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Research challenges in postoperative cognitive decline

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Epidemiology of Aging
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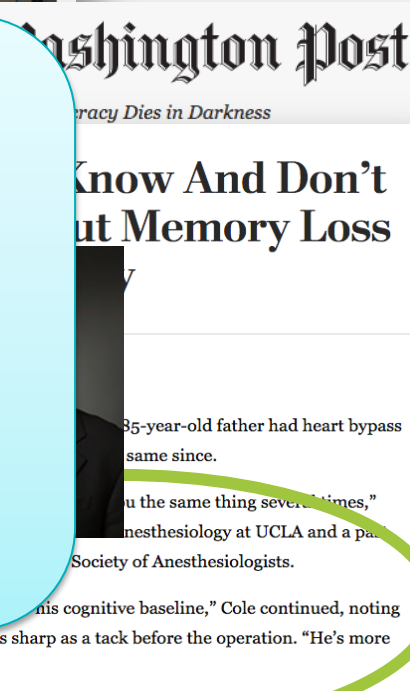
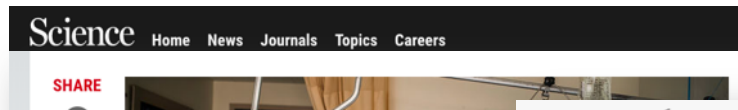
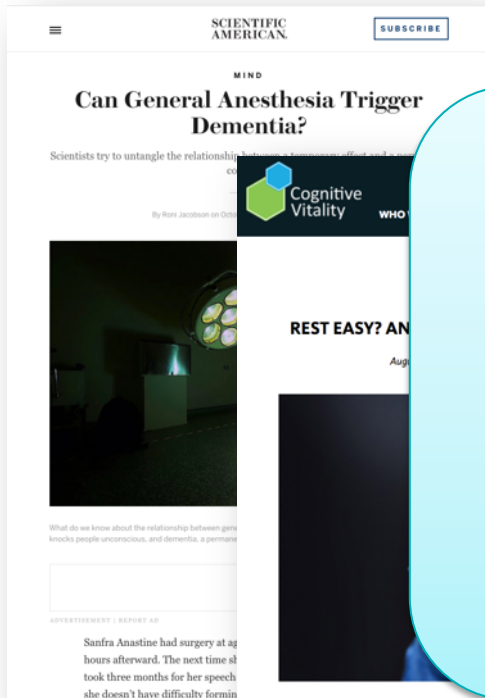
Have you heard about this?

Important to **patients**

Important to **families**

Impacts **risk/benefit**
conversations

Impacts **postoperative**
planning



If you've ever gotten a shot of Novocain before a tooth filling or an epidural to ease your labor pains, you can appreciate the benefits of anesthesia. Anesthetic drugs, usually administered before major or minor surgery, are useful for both the patient and the surgeon—keeping the pain at bay and the patient still. There are three main types of anesthesia:

“Postoperative cognitive dysfunction”

**I know it
when I see
it.**

**When is it POCD,
and when is it just
“feeling crappy after
surgery”?**

**Is it compared
with the patient’s
baseline, or a
control group?**

**Is it objective
decline,
subjective
decline, or both?**

- “Postoperative cognitive deficits that typically last for weeks to months”¹
- “Decline in cognition [after full recovery of consciousness] persisting well beyond the expected duration of physiological effects of anaesthesia”²
- “Decline in cognitive function (especially in memory and executive functions) that may last from 1-12 months after surgery”³
- “Some patients with POCD experience memory problems, others have difficulty multitasking, learning new things, following multistep procedures, or setting priorities.”³

Descriptive epidemiology of (old) POCD

Noncardiac surgery

Within-patient change:

41-71% at <3 weeks

0-56% at

0-35% at

Compared v

0-33% at

0-53% at

0-9% at 6

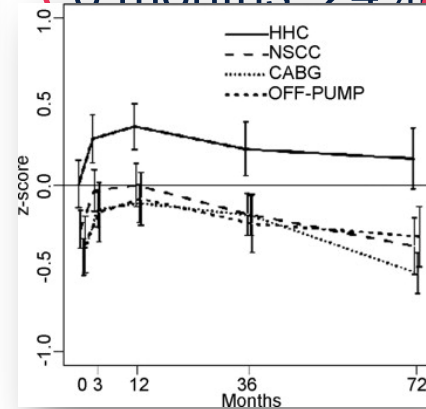
Tests	Definition of Decline
A5, A6, B5, B6, C1, C4, C5, D1, D3	Decrease in performance ≥ 0.5 SD in 20% tests
H1	ANCOVA on MMSE
B1, B22, C2, C4, C5, C7, C8, D2, E2	≥ 1 SD drop in ≥ 2 tests
H5	> 1 SD drop in 1 of 21 summary scores
A1, C5, D2, H7	≥ 1 SD drop in 1 test

Cardiac surgery

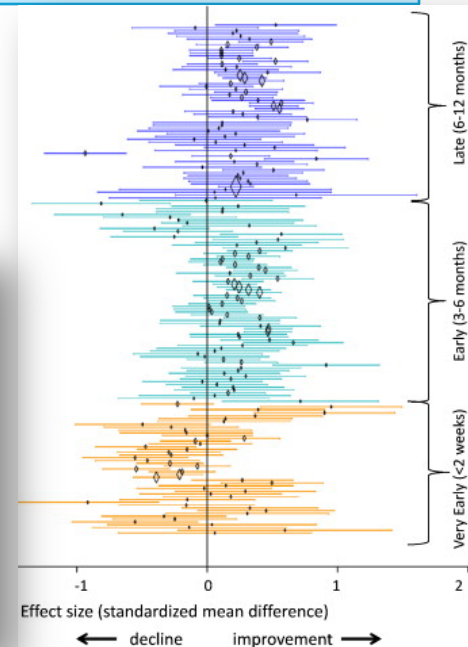
■ Discharge: 53%

■ 6 weeks: 36%

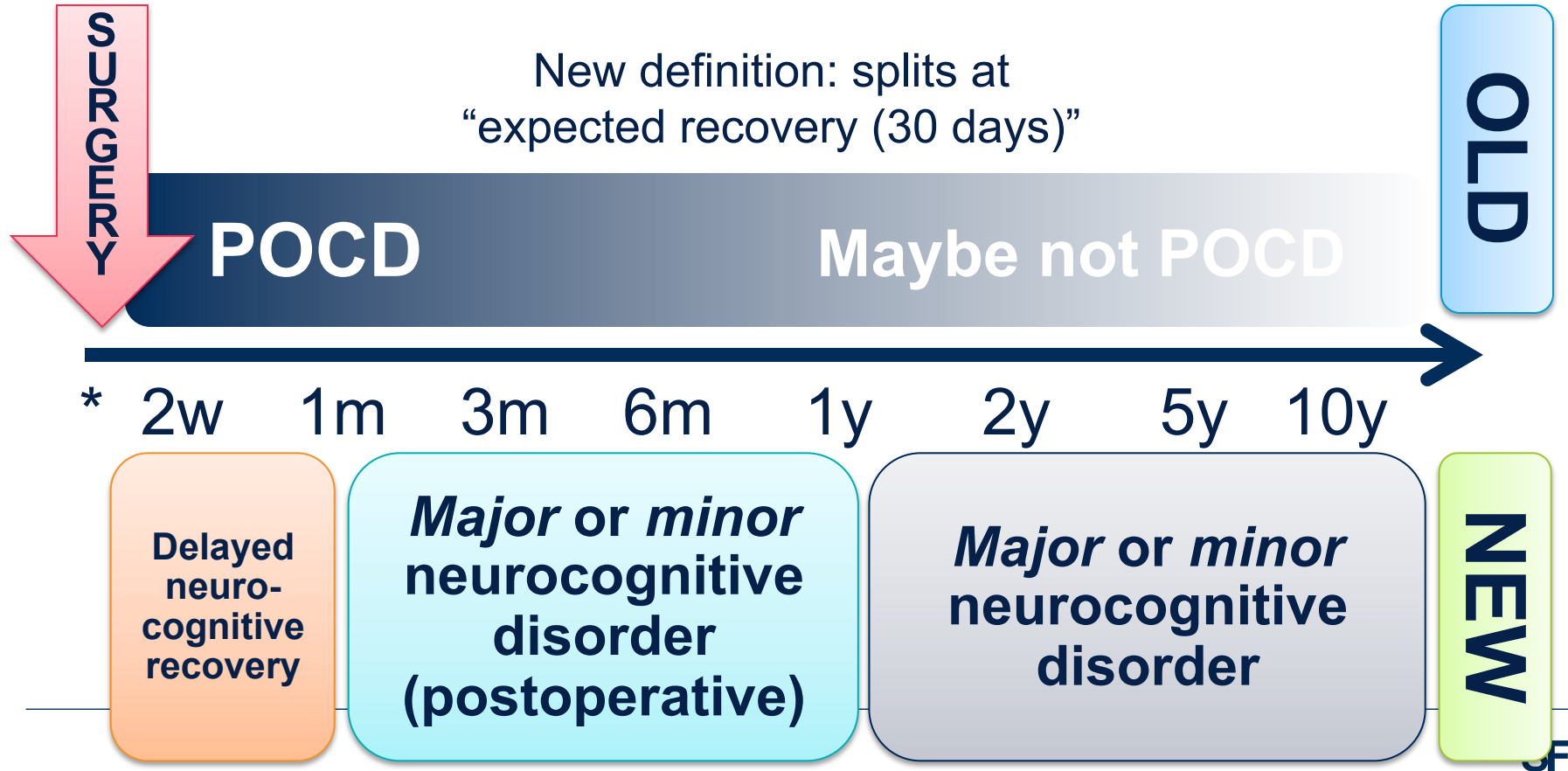
■ 6 months: 24%



1 stdev decline in any of 4 domains



Consensus nomenclature: published 11/2018



***Major or minor
neurocognitive
disorder
(postoperative)***

The entity formerly known as POCD

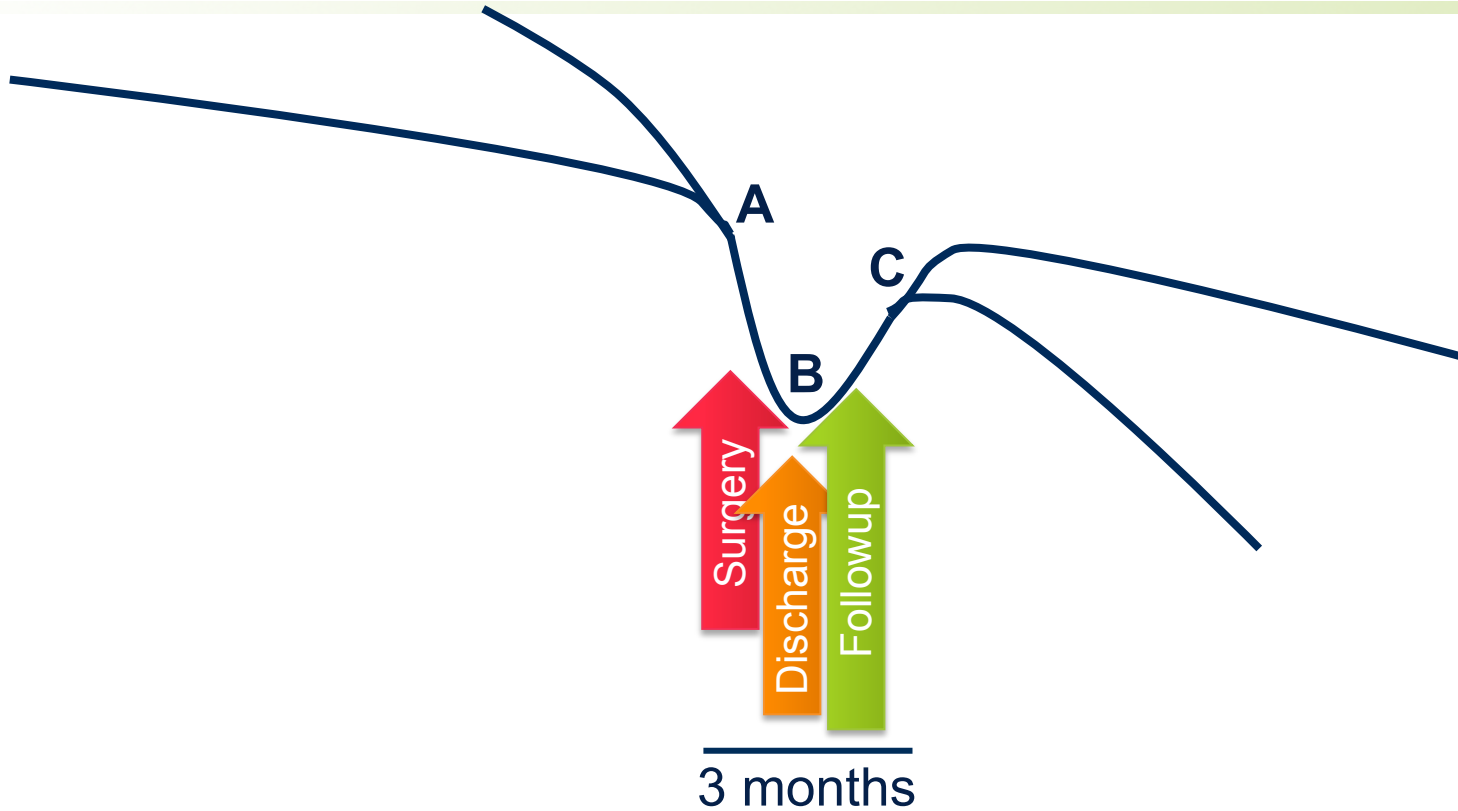
- Cognitive concern (patient, family, clinician), &
- A decline, as compared with norms, of:
 - 1-2 standard deviations or 3-10 %ile if not normally distributed
 - >2 standard deviations or <3 %ile, ADL decline
- In an appropriate neuropsychological assessment

**Self
baseline**

**General
population
data (age-
matched)**

**Specific,
appropriate
control
groups**

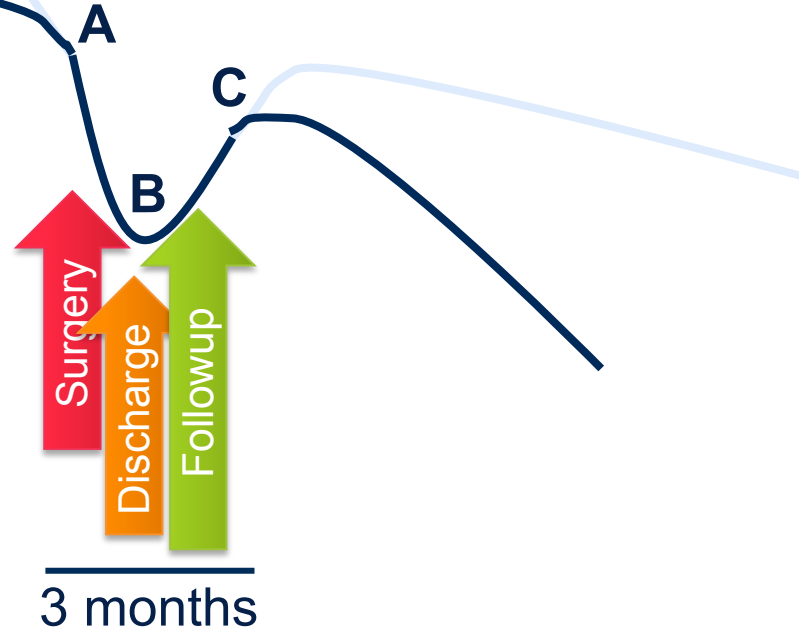
I have methods concerns.



I have methods concerns.

A, B and C are compatible with:

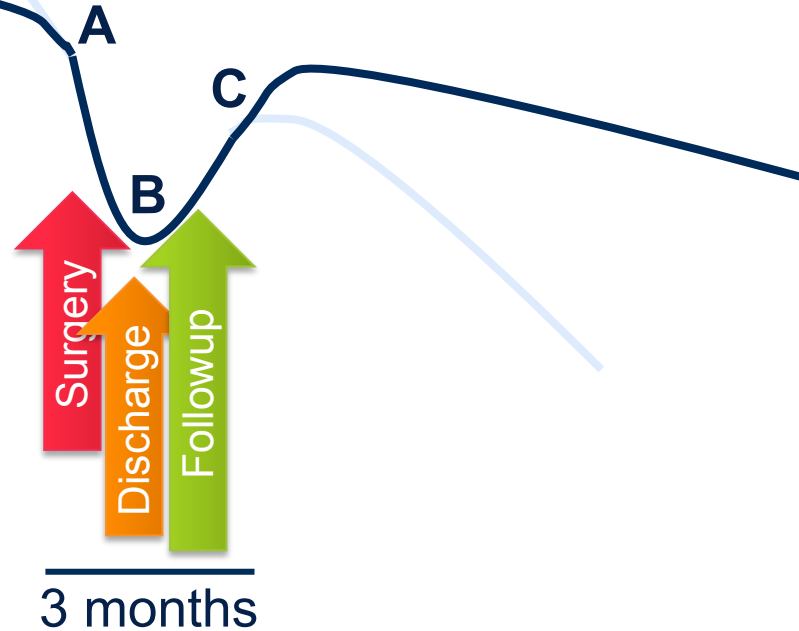
- Catastrophic decline



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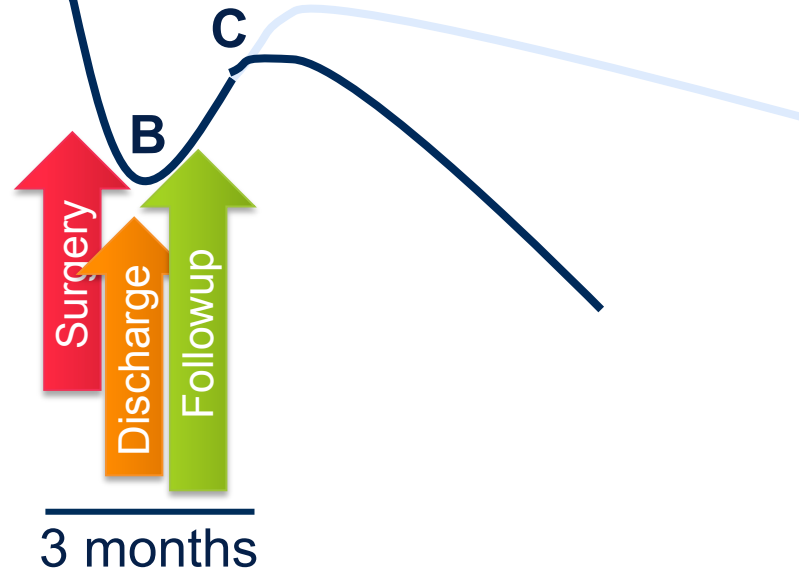
- Catastrophic decline
- No change



I have methods concerns.

A, B and C are compatible with:

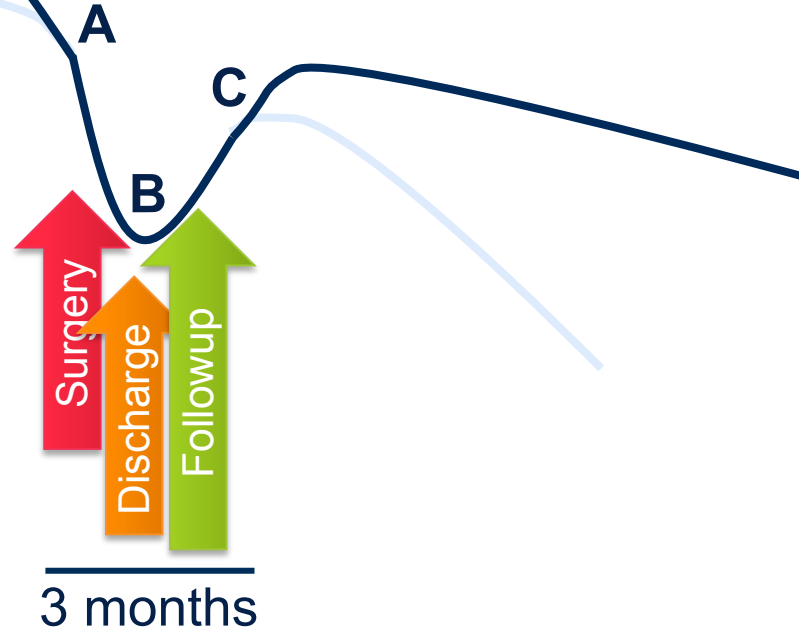
- Catastrophic decline
- No change



I have methods concerns.

A, B and C are compatible with:

- Catastrophic decline
- No change
- Cognitive rescue

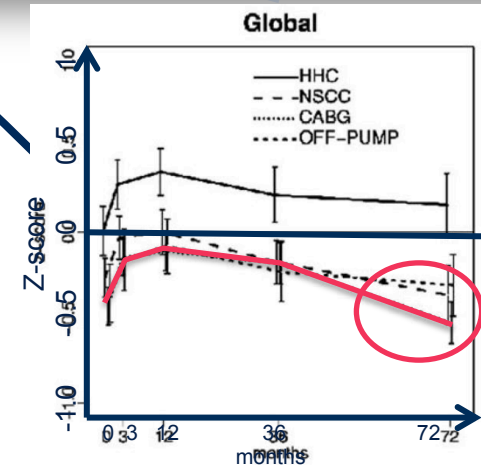
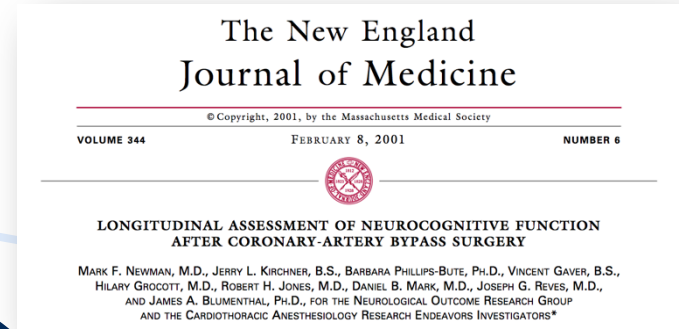
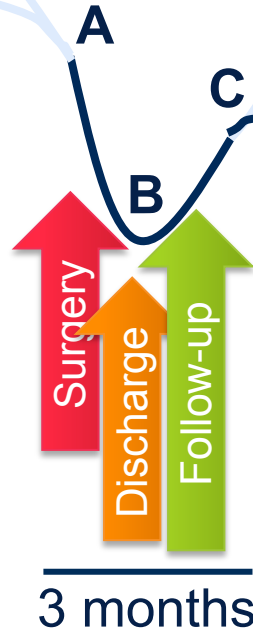


Postoperative cognition: controls?

A, B and C are compatible with:

- Catastrophic decline
- No change

What if you did compare with a control?



Postoperative cognition: Controls?



**Healthy
controls**

(Controls for
aging)



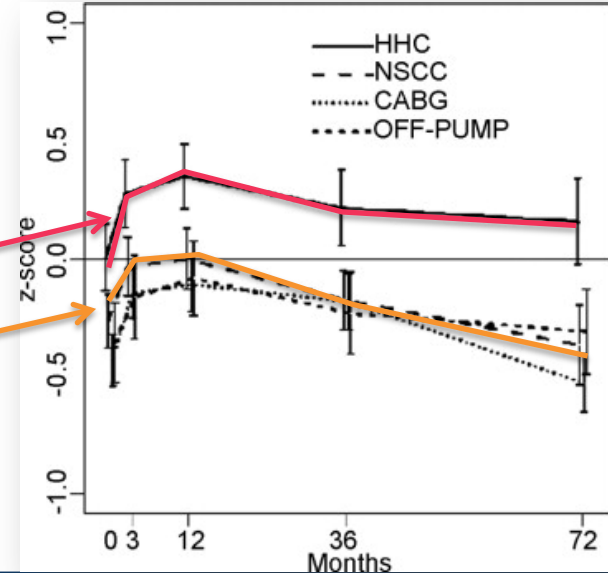
**Disease
controls**

(Aging +
presence of
disease)



**Nonsurgical
controls**

(Aging +
severity of
disease)



Uncontrolled:

Having this
& other
diseases,
surgery &
anesthesia

Disease
severity,
surgery &
anesthesia

Surgery &
anesthesia

Self baseline

General population
data (age-matched)

Specific, appropriate
control groups



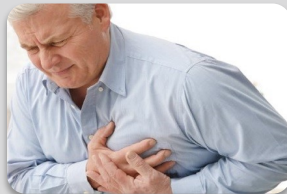
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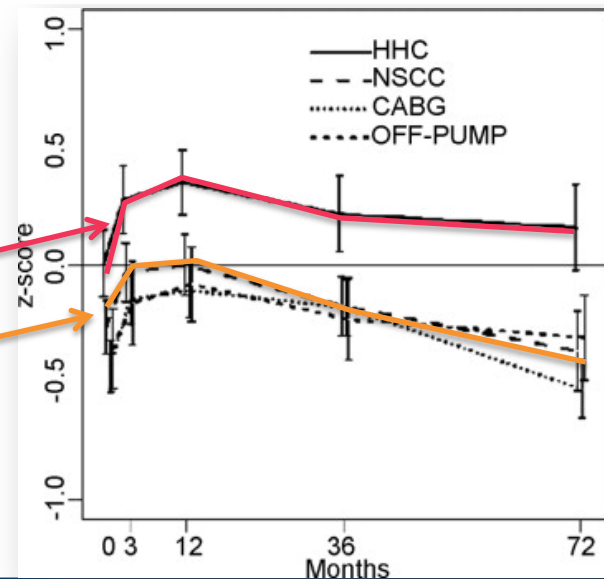
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Cognitive costs of comorbidities

- Heart failure
- Lung failure
- Kidney failure

VAD candidates: **67%** with impaired cognition at mean age 58

3-month mean z-score improvement 0.34 ($p < 0.0001$)

Lung tx candidates: **45%** with impaired cognition at mean age 59

3-month mean z-score verbal improvement 0.50 ($p < 0.0001$)

Kidney tx candidates: **58%** with impaired cognition mean age 54

0.44 g ($\approx$ z) global improvement post-transplant

On average, fixing the failed organ **improves** cognition

Cognitive costs of comorbidities

- Heart failure
- Lung failure

VAD candidates: **67%** with impaired cognition at mean age 58

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The individuals who remain stable or improve disguise those who decline...

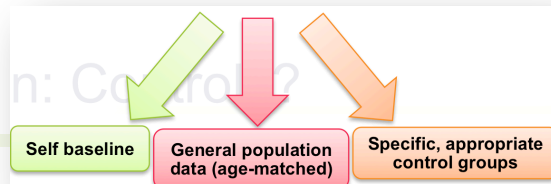
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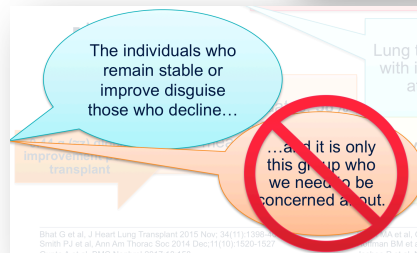
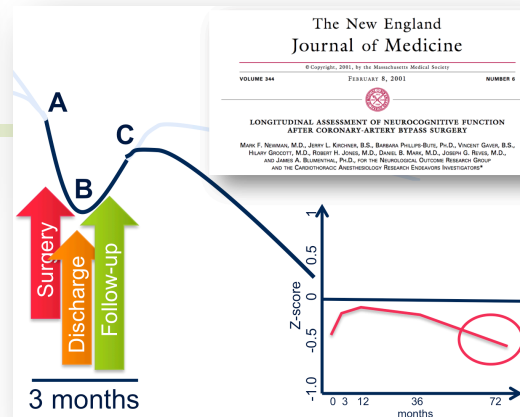
...and it is only this group who we need to be concerned about.

average, fixing the failed **improves** cognition

Issues:



- Controls are poorly specified, yet the cognitive change is attributed to the perioperative setting
- Preoperative cognitive trajectory is (usually) not known, yet subsequent cognitive decline is attributed to the perioperative setting
- Expert reviewers show bias in interpreting results (“Groupthink”? “Confirmation bias”?)
- Redefinition provides illusion of certainty
- Primary data studies: Selection bias
- Differential loss-to-followup in studies of cognitive decline



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