Sleep no more: making sense of the ABCDEF bundle

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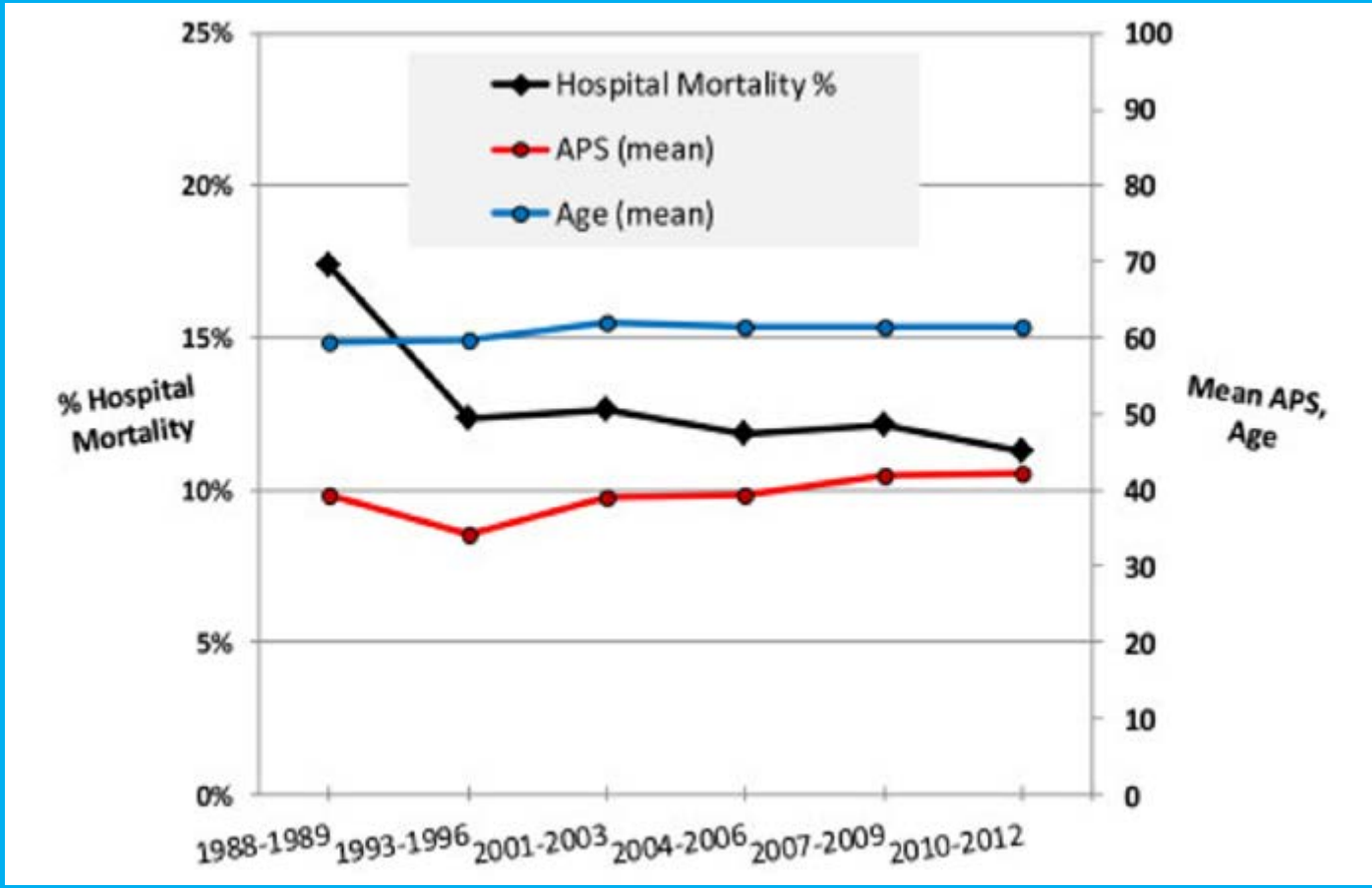
Objectives

- Describe the post-intensive care syndrome and its implications
- Explain the components of the ABCDEF bundle
- Evaluate the literature base rationalizing the ABCDEF bundle implementation
- Determine barriers and solutions to deployment of the ABCDEF bundle

Mortality Trends in the ICU



Crit Care. 2013 .27;17:R81.

A Patient's Story

"I had septic shock 4 years ago from urosepsis and I'm in my 50s. I am writing because I have never felt like myself again. I can't think clearly, my memory has suffered. I am fatigued like never before. Before sepsis I was active, hiking, biking, rock climbing, running and now I am sedentary. This has affected every aspect of my life, I even had to leave my job as an ICU nurse because it was wearing me out"

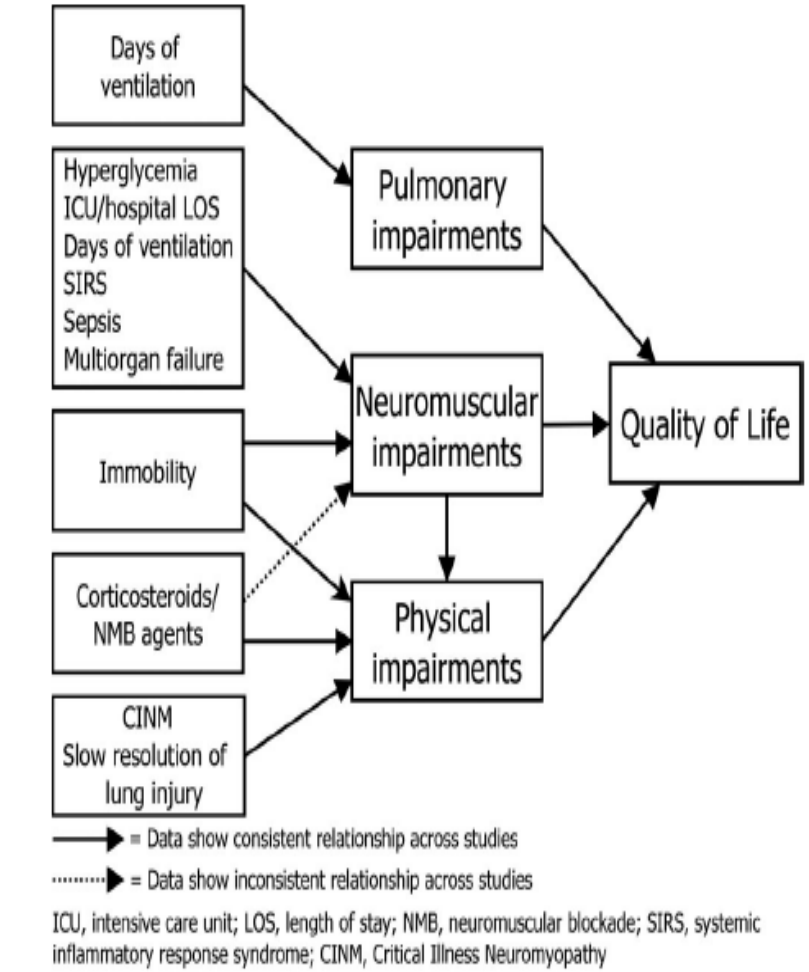
Crit Care Med 2017; 45:321–330.

Post Intensive Care Syndrome (PICS)

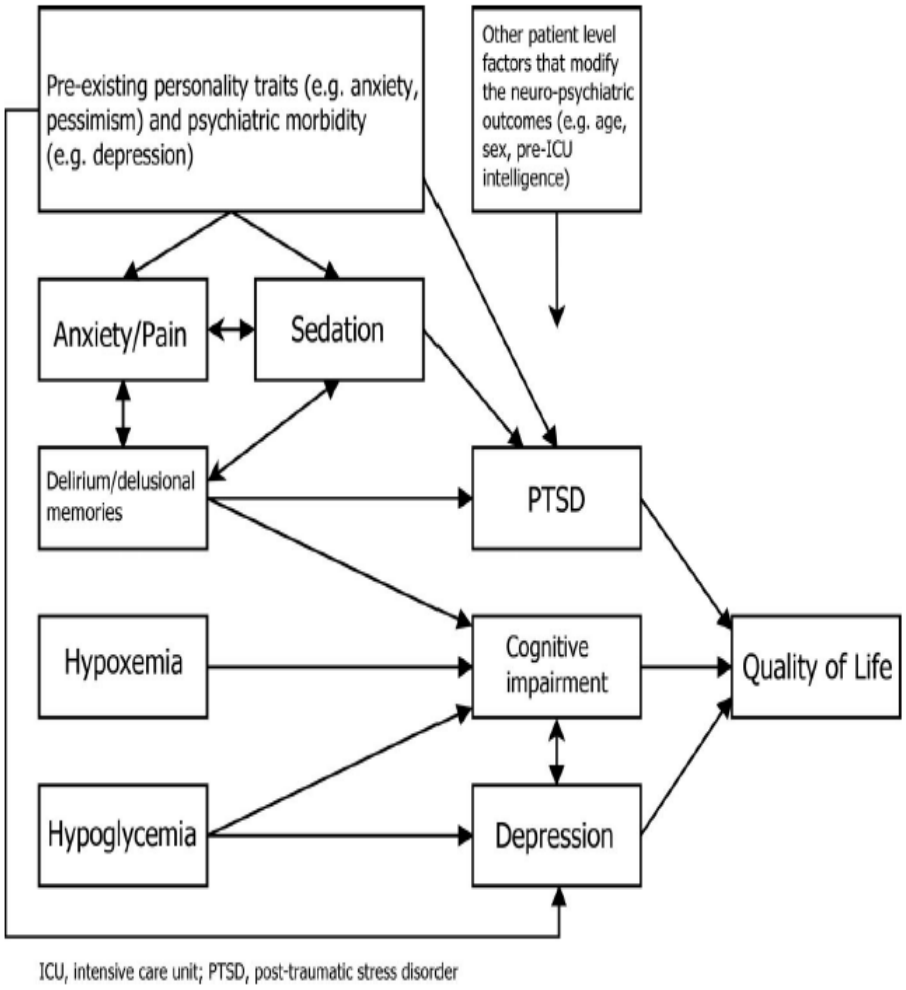
- Physical Impairment
- Cognitive Impairment
- Mental Impairment

PICS Risk Factors

Physical



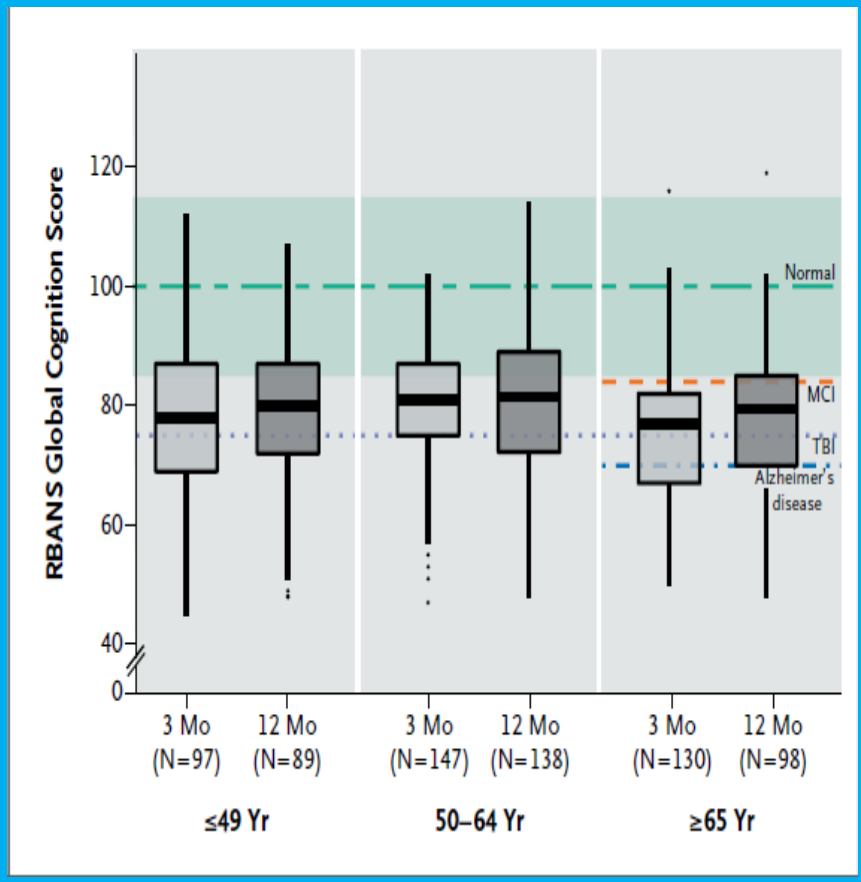
Cognitive/mental



Crit Care Med. 2011;39:371-9.

ARDS Survivors

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)
SF-36 score**			
Physical functioning			
Median (normal value)	35 (90)	55 (89)	60 (89)
Interquartile range	15–58	30–75	35–85
Physical role			
Median (normal value)	0 (85)	0 (84)	25 (84)
Interquartile range	0–0	0–50	0–100
Pain			
Median (normal value)	42 (77)	53 (77)	62 (77)
Interquartile range	31–73	37–84	41–100
General health			
Median (normal value)	52 (78)	56 (77)	52 (77)
Interquartile range	35–67	36–74	35–77
Vitality			
Median (normal value)	45 (69)	55 (68)	55 (68)
Interquartile range	30–55	28–63	28–63
Social functioning			
Median (normal value)	38 (88)	63 (88)	63 (88)
Interquartile range	19–69	38–88	38–100
Emotional role			
Median (normal value)	33 (84)	67 (84)	100 (84)
Interquartile range	0–100	0–100	17–100
Mental health			
Median (normal value)	68 (78)	70 (78)	72 (78)
Interquartile range	54–80	54–88	52–88



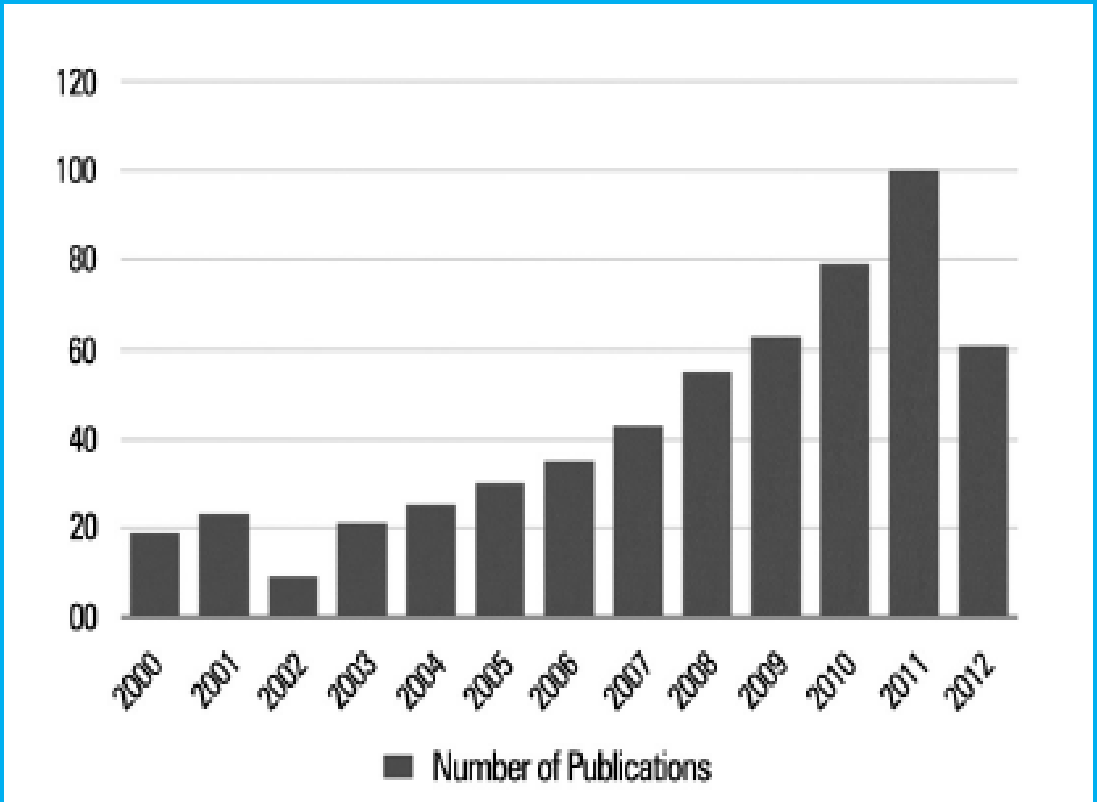
N Engl J Med 2003;348:683-93.
N Engl J Med 2013;369:1306-16.

The Old Way

Topic	2002 Recommendation
Pain assessment	Numeric Rating Scale
Sedation Goal	A sedation goal should be implemented
Sedation assessment	Validated sedation scale
Sedation strategy	Use of sedation protocols
Sedation selection	Lorazepam as drug of choice for most patients
Delirium risk factor	None
Delirium Prevention	None

Crit Care Med. 2002;30:119-41.

Publication Boom



Rev Bras Ter Intensiva. 2013;25:155-161

Changing Guidelines

Topic	2002 Recommendation	2013 Recommendation
Pain assessment	Numeric Rating Scale (NRS)	BPS or CPOT if NRS not assessable
Sedation Goal	A sedation goal should be implemented	Light sedation for most patients
Sedation strategy	Use of sedation protocols	Daily sedation interruption or light sedation
Sedation selection	Lorazepam as drug of choice for most patients	Non-benzodiazepines as first choice
Delirium risk factor	None	Benzodiazepines
Delirium Prevention	None	Early mobilization

BPS: behavioral pain scale
CPOT: critical care pain observation tool.

Crit Care Med. 2002;30:119-41.
Crit Care Med. 2013;41:263-306.

The Bundle

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

http://www.iculiberation.org/SiteCollectionDocuments/Bundles-ICU-Liberation-ABCDEF.pdf

How compliant is your institution with the ABCDEF bundle?

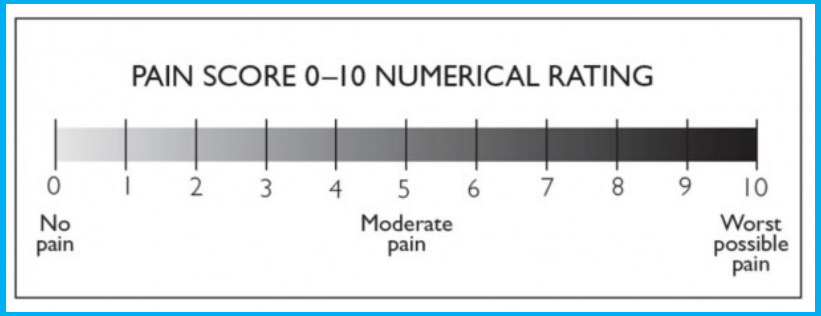
A. Full compliance, the entire bundle is followed
B. Most of the bundle is followed but resources make 100% compliance challenging
C. Some of the bundle is followed but I would like to implement more components into practice
D. None of the bundle is currently practiced
E. I am not sure

Pain in the ICU

- Pain experienced by nearly half of all ICU patients
- Often associated with various procedures
- Associated with significant stress after ICU stay
- Difficult to express and/or quantify pain

Chest 2009; 135:1075–1086
Crit Care Med. 1996; 24:1953-61.
Int J Nurs Stud 2007; 44:227–235
Am J Respir Crit Care Med. 2014;189:39–47
Crit Care. 2013;17:R101.

Assessing Symptoms



- Patient reported scales
  - Numerical Rating Scale
  - Visual Analog Scale
- Behavioral Pain Scales (BPS)
  - Behavioral Pain Scales (BPS)
  - Critical Care Pain Observation Tool (CPOT)
- Vital signs not reliable
  - On their own!
- Family might be helpful

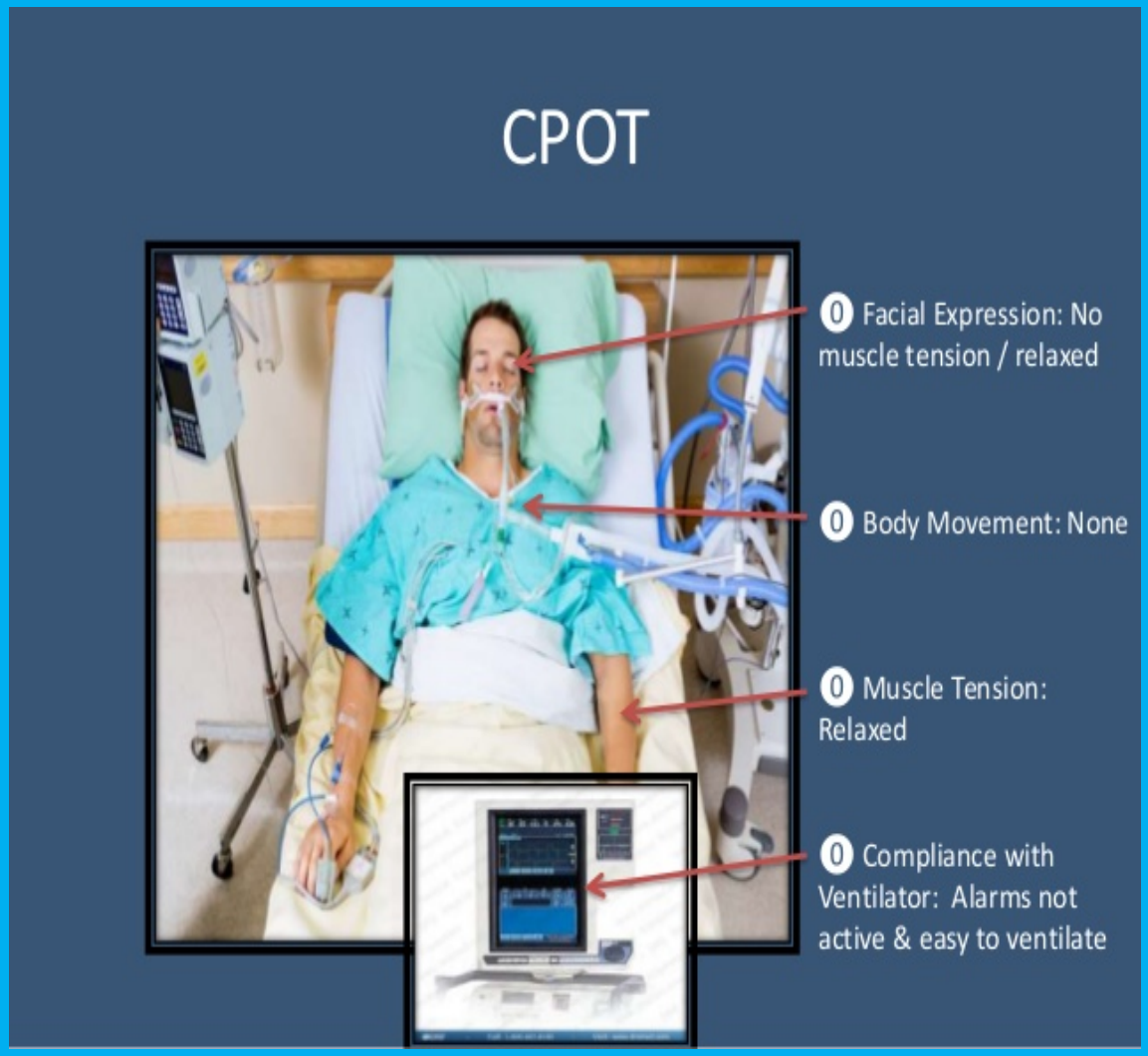
BPS and CPOT

Item	Description	Score
Facial expression	Relaxed	1
	Partially tightened	2
	Fully tightened	3
	Grimacing	4
Upper limbs movement	No movement	1
	Partially bent	2
	Fully bent with finger flexion	3
	Permanently retracted	4
Compliance with mechanical ventilation	Tolerating movement	1
	Coughing but tolerating most of the time	2
	Fighting ventilator	3
	Unable to control ventilation	4

Item	Description	Score
Facial expression	Relaxed	0
	Tense	1
	Grimacing	2
Body Movements	No movement	0
	Protection	1
	Restlessness/Agitation	2
Compliance with mechanical ventilation **Or** **Vocalization (extubated patients)**	Tolerating ventilator or movement	0
	Coughing but tolerating	1
	Fighting ventilator	2
	Talking in normal tone or no sound	0
	Sighing, moaning	1
	Crying out, sobbing	2
Muscle Tension	Relaxed	0
	Tense, rigid	1
	Very tense or rigid	2

Intensive Crit Care Nurs. 2006;22:32-09
Am J Crit Care. 2006;15:420-7.

CPOT Example



Limitations of Behavioral Scales

- Scores not proportional to patient reported
- Detect presence/lack of pain
  - Qualitative pain assessment
- Not reliable in patients unable to move or exhibit behaviors

Pain Manage Nurse 2011;12:230-50

Procedural Pain

Procedure	N (%)	Preprocedural Pain Intensity Median (IQR)	Pain Intensity During the Procedure Median (IQR)	Difference Median (IQR)	*P* Value*
Chest tube removal	292 (6.1)	2 (0–4)	5 (3–7)	2.5 (0.5–4)	<0.0001
Wound drain removal	75 (1.6)	2 (0–4)	4.5 (2–7)	2 (0–4.5)	<0.0001
Arterial line insertion	199 (4.1)	1 (0–2.5)	4 (2–6)	2.75 (0–5)	<0.0001
Endotracheal suctioning	767 (15.9)	1 (0–4)	4 (1–6)	1.5 (0–4)	<0.0001
Tracheal suctioning	302 (6.3)	1 (0–3.5)	4 (1–6)	1 (0–4)	<0.0001
Peripheral intravenous insertion	315 (6.5)	1 (0–3)	3 (1–5.5)	1 (0–3)	<0.0001
Peripheral blood draw	328 (6.8)	0.5 (0–3)	3 (1–5)	1 (0–3)	<0.0001
Turning	873 (18.1)	1.75 (0–4)	3 (0.25–6)	1 (0–2.5)	<0.0001
Respiratory exercises	439 (9.1)	2 (0–4)	3 (1–5)	1 (0–2)	<0.0001
Positioning	371 (7.7)	1 (0–4)	3 (0–5)	1 (0–2)	<0.0001
Wound care	301 (6.3)	2 (0–4)	3 (1–6)	0.5 (0–2)	<0.0001
Mobilization	526 (10.9)	1 (0–3)	2 (0–5)	0 (0–2)	<0.0001

Am J Respir Crit Care Med. 2014;189:39-47.

“A” Summary

- Assess pain frequently
- Treat NRS >3, BPS >5, or CPOT>2
- Prevent pain via pre-procedural analgesia or non pharmacological therapy

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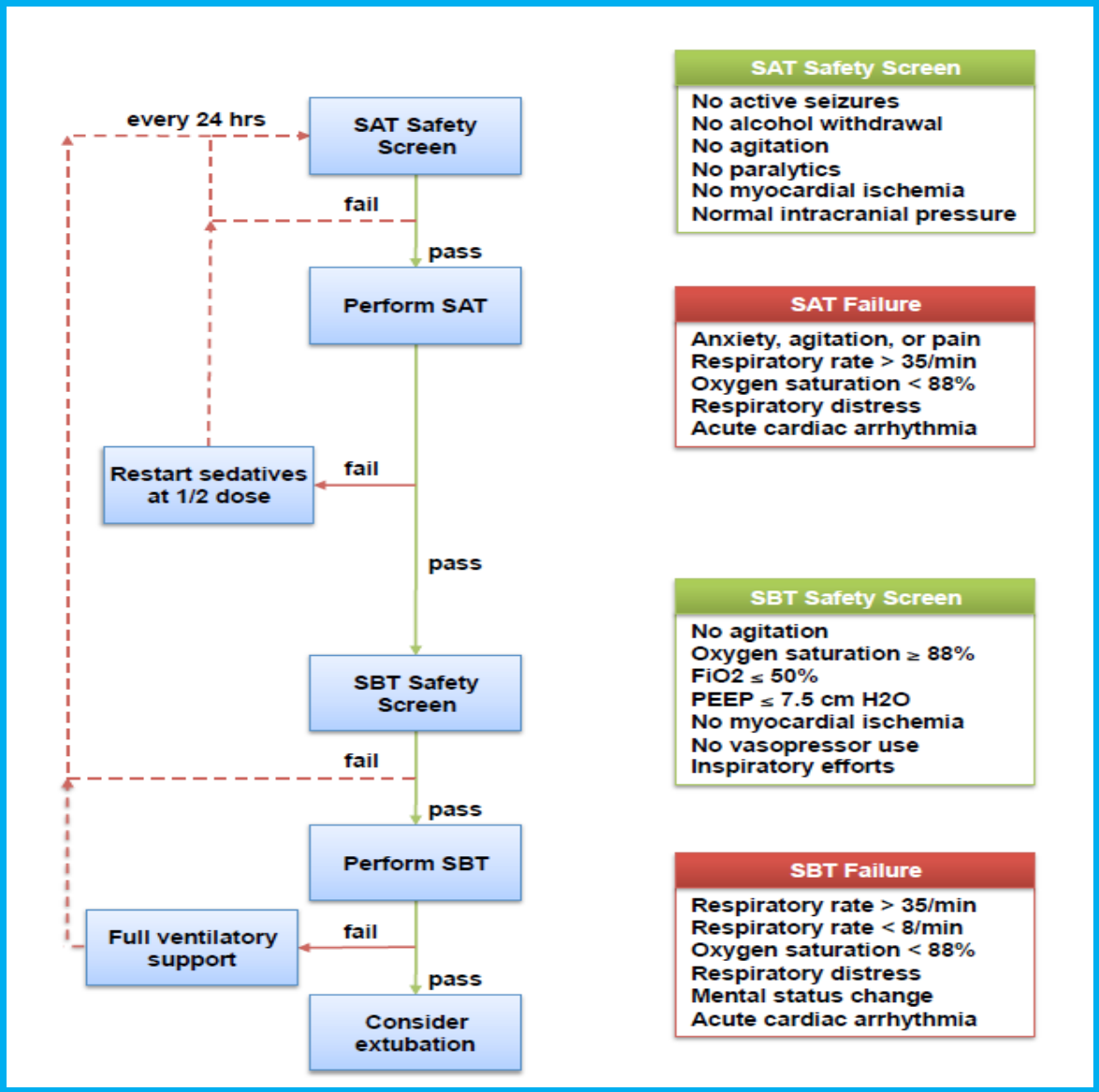
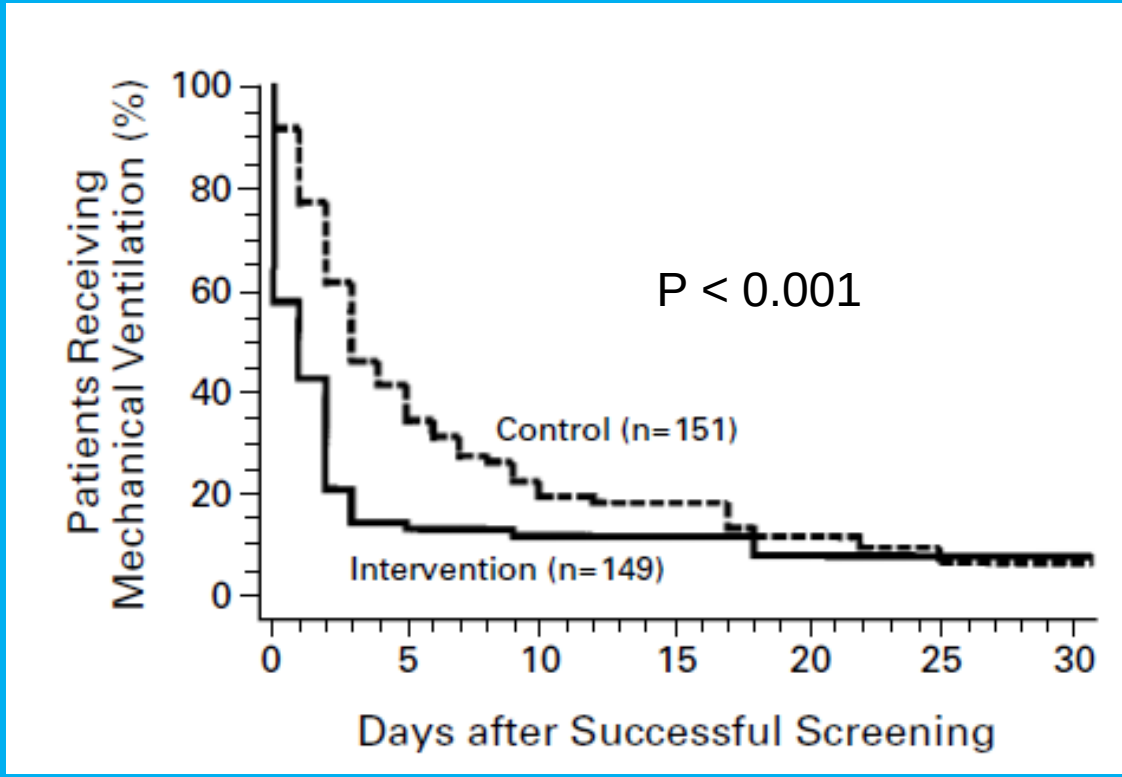
http://www.iculiberation.org/SiteCollectionDocuments/Bundles-ICU-Liberation-ABCDEF.pdf

Spontaneous Awakening and Breathing Trial



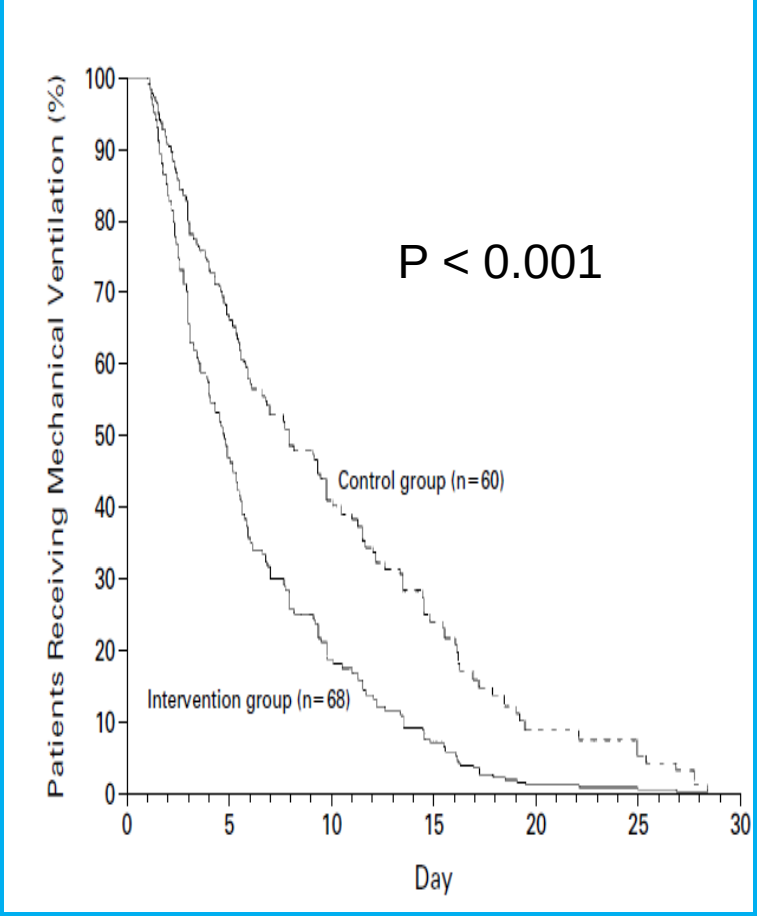
http://www.iculiberation.org/SiteCollectionDocuments/Bundles-ICU-Liberation-ABCDEF.pdf

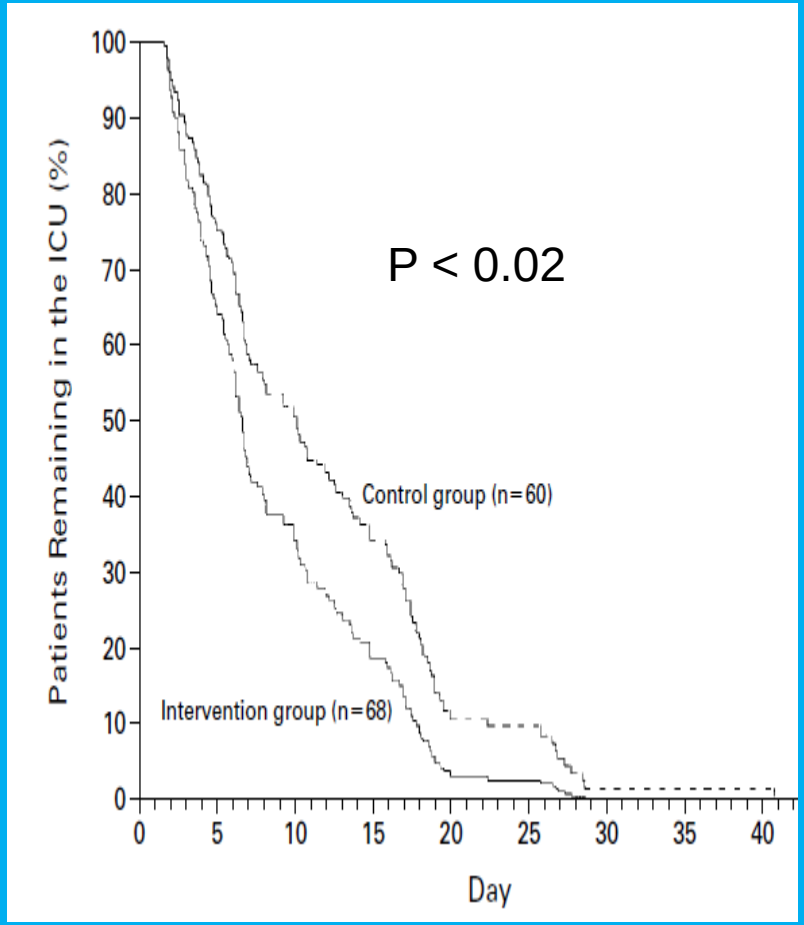
Spontaneous Breathing Trial



N Engl J Med 1996; 335:1864-1869

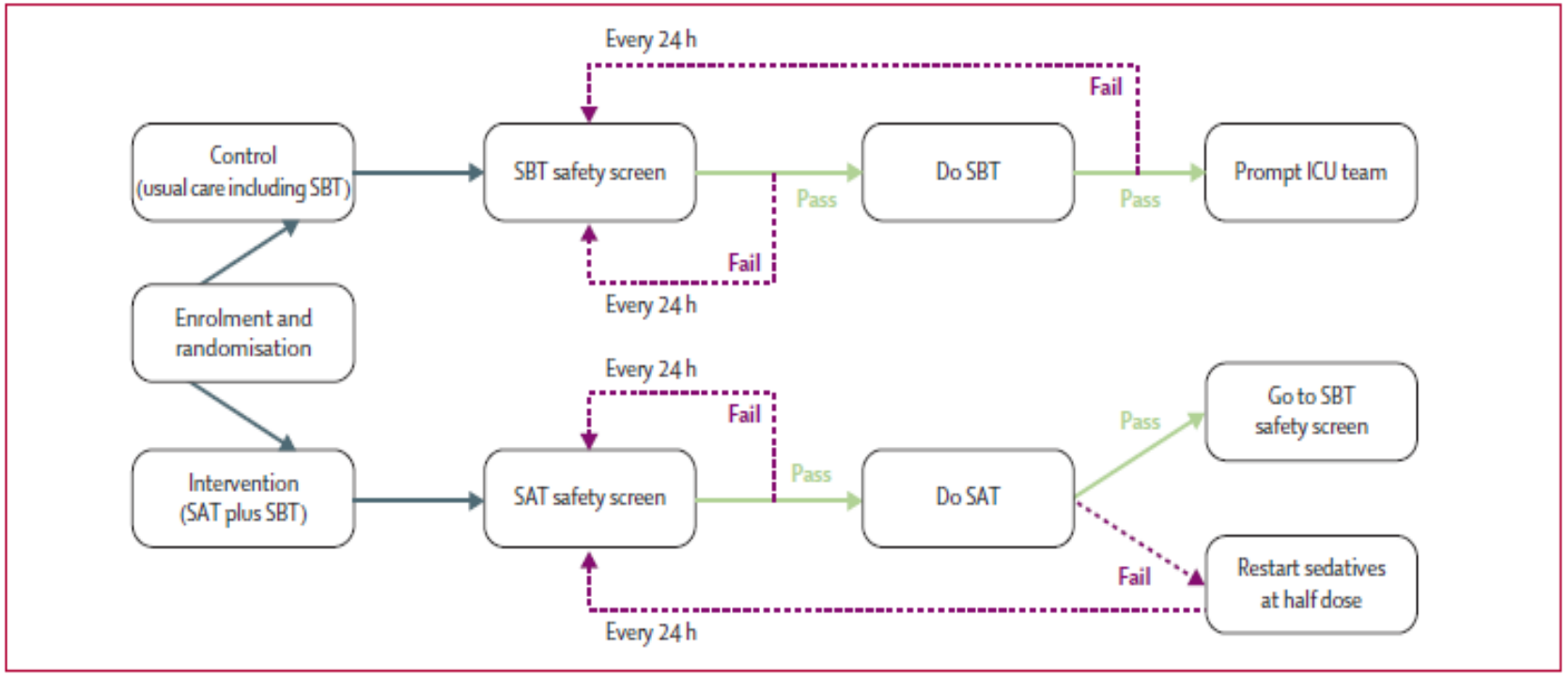
Sedation Vacation – Awakening Trial





N Engl J Med 2000;342:1471-7.

“Wake up and Breath”



Lancet. 2008;371:126-34.

ABC

	Intervention group (n=167)	Control group (n=168)	p value
Ventilator-free days*			
Mean	14·7 (0·9)	11·6 (0·9)	0·02
Median	20·0 (0 to 26·0)	8·1 (0 to 24·3)	
Time to discharge (days)			
From intensive care	9·1 (5·1 to 17·8)	12·9 (6·0 to 24·2)	0·01
From hospital	14·9 (8·9 to 26·8)	19·2 (10·3 to NA)†	0·04
28-day mortality	47 (28%)	58 (35%)	0·21
1-year mortality	74 (44%)	97 (58%)	0·01
Duration of brain dysfunction (days)			
Coma	2 (0 to 4)	3 (1 to 7)	0·002
Delirium	2 (0 to 5)	2 (0 to 6)	0·50
RASS at first successful SBT	−1 (−3 to 0)	−2·5 (−4 to 0)	0·0001
Complications			
Any self-extubation	16 (10%)	6 (4%)	0·03
Self-extubation requiring reintubation‡	5 (3%)	3 (2%)	0·47
Reintubation‡	23 (14%)	21 (13%)	0·73
Tracheostomy	21 (13%)	34 (20%)	0·06

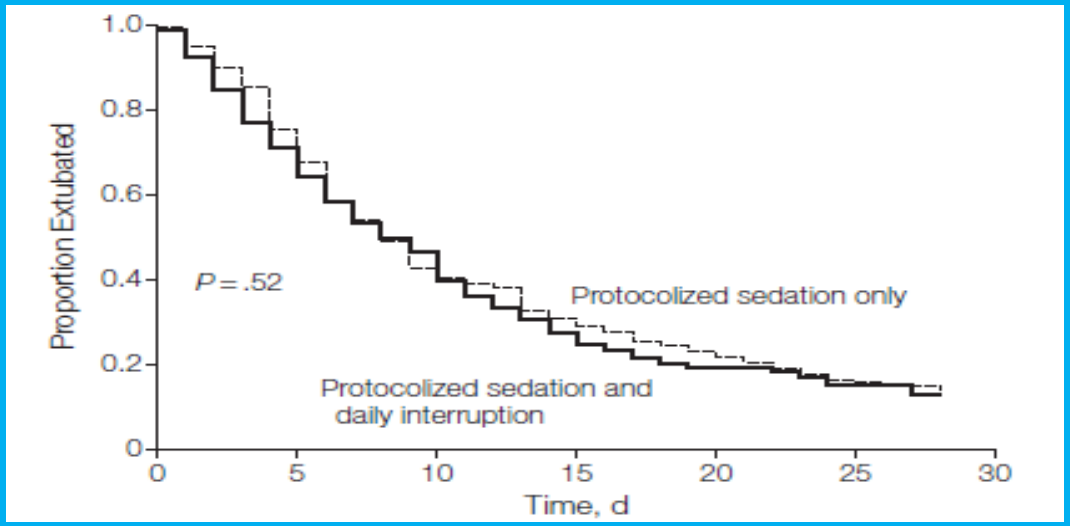
Lancet. 2008;371:126-34.

Light Sedation

Outcome	Ramsey 1 - 2	Ramsey 3 - 4	p value
Ventilator days, mean ± SD	2.9 ± 5.0	5.5 ± 10.8	0.02
ICU length of stay, median (range)	4.0 (1–129)	5.5 (2–99)	0.03

Crit Care Med. 2009;37:2527-34

SLEAP Trial



	Protocolized Sedation and Interruption (n = 214)	Protocolized Sedation (n = 209)	Measure of Effect, Mean Difference (95% CI)	*P* Value
Midazolam equivalents				
Total dose/patient, mg	1087 (4297) 222 (50 to 734)	1038 (4592) 237 (57 to 599)	48.4 (–804.4 to 901.2)	.91
Dose/patient/d, mg	102 (326) 8 (0 to 86)	82 (287) 0 (0 to 50)	19.23 (2.37 to 37.07)	.04
Dose/patient/d, infusion, mg	101 (325) 6 (0 to 86)	82 (287) 0 (0 to 50)	19.22 (1.92 to 36.53)	.03
Dose/patient/d, bolus, mg	0.99 (5.9) 0 (0 to 0)	0.49 (2.65) 0 (0 to 0)	0.50 (0.23 to 0.76)	<.001
Fentanyl equivalents				
Total dose/patient, μg	18 997 (59 928) 5286 (1512 to 16 437)	13 532 (23 219) 5936 (2056 to 15 236)	5464.6 (–3236.0 to 14 165.2)	.22
Dose/patient/d, μg	1780 (4135) 550 (50 to 1850)	1070 (2066) 260 (0 to 1400)	709.3 (522.0 to 897.7)	<.001
Dose/patient/d, infusion, μg	1664 (4070) 420 (0 to 1725)	984 (2002) 80 (0 to 1260)	679.7 (495.3 to 864.1)	<.001
Dose/patient/d bolus, μg	116 (215) 0 (0 to 100)	86 (169) 40 (0 to 150)	30.13 (19.15 to 41.11)	<.001

JAMA. 2012;308:1985-92.

“B” Summary

- Utilize validated sedation scales with frequent reassessment of sedation depth

- Coordinated SAT (or light sedation) and SBT can reduce mechanical ventilation, length of stay and delirium(?)

- Keep patients as awake and alert as possible, extubate when feasible

Which of the following is false regarding element “B”

A. SAT paired with SBT can reduce time on mechanical ventilation and ICU length of stay
B. SBT while targeting light sedation may be as effective as SAT paired with SBT
C. SAT and SBT should only be performed after safety screens are passed
D. Combining SAT and SBT does not generally lead to more self extubations

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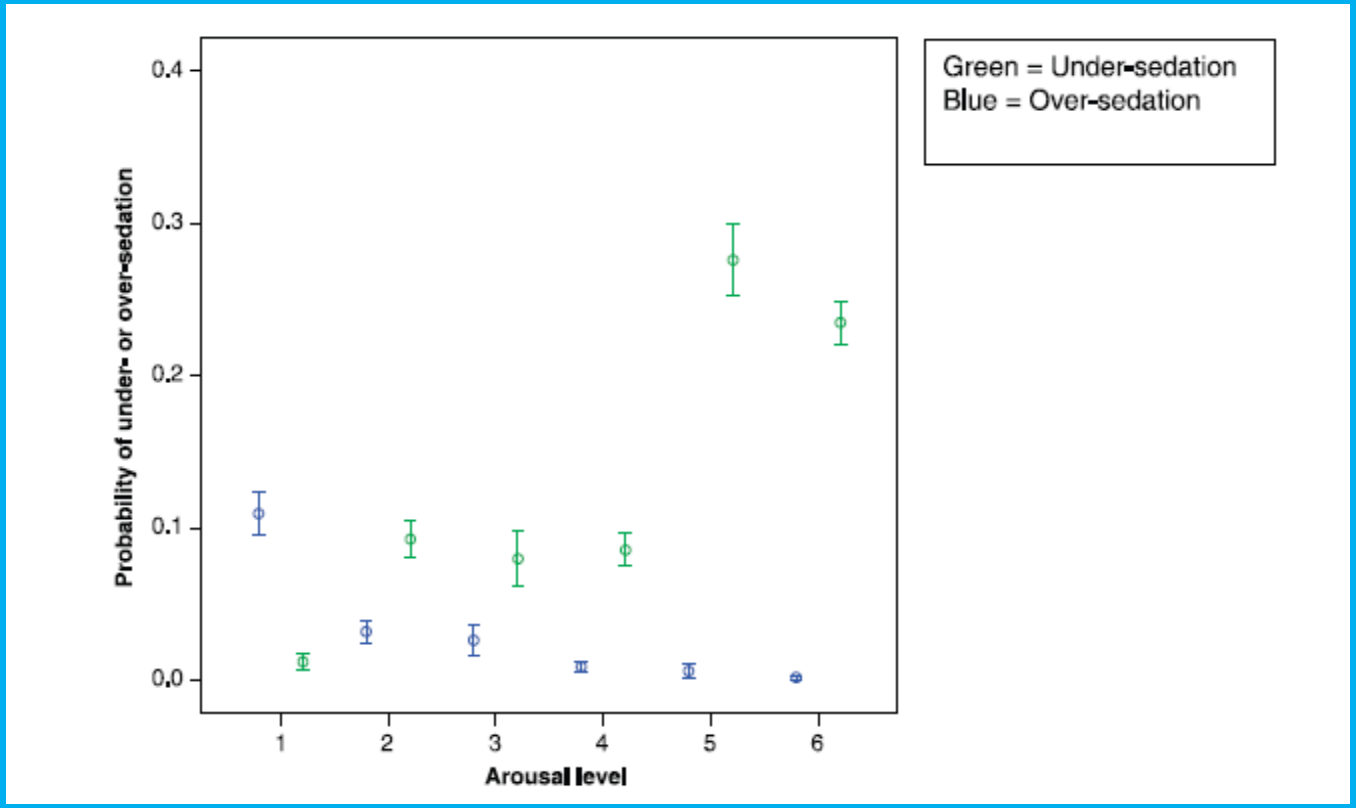
Sedation Scales

Richmond Agitation Sedation Scale (RASS)	
4	Combative
3	Very Agitated
2	Agitated
1	Restless
0	Alert and Calm
-1	Drowsy
-2	Light Sedation
-3	Moderate Sedation
-4	Deep Sedation
-5	Unarousable

Sedation Agitation Scale (SAS)	
7	Dangerously agitated
6	Very agitated
5	Agitated
4	Calm and cooperative
3	Sedated
2	Very Sedated
1	Unarousable

Am J Respir Crit Care Med. 2002 166:1338-44.
Crit Care Med. 1999;27:1325-9.

The Correct Sedation Target

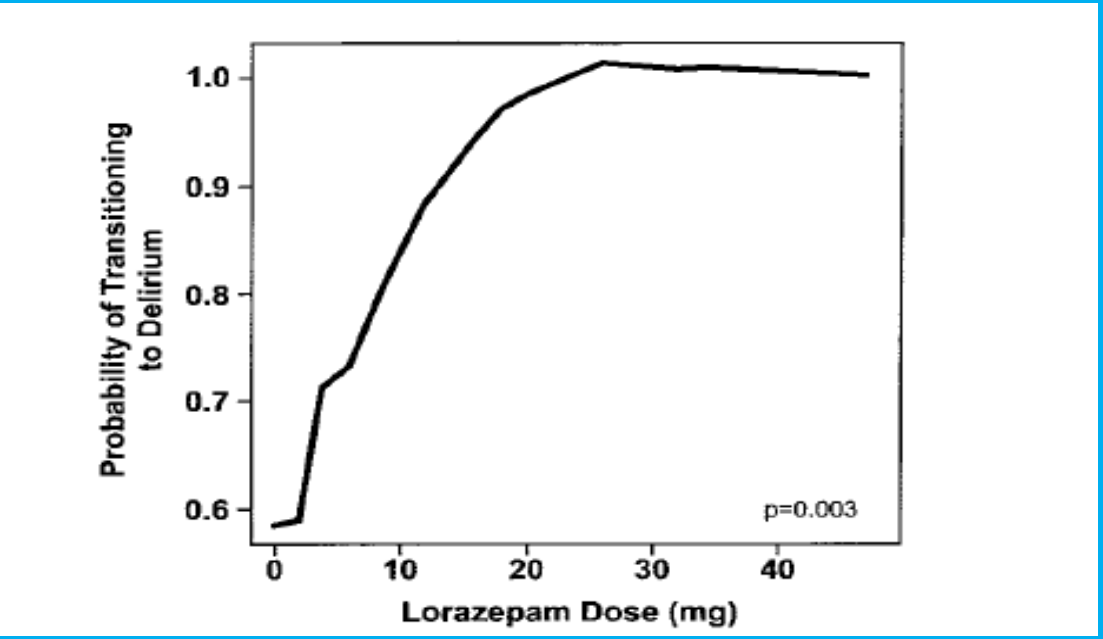


Crit Care Med. 2007;35:393-401.

Benzodiazepine Delirium Association

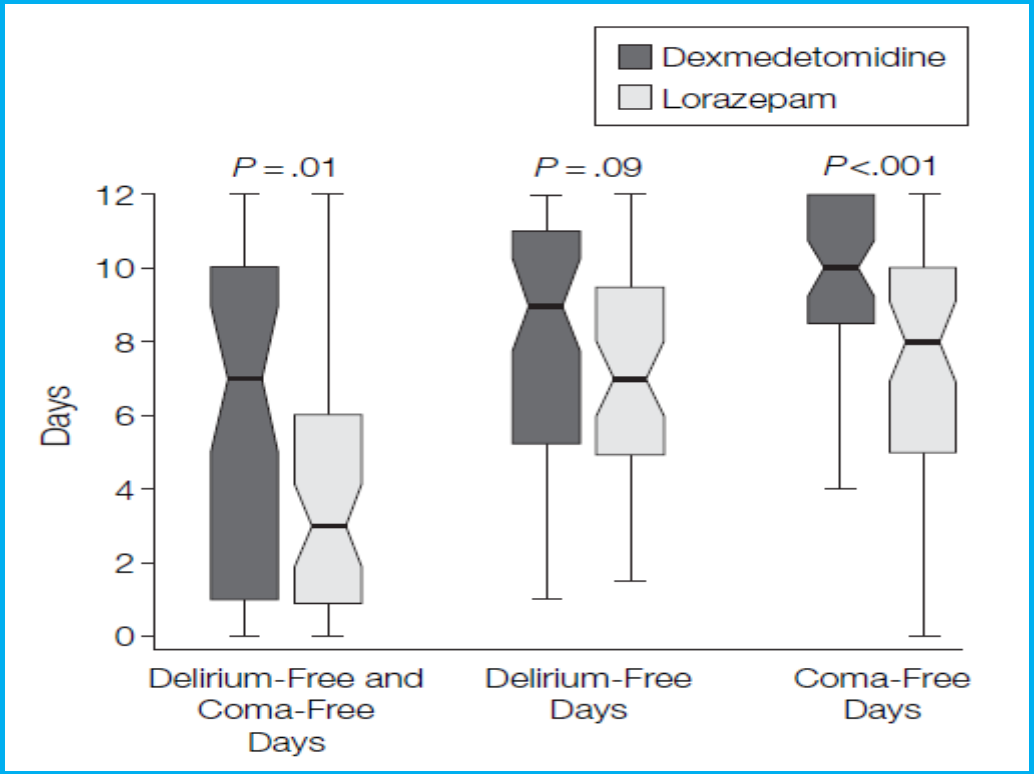
Outcome	Lorazepam (n = 64)	Propofol (n = 68)	p value
Ventilator days	8.4 (4.6, 14.7)	5.8 (3.5, 10.3)	0.04
Ventilator days, survivors	9.0 (5.3, 16.8)	4.4 (3.0, 8.7)	0.006
ICU length of stay, survivors	12.7 (7.8, 19.1)	8.6 (5.0, 14.7)	0.05

All values reported as median (IQR)



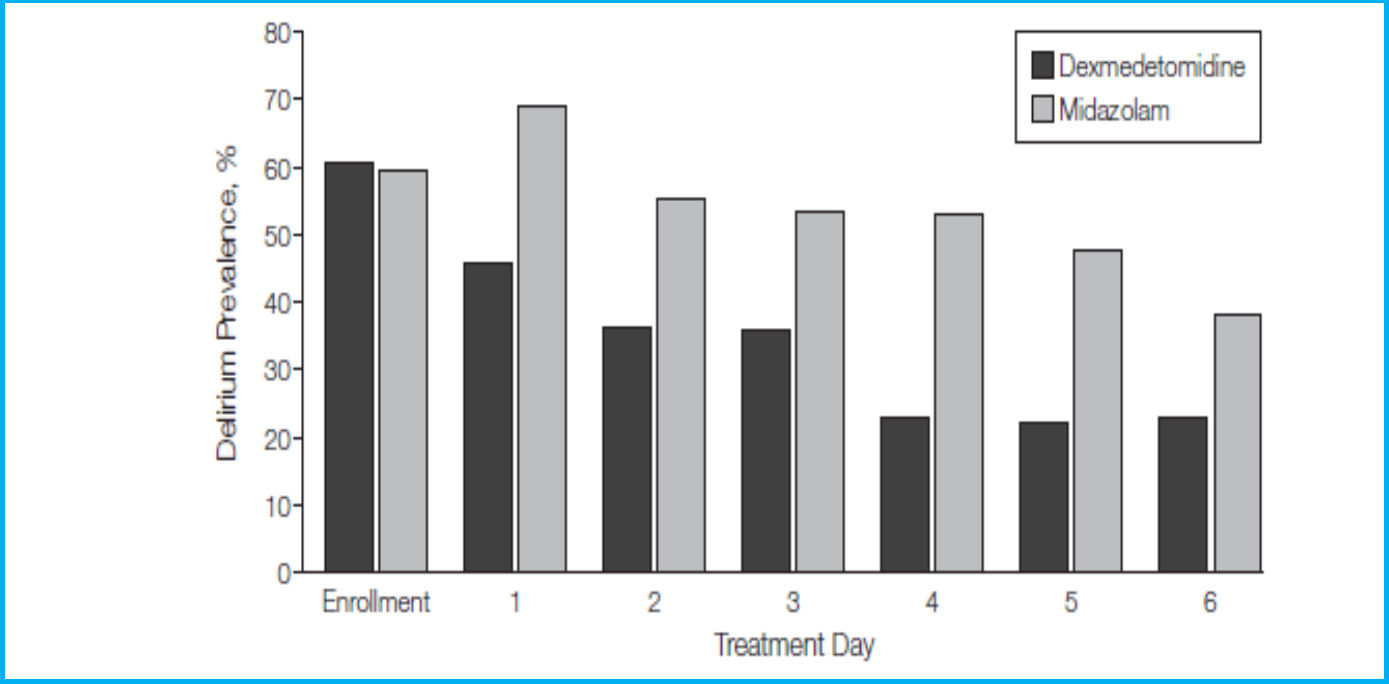
Crit Care Med 2006; 34:1326–1332
Anesthesiology. 2006;104:21-6.

MENDS Trial



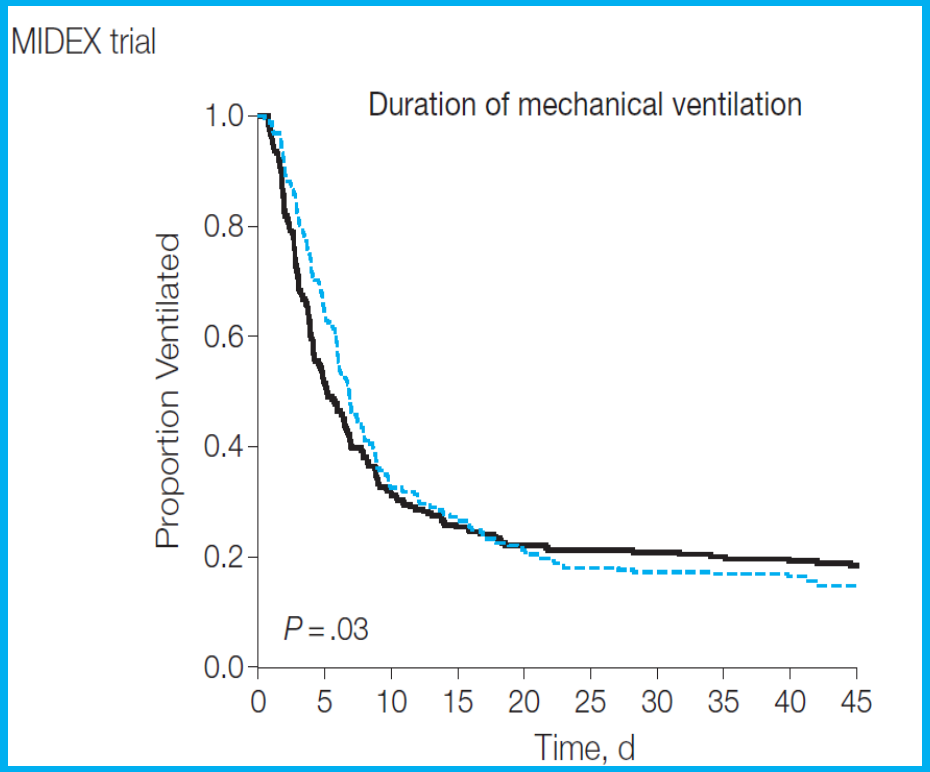
JAMA. 2007;298:2644-2653

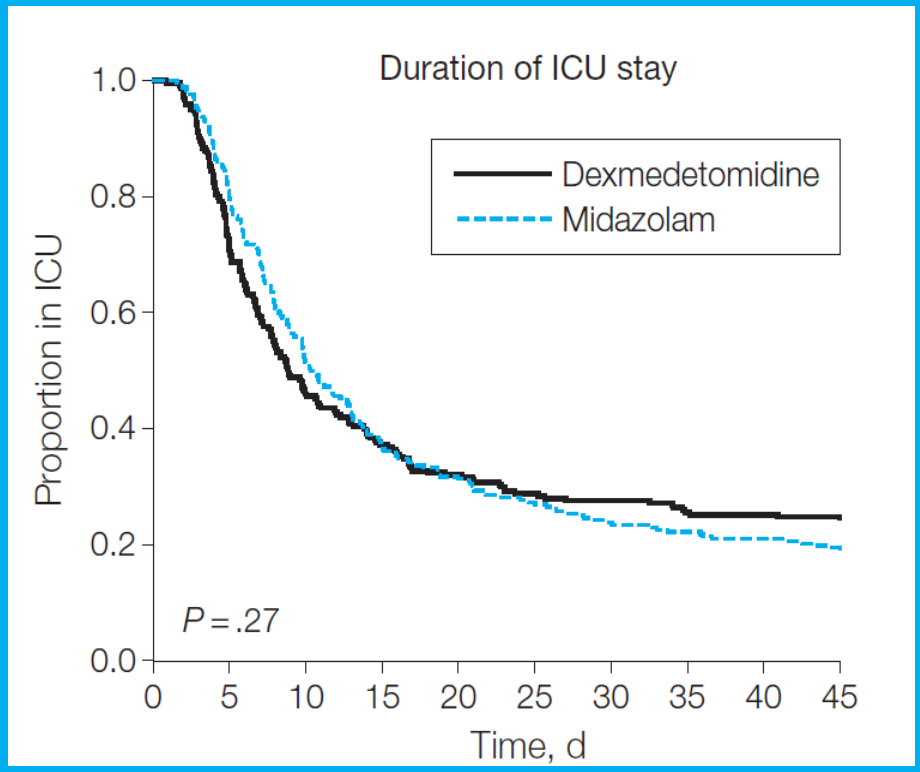
SEDCOM



JAMA. 2009;301:489-499

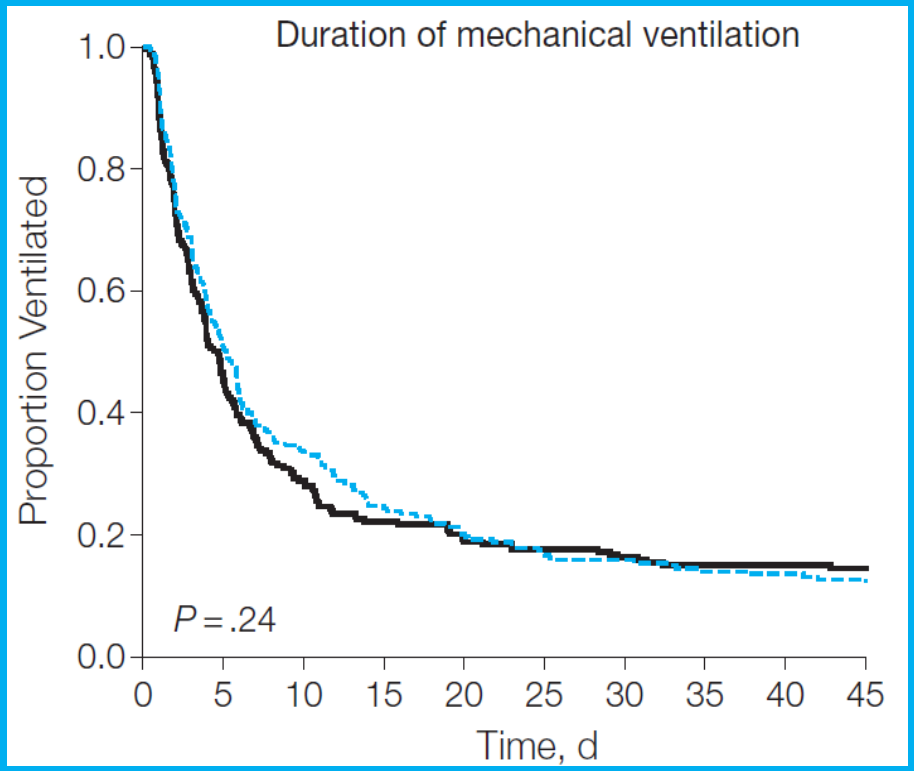
PRODEX/MIDEX

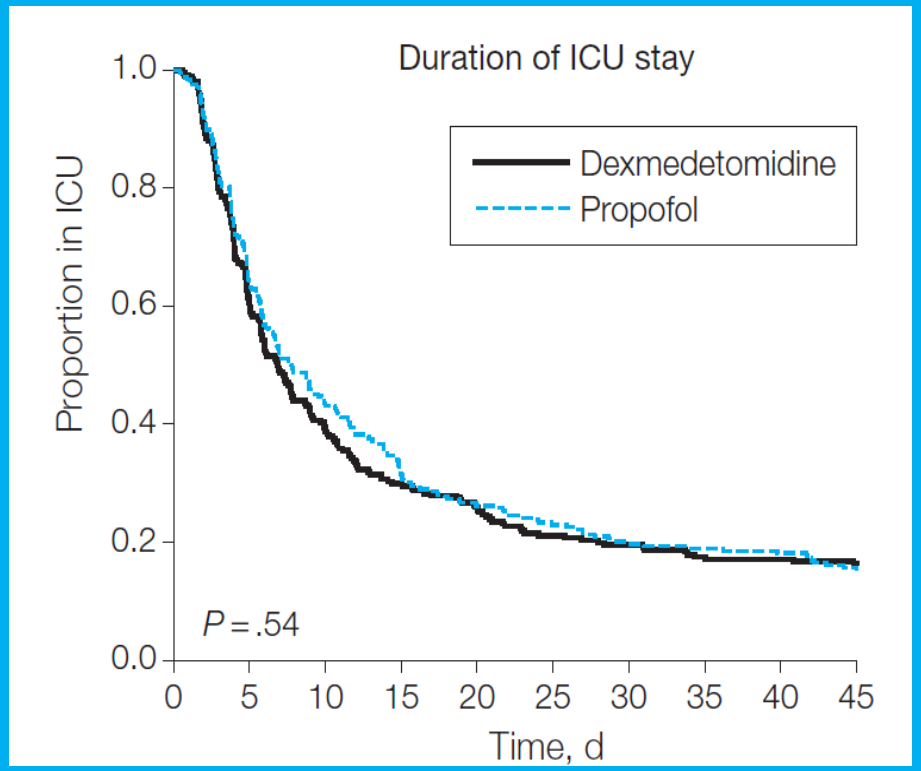




JAMA. 2012;307:1151-1160

PRODEX/MIDEX





JAMA. 2012;307:1151-1160

PRODEX/MIDEX

	Midex							Prodex						
	Dexmedetomidine			Midazolam				Dexmedetomidine			Propofol			
	N	(%)	Events	N	(%)	Events	P value	N	(%)	Events	N	(%)	Events	P value
CAM-ICU assessment at 48- hour follow-up														
Positive	28	(11.9)		33	(13.9)		0.393	22	(9.6)		31	(13.7)		0.231
Negative	138	(58.7)		123	(51.7)			148	(64.9)		139	(61.5)		
Unassessable	69	29.4		82	34.5			58	(25.4)		56	(24.8)		

Preferred term	Midex							Prodex						
	Dexmedetomidine (N = 247)			Midazolam (N = 250)				Dexmedetomidine (N = 246)			Propofol (N = 247)			
	N	(%)	events	N	(%)	events	P value	N	(%)	events	N	(%)	events	P value
Hypertension	53	(21.5)	70	52	(20.8)	74	0.913	52	(21.1)	62	37	(15.0)	40	0.08
Sinus tachycardia	34	(13.8)	46	54	(21.6)	89	0.025	48	(19.5)	85	28	(11.3)	46	0.013
Hypotension	51	(20.6)	58	29	(11.6)	51	0.007	32	(13.0)	38	33	(13.4)	41	
Atrial fibrillation	33	(13.4)	42	42	(16.8)	68	0.317	30	(12.2)	38	35	(14.2)	45	0.595
Agitation	39	(15.8)	44	41	(16.4)	44	0.903	19	(7.7)	20	29	(11.7)	33	0.171
Bradycardia	35	(14.2)	47	13	(5.2)	16	< 0.001	32	(13.0)	51	25	(10.1)	33	0.328

JAMA. 2012;307:1151-1160

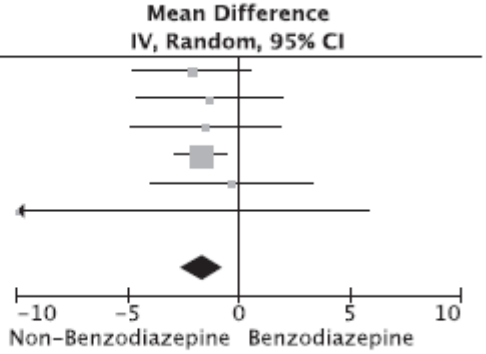
The Benzodiazepine Problem

ICU Length of Stay

Study or Subgroup	Non-Benzodiazepine Mean	SD	Total	Benzodiazepine Mean	SD	Total	Weight	Mean Difference IV, Random, 95% CI
Carson 2006	8.3	7.4	68	10.4	8.2	64	12.3%	−2.10 [−4.77, 0.57]
Jakob 2012	8.8	22.1	249	10.1	14.5	251	8.1%	−1.30 [−4.58, 1.98]
Pandharipande 2007	7.5	10.4	52	9	6.7	51	7.7%	−1.50 [−4.87, 1.87]
Riker 2009	5.9	5.2	244	7.6	5.4	122	65.1%	−1.70 [−2.86, −0.54]
Roukonen 2009	6.6	4.6	41	6.9	6.9	16	6.5%	−0.30 [−3.96, 3.36]
Weinbroum1997	21	22.3	31	31	42	36	0.3%	−10.00 [−25.81, 5.81]
Total (95% CI)			**685**			**540**	**100.0%**	**−1.64 [−2.57, −0.70]**

Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 1.76$, df = 5 (P = 0.88); $I^2 = 0\%$

Test for overall effect: Z = 3.44 (P = 0.0006)

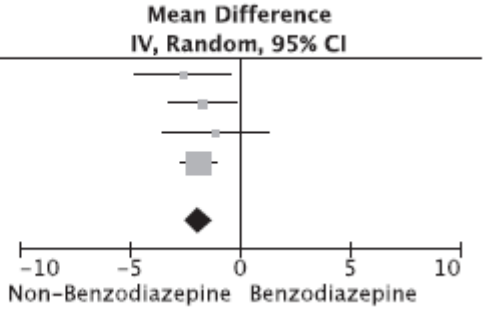


Duration of Mechanical Ventilation

Study or Subgroup	Non-Benzodiazepine Mean	SD	Total	Benzodiazepine Mean	SD	Total	Weight	Mean Difference IV, Random, 95% CI
Carson 2006	5.8	5	68	8.4	7.5	64	8.7%	−2.60 [−4.79, −0.41]
Jakob 2012	5.1	8.3	251	6.8	8.9	249	18.4%	−1.70 [−3.21, −0.19]
Pandharipande 2007	5.5	7.8	52	6.6	4.3	51	7.1%	−1.10 [−3.53, 1.33]
Riker 2009	3.7	3.6	244	5.6	3.7	122	65.8%	−1.90 [−2.70, −1.10]
Total (95% CI)			**615**			**486**	**100.0%**	**−1.87 [−2.51, −1.22]**

Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 0.87$, df = 3 (P = 0.83); $I^2 = 0\%$

Test for overall effect: Z = 5.66 (P < 0.00001)



Crit Care Med. 2013 ;41(9 Suppl 1):S30-8. doi

Analgo-Sedation

- Utilize opioids to treat pain before administering sedatives
- Attain analgesia and sedation from single drug
- Avoid sedative related adverse events
- Inappropriate for pharmacologic paralysis, increased ICP, alcohol/benzodiazepine withdrawal

“No Sedation Protocol”

	No sedation (n=55)	Sedation (n=58)	p value
Days without mechanical ventilation (from intubation to day 28)	13·8 (11·0); 18·0 (0–24·1)	9·6 (10·0); 6·9 (0–20·5)	0·0191*†
Length of stay (days)			
Intensive care unit	13·1 (5·7–··)‡	22·8 (11·7–··)‡	0·0316*§
Hospital	34 (17–65)	58 (33–85)	0·0039*§¶
Mortality			
Intensive care unit	12 (22%)	22 (38%)	0·06
Hospital	20 (36%)	27 (47%)	0·27
Drug doses (mg/kg)||			
Propofol (per h of infusion)**	0 (0–0·515)	0·773 (0·154–1·648)	0·0001
Midazolam (per h of infusion)	0 (0–0)	0·0034 (0–0·0240)	<0·0001
Morphine (per h of mechanical ventilation)	0·0048 (0·0014–0·0111)	0·0045 (0·0020–0·0064)	0·39
Haloperidol (per day of mechanical ventilation)	0 (0–0·0145)	0 (0–0)	0·0140
Tracheostomy	16 (29%)	17 (29%)	0·98
Ventilator-associated pneumonia	6 (11%)	7 (12%)	0·85

Lancet. 2010 ;375:475-80

“C” Summary

- Assess pain and level of sedation frequently
- Manage pain before using sedatives
- Consider non-opioid analgesics to decrease opioid requirement
- Consider neuropathic pain specific pharmacotherapy
- Consider non-benzodiazepine based sedation when necessary

Which of the following is true regarding sedation pharmacotherapy?

A. Propofol and benzodiazepines appear to be associated with similar time on mechanical ventilation

B. Propofol and benzodiazepines appear to be associated with similar rates of delirium

C. Dexmedetomidine has not been shown to be associated with less delirium than propofol

D. Dexmedetomidine has not been shown to be associated with less delirium than benzodiazepines

The Bundle

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

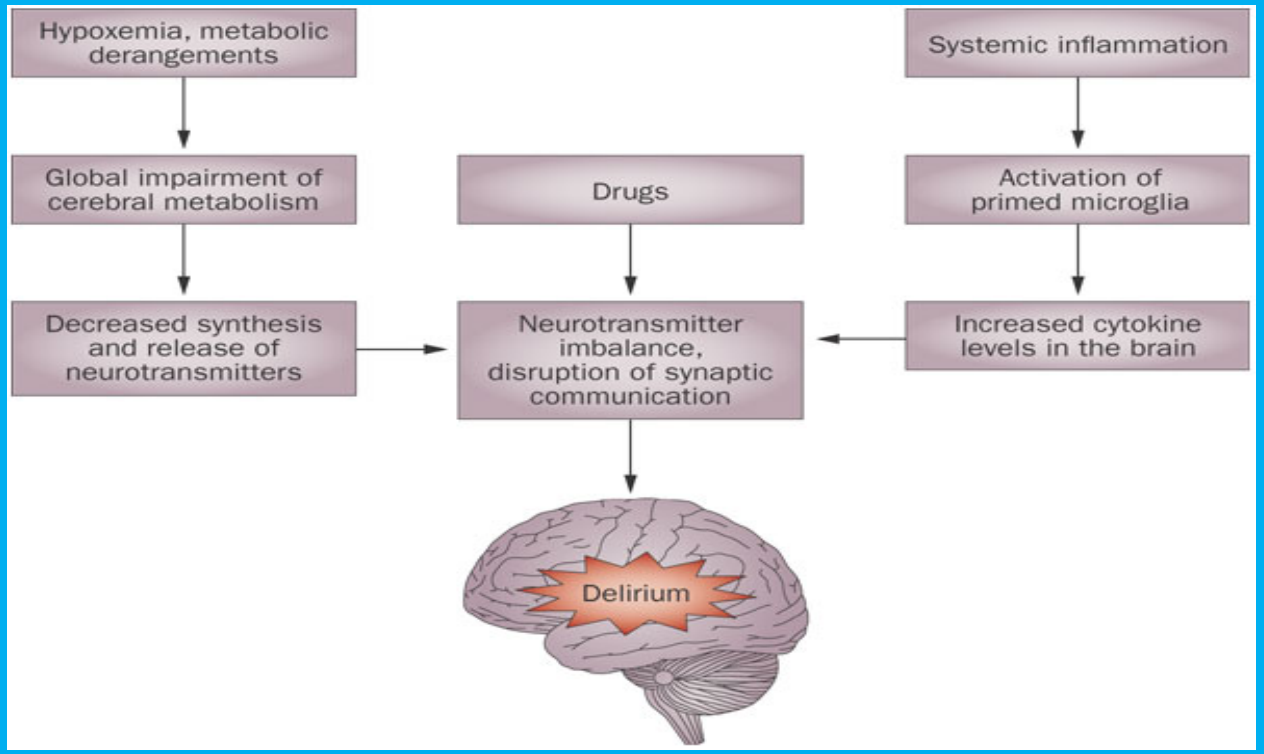
http://www.iculiberation.org/SiteCollectionDocuments/Bundles-ICU-Liberation-ABCDEF.pdf

Delirium

- Disturbance of consciousness and cognition developing acutely and fluctuating
- Occurs in up to 80% of ICU patients
- Costs $4 - $16 billion in the United States annually
- Associated with increased mortality

JAMA 2001;286:2703-2710
Crit Care Med 2004;32:955–962
Crit Care Med 2010; 38:2311–2318

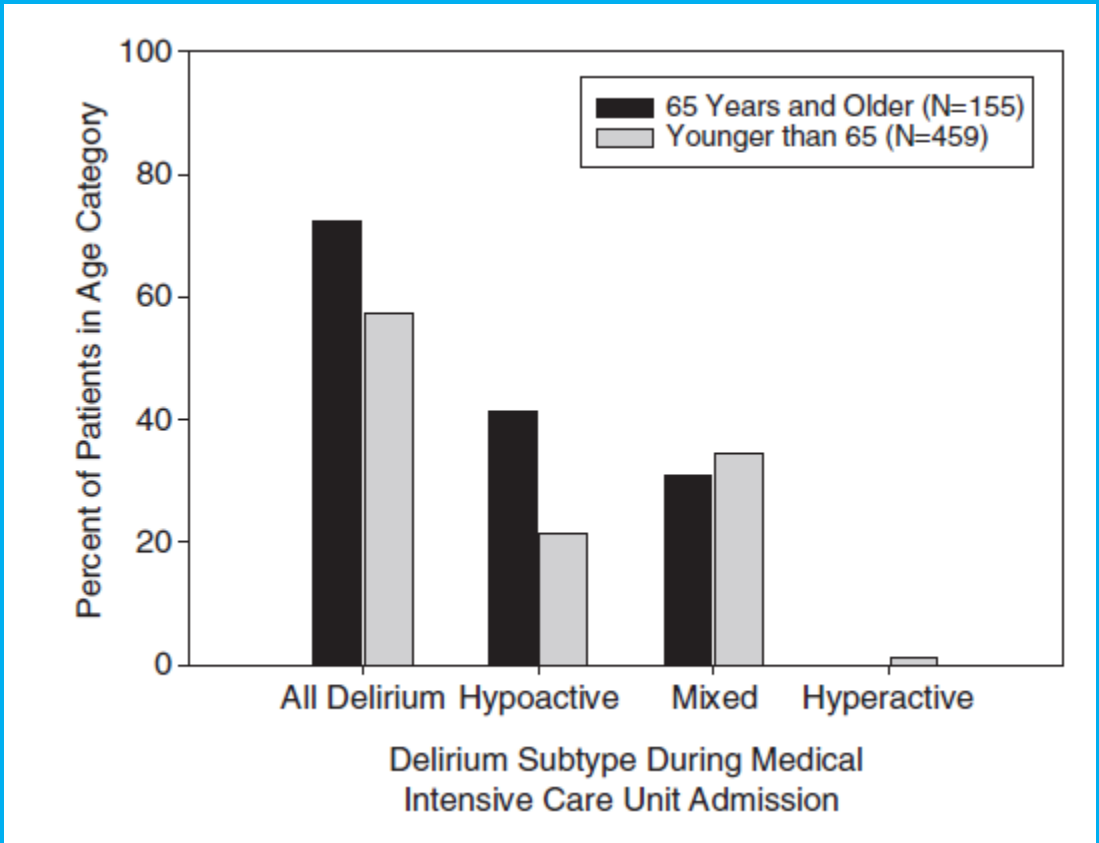
Delirium Risk Factors



Pharmacological	Non-Pharmacological
Antimicrobials	Pain
Benzodiazepines	Sepsis
Corticosteroids	Metabolic derangement
Anticholinergics	CNS infection
Opioids	Renal Failure

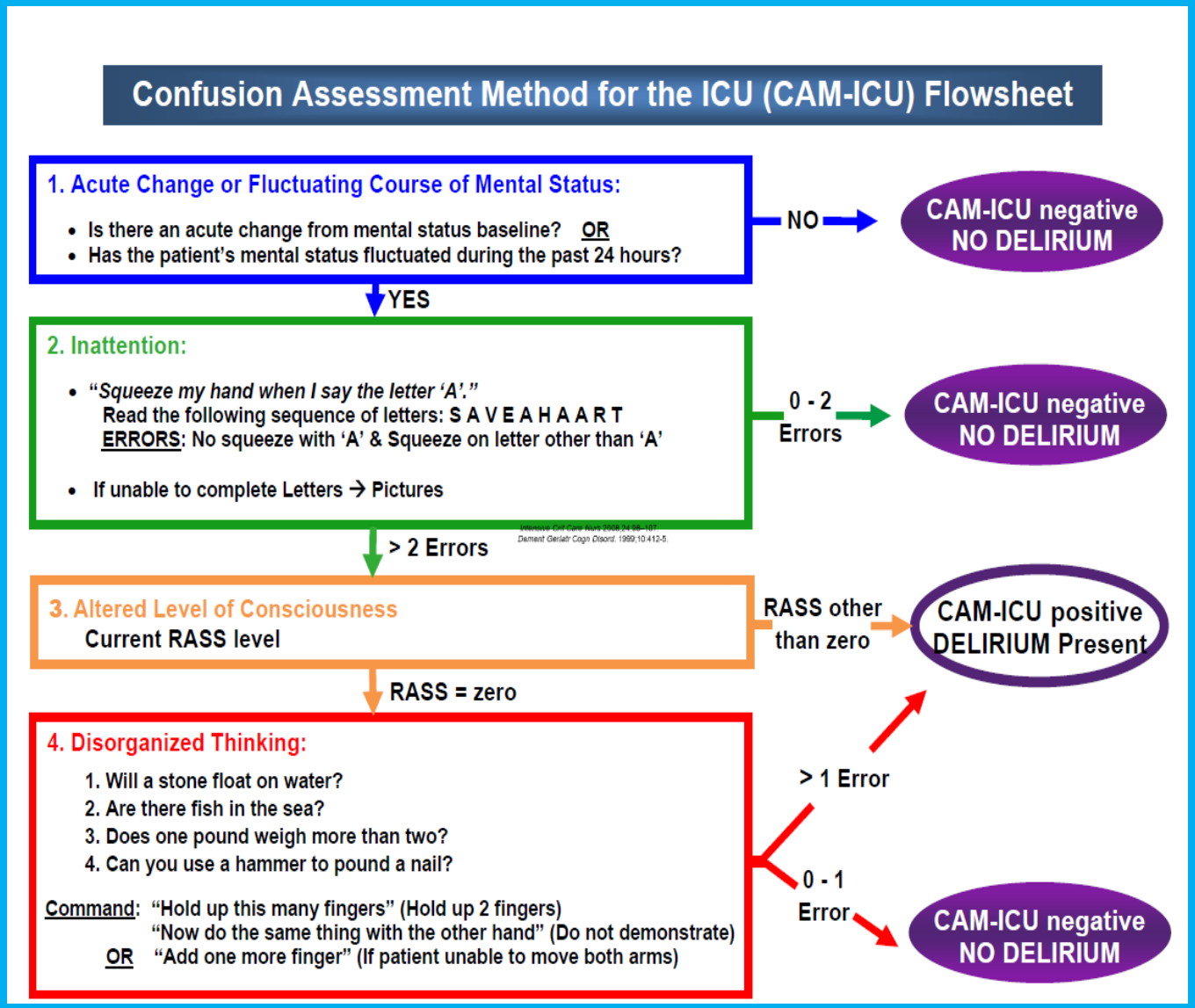
Intensive Crit Care Nurs 2008,24:98–107.
Dement Geriatr Cogn Disord. 1999;10:412-5.

Delirium Types



J Am Geriatr Soc. 2006 ;54:479-84.

Assessment – CAM-ICU



http://www.iculiberation.org/SiteCollectionDocuments/Bundles-ICU-Liberation-ABCDEF.pdf

Intensive Care Delirium Screening Checklist - ICDSC

- Altered level of consciousness
- Inattention
- Disorientation
- Hallucination, delusion, or psychosis
- Psychomotor agitation
- Inappropriate speech or mood
- Sleep/wake cycle disturbances
- Symptom fluctuation

- 1 point per domain
- > 4 = delirium

Delirium Pharmacotherapy

Study	Details	N	Findings
Skrobik 2004	RCT, haloperidol vs olanzapine	73	No difference in delirium severity over 5 days
HOPE-ICU	RCT, Haloperidol vs placebo	141	No difference time spent in delirium
Devlin 2010	RCT, Quetiapine vs placebo	36	Faster delirium resolution 1.0 vs. 4.5 days p =.001 less time spent in delirium 36 vs. 120 p =.006
MIND trial	RCT, haloperidol vs ziprasidone vs placebo	101	No difference in days alive without delirium
Michaud 2016	Retrospective cohort, quetiapine vs placebo for hypoactive delirium	113	Duration of hypoactive delirium shorter (1.5 vs 2.0 days, p=0.04)

Lancet Respir Med. 2013;1:515-23.
Intensive Care Med. 2004;30:444-9.
Crit Care Med. 2010;38:419-27.
Crit Care Med. 2010;38:428-37.
Pharmacotherapy. 2015 ;35:731-9.

Management and Prevention

- Avoid deliriogenic medications
- Pain Management
- Manage Constipation?
- Reorientation
- Non – pharmacologic sleep enhancement?
- Consider atypical antipsychotics to reduce duration of delirium
- Avoid pharmacological prophylaxis

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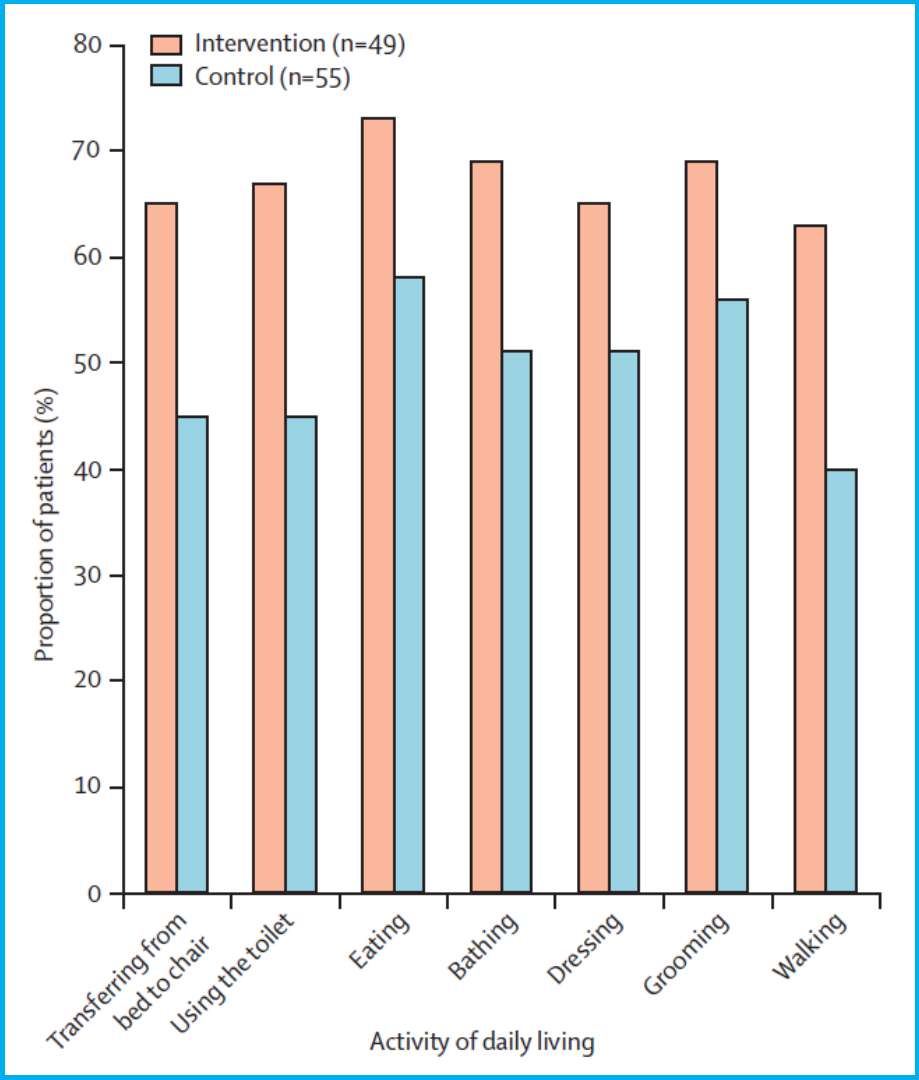
Early Mobility and Exercise

Early Mobility

	Intervention (n=49)	Control (n=55)	p value
Return to independent functional status at hospital discharge	29 (59%)	19 (35%)	0·02
ICU delirium (days)	2·0 (0·0–6·0)	4·0 (2·0–7·0)	0·03
Time in ICU with delirium (%)	33% (0–58)	57% (33–69)	0·02
Hospital delirium (days)	2·0 (0·0–6·0)	4·0 (2·0–8·0)	0·02
Hospital days with delirium (%)	28% (26)	41% (27)	0·01
Barthel Index score at hospital discharge	75 (7·5–95)	55 (0–85)	0·05
ICU-acquired paresis at hospital discharge	15 (31%)	27 (49%)	0·09
Ventilator-free days*	23·5 (7·4–25·6)	21·1 (0·0–23·8)	0·05
Duration of mechanical ventilation (days)	3·4 (2·3–7·3)	6·1 (4·0–9·6)	0·02
Duration of mechanical ventilation, survivors (days)	3·7 (2·3–7·7)	5·6 (3·4–8·4)	0·19
Duration of mechanical ventilation, non-survivors (days)	2·5 (2·4–5·5)	9·5 (5·9–14·1)	0·04
Length of stay in ICU (days)	5·9 (4·5–13·2)	7·9 (6·1–12·9)	0·08
Length of stay in hospital (days)	13·5 (8·0–23·1)	12·9 (8·9–19·8)	0·93
Hospital mortality	9 (18%)	14 (25%)	0·53

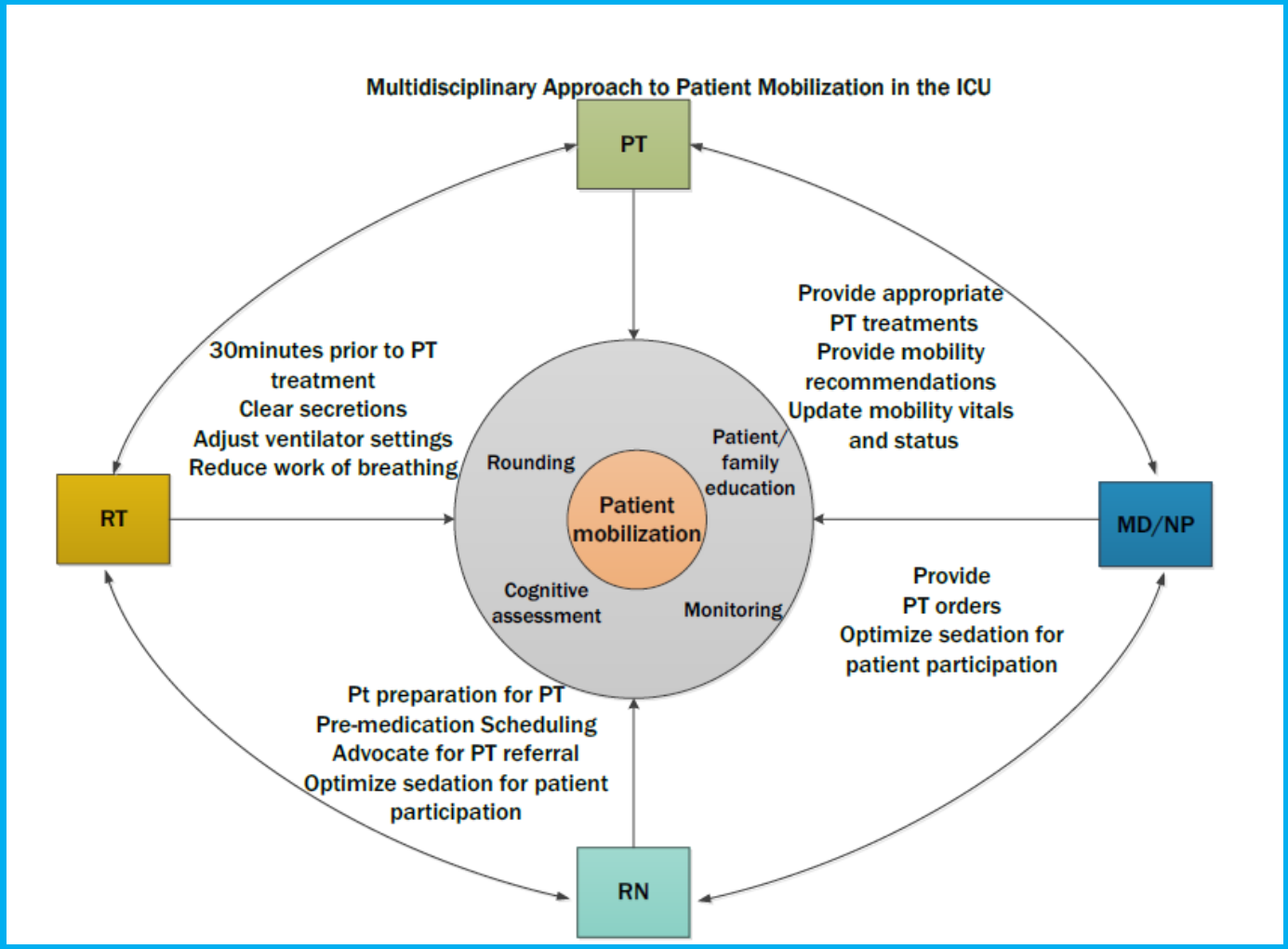
Lancet. 2009 ;373:1874-82.

Early Mobility and Quality of Life



Lancet. 2009 ;373:1874-82.

Mobilizing as a Team Effort



Phys Ther. 2013 ;93:975-85.

Early Mobility and Exercise Summary

- Mobility is responsibility of the entire team
- Wide spectrum of activities patients can do
  - In bed: Passive range of motion, turning side to side, sitting on side of bed
  - Out of bed: Standing at bedside, sitting in chair, walking
- Early mobility is effective in
  - Decreasing delirium incidence
  - Improving capacity for physical functioning
  - Decreasing time spent on mechanical ventilation

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Family Engagement

- Most recent addition to bundle
- Focus on emphasizing “patient and family-centered care”
- Keep family members present and engaged in care

Family Presence

- Approximately 90% of US ICUs had restrictive visitation policies in 2008-2009 Survey
  - Average of 2.8 limitations
- Concept of an “Open” ICU
  - Open visitation policies
  - Daily meetings with family
  - Participation in rounds?
  - Participation in CPR?
- Patient and Family benefits

Crit Care. 2013 16;17:R71
Crit Care Med. 2007;35:605-22.

Family Presence During CPR

Variable	Intervention Group (N=233)	Control Group (N=242)	P Value†	Family Member Present (N=289)	Family Member Absent (N=186)	P Value†
IES score — median (interquartile range)‡	22 (12–33)	24 (13–35)	0.26	21 (11–32)	26 (15–36)	0.007
Presence of PTSD-related symptoms — no. (%)§	64 (27)	90 (37)	0.01	78 (27)	76 (41)	0.01
HADS score — median (interquartile range)¶	10 (6–16)	11 (6–19)	0.44	9 (5–16)	12 (7–19)	0.02
Symptoms of anxiety — no./total no. (%)‖	34/230 (15)	55/239 (23)	<0.001	46/287 (16)	43/182 (24)	<0.001
Symptoms of depression — no./total no. (%)‖	39/230 (17)	50/239 (21)	0.13	42/287 (15)	47/182 (26)	0.009
Saw a psychologist after resuscitation of the patient — no./total no. (%)	20/232 (9)	18/242 (7)	0.83	25/289 (9)	13/185 (7)	0.23
Received newly prescribed psychotropic drugs after resuscitation of the patient — no./total no. (%)	64/230 (28)	77/238 (32)	0.22	72/287 (25)	69/181 (38)	<0.001
Made a suicide attempt after resuscitation of the patient — no./total no. (%)	2/227 (1)	3/238 (1)	—	5/285 (2)	0/180	—

Survival			
Return of spontaneous circulation — no. (%)	94 (27)	58 (25)	0.59
Survival to hospital admission — no. (%)	63 (18)	36 (16)	0.42
Survival to day 28 — no. (%)	11 (3)	9 (4)	0.64

N Engl J Med 2013;368:1008-18

The Bundle

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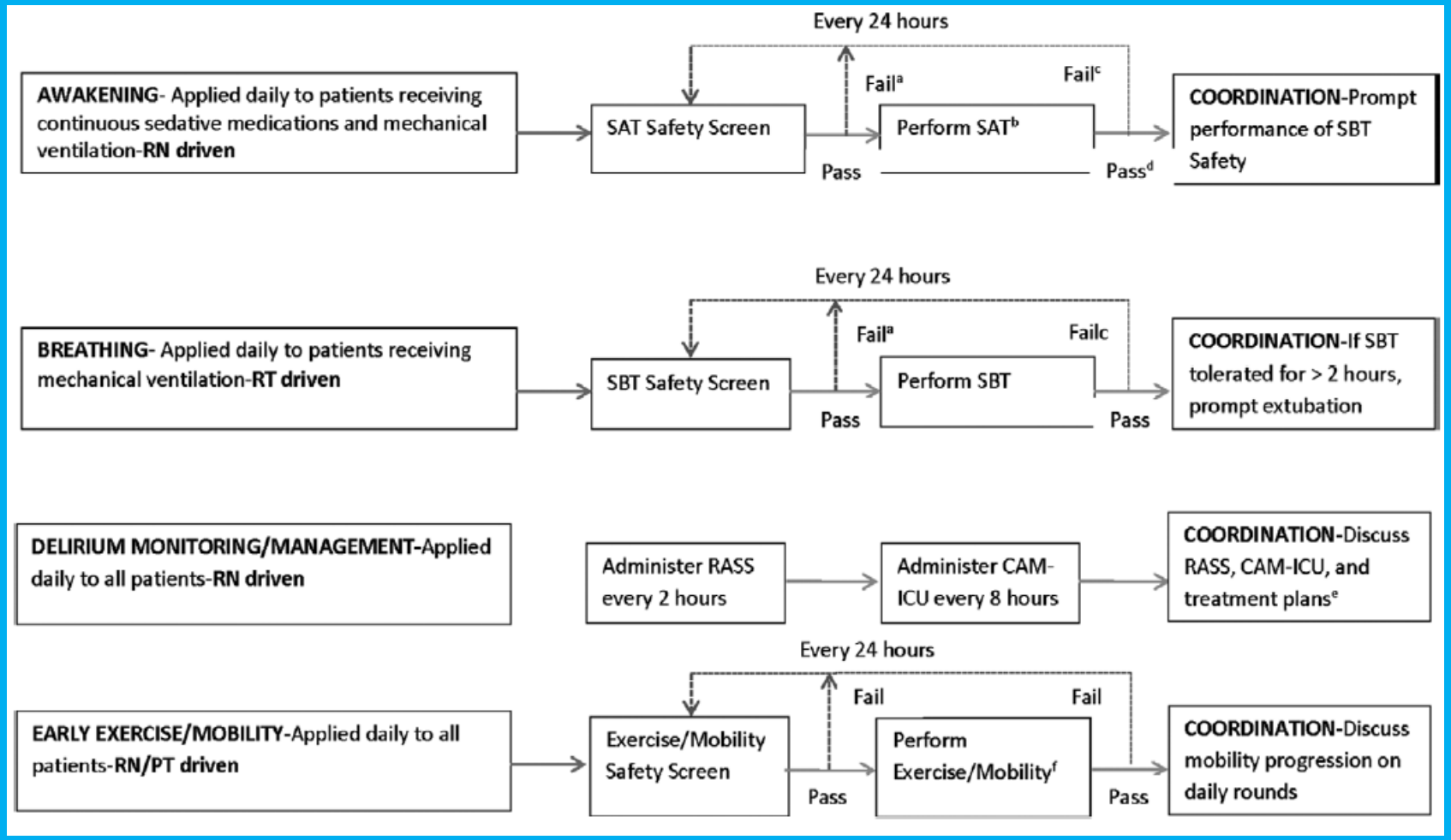
http://www.iculiberation.org/SiteCollectionDocuments/Bundles-ICU-Liberation-ABCDEF.pdf

Putting it all Together – Balas 2014



Crit Care Med. 2014;42:1024-36.

Bundle Efficacy Evaluation

ABCDE Bundle Component Outcome	Pre-ABCDE Bundle ($n = 146$)	Post-ABCDE Bundle ($n = 150$)	Unadjusted p	Adjusted Odds Ratio	Adjusted p
Awakening and breathing coordination[a]					
Ventilator-free days[a]					
Mean (SD)	15 (11.4)	18 (10.6)			
Median (IQR)	21 (0–25)	24 (7–26)	0.04		
Delirium monitoring/management					
Delirium anytime, *n* (%)	91 (62.3)	73 (48.7)	0.02	0.55[b] (0.33–0.93)	0.03
Early exercise/mobility					
Mobilized out of bed anytime in ICU, *n* (%)	70 (48)	99 (66.0)	0.002	2.11[b] (1.30–3.45)	0.003
28-day mortality[c]					
Hospital mortality (ICU and post-ICU), *n* (%)	29 (19.9)	17 (11.3)	0.04	0.56[b] (0.28–1.10)	0.09
ICU mortality, *n* (%)	24 (16.4)	14 (9.3)	0.07		
Time to discharge[d] (d)					
From ICU, median (IQR)	5 (3, 8)	4 (3, 5)	0.21	1.16[e] (0.89–1.50)	0.27
From hospital, median (IQR)	13 (9, 15)	11 (9, 13)	0.99	1.01[e] (0.77–1.31)	0.96

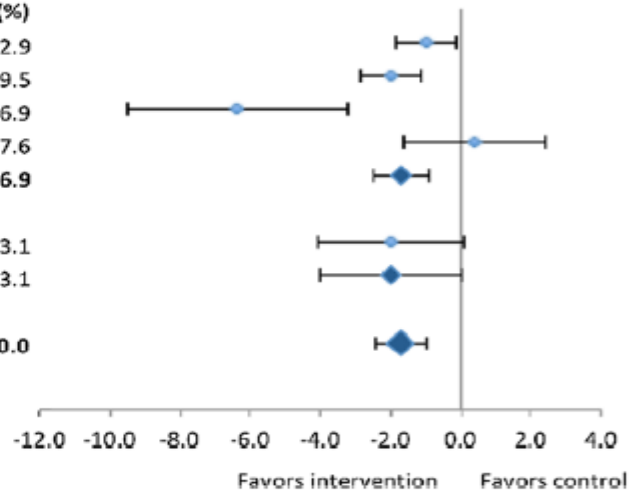
Crit Care Med. 2014;42:1024-36.

Bundle Components and Efficacy

C Length of Stay after implementation in studies using PAD or ABCDE (n=4) with high (I) versus low (II) number of implementation strategies

Author	WMD	(95% CI)	Weight (%)
Skrobik (2010)	-0.97	(-1.82; -0.12)	42.9
Radtke (2012) ICU1&2	-2.00	(-2.88; -1.12)	39.5
Mansouri (2013)	-6.35	(-9.50; -3.20)	6.9
Balas(2014)	0.40	(-1.61; 2.41)	7.6
Subgroup I	**-1.67**	**(-2.46; -0.88)**	**96.9**
Radtke (2012) ICU3	-2.00	(-4.11; 0.11)	3.1
Subgroup II	**-2.00**	**(-4.03; 0.03)**	3.1
Overall	**-1.71**	**(-2.45; -0.98)**	**100.0**

WMD - Weighted mean difference, CI - confidence interval

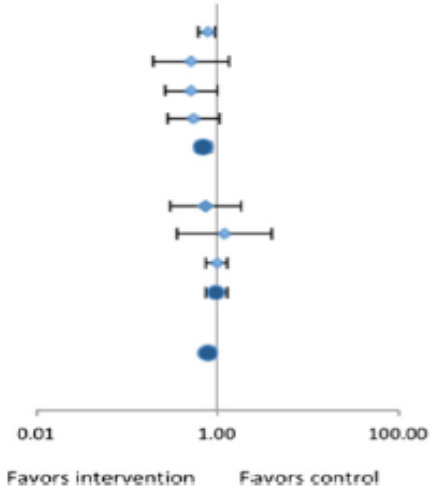


C Risk ratio of mortality after implementation in studies using PAD or ABCDE (n=6) with high (I) versus low (II) number of implementation strategies

Author	RR	(95% CI)	WT (random) %
Skrobik (2010)	0.78	(0.62; 0.98)	44.9
Radtke (2012) ICU 1&2	0.52	(0.20; 1.36)	3.2
Mansouri (2013)	0.53	(0.26; 1.04)	6.2
Balas (2014)	0.57	(0.29; 1.10)	6.7
Subgroup I Random effects (I^2 =0%)	**0.73**	**(0.59; 0.88)**	**61.0**
Robinson (2008)	0.76	(0.31; 1.90)	3.6
Radtke (2012) ICU 3	1.19	(0.36; 3.90)	2.1
Dale (2014)	1.00	(0.76; 1.32)	33.4
Subgroup II Random effects (I^2 =0%)	**0.98**	**(0.74; 1.30)**	**39.1**
Total Random effects	**0.81**	**(0.68; 0.96)**	**100.0**

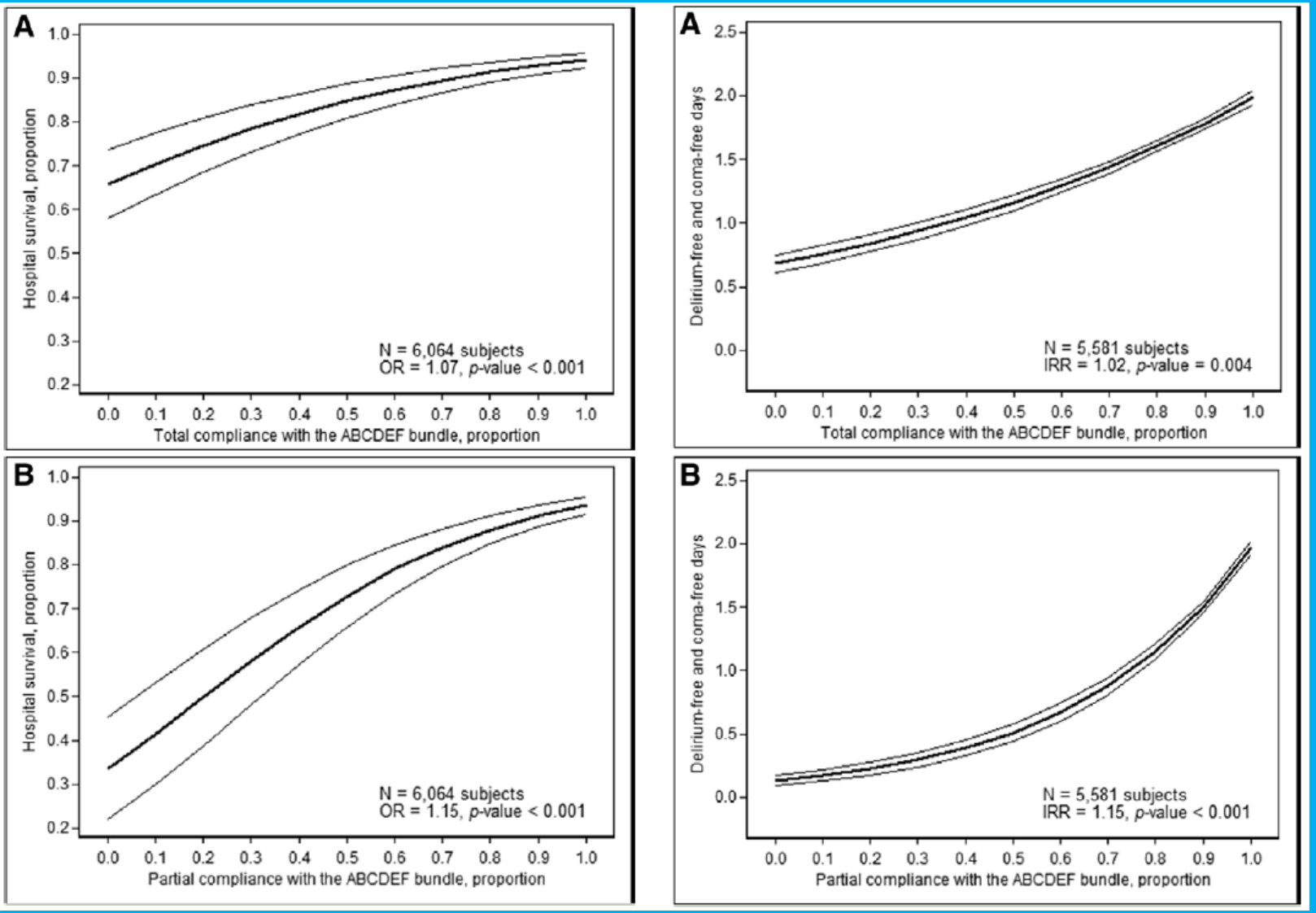
Heterogeneity: Q=6.36, I^2 =6%, p=0.348

RR - risk ratio, WT - weight



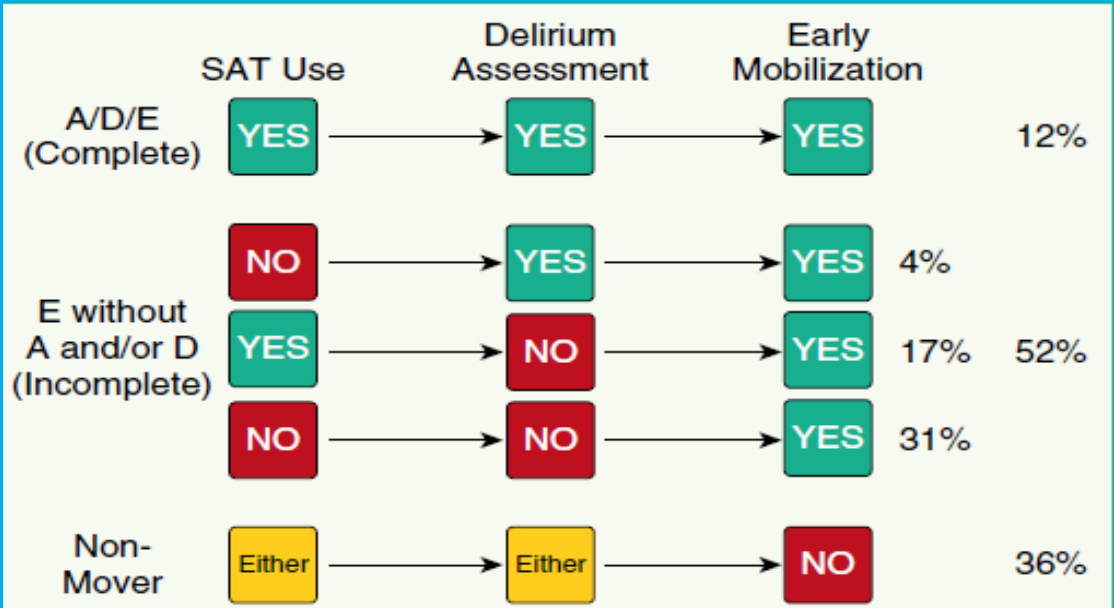
Crit Care. 2015 Apr 9;19:157.

Multi-Center Bundle Assessment



Crit Care Med 2017; 45:171–178

Challenges to Implementation



Component	Measure	Percentage of Respondents Self-Reporting Meeting Measure
A (BC)	>75% of ventilated patients undergo daily SAT	45
D	>75% of ventilated patients undergo daily delirium assessment	31
E	Early mobility is an active unit goal	65
Outcome	>10% of ventilated patients receiving physical therapy reach weight-bearing status before extubation (high levels of exercise)	23
Outcome	Routinely try to have patients engaged in active exercise within first 48–72 h of mechanical ventilation (early exercise)	39

Ann Am Thorac Soc. 2015 ;12:1066-71.

2017 World Wide Bundle Implementation

- 1521 respondents
  - 47 countries
- 57% bundle implementation
  - Varying degrees of compliance

Component	Compliance
A - Pain assessment	83% Compliance
B - Spontaneous Awakening/breathing trials	66%/67%
C - Choice of drugs	BZD minimization - 90%
E – Early mobility	Recommended often 31% mobility team
F – Family	67 % “family involved” 35% 24/7 open unit

Crit Care Med. 2017 Aug 3. doi: 10.1097/CCM.0000000000002640. [Epub ahead of print]

Specific Challenges

Patient-related barriers	Clinician-related barriers	Protocol-related barriers	ICU contextual barriers
Lack of patient cooperation	Safety of tubes, catheters, and wires	Learning curve	Lack of leadership/management
Patient instability and patient safety concerns	Lack of conceptual agreement with guidelines	Lack of clarity as to who is responsible	Lack of inter-professional team support and training/expertise
Patient status issues	Perception that rest equals healing	Unavailable or cumbersome to use protocols	Physical environment, equipment, and resources

Chest. 2017 ;152:304-311.

Conclusion

- While ICU care is constantly improving, the PICS continues to be an important problem
- The ABCDEF bundle utilizes several evidence based strategies to emphasize the patient-centered experience
- Compliance with the bundle can improve various ICU related outcomes and improve quality of life
- Widespread implementation has been challenging with several barriers identified

Sleep no more: making sense of the ABCDEF bundle

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