Matthew Aldrich, MD, is an Associate Professor in the Department of Anesthesia and Perioperative Care at University of California—San Francisco. Dr. Aldrich received his medical degree from Stanford. He completed a residency in Anesthesia at UCSF, as well as fellowships in Critical Care Medicine and Cardiothoracic Anesthesia. He is the Medical Director of Critical Care at UCSF. He was previously the Chair of the Medical Center’s Code Blue Committee and Medical Director of the Rapid Response Team. His academic interests are focused on quality improvement and harm reduction in critically ill patients. He is currently a co-investigator on an NIH/NHLBI R01 grant focused on creating a data fusion framework (SuperAlarm) to integrate monitor alarms, laboratory test results, and other non-monitored physiological variables to realize a more precise way of monitoring patients to provide early detection of patient crisis events with fewer false alarms. He was also the campus PI for a recent University of California quality improvement project: "UC-Wide Implementation of the Advanced Resuscitation Training (ART) Program." This five campus project sought to improve the culture of safety at each medical center and improve resuscitation outcomes by developing a system of robust oversight and training throughout the UC medical system.

Dr. Aldrich is actively involved in the Society of Critical Care Medicine’s ICU Liberation efforts. He is West Coast regional faculty for the Collaborative, leads the ICU Liberation team at UCSF, and is currently Co-Chair of the SCCM’s ICU Liberation Committee.

OBJECTIVES:
Participants should be better able to:

1. Describe the challenges of ICU survivorship and Post Intensive Care Syndrome;
2. Review the evidence for the ABCDEF Bundle and delineate the evolution of ICU Liberation;
3. Provide a roadmap for implementing the ABCDEF Bundle, highlighting barriers to success.
ICU Liberation
Implementing the ABCDEF Bundle and improving the lives of ICU patients

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Director, Critical Care Medicine

Disclosures

• SCCM, ICU Liberation
  – Collaborative, West Coast regional faculty member
  – Committee, Co-Chair
• NIH, R01 HL128679
  – Co-investigator
Acknowledgments

• SCCM, ICU Liberation Collaborative
  – Select slides and intellectual content
• Wes Ely, MD & the ICU Liberation Collaborative faculty and members

“I am troubled when I make rounds in critical care units today because of the grotesque and inhuman scenarios that I so frequently encounter...paralyzed, sedated patients, lying without motion, appearing to be dead, except for the monitors that tell me otherwise. Why this syndrome of sedation and paralysis has emerged baffles me, because this was not the case in the past...by being awake and alert, these individuals could interact with family, friends and the environment. They could feel human.”

-Dr. Thomas L. Petty, editorial in Chest 1998
Outline

- ICU survivorship & Post Intensive Care Syndrome (PICS)
- Evolution of the PAD guidelines & ICU Liberation
- Evidence for the A-F Bundle
- Future directions
Improving ICU outcomes

- ICU acquired infections
- Sepsis
- ARDS

Sepsis survival

Kumar et al. *Chest* 2011; 140(5)

Post Intensive Care Syndrome

- Proposed during 2010 SCCM interprofessional stakeholders’ conference
- Unifying definition for **PICS**:
  - “new or worsening impairments in physical, cognitive, or mental health status arising after critical illness and persisting beyond acute care hospitalization.”

Needham et al. *Crit Care Med* 2012; 40
Prospective study, 821 patients in medical and surgical ICUs
74% incidence of delirium during hospital stay
At 12 month follow-up:
• 34% with deficits similar to moderate TBI
• 24% with deficits similar to mild Alzheimer’s
Duration of delirium associated with worse global cognition & executive function
The burden of ICU survivorship

“I nearly ended my life a few times. When I returned to work, the work I did before seemed foreign and unfamiliar. I became isolated and excluded from everyone. No one wanted to be around me. My wife of more than 36 years told me that I was just “feeling sorry” for myself, and I just needed to get on with my life. I nearly ended my life a few times. My family believed that I was just faking it all.”

What can we do to prevent PICS and improve lives?
Outline

- ICU survivorship & PICS
- Evolution of the PAD guidelines & ICU Liberation
- Evidence for the A-F Bundle
- Future directions

The path to ABCDEF

- Understanding ICUAW & brain dysfunction
- ABCDEF/ICU Liberation
- Initial delirium screening tools
- SCCM PAD Guidelines 2013
- SCCM SA guidelines 2002
- RCTs of varying bundle elements
SCCM ICU Liberation ABCDEF Bundle Implementation Collaborative Mission

“To create lean, sustainable, & highly functioning ICU interdisciplinary teams that partner with patients & families to create a safe & comfortable patient environment by implementing the PAD guideline recommendations utilizing the ABCDEF bundle.”
ICU Liberation sites

ABCDEF Bundle

A: Assess, prevent, manage pain
B: Both spontaneous breathing and spontaneous awakening trials (SAT & SBT)
C: Choice of sedation and analgesia
D: Delirium assessment, prevention, and management
E: Early mobility
F: Family engagement and empowerment
Outline

• ICU survivorship & PICS
• Evolution of the PAD guidelines & ICU Liberation
• Evidence for the A-F Bundle
• Future directions

A: Assess, prevent, & manage pain

• Pain affects majority of ICU patients
• Patients with diminished communication or cognitive capabilities at risk
• Reliable & valid pain assessment is the foundation for effective pain treatment
• Choosing the best intervention to treat pain is challenging
**SCCM Pain Care Bundle**

- **Assess**
  - Assess pain ≥ 4x/shift & PRN
  - **Significant pain with NRS >3, BPS >5, or CPOT>2**

- **Treat**
  - Treat pain within 30 minutes of detecting significant pain & REASSESS
  - Non-pharmacological treatment (e.g. relaxation)
  - Pharmacological treatment

- **Prevent**
  - Administer pre-procedural analgesia and/or non-pharmacological interventions
  - Treat pain first, then sedate

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**Behavioral Pain Scales**

- The **Critical Care Pain Observation Tool (CPOT)** & the **Behavioral Pain Scale (BPS)**
  - most valid scales for monitoring pain in medical, postoperative, and trauma (except for brain injury) patients unable to self-report
  - motor function is intact & behaviors are observable

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Barr J Crit Care Med 2013;41(1)
**Pain: prevent and treat**

- PAD guidelines offer conservative recs for pain management
  - Administer pre-procedural analgesia and/or non-pharmacologic interventions (e.g., relaxation therapy) for chest tube removal (+1C)
  - Limited recs for epidural analgesia
- Recognize pain associated with common procedures
- Recommend IV opioids be considered as the first-line drug class of choice for non-neuropathic pain (+1C).
- Non-opioid analgesics be considered to decrease total dose of opioids and related side effects (+2C).

**B: Both SAT and SBT**

- Goal: reduce time of mechanical ventilation
- Coordinate SAT and SBT each day
- Deep sedation *is harmful*
- Depth and quality of sedation should be routinely assessed in all ICU patients
Negative Consequences of Deep Sedation

• Reduced six-month survival
• Increased hospital mortality
• Longer duration of mechanical ventilation
• Longer ICU length of stay

Brook A. Crit Care Med. 1999;27
Girard T. Lancet. 2008;371
Kress J. NEJM. 2000;342
Treggiari M. Crit Care Med. 2009;37
Kollef M. Chest. 1998;114
Shehabi Y. AJRCCM. 2012;186

Daily sedation interruption decreases duration of mechanical ventilation

• Held sedation infusion until patient awake, then restarted at 50% of prior dose
• “Awake” defined as any 3 of the following:
  – Open eyes in response to voice
  – Use eyes to follow investigator on request
  – Squeeze hand on request
  – Stick out tongue on request

Kress J. NEJM 2000;342

• Length of MV 4.9 vs. 7.3 days (P=0.004)
• ICU LOS 6.4 vs. 9.9 days (P=0.02)
• Fewer diagnostic tests to assess changes in mental status
• No increase in rate of agitated-related complications or episodes of patient-initiated device removal
• No increase in PTSD or cardiac ischemia
PAD guidelines: SATs

- Recommend that sedative medications be titrated to maintain a light rather than a deep level of sedation in adult ICU patients, unless clinically contraindicated (+1B).
- Recommend that either daily sedation interruption or a light target level of sedation be routinely used in mechanically ventilated adult ICU patients (+1B).

ABC Trial

Efficacy and safety of a paired sedation and ventilator weaning protocol for mechanically ventilated patients in intensive care (Awakening and Breathing Controlled trial): a randomised controlled trial


Lancet 2008;371
C: Choice of sedation and analgesia

- Treat pain first before administering sedatives, i.e. “algosedation”
- Monitor depth of sedation using sedation assessment tool (RASS or SAS)
- Target lightest sedation level possible
  - Caution with increased doses at night*
- Use non-benzodiazepine approach
  - Propofol or dexmedetomodine

* Seymour et al. Crit Care Med 2012; 40
Analgo-sedation strategy

- Limited evidence but often effective (in my experience) and a strategy promoted by ICU Liberation
- Address pain and discomfort **first** before administering sedatives
- Utilization of one drug for two purposes
- Usually accomplished with an opioid

Strøm et al. *Lancet* 2010; 375
Devabhakthuni S. *Ann Pharmacother* 2012;46

Risk of developing delirium with benzodiazepine use

- A cohort study (N = 198) investigated whether analgesia and sedative medications increased the risk of ICU patients developing delirium.
- Lorazepam (OR 1.2, $P = 0.003$) is an independent risk factor for daily transition to delirium

*Pandharipande R. Anesthesiology* 2006;104
Effect of Sedation With Dexmedetomidine vs Lorazepam on Acute Brain Dysfunction in Mechanically Ventilated Patients
The MENDS Randomized Controlled Trial

- Double-blind, randomized, controlled trial of mechanically ventilated medical and surgical ICU patients (N = 106)
- Results:
  - Dexmedetomidine sedation:
    - more days alive without delirium or coma ($p = 0.01$)
    - lower prevalence of coma ($P < 0.001$)
    - more time spent within sedation goals than with lorazepam ($P = 0.04$)
  - No differences in 28-day mortality and delirium-free days
  - Incidence of bradycardia and hypotension were similar

Pandharipande et al. JAMA. 2007;298

SEDCOM trial: dexmedetomidine vs midazolam

- Multi-center RCT comparing long-term (> 24 hr) dexmedetomidine (n = 244) with midazolam (n = 122)
- Results:
  - No difference between groups in percentage of time patients were in targeted sedation range ($P = 0.18$)
  - Lower delirium prevalence in the dexmedetomidine group ($P < 0.001$)
  - Shorter sedation duration in the dexmedetomidine group ($P = 0.01$)
  - Shorter time to extubation in the dexmedetomidine group ($P = 0.01$)

D: Delirium assessment, prevention, & management

- **Very common in ICU**
  - 50% to 80% of mechanically ventilated patients
  - 20% to 50% of lower severity patients

- **Poor associated outcomes**
  - Prolonged hospitalization
  - Increased mortality
  - Increased cost

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Ely E. *JAMA*. 2001;286
Dubois M. *ICM*. 2001;27
Ely E. *JAMA*. 2003;289
Ely E. *JAMA*. 2004;291
Thomason JW. *Crit Care*. 2005;9
Milbrandt EB *Crit Care Med.* 2004; 32
Delirium: long-term outcomes

• **Mortality**
  – Each day of delirium in the ICU increases the hazard of 1-year mortality by 10% \(^1\)

• **Cognitive Impairment**
  – ICU delirium is an independent risk factor for long-term cognitive impairment \(^2,3\)

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Delirium: motoric subtypes

<table>
<thead>
<tr>
<th>Alert and Calm</th>
<th>Hyperactive Delirium (~1%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lethargic</td>
<td>Mixed Delirium (64%)</td>
</tr>
<tr>
<td>Sedated</td>
<td></td>
</tr>
<tr>
<td>Stupor</td>
<td></td>
</tr>
</tbody>
</table>

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*Pisani MA AJRCCM. 2009;180
Girard T Crit Care Med. 2010;38.
Pandharipande PP NEJM. 2013;369(14).*
PAD guidelines: delirium assessment

• Routinely monitor for delirium in all adult ICU patients (+1B)
• Use either:
  − Confusion Assessment Method for ICU (CAM-ICU)
  − Intensive Care Delirium Screening Checklist (ICDSC)

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Barr J Crit Care Med. 2013;41

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CAM-ICU

Pooled Test Characteristics:
• Sensitivity 80%
• Specificity 96%
• $\kappa > 0.91$
Interventions for delirium

- Early mobility and rehabilitation
- Sleep enhancement (via nonpharm and hygiene bundles)
- Reducing unnecessary and deliriogenic medications
- Structured reorientation
- Adequate oxygenation

Inouye SK NEJM. 1999;340(9)
McNamara L. Am J Crit Care. 2008;17

Limits of the evidence: delirium prevention & treatment

- Perform early mobilization of adult ICU patients whenever feasible to reduce the incidence and duration of delirium (+1B)
- No recommendation for:
  - pharmacologic prophylaxis (including haloperidol and quetiapine)
  - use of dexmedetomidine to prevent delirium in adult ICU patients...”as there is no compelling evidence regarding its effectiveness in these patients (O,C)”

E: Early mobility

• Safe
• Positive outcomes
  – Decreased LOS, duration of mechanical ventilation, incidence of delirium
• Early mobility programs require interprofessional practice and compliance with the whole bundle

Side effects of bed rest

• Muscle strength in a healthy person can decrease 1.3% to 3% for every day spent on bedrest.¹
• Effects are more profound in older people and in those with critical illness.²
• One study suggests that 3% to 11% strength loss occurs for every day in bed in an ICU setting.³
  – Age and days on bedrest are independent predictors of worsening function.

Schweickert W et al. *Lancet* 2009; 373

- RCT in SICUs of five university hospitals
- 200 patients
- Intervention: inter-professional approach of closed-loop communication and the SICU optimal mobilisation score (SOMS) algorithm
- Outcomes:
  - Reduced ICU LOS
  - Improved functional status at hospital discharge

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**THE LANCET**

Early, goal-directed mobilisation in the surgical intensive care unit: a randomised controlled trial


- RCT in SICUs of five university hospitals
- 200 patients
- Intervention: inter-professional approach of closed-loop communication and the SICU optimal mobilisation score (SOMS) algorithm
- Outcomes:
  - Reduced ICU LOS
  - Improved functional status at hospital discharge

*Lancet* 2016; 388
Keys for early mobility success

• Bundle compliance
  – Deeply sedated patients don’t mobilize!
• Nursing commitment to mobility
• Institutional support for PTs in ICU
• Clear safety guidelines
• Appropriate equipment

F: Family engagement & empowerment

Guidelines for Family-Centered Care in the Neonatal, Pediatric, and Adult ICU

• 29 international experts with consultation from 27 former patients and family members
• Nascent field of research thus all recommendations are graded as weak based on very low-mod quality of evidence

Davidson et al. Crit Care Med 2017; 45:103–128
Key aspects of family engagement

• Presence
  – Open and flexible visitation policies
  – Participation in interdisciplinary rounds
  – Codes, procedures with staff support

• Support
  – ICU diaries, leaflets, education programs

• Communication
  – Family conferences, validated decision support tools

• Consultations
  – Palliative Care, Ethics

• Operations & environmental issues
  – Noise reduction, sleep

Davidson et al. Crit Care Med 2017; 45:103–128

Implementation of the A-F Bundle

• Several recent studies demonstrate positive outcomes with bundle implementation

• Success likely depends on multiple strategies used to change practice and culture

• Organizational change and senior leadership support is essential
Prospective cohort quality improvement initiative

- For every 10% increase in:
  - Total bundle compliance: 7% increase in hospital survival
  - Partial bundle compliance: 15% increase in hospital survival
  - More days without delirium and coma with total and partial bundle compliance

Outline

- ICU survivorship & PICS
- Evolution of the PAD guidelines & ICU Liberation
- Evidence for the A-F Bundle
  - Future directions
UCSF & ICU Liberation: lessons learned

• Early adopter of protocols (SATs/SBTs, CPOT, CAM-ICU, EM, etc.) but we still struggle with compliance and culture
• Challenging to obtain performance and compliance data for all patients
• Recent surveys & data analysis demonstrate the need for daily work and commitment
  – RASS goals, SAT and SBT coordination, family engagement, interprofessional rounds

<table>
<thead>
<tr>
<th>Bundle element</th>
<th>2015</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>RASS</td>
<td>89%</td>
<td>90%</td>
</tr>
<tr>
<td>CAM-ICU</td>
<td>67%</td>
<td>68%</td>
</tr>
<tr>
<td>Delirium discussed on rounds</td>
<td>20%</td>
<td>37%</td>
</tr>
<tr>
<td>SAT discussed on rounds</td>
<td>25%</td>
<td>73%</td>
</tr>
<tr>
<td>SBT discussed on rounds</td>
<td>69%</td>
<td>92%</td>
</tr>
<tr>
<td>Pain interventions discussed on rounds</td>
<td>59%</td>
<td>59%</td>
</tr>
<tr>
<td>RN participation on rounds</td>
<td>70%</td>
<td>66%</td>
</tr>
</tbody>
</table>
Future directions & challenges

• ICU Liberation Committee
• Target the implementation challenges discovered during the Collaborative
  – Data collection, compliance vs. performance, interprofessional practice
• Focus on PICS
  – SCCM PCOR-ICU Collaborative
  – SCCM Thrive Initiative

Thank you
**Question 1**

PICS can include which of the following physical and mental health problems?

- a. ICU‐acquired weakness
- b. Cognitive dysfunction
- c. Depression and stress disorders (e.g. PTSD)
- d. All of the above
Question 2

True or False:

ICU delirium is a risk factor for long-term cognitive impairment
Question 3

The Sutter Hospitals prospective QI study of A-F Bundle implementation demonstrated the following:

a. 7% increase in hospital survival for every 10% increase in total bundle compliance
b. 15% increase in hospital survival for every 10% increase in partial bundle compliance
c. No change in incidence of delirium with increase in total bundle compliance
d. a and b