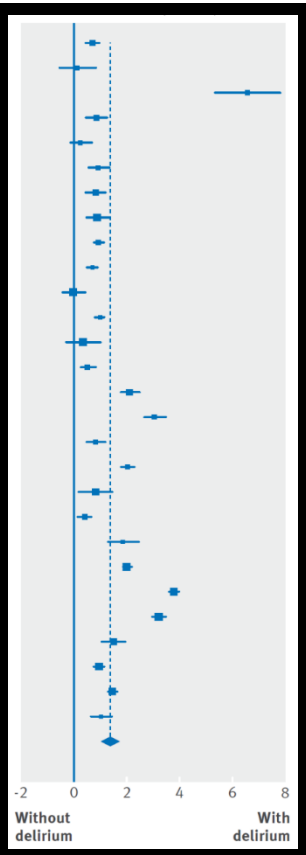
Figure 2 | Outcomes of delirium.

Fong TG, et al. Nat Rev Neurol.

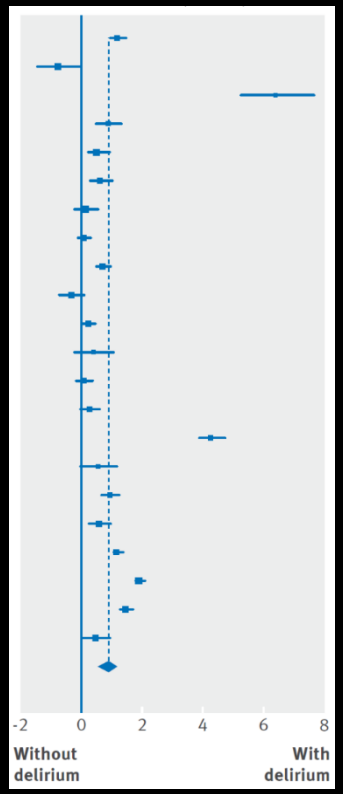
Outcome of delirium in critically ill patients: systematic review and meta-analysis



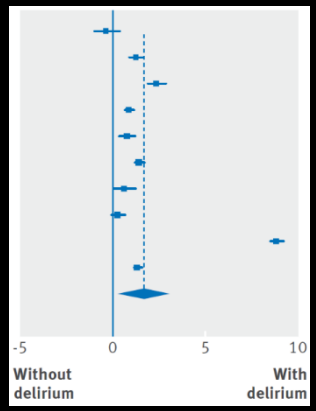
Mortality



ICU LOS



Hospital LOS



MV duration

Salluh J et al. BMJ 2015; 350:h2538

Delirium as a Predictor of Mortality in Mechanically Ventilated Patients in the Intensive Care Unit

E. Wesley Ely; Ayumi Shintani; Brenda Truman; et al.

JAMA. 2004;291(14):1753-1762 (doi:10.1001/jama.291.14.1753)

http://jama.ama-assn.org/cgi/content/full/291/14/1753

Figure 3. Kaplan-Meier Analysis of Delirium in the Intensive Care Unit and 6-Month Survival

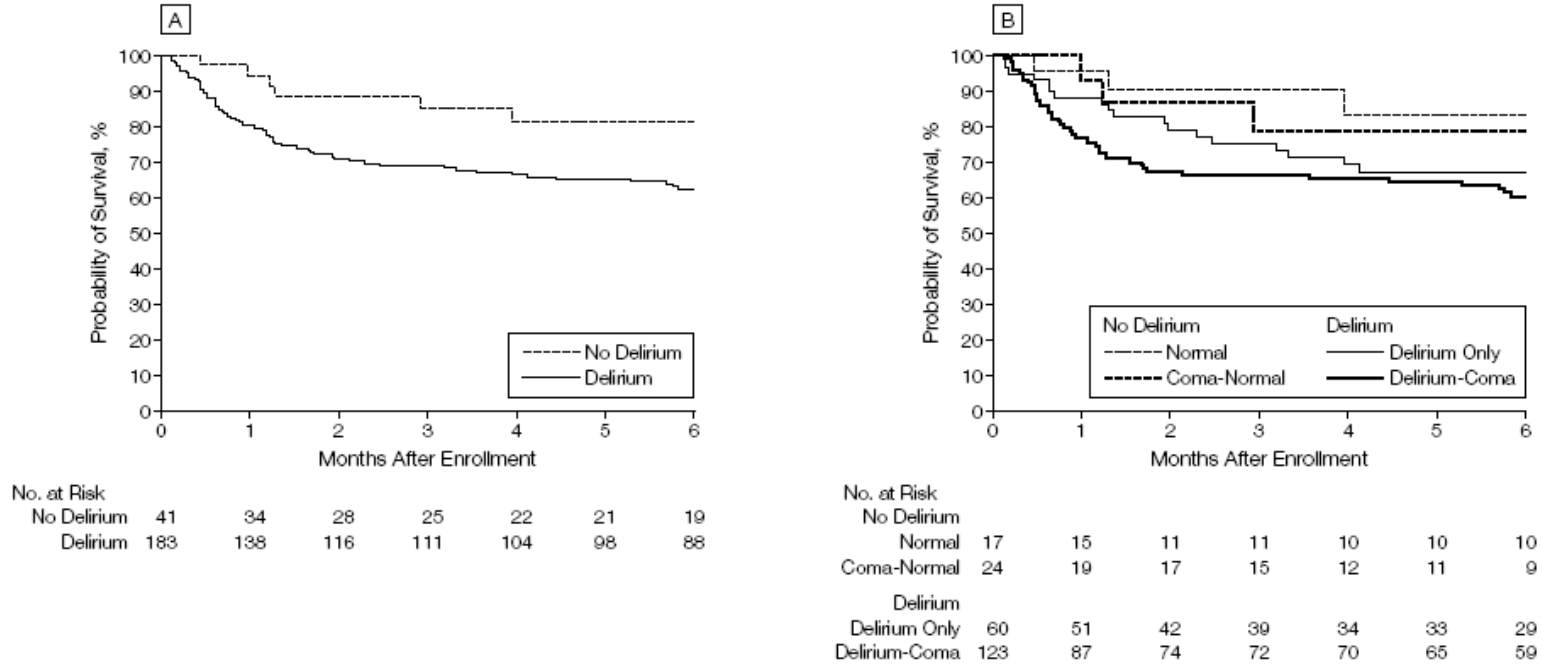
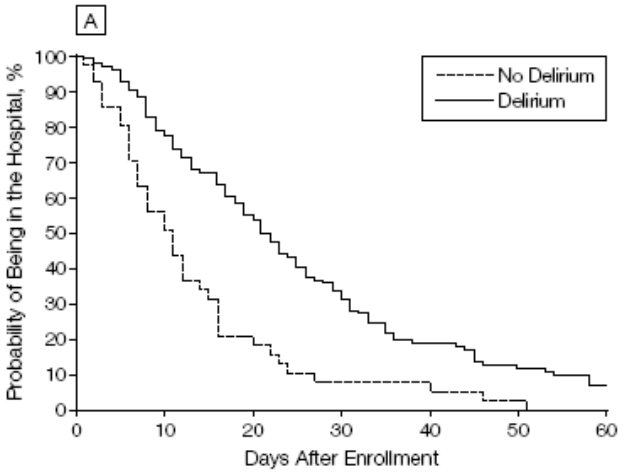
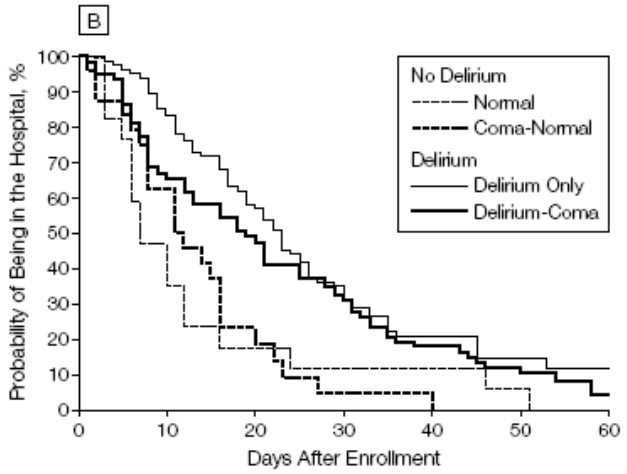


Figure 4. Kaplan-Meier Analysis of Delirium in the Intensive Care Unit and Hospital Length of Stay



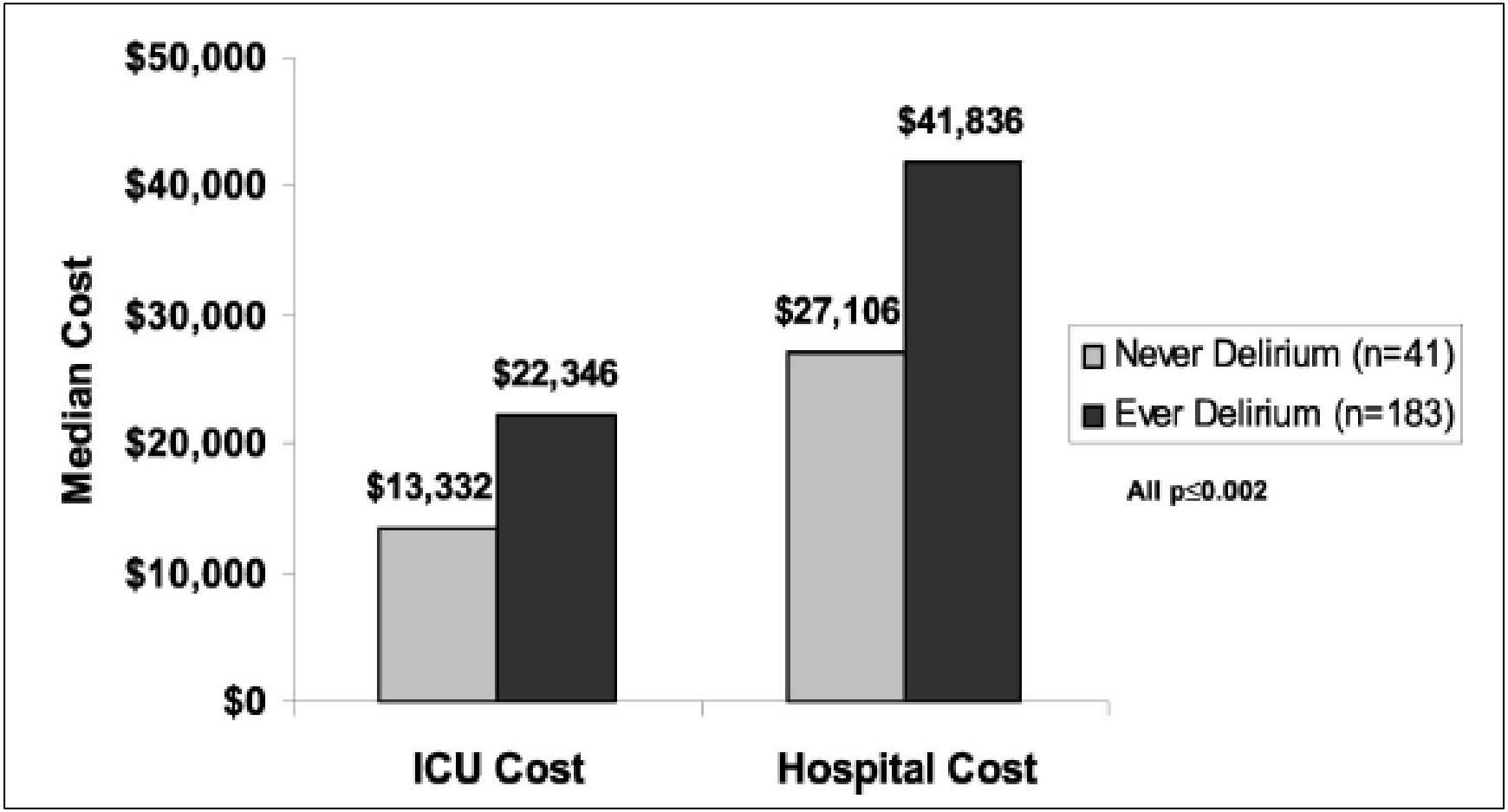
No. at Risk							
No Delirium	41	23	8	3	3	1	0
Delirium	183	137	82	43	20	13	4



No. at Risk							
No Delirium							
Normal	17	8	3	2	2	1	0
Coma-Normal	24	15	5	1	1	0	0
Delirium							
Delirium Only	60	38	25	17	8	5	2
Delirium-Coma	123	99	57	26	12	8	2

Costs associated with delirium in mechanically ventilated patients*

Eric B. Milbrandt, MD, MPH; Stephen Deppen, MA, MS; Patricia L. Harrison, MPH;
Ayumi K. Shintani, PhD, MPH; Theodore Speroff, PhD; Renée A. Stiles, PhD; Brenda Truman, RN, MSN;
Gordon R. Bernard, MD; Robert S. Dittus, MD, MPH; E. Wesley Ely, MD, MPH



Crit Care Med 2004

Intensive Care Med (2001) 27: 1297–1304
DOI 10.1007/s001340101017

ORIGINAL

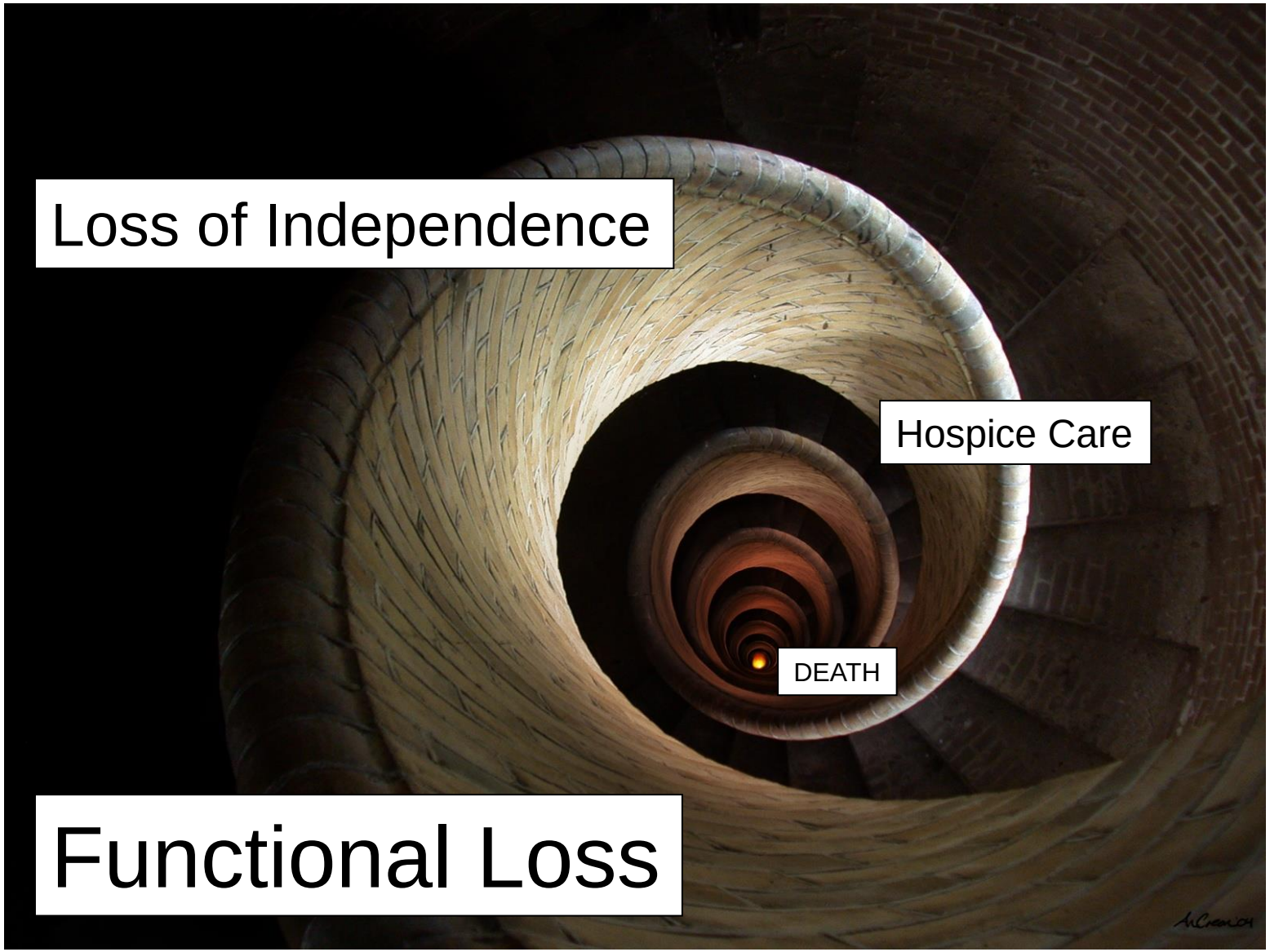
Marc-Jacques Dubois
Nicolas Bergeron
Marc Dumont
Sandra Dial
Yoanna Skrobik

Delirium in an intensive care unit: a study of risk factors

Table 4 Morbidity and mortality associated with the development of delirium (numbers in parenthesis represent percentage)

Event[a]	Delirious patients	Non-delirious patients	*p* value
Self-extubation	4 (10)	4 (2.3)	0.02
Removal of catheters	8 (20)	10 (5.7)	0.003
Mortality	6 (15)	24 (13.6)	0.82
Length of stay (days)	9.3 ± 12	7 ± 7.9	0.14

[a] Self-extubation, removal of catheters and mortality were calculated on 216 patients; length of stay was calculated on 209 patients


Loss of Independence
Hospice Care
DEATH
Functional Loss

Improvement

In Short Term Outcomes of Critically Ill (eg. Sepsis, MV)

- Yende & Angus et al, Curr Infect Dis Rep. 2007 Sep;9(5):382-6..
- Esteban et al,Am J Respir Crit Care Med. 2008

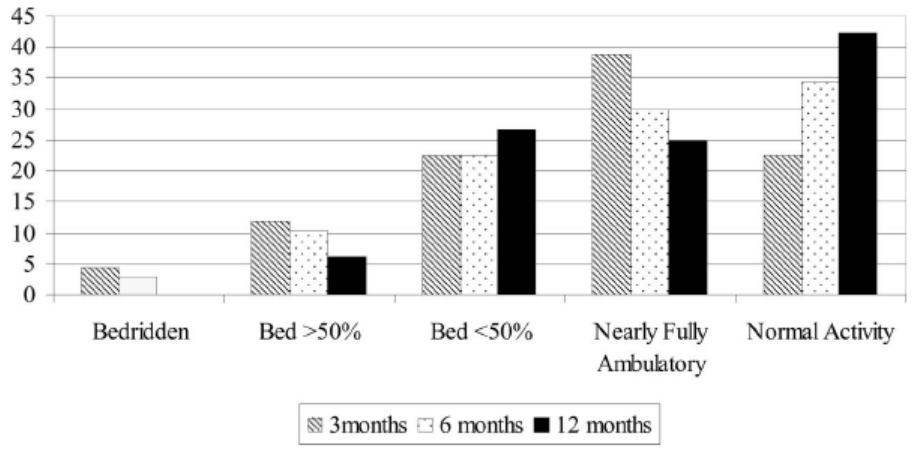
Need for changes in endpoints (eg.90-day, hosp. mortality; 6 and 12mo outcomes)

- Rubenfeld et al Am J Respir Crit Care Med. 1999 Jul;160(1):358-67.
- Reade & Angus, Crit Care Med. 2009 Jan;37(1 Suppl):S1-9.

New studies generated a "Picture of Survivors" with the evaluation of several domains (eg- Organ function recovery; QOL, social/employment insertion)

- Herridge et al, N Engl J Med. 2003 Feb 20;348(8):683-93.
- Azoulay et al, Chest. 2008 Feb;133(2):339-41.

Survivors of acute respiratory distress syndrome: Relationship between pulmonary dysfunction and long-term health-related quality of life*

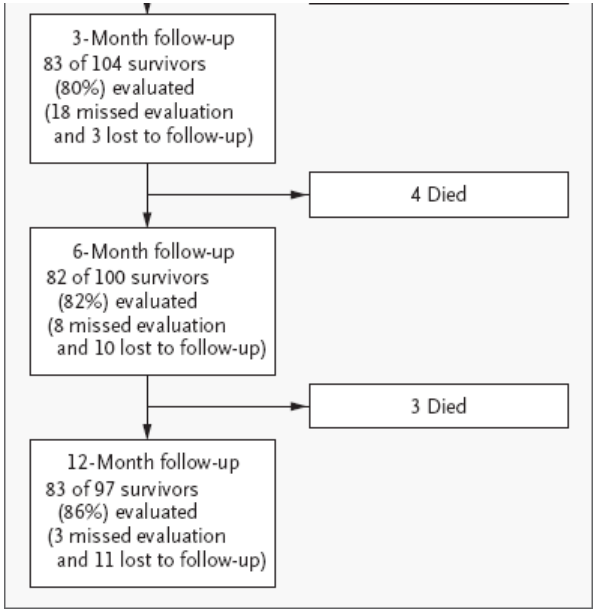


Heyland et al, Crit Care Med 2005; 33:1549 – 1556

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 FEBRUARY 20, 2003 VOL. 348 NO. 8

One-Year Outcomes in Survivors of the Acute Respiratory Distress Syndrome



Herridge et al, NEJM,(2003)

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 FEBRUARY 20, 2003 VOL. 348 NO. 8

One-Year Outcomes in Survivors of the Acute Respiratory Distress Syndrome

Outcome	3 Months	6 Months	12 Months
Distance walked in 6 min			
No. evaluated	80*	78†	81‡
Median — m	281	396	422
Interquartile range — m	55–454	244–500	277–510
Percentage of predicted value§	49	64	66
Returned to work — no./total no. (%)¶	13/83 (16)	26/82 (32)	40/82 (49)‖
Returned to original work — no./total no. (%)	10/13 (77)	23/26 (88)	31/40 (78)

Despite improvements in lung function less than 50% returned to work

Herridge et al, NEJM,(2003)

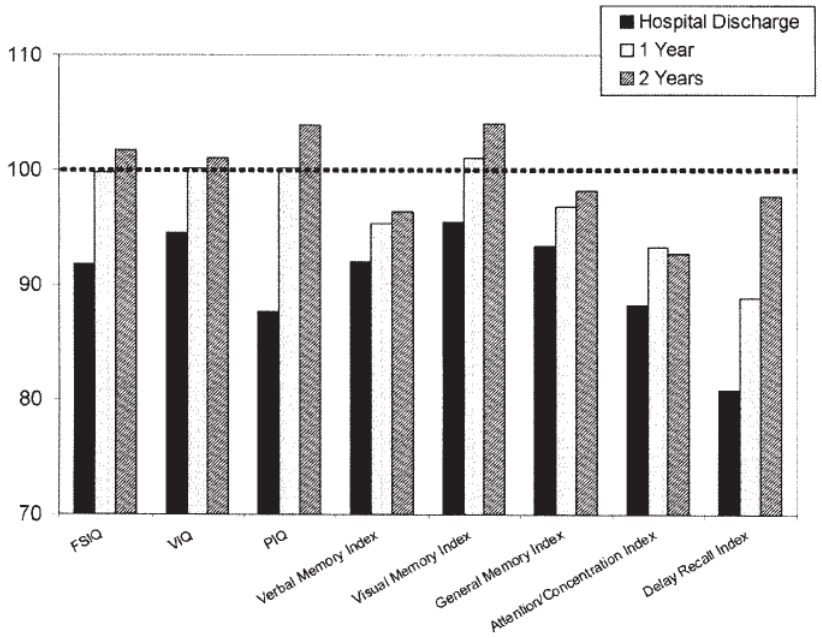
Survivors of acute respiratory distress syndrome: Relationship between pulmonary dysfunction and long-term health-related quality of life*

Survivors of ARDS have considerable respiratory symptoms and reduced HRQOL that is still prevalent at 12 months following onset of injury.

There are correlations between lung spirometry, pulmonary symptoms, and overall HRQOL.

Heyland et al, Crit Care Med 2005; 33:1549 – 1556

Two-Year Cognitive, Emotional, and Quality-of-Life Outcomes in Acute Respiratory Distress Syndrome



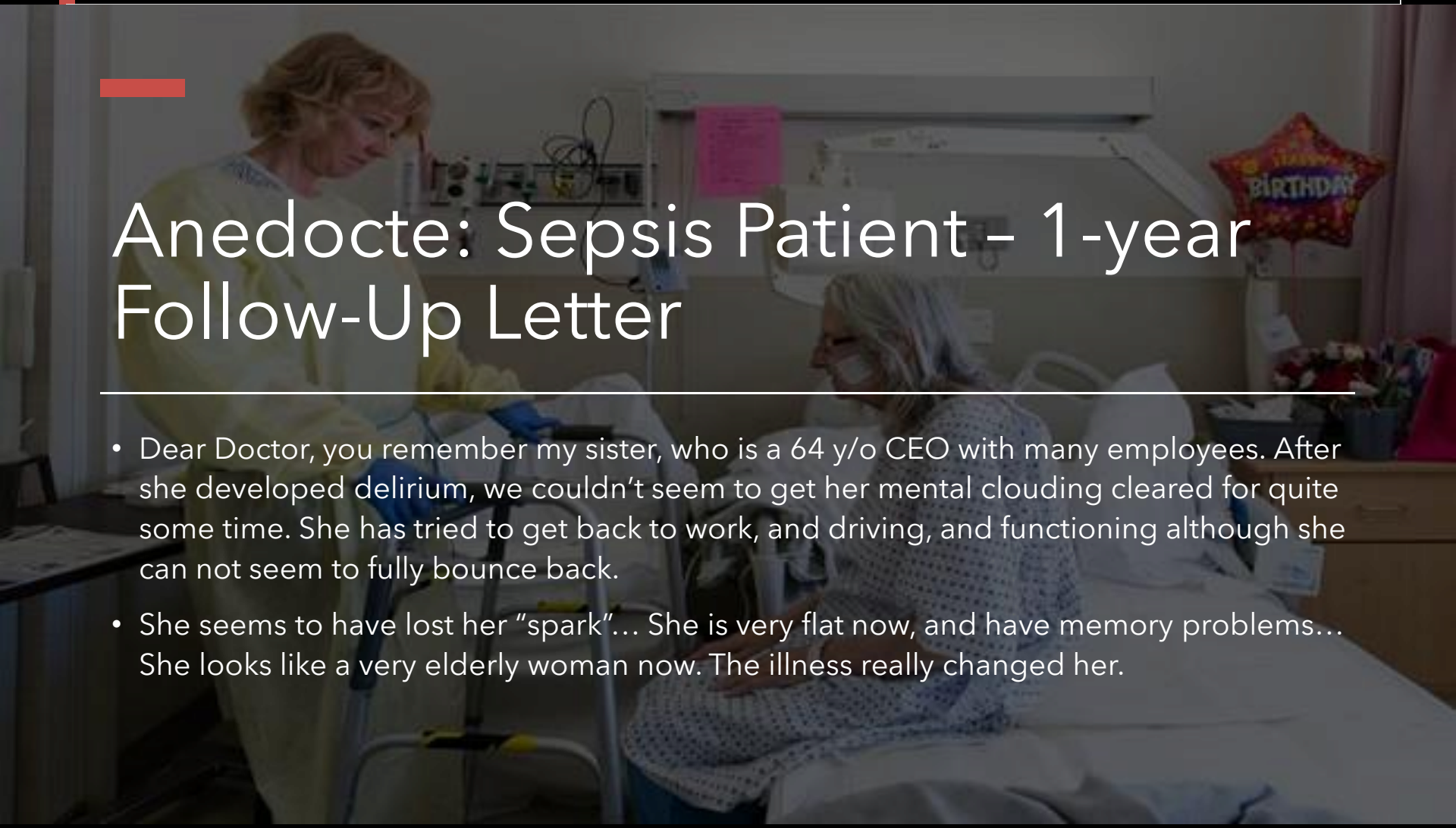
Significant impairment in neurocognitive tests, visual and verbal memory, concentration and attention at 1 year

Hopkins et al, AJRCCM (2005)171

Anedocte Sepsis Patient

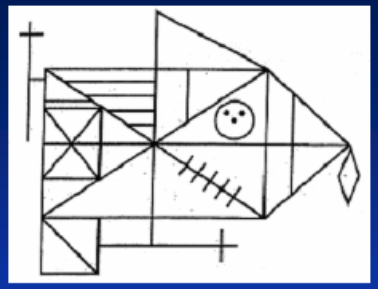
- 64y/o executive
- Previously Healthy
- Pneumonia and Sepsis
- On ventilator for 10 days
- Dense ICU delirium
- Lung, heart, kidneys recovered without complications
- Head CT and MRI normal, neuro exam non-focal
- Debilitating Executive Dysfunction Syndrome

Wesley Ely.



Anedocte: Sepsis Patient – 1-year Follow-Up Letter

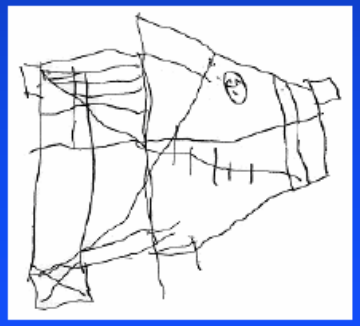
- Dear Doctor, you remember my sister, who is a 64 y/o CEO with many employees. After she developed delirium, we couldn't seem to get her mental clouding cleared for quite some time. She has tried to get back to work, and driving, and functioning although she can not seem to fully bounce back.
- She seems to have lost her "spark"… She is very flat now, and have memory problems… She looks like a very elderly woman now. The illness really changed her.



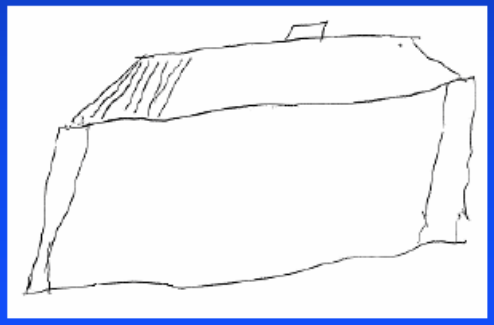
The REY-O Copy Test

In ambulatory patient with no motor deficits or stroke

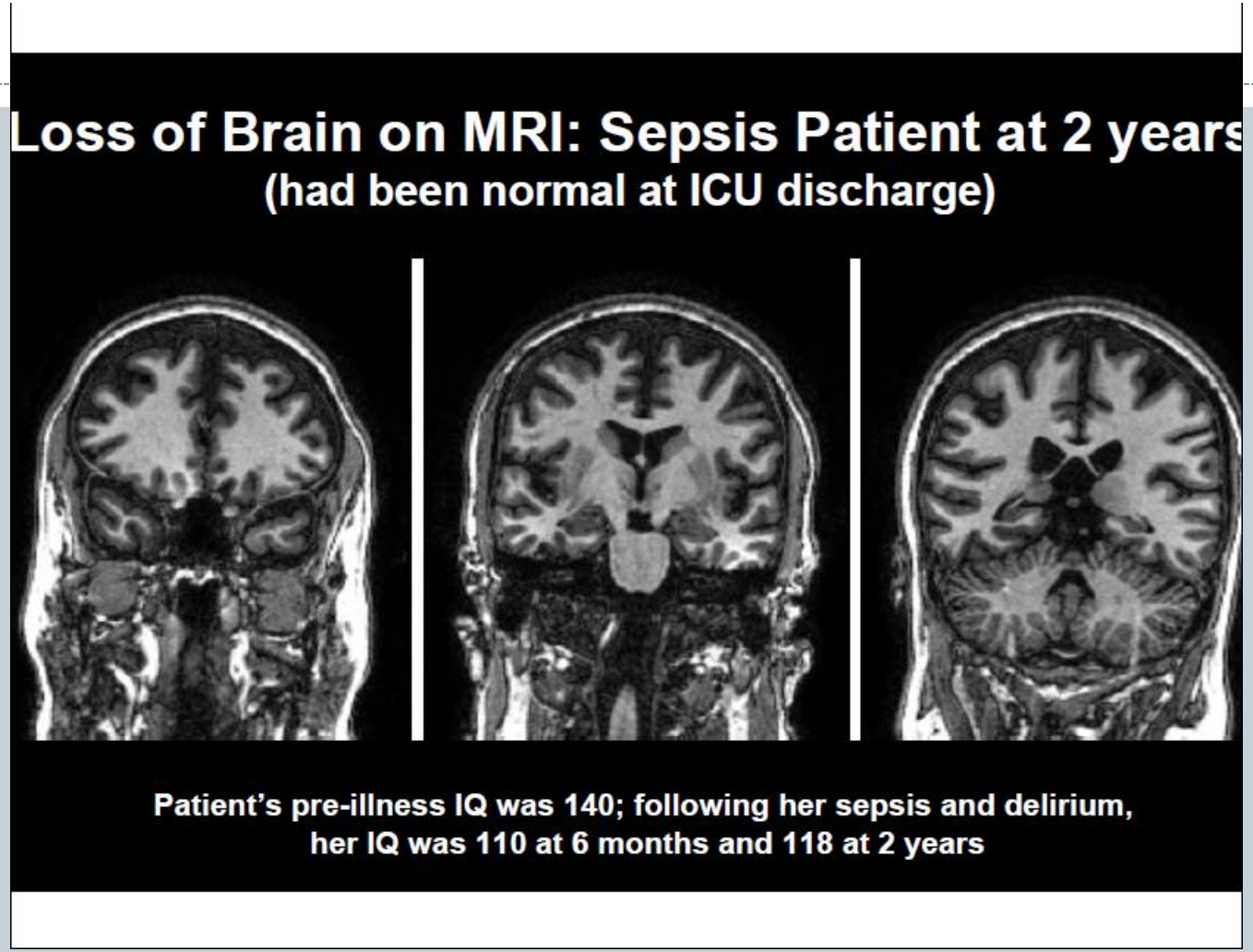
Immediate Copy



30 min later…



Wesley Ely


Loss of Brain on MRI: Sepsis Patient at 2 years
(had been normal at ICU discharge)
Patient's pre-illness IQ was 140; following her sepsis and delirium,
her IQ was 110 at 6 months and 118 at 2 years

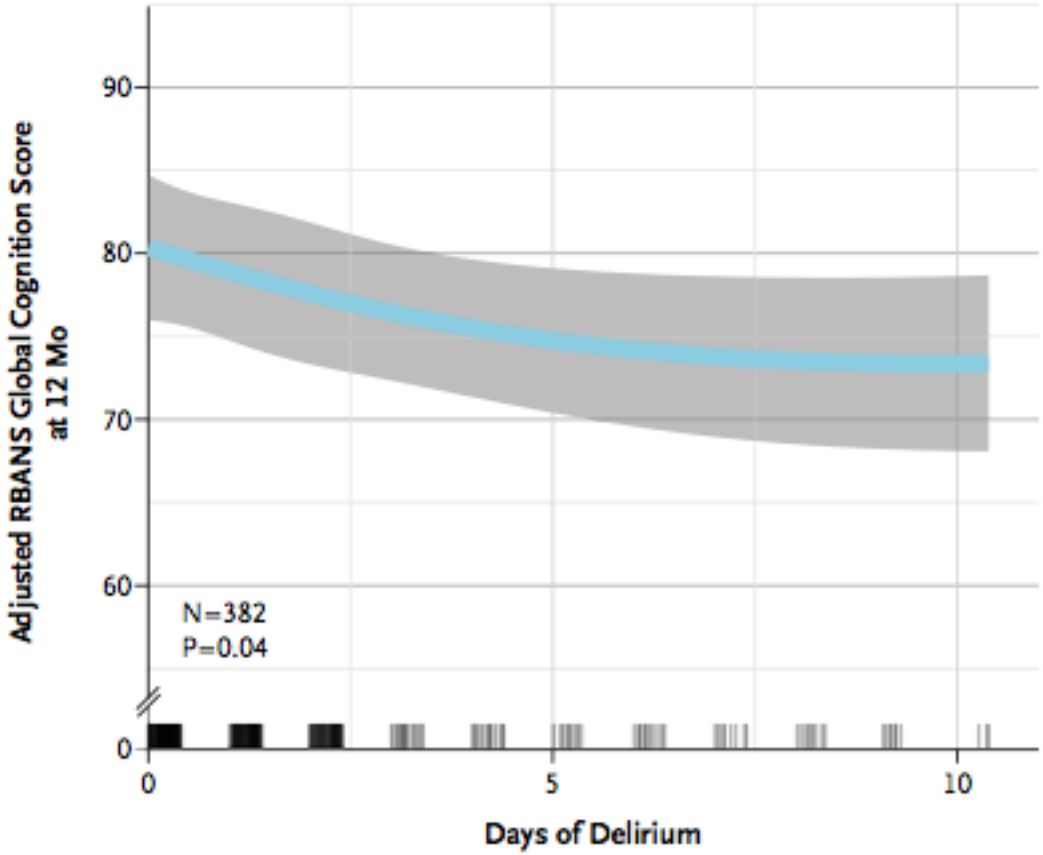
Wesley Ely

Long term cognitive impairment after critical illness

- **Association Between Acute Care and Critical Illness Hospitalization and Cognitive Function in Older Adults - Ehlenbach, W. J. et al. JAMA 2010;303:763-770**
  - 2.3x likelihood of cognitive decline after critical illness hospitalization compared with those who had no hospitalization

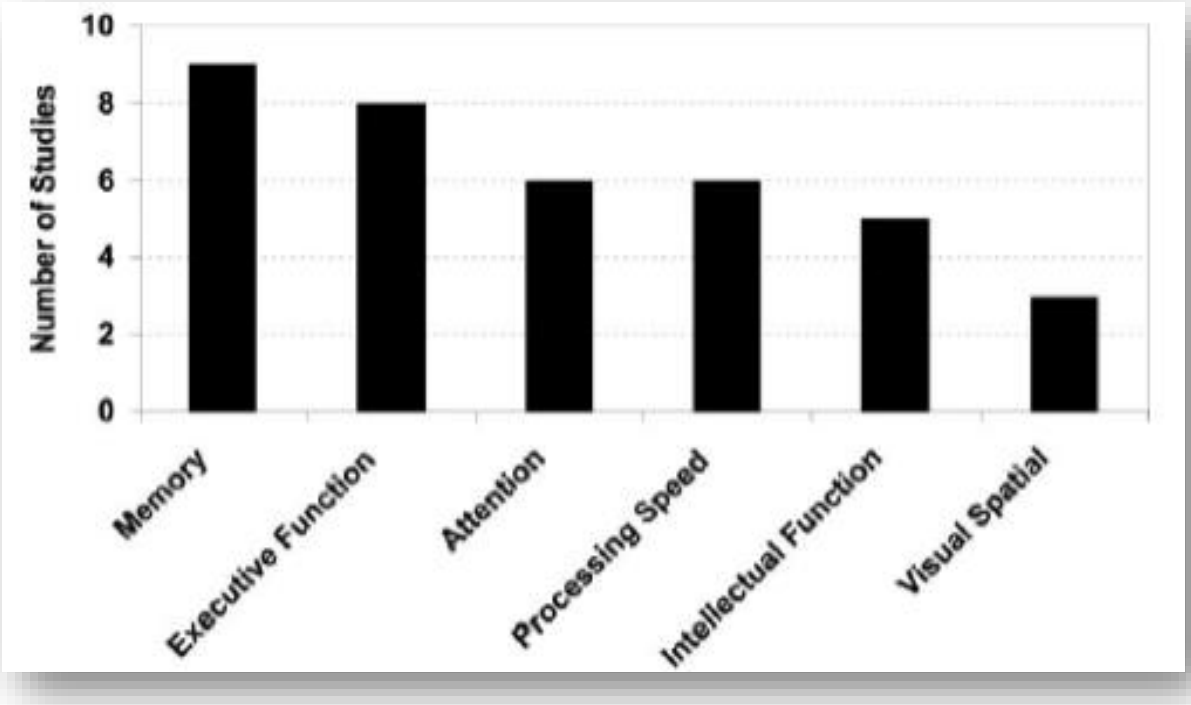
- **Long-term cognitive impairment and functional disability among survivors of severe sepsis. Iwashyna, TJ et al. JAMA. 2010;304(16):1787-1794**
  - Severe sepsis in this older population was independently associated with substantial and persistent new cognitive impairment and functional disability among survivors.

The duration of acute brain dysfunction in ICU survivors is associated with 12-Mo cognitive function



N Engl J Med 2013;369:1306-16.

Prevalence of neurocognitive effects



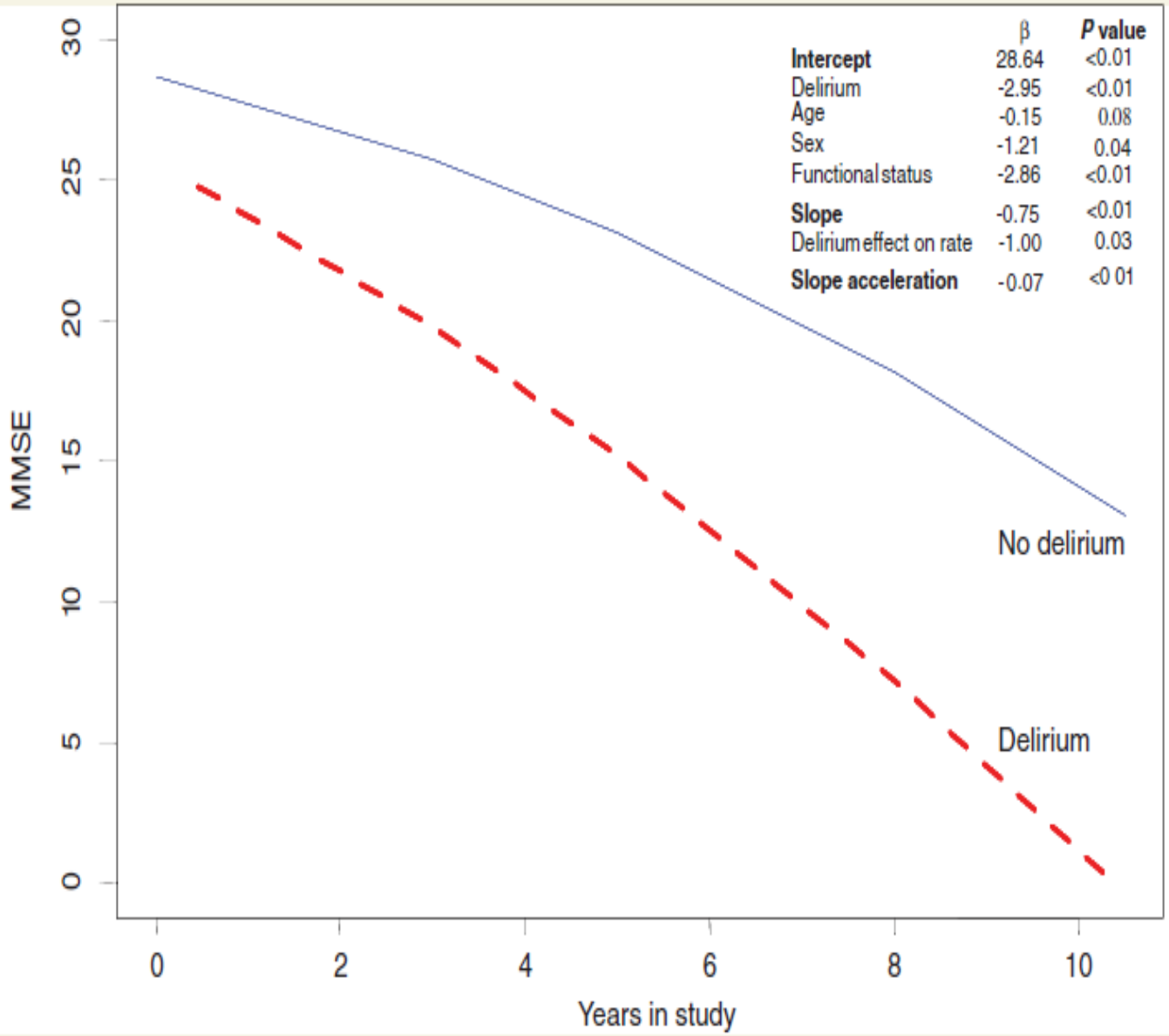
Hopkins et al, CHEST 2006

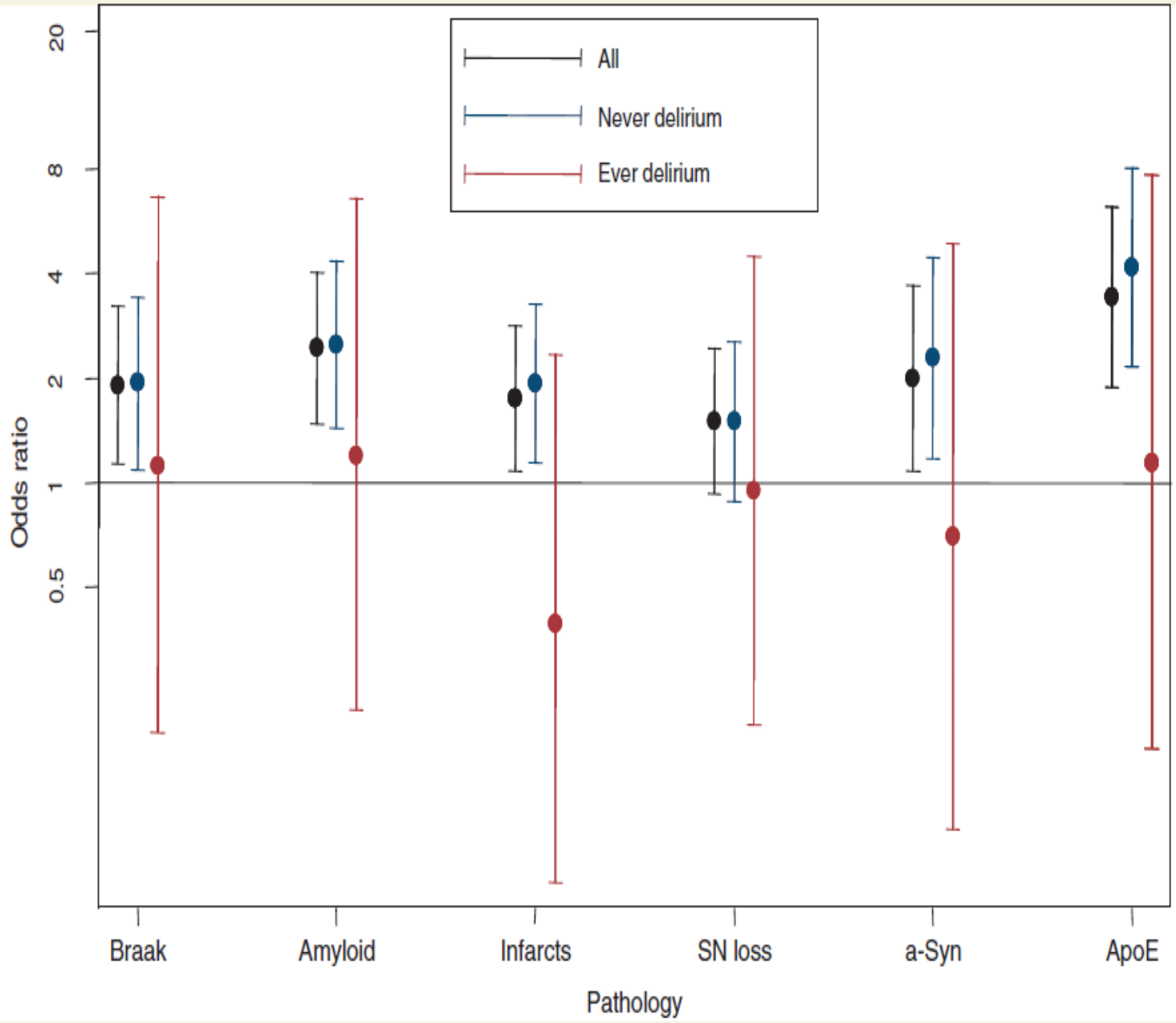
Delirium is a strong risk factor for dementia in the oldest-old: a population-based cohort study

Daniel H. J. Davis,[1,2] Graciela Muniz Terrera,[3] Hannah Keage,[1,4] Terhi Rahkonen,[5] Minna Oinas,[6,7] Fiona E. Matthews,[3] Colm Cunningham,[8] Tuomo Polvikoski,[9] Raimo Sulkava,[10] Alasdair M. J. MacLullich[2,11] and Carol Brayne[2]

Brain 2012: 135; 2809–2816

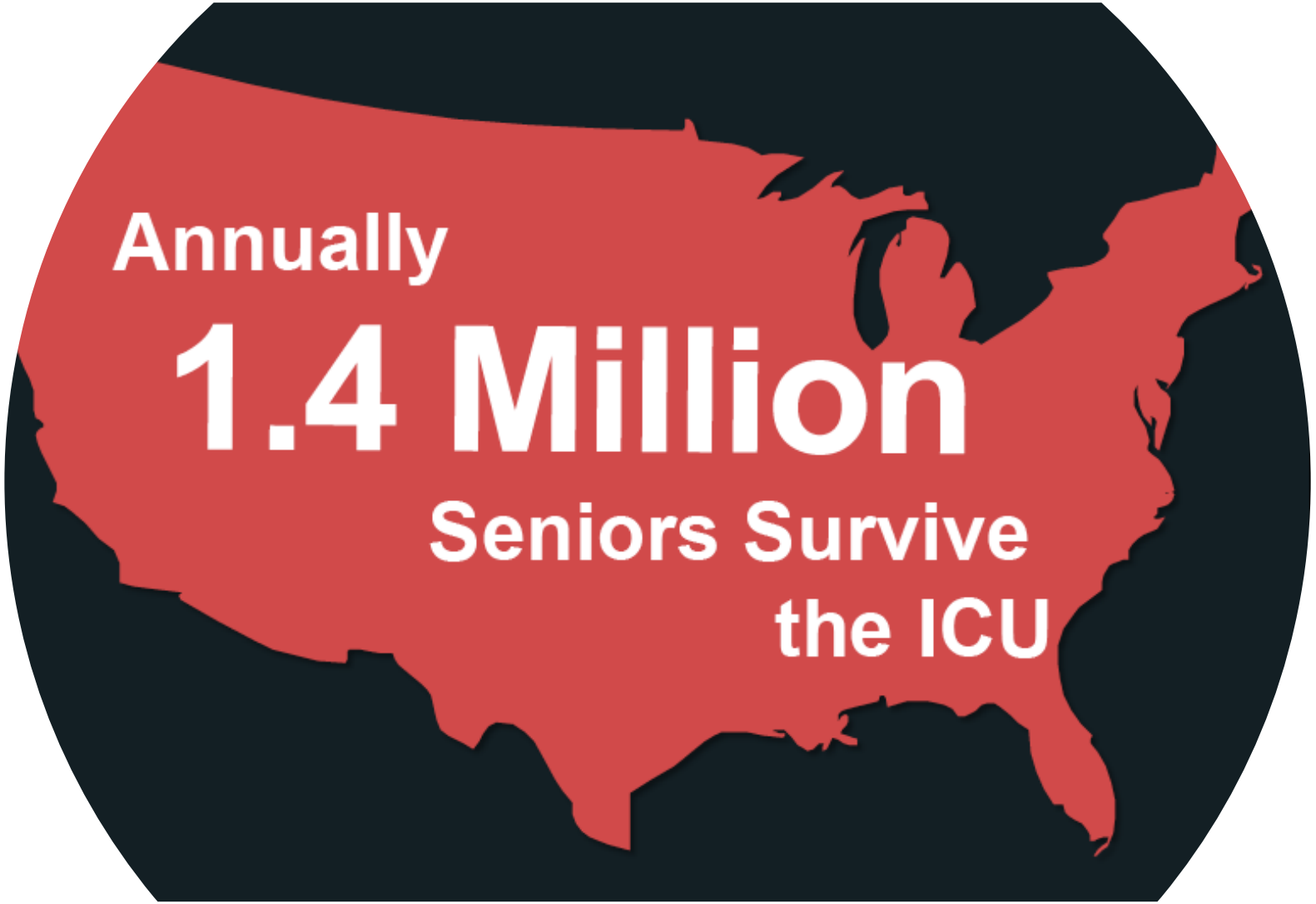
BRAIN
A JOURNAL OF NEUROLOGY


β
P value
Intercept 28.64 <0.01
Delirium -2.95 <0.01
Age -0.15 0.08
Sex -1.21 0.04
Functional status -2.86 <0.01
Slope -0.75 <0.01
Delirium effect on rate -1.00 0.03
Slope acceleration -0.07 <0 01
No delirium
Delirium
MMSE
0
5
10
15
20
25
30
0
2
4
6
8
10
Years in study


All
Never delirium
Ever delirium
Odds ratio
20
8
4
2
1
0.5
Braak
Amyloid
Infarcts
SN loss
a-Syn
ApoE
Pathology

6 out of 10 ICU patients are ≥ 65

Angus *Crit Care Med* 2006; 34: 1016-1024
Angus *JAMA* 2000; 284: 2762-2770
Society of Critical Care Medicine, Critical Care Statistics in the United States, 2012

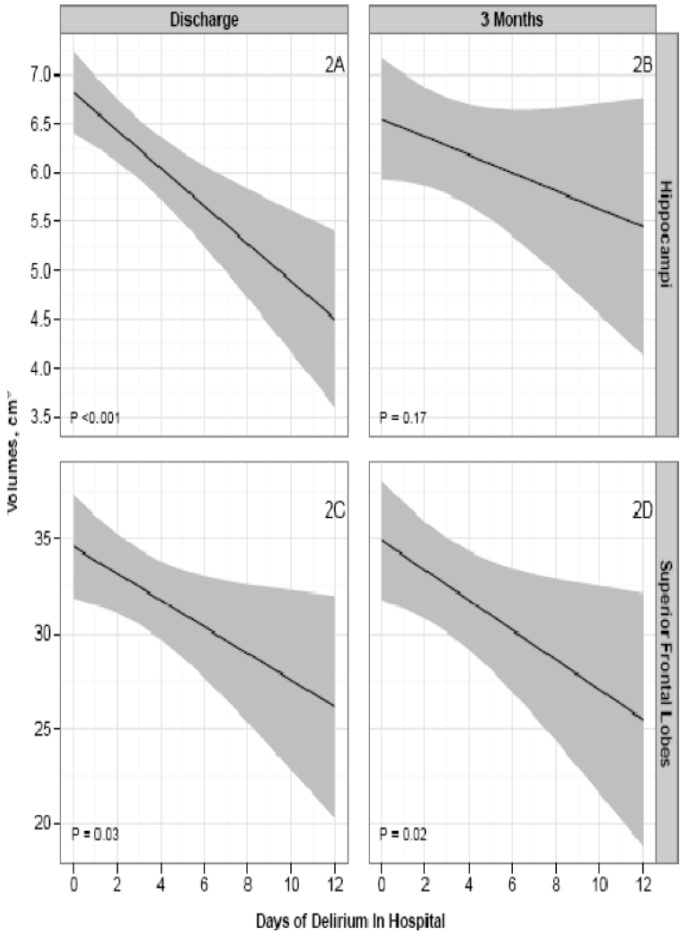

Annually
1.4 Million
Seniors Survive
the ICU

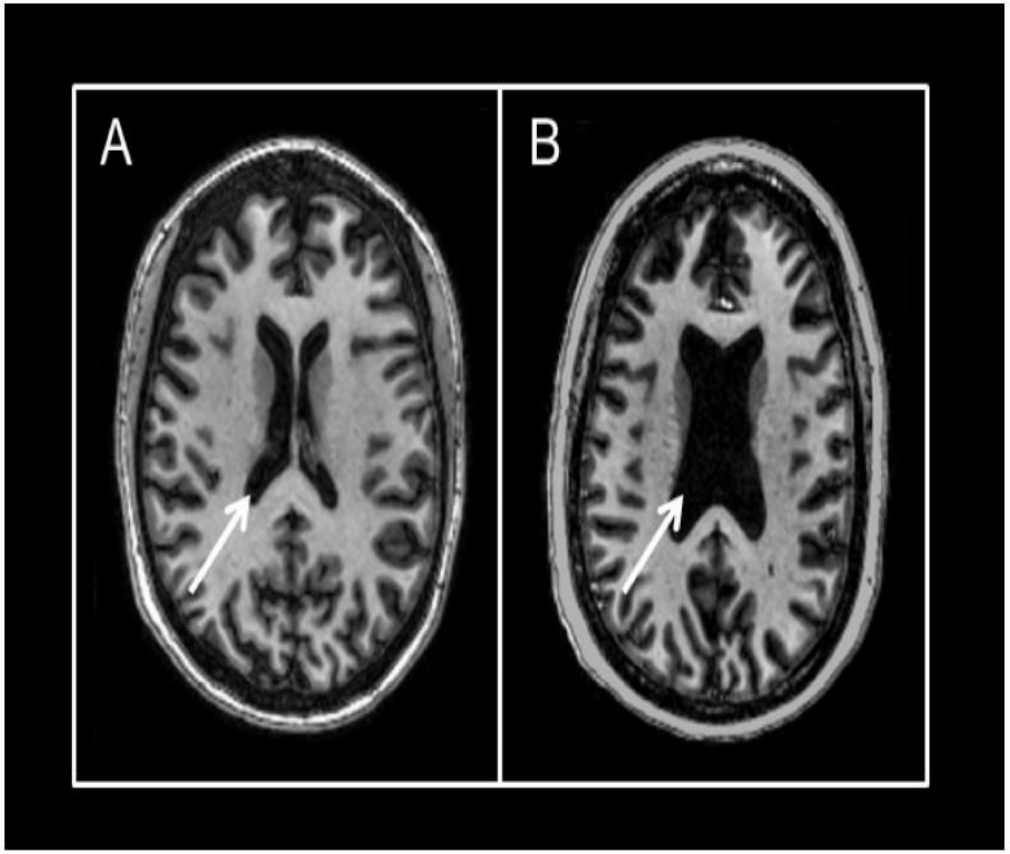

50-70%
Cognitively
Impaired


60-80%
Functionally
Impaired
vijk via Flickr

The Association between Brain Volumes, Delirium Duration and Cognitive Outcomes in Intensive Care Unit Survivors: A Prospective Exploratory Cohort Magnetic Resonance Imaging Study

Max L. Gunther, PHD[1,2,3,4,5], Alessandro Morandi, MD, MPH[4,5,6], Erin Krauskopf, BS[7], Pratik Pandharipande, MD, MSCI[8,9], Timothy D. Girard, MD, MSCI[4,5,6,10], James C. Jackson, PSYD[1,4,5,10], Jennifer Thompson, MPH[11], Ayumi K. Shintani, PHD[11], Sunil Geevarghese, MD, MSCI[12], Russell R Miller III, MD, MPH[13], Angelo Canonico, MD[14], Kristen Merkle, BA[3], Christopher J. Cannistraci, MS[3], Baxter P. Rogers, PHD[2,3,16], J. Chris Gatenby, PHD[2,3,16], Stephan Heckers, MD, MSC[1,2], John C. Gore, PHD[2,3,16], Ramona O. Hopkins, PHD[7,13,15], E. Wesley Ely, MD, MPH[4,5,6,10], and for the VISIONS Investigation (VISualizing Icu SurvivOrs Neuroradiological Sequelae)

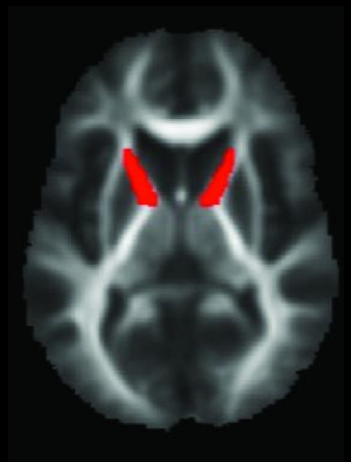

Discharge
3 Months
2A
2B
2C
2D
Hippocampi
Superior Frontal Lobes
P <0.001
P = 0.17
P = 0.03
P = 0.02
Volumes, cm³
Days of Delirium In Hospital


A
B

Published in final edited form as:
Crit Care Med. 2012 July ; 40(7): 2182–2189. doi:10.1097/CCM.0b013e318250acdc.

The Relationship between Delirium Duration, White Matter Integrity, and Cognitive Impairment in Intensive Care Unit Survivors as Determined by Diffusion Tensor Imaging

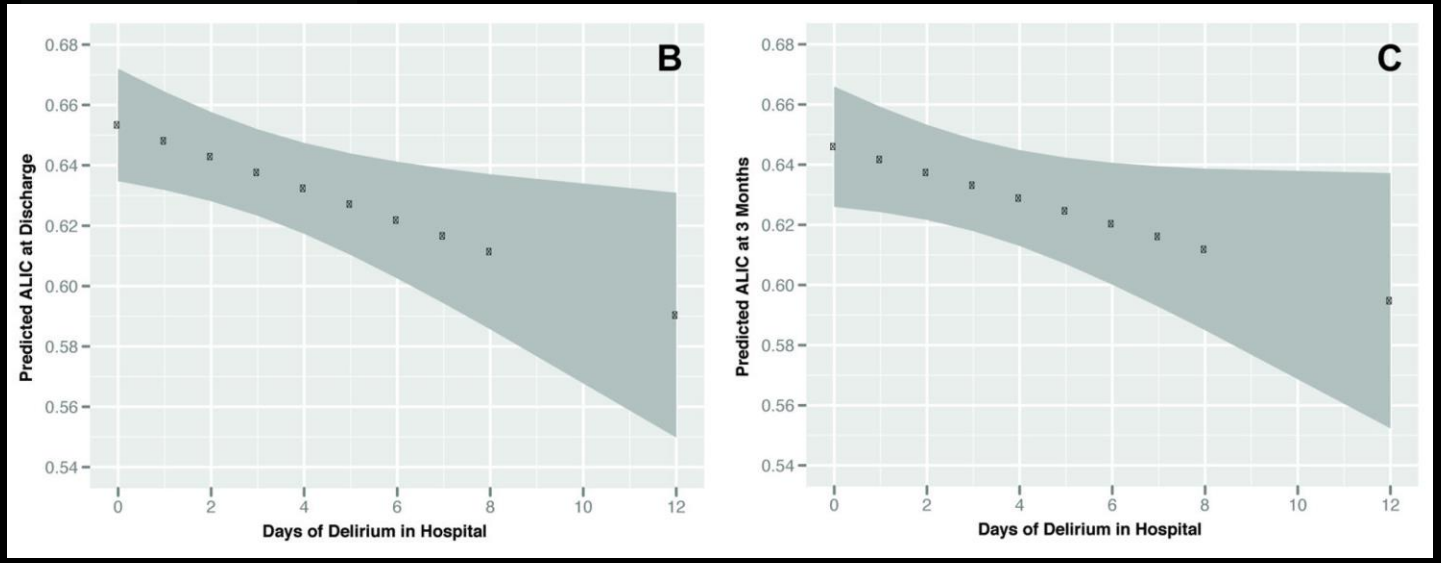
Alessandro Morandi, MD, MPH[1,2,3], Baxter P. Rogers, PhD[4,5,6], Max L. Gunther, PhD[4,5,7], Kristen Merkle, BA[5], Pratik Pandharipande, MD, MSCI[8,9], Timothy D. Girard, MD, MSCI[1,2,3,10], James C. Jackson, PSyD[2,4,7,10], Jennifer Thompson, MPH[11], Ayumi K. Shintani, PhD[11], Sunil Geevarghese, MD, MSCI[12], Russell R Miller III, MD, MPH[13], Angelo Canonico, MD[14], Christopher J. Cannistraci, MS[5], Gore John C., PhD[4,5,6], E. Wesley Ely, MD, MPH[1,2,3,10], and Ramona O. Hopkins, PhD[13,15] for the VISIONS Investigation (VISualizing Icu SurvivOrs Neuroradiological Sequelae)



White Matter Integrity and Delirium

Anterior limb of the internal capsule

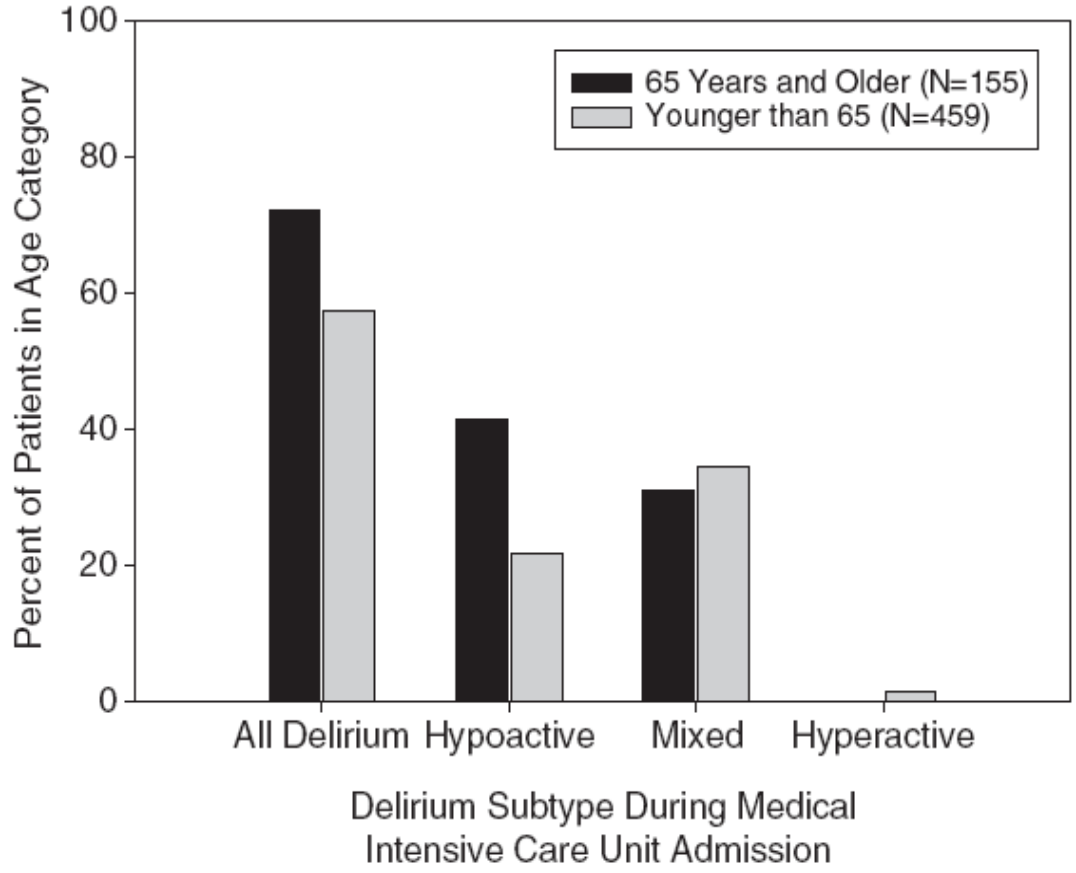
Reduced fractional anisotropy = white matter disruption



Morandi A M et al. *CCM* 2012;40:2182-9.

HOW DO WE DIAGNOSE DELIRIUM?

WE HAVE TO LOOK FOR THE DIAGNOSIS...



Peterson JF, et al. JAGS, 2006.

DELIRIUM EVALUATION

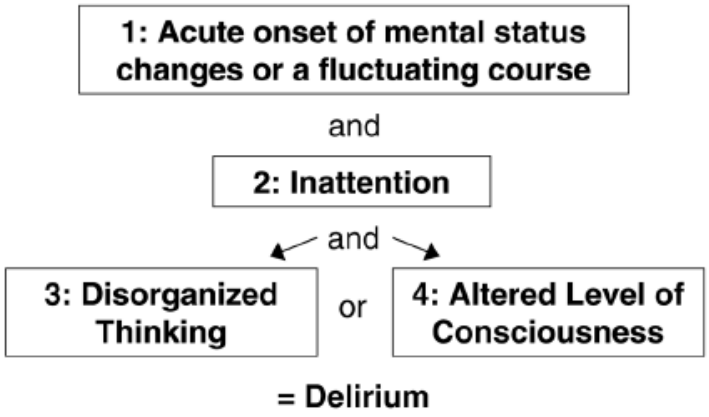
Figure 2

Step 1: Assess the level of sedation (RASS*)

+4 – Overtly combative, violent, immediate danger to staff
+3 – Pulls or removes tube(s) or catheter(s); aggressive
+2 – Frequent nonpurposeful movement, fights ventilator
+1 – Anxious but movements not aggressive or vigorous
0 – Alert and calm
–1 – Not fully alert, but has sustained awakening (eye-opening or eye-contact) in response to voice (>10 seconds)
–2 – Briefly awakens with eye contact to voice (<10 seconds)
–3 – Movement or eye opening to voice, but no eye contact
–4 – No response to voice, but movement or eye opening to physical stimulation
–5 – No response to voice or physical stimulation

If RASS is –4 or –5, then Stop and Reassess patient later
If RASS is above –4 (–3 through +4) then Proceed to Step 2

Step 2: Assess for delirium (CAM-ICU‡)



Ely EW, et al. JAMA

Confusion Assessment Method in the ICU

RASS is above - 4 (-3 through +4)

Proceed to next Step

If RASS is -4 or -5

Stop

Reassess patient at later time

Delirium Assessment (CAM-ICU): 1 AND 2 AND (Either 3 OR 4)

1 Acute Onset or Fluctuating Course
An acute change from mental status baseline?
Or Patient's mental status fluctuating during the past 24hrs

→ **No** → **Stop No delirium**

Yes

2 Inattention
Please read the following ten letters: **S A V E A H A A R T**
Scoring: Error: when patient fails to squeeze on the letter "A"
Error: when the patient squeezes on any letter other than "A."

→ **< 3 Errors** → **Stop No delirium**

≥3 Errrors

3 Altered Level of Consciousness ("actual" RASS)
If RASS is zero, Proceed to next step

→ **If RASS is other than zero** → **Stop Patient is Delirious**

0 RASS

4 Disorganized Thinking
1. Will a stone float on water? (Or: Will a leaf float on water?)
2. Are there fish in the sea? (Or: Are there elephants in the sea?)
3. Does one pound weigh more than two pounds? (Or: Do two pounds weigh more than one?)
4. Can you use a hammer to pound a nail? (Or: Can you use a hammer to cut wood?)
5. **Command:**

Say to patient: "*Hold up this many fingers*" (Examiner holds two fingers in front of patient)
"*Now do the same thing with the other hand*" (Not repeating the number of fingers).
If patient is unable to move both arms for the second part, ask patient "*add one more finger*"

→ **≥ 2 Errors** → **Patient is Delirious**

→ **< 2 Errors** → **Stop No delirium**

OBRIGADA!

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