

Reducing ICU Delirium

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Disclosures

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How do you evaluate, describe and document encephalopathy/delirium in your patients?

N=7 Delphi Rounds

Preferred Terms

Acute Encephalopathy

[rapidly developing (< 4 wks)
pathiobiologic process in the brain]

Subsyndromal
Delirium*

Delirium*

Coma*

**Clinical sequelae of acute encephalopathy*

Terms that *Should Not* be Used as a Replacement for Acute Encephalopathy or Delirium

- Acute Confusional State
- Acute Brain Dysfunction
- Acute Brain Failure
- Altered Mental Status

**Prevalence of delirium
in critically ill
older adults 50-70%**



**ICU
Survivorship**

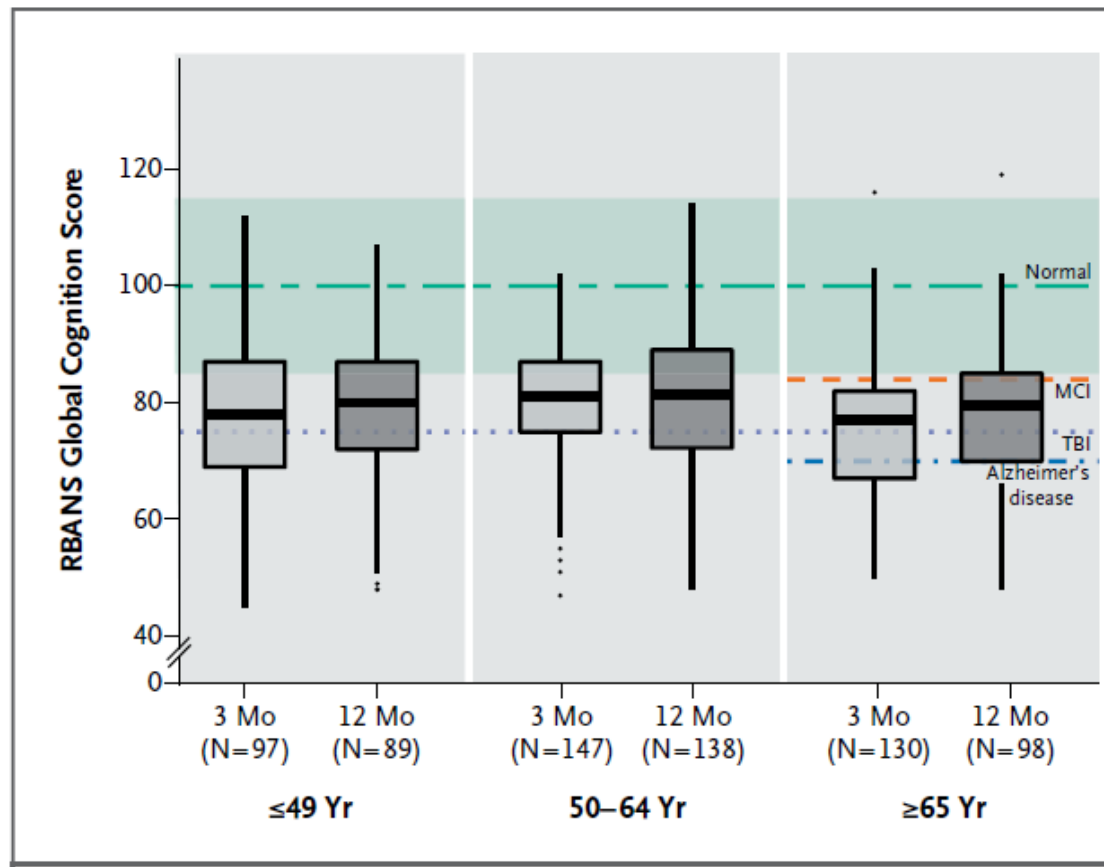


ORIGINAL ARTICLE

Long-Term Cognitive Impairment after Critical Illness

N=826 critically ill adults

- Age = 61 [41-71]
- Apache II = 25 [19-31]
- Medical 68%
- Mech Ventilation =91%
- Delirium = 74 % for 4 [2-7] days
- Coma = 63% for 3 [2-6] days
- Benzodiazepine = 62%
- Propofol = 52%
- Dexmedetomidine = 13%
- Opioids = 78%



A longer duration of delirium was independently associated with:

- a) **worse global cognition** at 3 months (P=0.001) and 12 months (P=0.004)
- b) **worse executive function** at 3 months (P=0.004) and 12 months (P=0.007)

Post-intensive care syndrome (PICS)

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graph TD; PICS[Post-intensive care syndrome (PICS)] --> Psychological[Psychological Symptoms]; PICS --> Cognitive[Cognitive Symptoms]; PICS --> Physical[Physical Symptoms];
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Psychological Symptoms

- Anxiety
- Depression
- PTSD
- Sleep problems

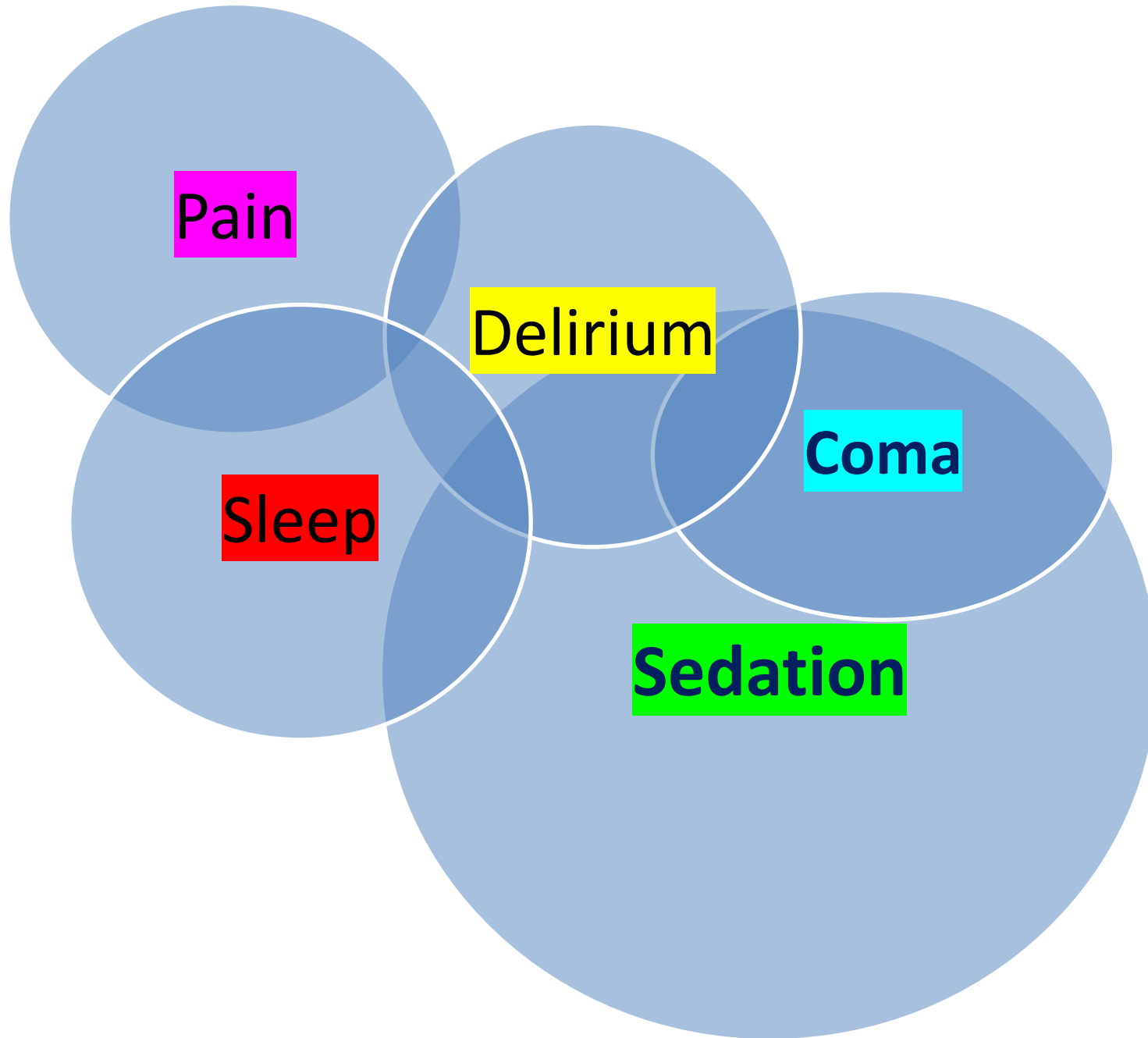
Cognitive Symptoms

- Executive function
- Memory
- Attention
- Visual-spatial
- Mental processing speed

Physical Symptoms

- Breathing difficulties
- Weakness and balance problems
- Neuromuscular impairment
- Pain or numbness

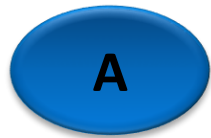
Herridge MS, Cheung AM, Tansey CM, et al: et al, N Engl J Med 2003; 348:682
Krumholz HM, N Engl J Med 2013; 368:100
Iwashyna TJ, Ely EW, Smith DM, et al: JAMA 2010; 304:1787
Fan E, Dowdy DW, Colantuoni E, et al: Crit Care Med 2014; 42:849
Needham DM, Wozniak AW, Hough CL, et al: Am J Respir Crit Care Med 2014;42:849
Parker AM, Srichiaroenchai T, Raparla S, et al: Crit Care Med 2015; 43:1121
Marra A, Pandharipande PP, Girdard TD, et al: Crit Care Med 2018; 46:1393.



Four Key Strategies to Reduce ICU Delirium

1. Screen critically ill adults regularly and reliably for delirium.
2. Recognize and reduce modifiable risk factors for delirium.
3. Focus on non-pharmacologic interventions known to reduce delirium that may include use a multimodal protocol (e.g., ABCDEF bundle).
4. Generally, avoid pharmacologic interventions to reduce delirium in most patients.

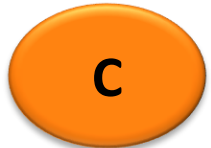
ABCDEF Bundle Elements



Assess, Prevent and manage Pain



Both SAT and SBT



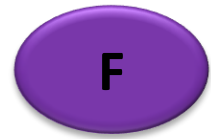
Choice of Analgesia and Sedation



Delirium: Assess, Prevent and Manage




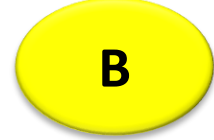




Early Mobility and Exercise



Family Engagement and Empowerment

ABCDEE Bundle Elements

Which of the following bundle elements is associated is least completed in your ICU?

-  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

Caring for Critically Ill Patients with the ABCDEF Bundle: Results of the ICU Liberation Collaborative in Over 15,000 Adults

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Juliana Barr, MD, FCCM^{7,8}; Diane Byrum MSN, RN, CCRN-K, CCNS, FCCM⁹; Shannon S. Carson, MD¹⁰;
John W. Devlin, PharmD, FCCM¹¹; Heidi J. Engel, PT, DPT¹²; Cheryl L. Esbrook, OTR/L, BCPR¹³;
Ken D. Hargett, MHA, FAARC, FCCM¹⁴; Lori Harmon, RRT, MBA, CPHQ¹⁵; Christina Hielsberg, MA¹⁵;
James C. Jackson, PsyD¹; Tamra L. Kelly, BS, RRT, MHA⁴; Vishakha Kumar, MD, MBA¹⁵;
Lawson Millner, RRT¹⁶; Alexandra Morse, PharmD⁴; Christiane S. Perme, PT, CCS, FCCM¹⁴;
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ICU Liberation Collaborative - Methods

- **Collaborative Overview**
 - 68 academic, community and VA ICUs
 - 20 months
 - Operationalized the bundle (with flexibility)
 - Operationalized the daily benchmarks for each element
 - Each Site: Interprofessional Executive Team
 - Education and Support Provided:
 - In Person Meetings
 - Coaching Calls
 - Peer Benchmarking
 - Online materials
 - Resource Sharing

Bundle Performance

ABCDEF bundle performance (our main exposure) was evaluated in two ways:

1. Complete performance:

- patient received every eligible bundle element on any given day

2. Proportional performance

- percentage of eligible bundle elements performed on any given day

Relationship Between Degree of Bundle Performance and Outcomes

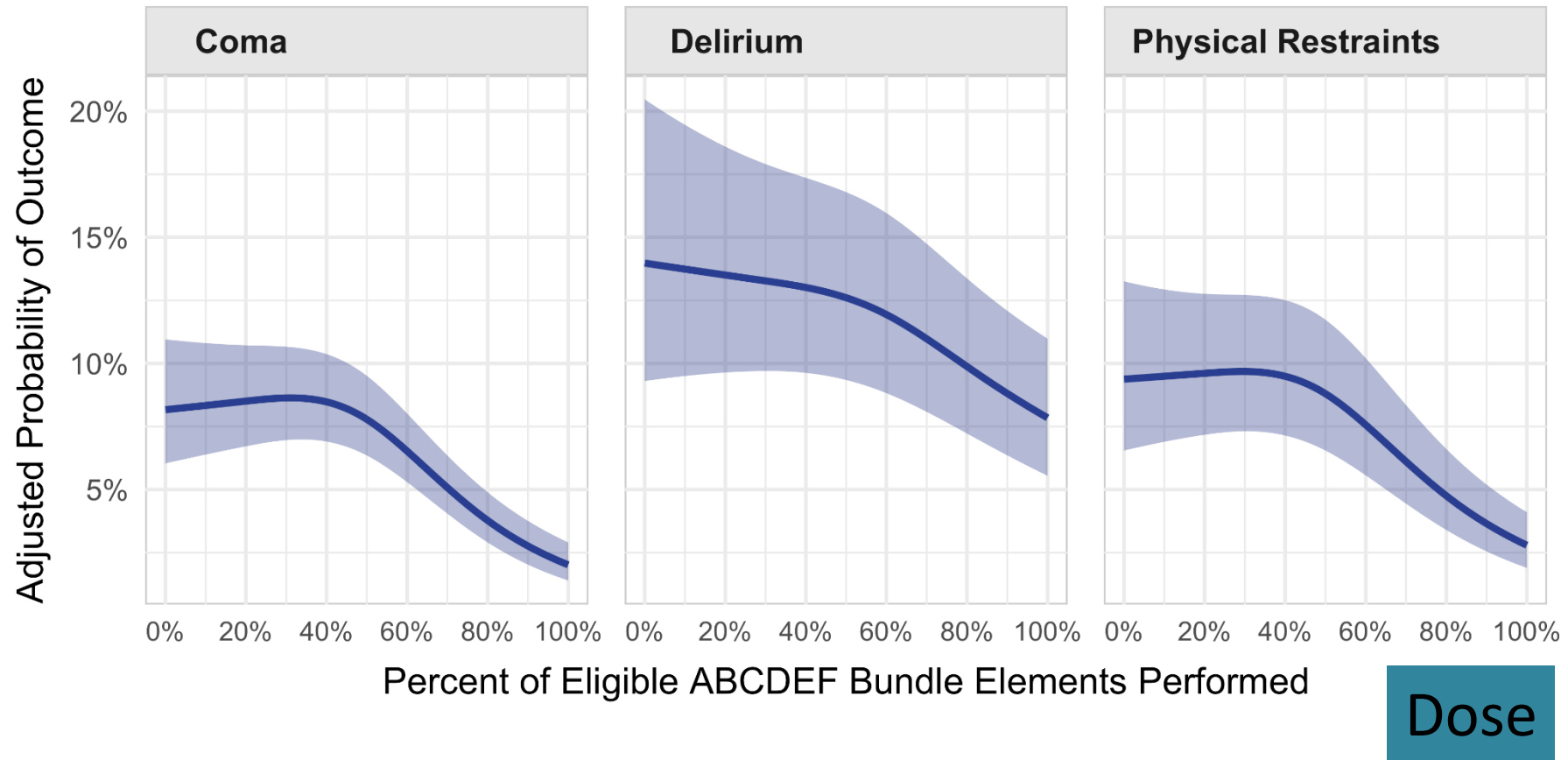
We explored the association between complete and proportional ABCDEF bundle performance and the three sets of outcomes:

*All models were adjusted for a minimum of 18 a priori-determined potential confounders.

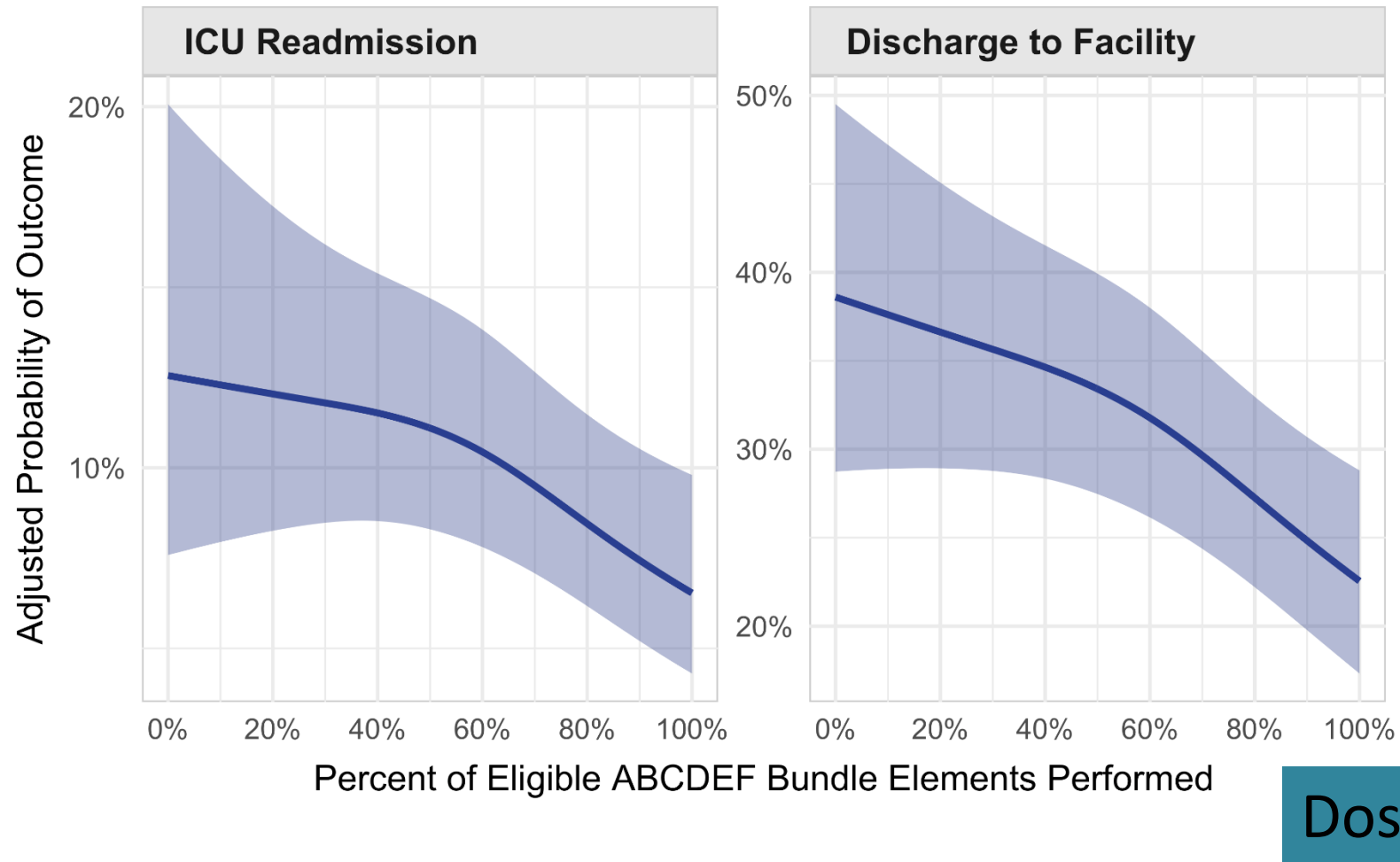
TABLE 2. Outcomes for Patients With Complete (vs Incomplete) ABCDEF Bundle Performance: Data are Adjusted Hazard Ratios (AHRs) and Adjusted Odds Ratios (AORs)

Outcomes	Complete Bundle Performance	p Value
Patient-Related Outcomes	AHR (95% CI)	
ICU discharge ^a	1.17 (1.05–1.30)	< 0.004
Hospital discharge ^b	1.19 (1.01–1.40)	< 0.033
Death ^c	0.32 (0.17–0.62)	< 0.001
Symptom-Related Outcomes^d	AOR (95%CI)	
Mechanical ventilation	0.28 (0.22–0.36)	< 0.0001
Coma	0.35 (0.22–0.56)	< 0.0001
Delirium	0.60 (0.49–0.72)	< 0.0001
Significant pain	1.03 (0.88–1.21)	0.7000
Physical restraints	0.37 (0.30–0.46)	< 0.0001
System-Related Outcomes	Adjusted OR (95%CI)	
ICU readmission ^e	0.54 (0.37–0.79)	< 0.001
Discharge destination ^f	0.64 (0.51–0.80)	< 0.001

Results: Symptom-Related Outcomes



Results: System-Related Outcomes



OPEN

Strategies to Optimize ICU Liberation (A to F) Bundle Performance in Critically Ill Adults With Coronavirus Disease 2019

John W. Devlin, PharmD, MCCM¹; Hollis R. O'Neal Jr, MD, MS²; Christopher Thomas, MD²;
Mary Ann Barnes Daly, MS, RN, CCRN³; Joanna L. Stollings, PharmD, FCCM^{4,5}; David R. Janz, MD, MS⁶;
E. Wesley Ely, MD, MS, FCCM^{5,7}; John C. Lin, MD⁸



A **Assess, Prevent and Manage Pain**

1. Assessment

- **Use a valid assessment tool every 4 hours**

2. Prevention

- **Anticipate pain (e.g., risk factors; procedures)**

3. Management of Pain

- **Treat pain before using a sedative**

B

Both Spontaneous Breathing Trial/Spontaneous Breathing Trial

- 1. Establish clear 24 sedation goal**
 - Evaluate sedation every 4 hours with RASS or SAS**
- 2. Work with night nurses to maintain wakefulness**
 - Sedation ≠ Good Sleep**
 - Deep sedation/coma in am should be a “never event”**
- 3. Consider q2h sedative protocol**
 - Preferred by RNs over SATs**
- 4. SBT safety screens and SBT attempts**

c

C Choice of Analgesia and Sedation

1. Administer opioid and/or sedative boluses before initiating an infusions
 - Evaluate the continued need for opioid/sedative infusions daily
2. Consider Non-opioid Analgesics
 - Multimodal protocol useful in surgical patients
3. Reevaluate opioid/analgesic and sedative choices daily
 - Use of the same sedative from intubation to extubation rarely optimal

Opioid Use Increases the Risk of Delirium in Critically Ill Adults Independently of Pain

Matthew S. Duprey¹, Sandra M. A. Dijkstra-Kersten^{2,3}, Irene J. Zaal^{2,3}, Becky A. Briesacher¹, Jane S. Saczynski¹, John L. Griffith⁴, John W. Devlin^{1,5}, and Arjen J. C. Slooter^{2,3,6}

Multinomial model on transitions of daily mental status conditional on opioid exposure

Mental Status		Opioid Exposure	Adjusted Odds ratio*^		P value
Day t	Day t+1				
Awake without delirium	Awake without delirium	No	reference		
Awake without delirium	Delirium	Yes	1.45	(1.24-1.69)	<0.001
Awake without delirium	Delirium	10mg MEQ [#]	1.24	(1.15-1.39)	<0.001

*adjusted for time-fixed covariables: admission category (medical, surgical, trauma), age, gender, Acute Physiology and Chronic Health Evaluation (APACHE) IV Score, body mass index, Charlson Comorbidity Index

^adjusted for time-varying covariables on day t: day of ICU admission, modified Sequential Organ Failure Assessment score (without neurologic component), use of mechanical ventilation, use of a benzodiazepine, presence of severe pain

#adjusted odds ratio represents the odds for a 1 log-fold increase in morphine equivalent dose

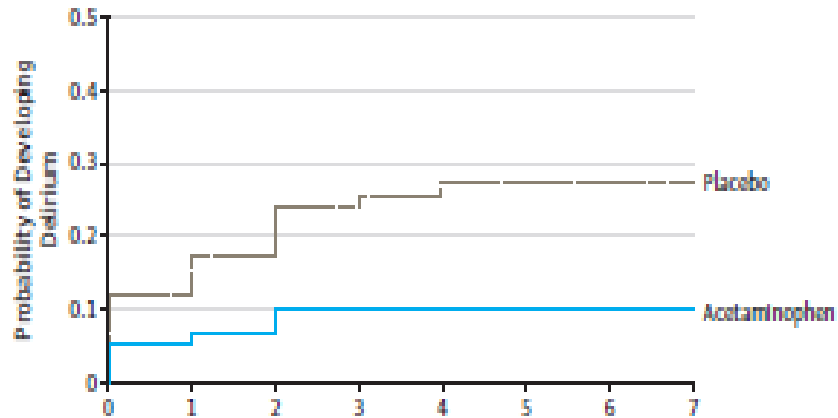
Odds for delirium remained stable across study years and age groups, was observed in both medical and surgical patients, and was not dependent on the degree of pain present on the day preceding a transition to delirium.

***Severe pain was inversely associated with a transition to delirium (OR 0.72; 95% CI 0.53-0.97).**

Effect of Intravenous Acetaminophen vs Placebo Combined With Propofol or Dexmedetomidine on Postoperative Delirium Among Older Patients Following Cardiac Surgery

The DEXACET Randomized Clinical Trial

B Analgesic: acetaminophen vs placebo



Outcomes	Analgesic		Difference (95% CI)	P Value	Sedative		Difference (95% CI)	P Value
	Acetaminophen (n = 60)	Placebo (n = 60)			Dexmedetomidine (n = 59)	Propofol (n = 61)		
MoCA score^b								
Baseline, median (IQR)	24.0 (22.0 to 26.0)	23.5 (20.4 to 26.0)	0.5 (-1 to 2)	.39	24.0 (21.0 to 26.0)	24.0 (21.0 to 26.0)	0 (-1 to 1)	.84
Discharge, median (IQR)	24.0 (21.0 to 26.0)	24.0 (20.0 to 26.0)	0 (-1 to 2)	.29	24.0 (21.0 to 25.0)	24.0 (21.0 to 26.0)	0 (-2 to 1)	.55
Change from baseline, median (IQR)	0.0 (-2.0 to 1.0)	-0.4 (-2.0 to 1.0)	0.4 (-1.0 to 1.0)	.82	0.0 (-1.5 to 1.0)	-0.9 (-2.0 to 1.2)	0.9 (-1.0 to 1.0)	.82
48-h Postoperative medication administration								
Total morphine equivalent administered, median (IQR), µg ^c	10 082.5 (7524.0 to 15 090.0)	12 609.0 (10 076.0 to 20 141.5)	-2530 (-5064 to -22)	.03	10 110.0 (5113.0 to 15 075.0)	12 612.5 (10 052.5 to 20 067.5)	-2567 (-5094 to -26)	.03



Irene J. Zaal
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Arendina W. van der Kooi
David S. Y. Ong
Olaf L. Cremer
Rolf H. Groenwold
Arjen J. C. Slooter

Benzodiazepine-associated delirium in critically ill adults

- N=1112 critically adults were included
- Among the 5299 (53.7 %) observation days patients were awake without delirium, 562 (11 %) transitions to delirium occurred the next day.

Mental status		Exposure	Adjusted odds ratio ^{a,b,c}	p value
Day <i>t</i>	Day <i>t</i> + 1			
Awake without delirium	Awake without delirium	No	Reference	
Awake without delirium	Delirium	Yes ^d	1.04 (1.02–1.05)	<0.001

Relative Risk for each 5 mg BZ administered in midazolam equivalents

Midazolam infusion 3 mg/hr = 72mg/24 hours.....72/5 = 14.4 x 4% = 57.6% chance of transitioning from awake and no delirium to delirium the next day.

ORIGINAL ARTICLE

Dexmedetomidine or Propofol for Sedation
in Mechanically Ventilated Adults with Sepsis

	Dexmedetomidine N=214	Propofol N=208	Difference
Baseline			
Age	59 [48, 68]	60 [50, 68]	NS
APACHE-II	27 [21, 32]	27 [22, 32]	NS
Medical	64%	65%	NS
RASS score \geq -2 at randomization	49%	46%	NS
Outcomes			
Days without delirium or coma at 14 d* median [95% CI]	10.7 [8.5, 12.5]	10.8 [8.7, 12.6]	NS
Ventilator-free days at 28 days* median [95% CI]	23.7 [20.5, 25.4]	24.0 [20.9, 25.4]	NS
Mortality at 90 days*	38%	39%	NS
Telephone Interview for Cognitive Status (TICS) at 6 mo.%	40.9 [33.6, 47.1]	41.4 [34.0, 47.3]	NS

*Multivariable adjustment for n=16 variables; % age-adjusted



Delirium: Assess, Prevent and Manage

1. Assess for Delirium every RN shift with CAM-ICU or ICDSC
 - Ensure patients are maximally awake before CAM-ICU screening
 - Delirium assessments should be documented/reported on rounds
 - All ICU clinicians should be trained on proper CAM-ICU use
2. Evaluate patients for new risk factors for delirium daily

Risk Factors

Question:

Which predisposing and precipitating risk factors are associated with delirium occurrence (i.e., incidence, prevalence, or daily transition), delirium duration, or severity in critically ill adults?

Rationale: 68 studies published from 2000-2015

- Evaluated critically ill adults for delirium using multivariable analysis or randomization to evaluate variables as potential risk factors

Ungraded Statement:

For the following risk factors, **strong evidence** indicates these are associated with delirium in critically ill adults:

Modifiable: drug-induced coma, benzodiazepine use, opioid use, ICU severity of illness, and blood transfusions

Non-modifiable: greater age, dementia, pre-ICU emergency surgery or trauma, greater baseline APACHE-II score

Dr. DRE:

***Important to use a standardized approach to mitigate delirium risk factors on a daily basis during ICU rounds**

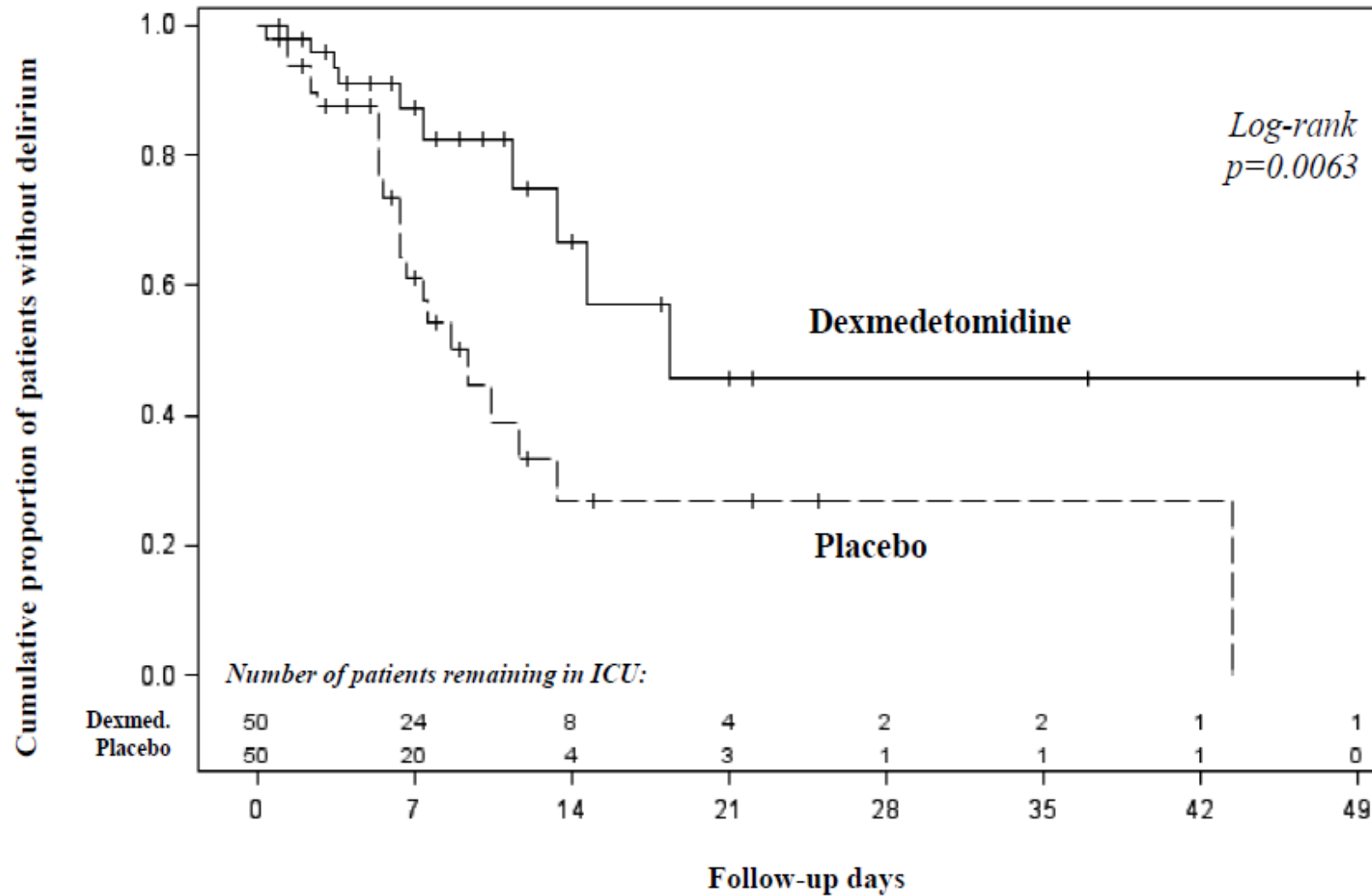
<u>D</u>iseases	New onset sepsis/infection Worsening organ dysfunction Worsening hypoxemia Dehydration
<u>DR</u>ug Removal	Sedative de-escalation e.g., SATs Reduce benzodiazepines and opioids Stop/reduce psychoactive meds
<u>E</u>nvironment	Immobilization Sleep disruption Noise/light Hearing aids/glasses

Delirium Pharmacological Prevention

Recommendation:

We suggest **NOT** using haloperidol, an atypical antipsychotic, dexmedetomidine, a statin, or ketamine to *prevent* delirium in **all** critically ill adults (Conditional recommendation, very low to low quality of evidence)

Low-dose Nocturnal Dexmedetomidine Prevents ICU Delirium: A Randomized, Placebo-Controlled trial



No difference in LEEDS Sleep Score between groups

Haloperidol and Ziprasidone for Treatment of Delirium in Critical Illness

T.D. Girard, M.C. Exline, S.S. Carson, C.L. Hough, P. Rock, M.N. Gong, I.S. Douglas, A. Malhotra, R.L. Owens, D.J. Feinstein, B. Khan, M.A. Pisani, R.C. Hyzy, G.A. Schmidt, W.D. Schweickert, R.D. Hite, D.L. Bowton, A.L. Masica, J.L. Thompson, R. Chandrasekhar, B.T. Pun, C. Strength, L.M. Boehm, J.C. Jackson, P.P. Pandharipande, N.E. Brummel, C.G. Hughes, M.B. Patel, J.L. Stollings, G.R. Bernard, R.S. Dittus, and E.W. Ely, for the MIND-USA Investigators*

A Days Alive without Delirium or Coma

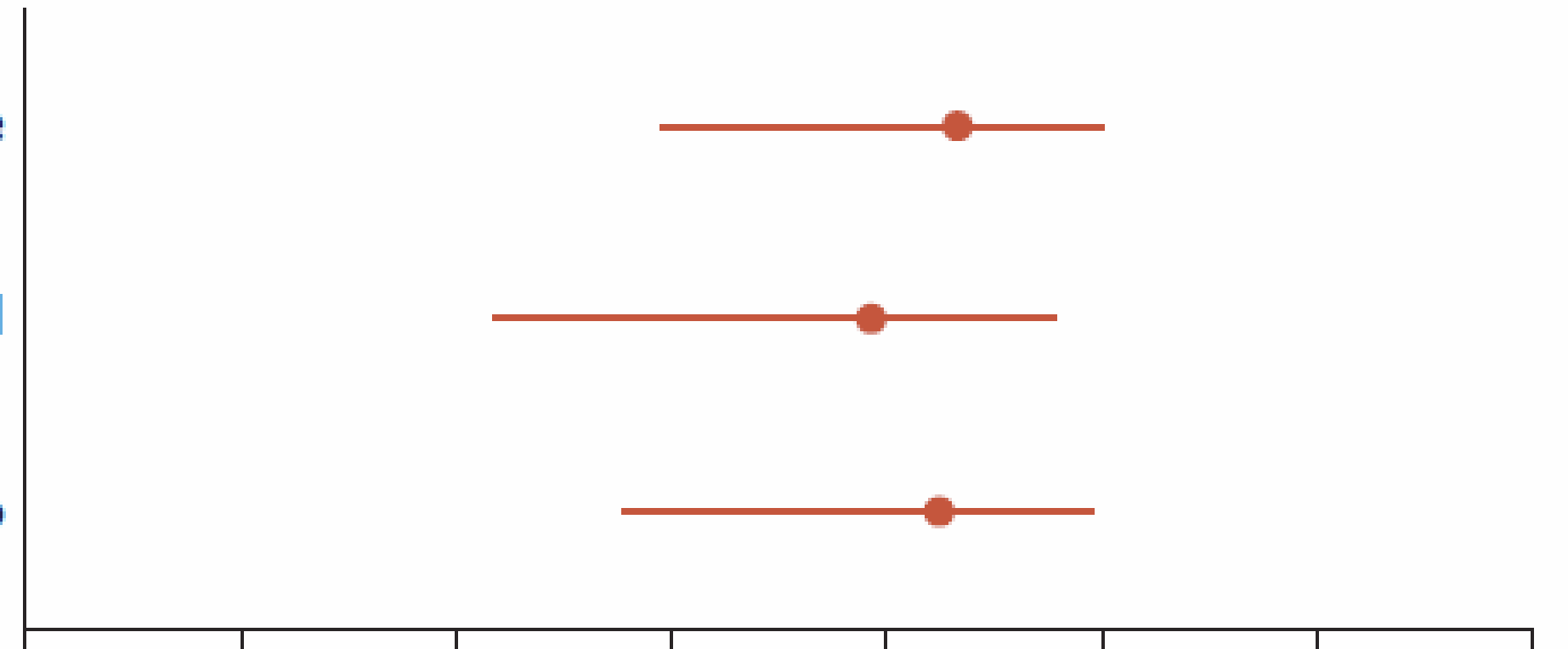
Ziprasidone

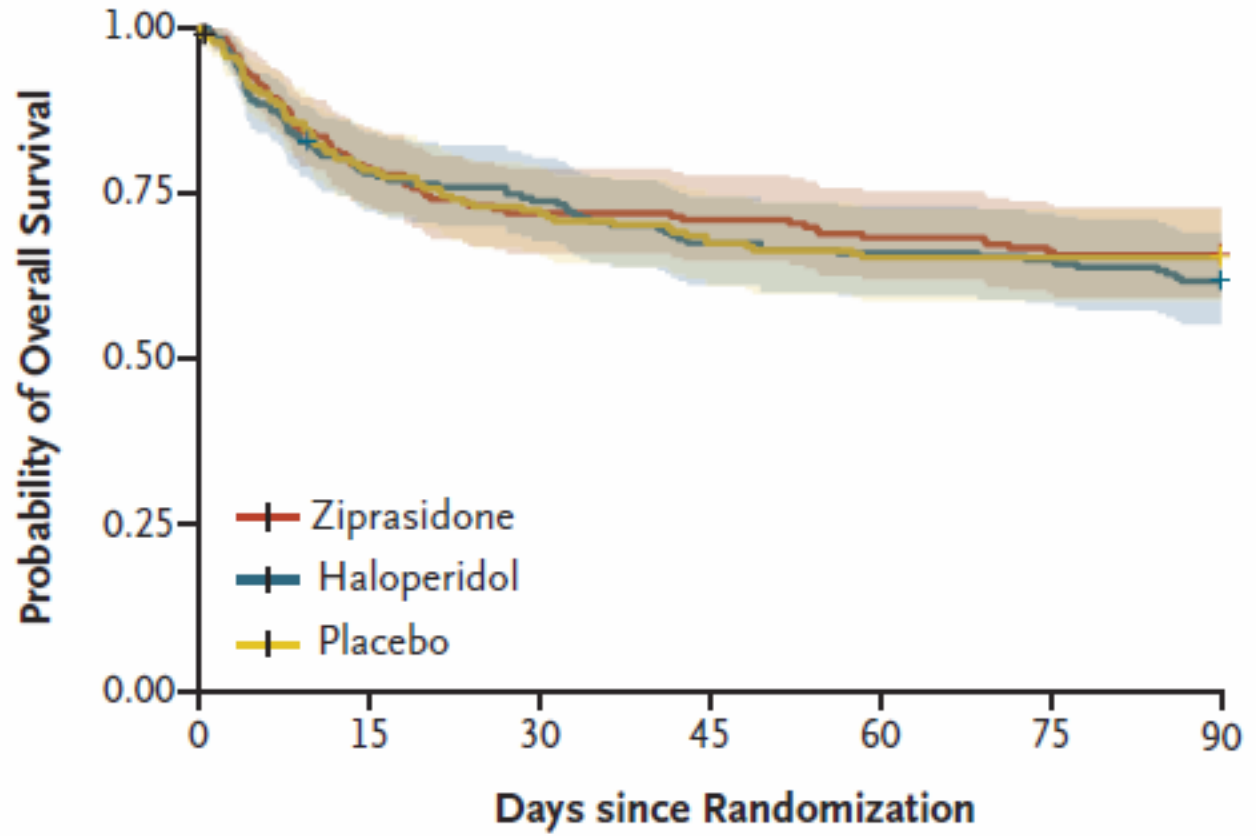
Haloperidol

Placebo

0 2 4 6 8 10 12 14

Adjusted Median Days (95% CI)





No. at Risk (cumulative no. of deaths)

Ziprasidone	190 (0)	150 (40)	137 (53)	135 (55)	130 (60)	126 (64)	125 (65)
Haloperidol	192 (0)	149 (42)	141 (50)	129 (62)	126 (65)	124 (67)	118 (73)
Placebo	184 (0)	143 (39)	132 (50)	123 (59)	119 (63)	119 (63)	119 (63)

Figure 3. Effects of Haloperidol, Ziprasidone, and Placebo on 90-Day Survival.

Antipsychotic vs. None (Treatment)

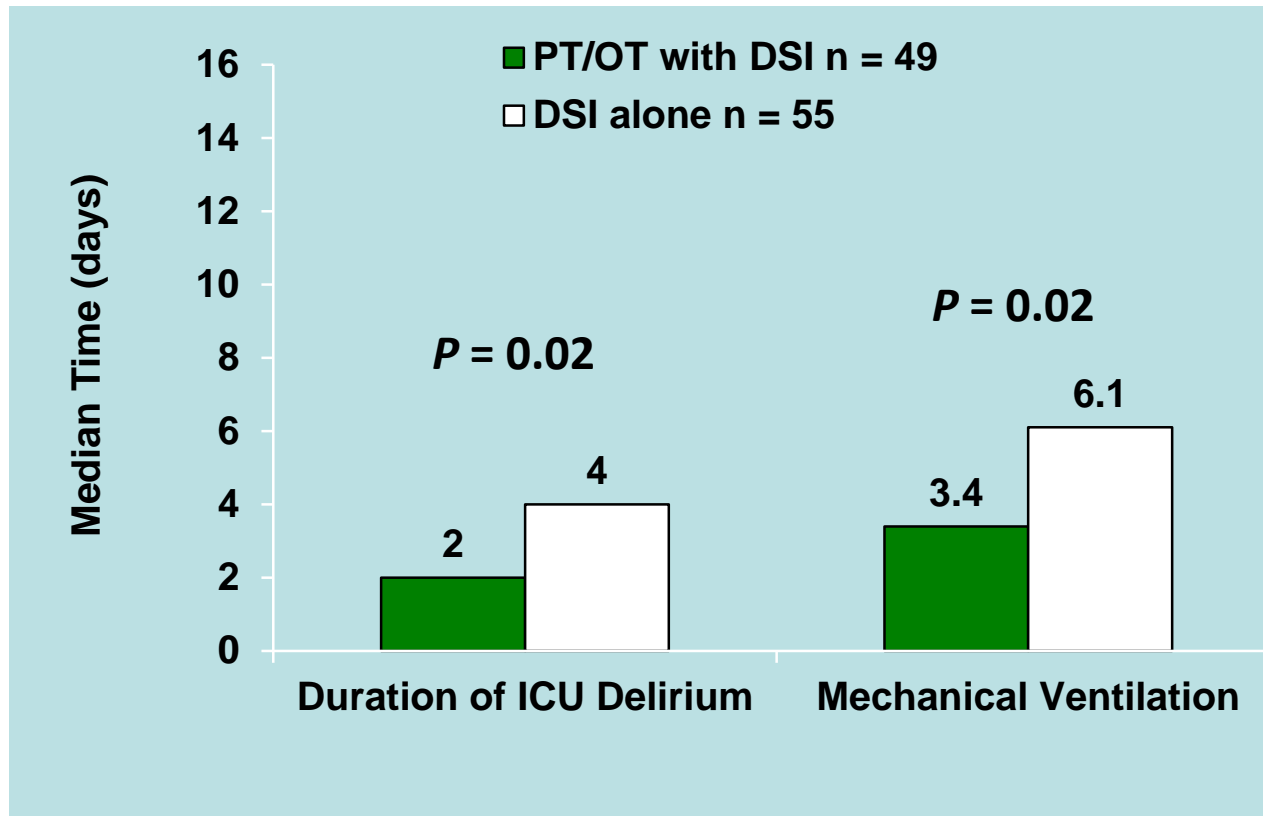
Rationale, includes:

- No benefit for any critical outcomes
- **Not Routinely (vs. Never)** given that patients with fear, anxiety or agitation not-related to pain may still benefit from a short-course of antipsychotic therapy
- **Unnecessary continuation causes significant morbidity & cost**

Recommendation:

We **suggest NOT** routinely using haloperidol and atypical antipsychotic to treat delirium (conditional recommendation, low quality of evidence).

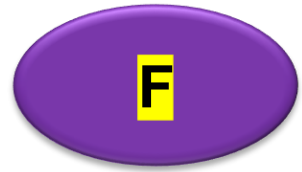
Early Mobilization



**E**

Early Mobilization and Rehabilitation

- 1. Screen Every ICU Patient Daily for Rehabilitation/Mobility**
 - PT ideal for screening**
 - RN, RT, RN assistants (and family) can deliver the mobilization**
 - In bed rehabilitation will benefit patient**
- 2. Ensure consensus re: Mobilization Start/Stop Criteria.**
- 3. Start mobilization efforts in 1-2 ICU beds and then slowly expand**
- 4. Mobility RCTs show early mobility is far more effective than late mobility**



Family Engagement and Empowerment

- 1. Attempt to involve, engage and empower patients and families to be active participants in ICU Care**
- 2. The best way for this to be done remains unclear**
- 3. While family participation in ICU rounds is ideal; it is often NOT feasible.**

Figure 1 (Devlin)

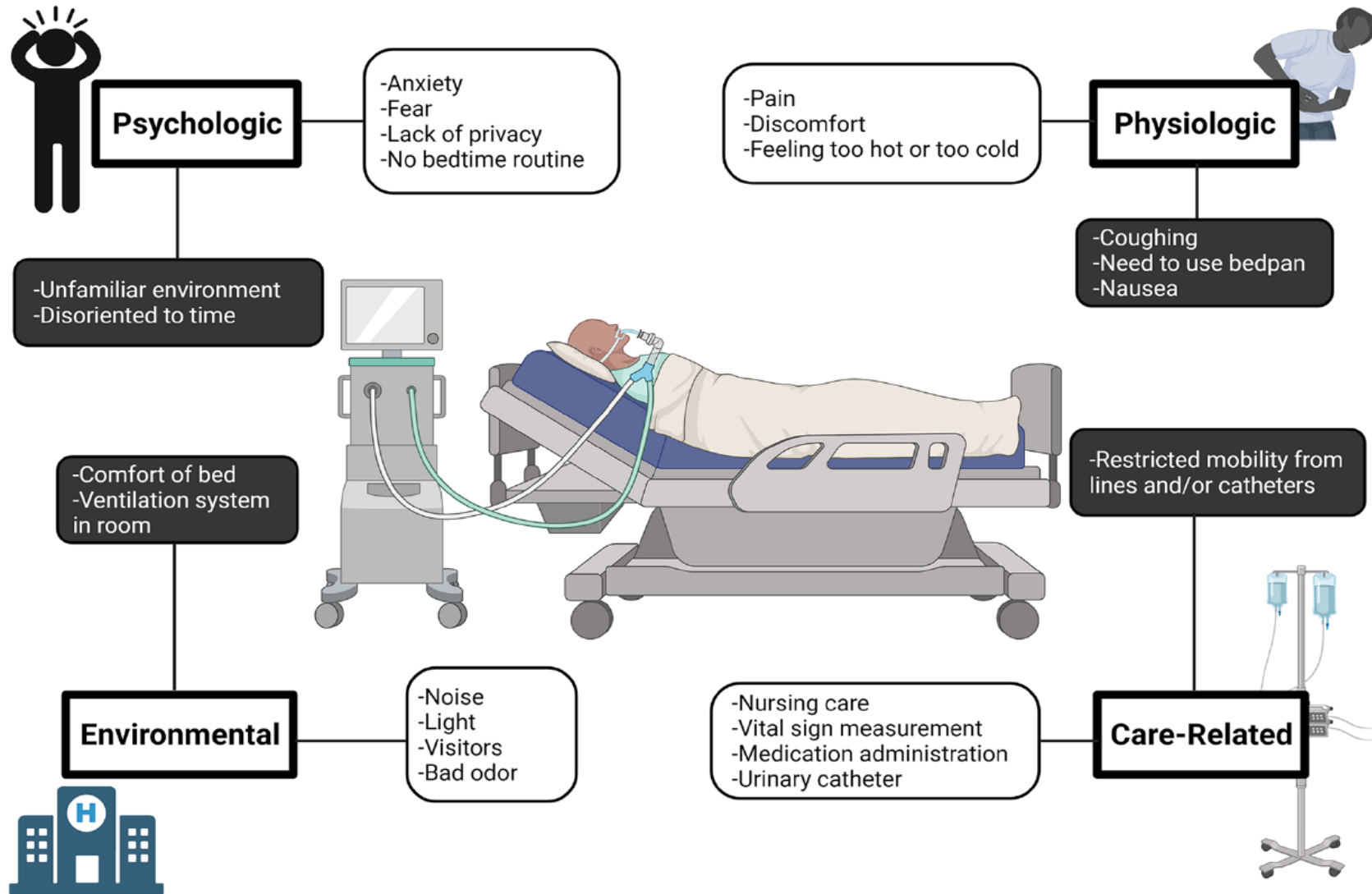
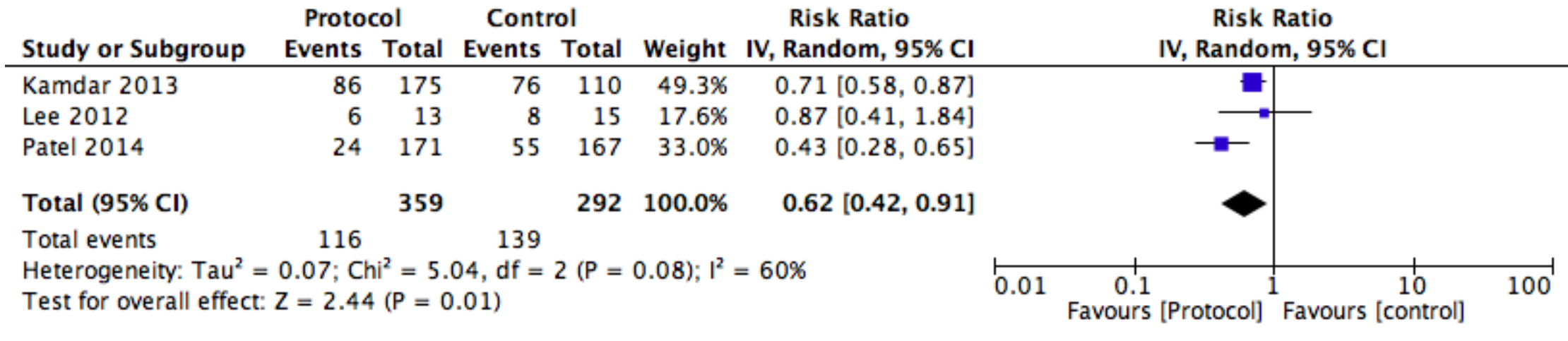


Figure 1. Intensive care unit factors known to influence sleep quality.^a

^aRounded boxes shaded in white: modifiable factors; rounded boxes shaded in black: nonmodifiable factors.

Honarmond K, Rafay H, Le J, Mohan, S, Rochweg B, Devlin JW, et al.
A systematic review of risk factors for sleep disruption in critically ill adults.
Crit Care Med 2020; 48(7):1066-1074.

Evidence: Sleep Promoting Protocol



Delirium prevalence: RR: 0.62; 95% CI, 0.42 to 0.91 (for n=3 before-after studies)

Recommendation:

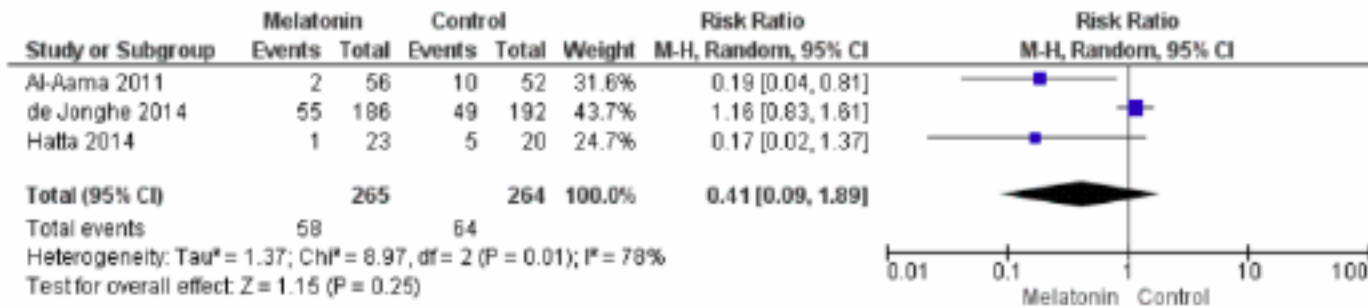
We suggest using a sleep-promoting, multicomponent protocol in critically ill adults (conditional recommendation, low quality evidence).

Melatonin to Improve Sleep

Rationale:

- 3 small RCT (n=60), 3-10 mg HS
- Only evaluated, lower, acuity patients with chronic respiratory failure
- No clear improvements in sleep or reduced delirium

Figure 6. Forest plot of comparison: 4 Prophylactic melatonin versus placebo, outcome: 4.1 Incident delirium.



- While relatively safe and low cost, not FDA regulated.

Recommendation:

We make **no recommendation regarding the use of melatonin** to improve sleep in critically ill adults (no recommendation, very low quality of evidence).

Four Key Strategies to Reduce ICU Delirium

1. Screen critically ill adults regularly and reliably for delirium.
2. Recognize and reduce modifiable risk factors for delirium.
3. Focus on non-pharmacologic interventions known to reduce delirium that may include use a multimodal protocol (e.g., ABCDEF bundle).
4. Generally, avoid pharmacologic interventions to reduce delirium in most patients.

Case of RS – ICU day #2

- RS is a 72-year old female who remains in the Surgical ICU POD #2 after emergent surgical repair of a leaking 3-inch abdominal aortic aneurysm.
- HR =110, BP = 98/63, RR = 20
- CPOT= 2, RASS = -3, CAM-ICU = negative
- Mechanically ventilated: SIMV =14, TV 500, FiO2 = 40%, PEEP=5
- Tolerating tube feeds at 20 mL/hr
- Receiving fentanyl 25-50 mcg IVP q4h prn pain, propofol @ 30 mcg/kg min, and haloperidol 1mg IV q6h
- She has not left the bed since she arrived in the emergency department.
- Prior to admission she enjoyed bridge and golfed weekly in a women's golf league.

What is the most important intervention to make in RS's care at this time?

- a. Increase haloperidol to 2mg IV q6h as this is the dose shown in the REDUCE RCT (JAMA 2018) to prevent delirium and reduce 28-d mortality.
- b. Hold her propofol to reach a RASS = 0 and conduct an SBT screen.
- c. Hold her propofol to reach a RASS = 0 and try to mobilize her out of bed.
- d. Given she is in pain, a known risk factor for delirium, start a continuous IV fentanyl infusion @ 50 mcg/hr.

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