CALIFORNIA THORACIC SOCIETY
SOUTHERN CALIFORNIA
ANNUAL EDUCATIONAL CONFERENCE

CRITICAL CARE UPDATES: LIBERATION, PADIS, PCIS AND BURNOUT

FRIDAY, OCTOBER 4, 2019

REGISTRATION, EXHIBITS, AND BREAKFAST

Friday, October 4, 2019 – 7:30 a.m. – 8:00 a.m.

WELCOME AND PRE-TEST

George Su, MD
UC San Francisco

Michelle Cao, DO
Stanford University

Friday, January 18, 2019 – 8:00 a.m. – 8:10 a.m.

UNPLANNED INTUBATION

Neil R. MacIntyre, MD
Duke University

SPONSORED BY RESPIRATORY COMPROMISE INSTITUTE

Friday, October 4, 2019 – 8:10 a.m. – 8:40 a.m.

Neil R. MacIntyre, MD is a Professor of Medicine and Medical Director of Respiratory Care Services at Duke University. He received his MD degree from Cornell University, did an internal medicine residency at Cornell-NY Hospital and a pulmonary fellowship at UCSF. In his 31 year career, he has been principal investigator or co-principal investigator on over 37 clinical trials that have enrolled hundreds of patients. Among the most important of these have been the NIH funded ARDS Network evaluating many aspects of respiratory failure, the National Emphysema Treatment Trial (NETT) evaluating lung volume reduction surgery for emphysema and the Long Term Oxygen Treatment Trial (LOTT) evaluating oxygen therapy in COPD patients. He has held a number of national and international leadership positions, including the chair of the large ACCP/SCCM/AARC Evidence Based Guidelines Committee for Ventilator Weaning, the chair of the joint ATS/ERS Committee to Standardize DLCO, the chair of the ACCP Mechanical Ventilation Simulation Program, and on the steering/writing committees of ATS and AACVPR addressing pulmonary rehabilitation and exercise assessment.

Inpatient Respiratory Compromise:
Using Data to Drive Care

Neil MacIntyre MD
Duke University Medical Center
Durham NC

DukeMedicine

RCI
RESPIRATORY COMPROMISE INSTITUTE

1

Disclosures

- Inspirx Pharmaceuticals
- Ventec
- Breathe Technologies
- Alana Health Care
- Member of Clinical Advisory Group – Respiratory Care Institute

2

Objective

Develop risk stratification and monitoring strategies for patients on general care wards

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Respiratory Compromise:
Using Data to Drive Care

- What do we mean by "Respiratory Compromise"
  - Why is it important
  - What is the "Respiratory Compromise Institute"?
- Exploring the Medicare claims data
- A focus on "unplanned intubations" on lightly monitored general care wards
  - Data analysis from an integrated health care system
- Future directions

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Respiratory Compromise

- Respiratory compromise: A deterioration in respiratory function from either a normal state or a stable chronic state that puts the patient at risk for respiratory failure needing life support technology or death.
- Why is it important?
  - Respiratory failure requiring emergency mechanical ventilation (MV) in > 44,000 patients/year in the US[1]
  - 1.03% of all surgical patients require an unplanned post-operative intubation[2]
  - The development of in-hospital respiratory failure requiring MV is associated with a mortality of nearly 40%[1]

[1]Andersen LW. *Resuscitation* 2016; 105:123
[2]Alvarez MP. *Am Surg* 2015; 81:820

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Respiratory Compromise Institute

- An alliance of 12 professional societies and other interested individuals formed in 2015 as a stand alone 5013c organization.
- Mission is to provide education and to support research and other projects to better understand respiratory compromise and develop strategies to better detect and manage it.
- Projects to date:
  - Published consensus conference 2015
  - Three funded research programs either completed or ongoing
  - Multiple web based publications
- Funding largely from unrestricted grants from industry

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Healthcare Administrative Data

- Synonyms: “health care utilization data”, “billing data”, “claims data”
- These data are collected for administrative or billing purposes, yet may be leveraged to study health care delivery, outcomes and costs.

Pros

- Readily available source of “real world” health care data
- Large population of unselected patients
- No additional costs for collecting data
- Long periods of time

Cons

- May not include all patients (e.g., Medicare only)
- Collected for billing, lacks clinical information
- Case selection based on codes: validation studies needed
- Difficult to control confounding variables and draw casual relationships

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Methodology

- 5% Medicare Standard Analytic Files for inpatient admissions to short term acute care hospitals
- Three (3) years: January 1, 2012 to December 31, 2014
- ICD-9 procedure code for ventilation (93.90, 96.7x, 96.04) or ICD-9 diagnosis code for acute respiratory failure (518.51, 518.52, 518.53, 518.81, 518.82, 518.84, 799.1x)
- On any day ≥ 2nd inpatient day, one or more physician visit with ICD-9 diagnosis for acute respiratory failure (518.51, 518.52, 518.53, 518.81, 518.82, 518.84, 799.1x) or a CPT code for critical care or ventilator management (99291, 99292, 94002, 94003, or 94660) – need physician billing to determine timing of diagnosis (ICD-9 codes are not timed)

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Results (extrapolated to all Medicare patients)

- Claims classified into 2 cohorts: medical & surgical DRG
- Medical DRGs:
  - 16,653 patients with a **medical DRG** developed respiratory failure after hospitalization (defined by physician billing)
- Surgical DRGs:
  - 13,895 patients with a **surgical DRG** developed respiratory failure after hospitalization (defined by physician billing)

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Mortality

	Hospital-acquired RF	Present on admission	P value
In-hospital mortality	32.7%	27.8%	<0.0001
30 day post-hospital mortality	15.3%	12.9%	0.0001

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ICD-9 Diagnosis Codes for RF Patients

	Hospital-acquired RF	RF present on admission	P value
CHF	+		.001
Hypertension	+		.001
Atrial fibrillation		+	.001
Acute kidney failure		+	.001
Pneumonia		+	.001
Septicemia	+		.05
Diabetes mellitus	+		.001
Severe sepsis	+		.001
Acidosis	+		.001
UTI		+	.001

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Summary: Medicare Claims Data Analysis

- In hospital respiratory compromise (IHRC) affects up to 40,000 Medicare patients annually. More common than respiratory compromise on admission
- Prominent risk factors for IHRC are underlying CV disease and sepsis
- Mortality high (over 30% in medical patients) with IHRC – higher than patients with respiratory compromise on admission

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Duke-RCI Project:
Unplanned Intubations (the "extreme" of Respiratory Compromise) on general care wards

- Clinical Focus: Severe, unexpected respiratory compromise requiring an urgent insertion of an endotracheal tube on the lightly monitored general care wards – Patients deemed "safe enough" by their MDs to be cared for on these wards
- Duke-RCI project:
  - How often does this occur and what are the outcomes?
  - What are the clinical characteristics of these patients (including medications)?
  - What are the monitoring strategies being used?
  - What are the vital sign trajectories in the hours prior to the event?

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Cohort Eligibility

- Inclusion criteria:
  - Treated at Duke University Hospital, Duke Regional Hospital, Duke Raleigh Hospital. Bed capacity: DUH 980, DRH 390, DRaH 290 – total = 1660
  - On general medicine or surgery floor > 24hrs post admission and >24hrs post surgery (if surgical patient)
  - 19 years of age or greater (use 1 year look back to identify comorbidities)
  - Eligibility period: January 1, 2014 to December 31 2017

- Exclusion criteria:
  - DNR order
  - Endotracheal or tracheal tube prior to admission/surgery or within 24 hrs of admission

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Cases and Control

- **Case definition:**
  - Patients receiving care at one of three hospitals who had an unplanned intubation ≥ 24 hours after admission or surgery based on ICD-9/10, CPT codes for endotracheal or tracheal tube, or CPR + death event.
  - 463 events in 448 patients identified (69 events/year/1000 beds). Translates to 69,000 events/yr in the US
    - ***49% in hospital mortality***

- **Control definition:**
  - Patients receiving care at one of three hospitals who did not have an unplanned intubation ≥ 24 hours after admission or surgery based on ICD-9/10, CPT codes for endotracheal or tracheal tube, or CPR + death event.
  - Random sample 10% of eligible controls (there will be >200,000 eligible controls)
    - ***1.1% in hospital mortality***

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Analysis Plan

- Aim 1: Quantify demographic and clinical characteristics associated with unplanned intubations
  - Cases vs Controls
  - Incidence rates stratified by:
    - Hospital (DUH vs. Duke Regional vs. Duke Raleigh)
- Aim 2: Identify clinical characteristics and events in the 24 hours preceding an unplanned intubation
  - Survival analysis (e.g., time varying Cox models)
  - Visualizations

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Analysis Plan

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Clinical Characteristics

Cases were older men with more co-morbidities

	CASES n=448	CONTROLS n=22261
Age	66.2	59.9
Gender (%males)	57.1	43.5
Ever smoker (%)	61	52
Current alcohol (%)	22	32
Co-morbidities (%)		
Diabetes	39	22
HTN	63	45
CAD	32	14
Cancer	23	21
COPD	31	19
Emergency admission	71	49

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Important Diagnoses/Meds in Hospital

	CASES n=448	CONTROLS n=22261
Cardiovascular disease (%)	19	9
Pneumonia (%)	15	7
OSA (%)	16	12
Transplant (%)	12	7
CHF (%)	32	14
Peripheral VD (%)	26	12
Analgesics (%)	71	76
Anticoagulants (%)	60	50
CV drugs (%)	69	63
Psychotherapy (%)	46	45
Sedatives/opioids (%)	32	28
Oxygen (%)	100	100

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Medications/Devices/Monitors in 12 Hours Prior to Intubation

Sedatives	22%
Steroids	11%
Inotropes	4%
Opioids	36%
Oxygen	94%
BiPAP/CPAP	6%
HFNC	2%
Capnography	2%
Telemetry	1%
Pulse oximetry	98%

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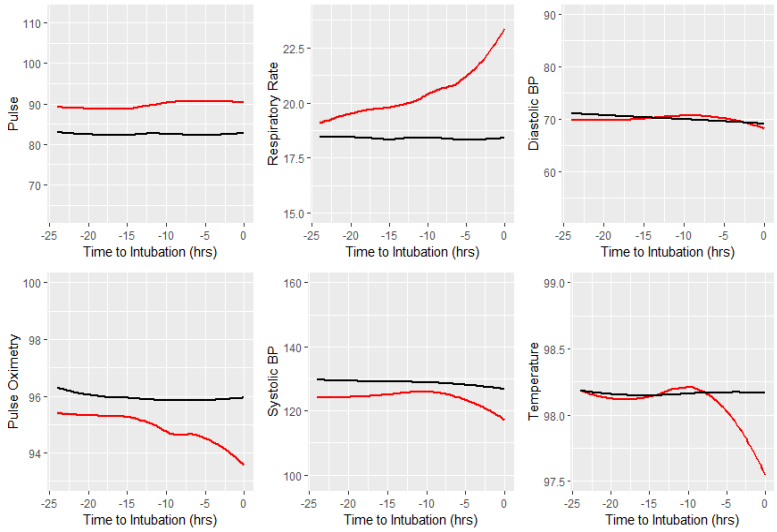
Vital Sign Trajectories



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Significant VS Changes Over 24 Hrs

	Decrease	Increase
Respirations	10.8%	16%
Sys BP	12.4%	7.2%
Dias BP	10.4%	6.5%
SpO2	12.4%	5.6%
Temp	4.9%	4.9%

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Current Conclusions

- Extreme respiratory compromise (an unplanned intubation) occurs on lightly monitored general care floors at a rate of 69/year/1000 beds
- Mortality in this population is high – 49% vs 1.1% in control patients
- Those at risk were older men with significant co-morbidities – no clear cut high risk patterns
- In the 12 hours prior to the intubation, sedative and opioid use were high but occurred in less than 50% of those requiring intubation – no obvious high risk patterns
- Clinicians appeared unconcerned about these patients – They were on general care wards and in the 12 hours prior to the intubation, high level monitoring (exhaled CO2 and telemetry) were rare
- Routine VS trends revealed significant changes in many patients prior to the intubation

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Respiratory Compromise Institute

Future Research Considerations

- Build on evolving evidence base
  - Describe deterioration trajectory of different diseases
  - Characterize respiratory compromise in other settings
  - Characterize cost implications
  - Develop risk prediction models
- Identify and develop strategies for detection/prevention

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Disease states at risk

- Neurologic – impairment of control of breathing
- Cardiovascular – impairment of perfusion
- Respiratory – impairment of ventilation, V/Q matching
- Systemic inflammation – impairment of O2 uptake
- Role of co-morbidities (diabetes, immunosuppression, renal) complicate the situation

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Trajectories of deterioration

- Sudden, unexpected, catastrophic
  - Neurologic disaster (CVA)
  - Cardiovascular collapse (MI, shock)
  - Respiratory event (aspirations, emboli, pneumothorax, bronchospasm)
- Gradual deterioration
  - Neurologic (drugs)
  - Cardiovascular (fluid overload, drugs)
  - Respiratory (infection, sepsis, ARDS)

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Respiratory Compromise Institute

Future Research Considerations

- Build on evolving evidence base
  - Describe deterioration trajectory of different diseases
  - Characterize respiratory compromise in other settings
    - ED, “fresh” admissions or transfers from ICU or stepdown
  - Characterize cost implications
  - Develop risk prediction models
- Identify and develop strategies for detection/prevention

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Respiratory Compromise Institute

Future Research Considerations

- Build on evolving evidence base
  - Describe deterioration trajectory of different diseases
  - Characterize respiratory compromise in other settings
  - Characterize cost implications
    - Direct patient care costs, costs of patient disability
  - Develop risk prediction models
- Identify and develop strategies for detection/prevention

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Respiratory Compromise Institute

Future Research Considerations

- Build on evolving evidence base
  - Describe deterioration trajectory of different diseases
  - Characterize respiratory compromise in other settings
  - Characterize cost implications
  - Develop risk prediction models
    - Build and validate scoring systems
- Identify and develop strategies for detection/prevention

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Respiratory Compromise Institute

Future Research Considerations

- Build on evolving evidence base
  - Describe deterioration trajectory of different diseases
  - Characterize respiratory compromise in other settings
  - Characterize cost implications
  - Develop risk prediction models
- Identify and develop strategies for detection/prevention
  - Identify high risk
  - Determine effective monitoring for high risk
  - Intervention protocols

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UPDATES IN ASTHMA VENTILATOR CARE

To Be Announced

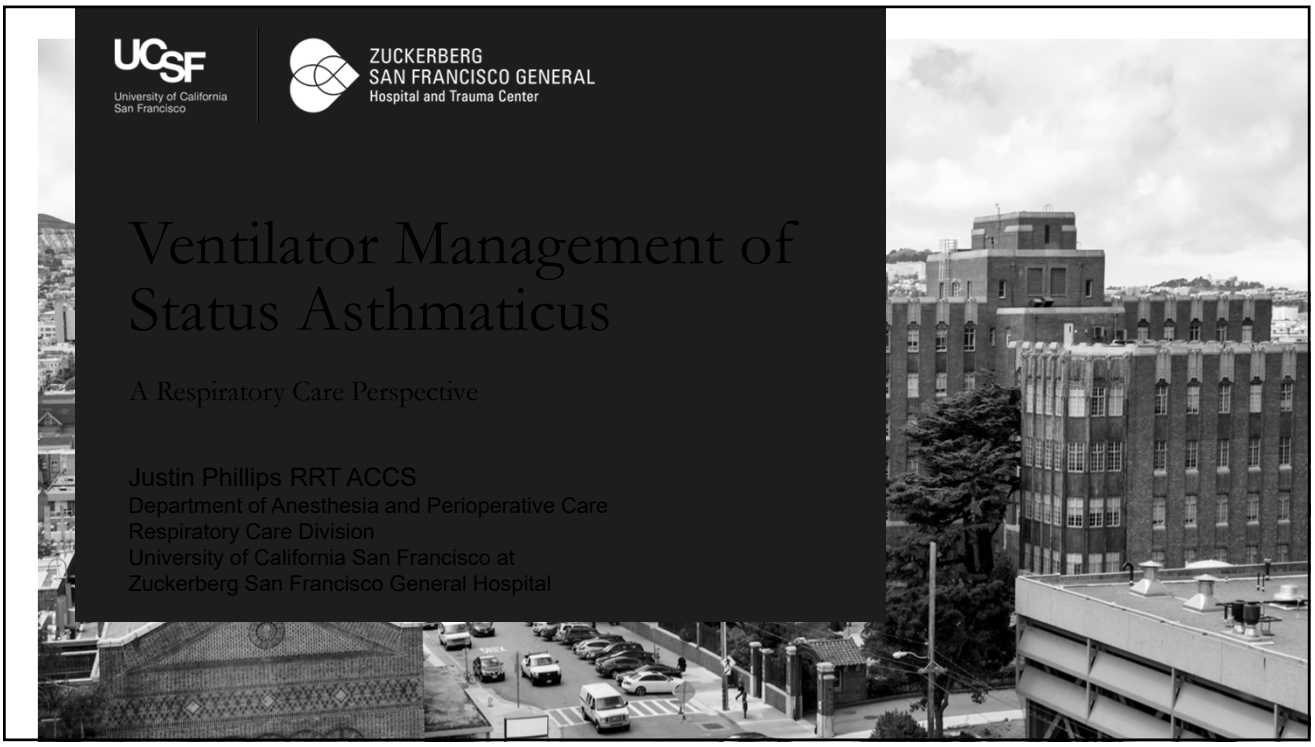
Friday, October 4, 2019 – 8:40 a.m. – 9:10 a.m.

LIBERATION, ASTHMA, AND OXYGEN: AN RT PERSPECTIVE

Justin Scott Phillips
RCP, RRT-ACCS
University of California at San Francisco

Friday, October 4, 2019 – 9:10 a.m. – 9:40 a.m.

Justin Phillips is a Adult Critical Care Respiratory Therapist for the University of California San Francisco, Department of Anesthesia at Zuckerberg San Francisco General Hospital and Trauma Center (ZSFG). There, he currently serves as a bedside therapist and educator. Justin is a lecturer for the Critical Care Residency Program at ZSFG on the topics of Mechanical Ventilation Mechanics and ARDS management. Additionally, he is Adjunct Faculty for the Respiratory Care Program at Ohlone College for Health Sciences and Technology. Justin is a published researcher and has spoken nationally at a number of respiratory and critical care conferences on the subjects of strategic ventilation practices and the use of non-invasive end-tidal monitoring.



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Disclosure of Conflict of Interest

- I have no relevant financial relationships with commercial interests to disclose

2

How Can Ventilator Mechanics Waveforms and Volumetric Capnography Assist Us in Managing Status Asthmaticus?

- Alterations in Pulmonary Mechanics
- Ventilator Settings
- Non-Invasive Monitoring: Assessing Mechanics and Gas Exchange
  - Scalar Waveforms
  - Volumetric Capnography

Pathophysiologic Changes in Pulmonary Mechanics

- Unlike COPD:
  - Alveolar Integrity & Elastic Recoil are Normal
    - High expiratory pressures available to help drive expiratory flow against increased resistance.
    - Alveolar tethering of peripheral airways ("radial traction") is preserved (i.e. Raw-exp from dynamic airway compression is *not* the *predominant pathophysiologic factor*
- Primary Airways Resistance: bronchoconstriction/mucus obstruction
  - Aggressive pulmonary hygiene and bronchodilators
- Implications for Using External PEEP
  - May cause some mechanical airway dilation (likely impact < radial traction)
  - More likely to cause further hyperinflation
  - Empirical Test: N of 1 trials ~ 0 to 8cmH_2O → measure impact on Pplat, Pdrive end-expiratory flow, trapped volume and V_D/V_T.

Mechanical Foundation for Managing Status Asthmaticus and Its Implications

- Primary Problem: Dynamic hyperinflation (elevated EELV):
- Directly proportional to Minute Ventilation
- Directly proportional to expiratory resistance (i.e. expiratory time constant or "tau")
- Inversely proportional to expiratory time
- $EELV \cong \frac{V_E \, x \, Tau \, exp}{Texp}$
- Avoid high V_T (which ↑ expiratory equilibration time), High RR; *prolonged* T insp (↓ expiratory time)
- Permissive hypercapnia: *slowly* induce: ↑ Pa_{CO2} 8-10 mmHg/hr (~ pH decrement of 0.05 per hr)

Time Constants ("Tau"): More of a Conceptual Tool to Understand Ventilator Adjustments (but can be measured clinically)

- Tau: *equilibration constant* for volume (or pressure) between 2 points in the pulmonary system at a *constant amplitude* (i.e. peak distending volume or pressure)
- 1 *tau* = 63%, 2 *tau* ~ 87%, 3 tau = 95%, 4 *tau* ~ 98% equilibration
- Rule of Thumb: Expiratory *Tau* > Inspiratory *Tau*
- Accurate Measurement requires *passive ventilation*:
- Linear expression: *tau* = Raw x Crs (VCV, correct for PEEPi, inspiratory *tau only*)
- Scalar Waveforms: some vents allow very precise time measurements → identify 63% of inspired or expired V_T (PCV for inspiratory *tau* or either VCV/PCV for expiratory *tau*)

Linear Expression of *Tau*

- Raw-max x Crs
- (PIP-Pplat ÷ $\dot{V}$) x (V_T ÷ Pplat-PEEPtot)
- $\frac{15\ cmH_2O}{1\ L/sec} \times \frac{1L}{20\ cm\ H_2O*} = \frac{15\ cmH_2O \cdot sec}{20\ cm\ H_2O}$ = 0.75 sec (normal: ~ 0.42-0.48)
- 0.75 sec x 3 = 2.25 sec to achieve 95% equilibration

* Crs = 50mL/cmH_2O = 20 cmH_2O per L

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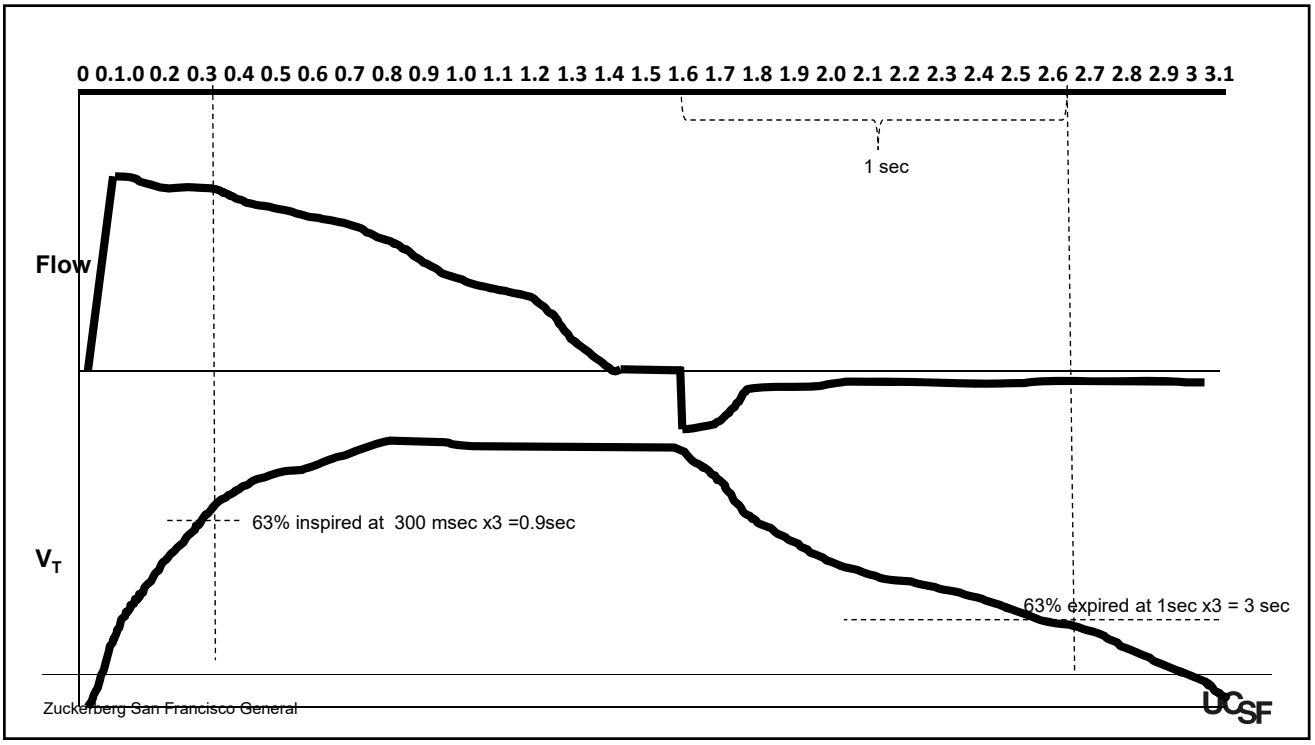

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Time Constant Abnormalities are a Substantial Management Problem: Avoid Too Brief Tinsp and Too Prolonged Texp

- Inspiratory Time: Gas Delivery + Mixing Time (Alveolar Residence Time and Inter-alveolar/compartmental Redistribution
- Using Brief ("~pediatric") Tinsp for Adults (e.g. < 0.7 sec) → functional increase in alveolar dead-space
- Excessive Expiratory Time → Negligible impact on lung decompression

Initial Ventilator Settings and Associated Dependent Variables

V_T	6-8 mL/kg
Rate	8 to 15
Inspiratory Time	0.8 to 1.0sec
I:E Ratio	$\geq$ 1:3
Flow Rate	40-60 L/min ? (empirical judgement)
PEEP	0-8 cmH_2O? (empirical judgement)
PEEPi	$\leq$ 5 cmH_2O above set EEP
PEEPtot (realistic goal)	< 15 cmH_2O
Pplat	$\leq$ 35 cmH_2O (factor in PEEPi, Pdrive)
Pdrive	$\leq$ 15 cmH_2O
V at end-inspiration	$\leq$ 1.4L (V_T + Trapped Volume)

Be Prepared: Having Bedside Tables Helpful: Balancing Rate, Tinsp & I:E → allows further titration of V_T to reduce PEEPi and V_D/V_T.

Set Rate	Ttot	Tinsp	Texp	I:E
8	7.5	0.8	6.7	8.4
9	6.7	0.8	5.9	7.3
10	6.0	0.8	5.2	6.5
11	5.5	0.8	4.7	5.8
12	5.0	0.8	4.2	5.3
13	4.6	0.8	3.8	4.8
14	4.3	0.8	3.5	4.4
15	4.0	0.8	3.2	4.0

Set Rate	Ttot	Tinsp	Texp	I:E
8	7.5	0.9	6.6	7.3
9	6.7	0.9	5.8	6.4
10	6.0	0.9	5.1	5.7
11	5.5	0.9	4.6	5.1
12	5.0	0.9	4.1	4.6
13	4.6	0.9	3.7	4.1
14	4.3	0.9	3.4	3.8
15	4.0	0.9	3.1	3.4

Set Rate	Ttot	Tinsp	Texp	I:E
8	7.5	1.0	6.5	6.5
9	6.7	1.0	5.7	5.7
10	6.0	1.0	5.0	5.0
11	5.5	1.0	4.5	4.5
12	5.0	1.0	4.0	4.0
13	4.6	1.0	3.6	3.6
14	4.3	1.0	3.3	3.3
15	4.0	1.0	3.0	3.0

Take home message: using pediatric Tinsp to minimize PEEPi in adults often is counterproductive: paradoxically worsens CO_2 excretion because it ↓ alveolar residence time for gas mixing. Balancing act!

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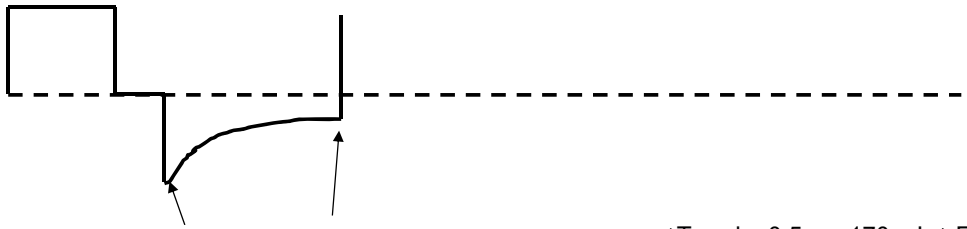
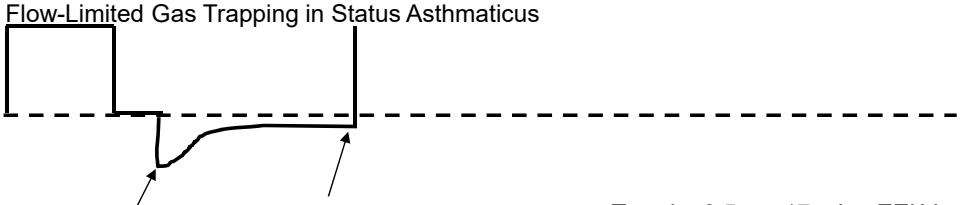
Excessive Limitations on Tinsp & Rate are Ineffective in Reducing Dynamic Hyperinflation (The Importance of monitoring end expiratory flow rate)

Dynamic Gas Trapping in ARDS



50 L/m 20L/m (330mL/s or 33 mL/0.1s) → ↑Texp by 0.5s: ~ 170 mL ↓ EELV

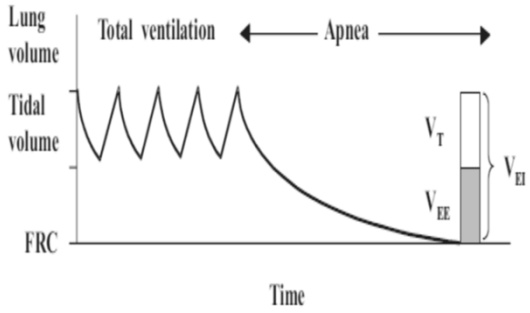
Flow-Limited Gas Trapping in Status Asthmaticus



20 L/m 2L/m (33 mL/s or 3.3 mL/0.1s →↑Texp by 0.5s: ~ 17 mL ↓ EELV

12

Monitoring Hyperinflation Severity



Rationale & Technique

- Estimate of end-inspiratory strain: trapped volume (in tissue w/ communicating airways)
- *Requires passive ventilation*
- Δ from CMV to CPAP** at end inspiration
- Measure total ΔV and time to reach expiratory volume plateau
- Duration: 20-60s (clinical judgement degree of acidemia or CV stability)

** Can be used to assess whether use or magnitude of PEEP is beneficial or detrimental)

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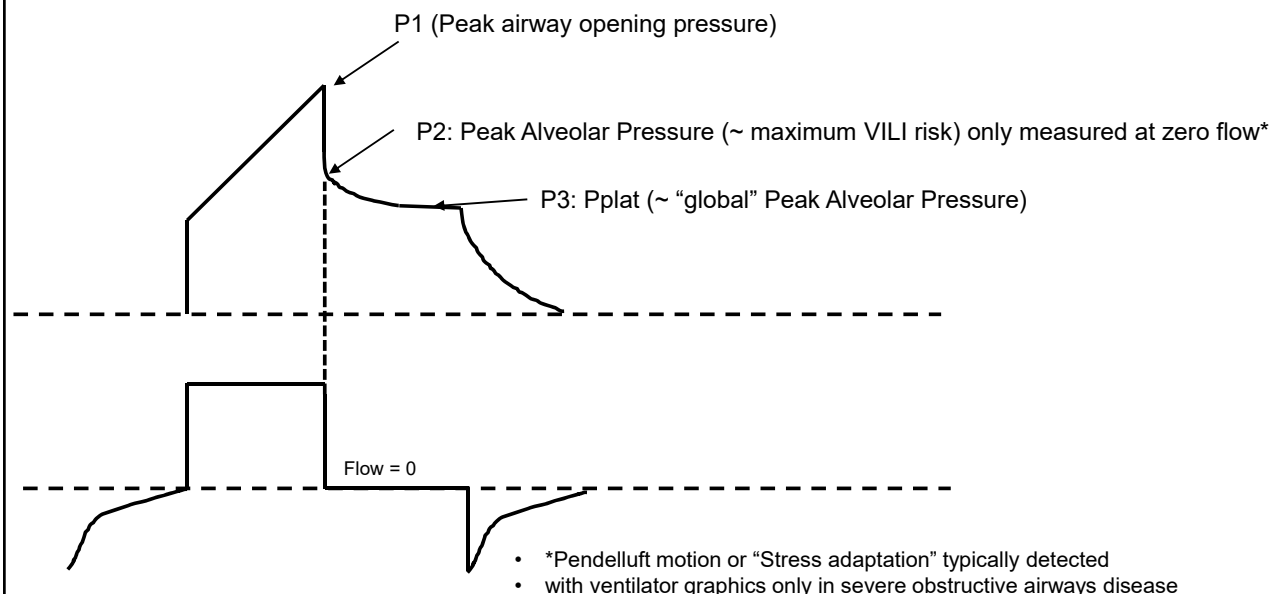

- *Pendelluft motion or "Stress adaptation" typically detected
- with ventilator graphics only in severe obstructive airways disease

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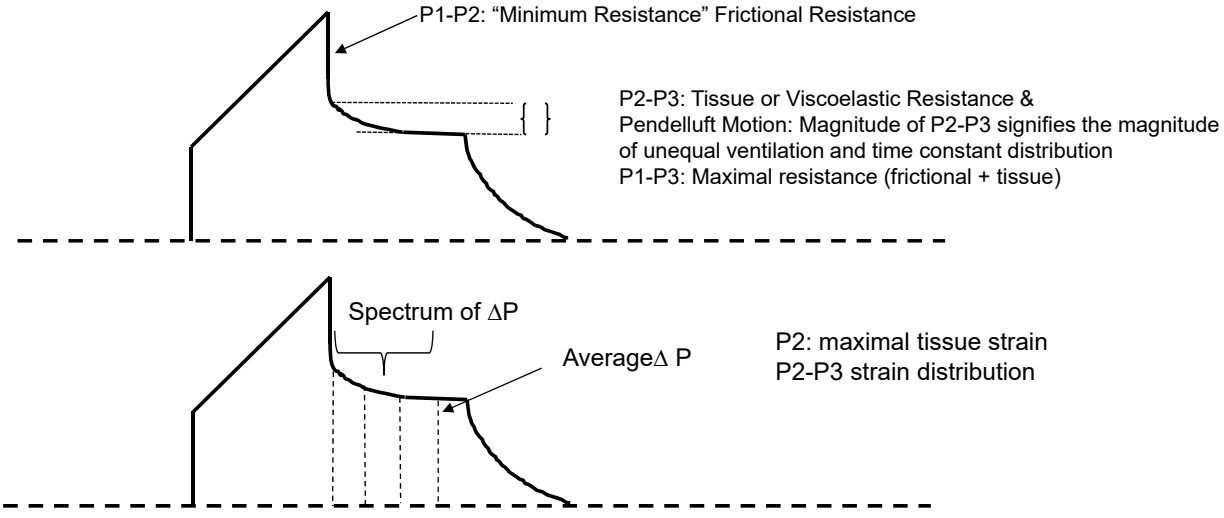
Monitoring P2, P3 and ΔP2-P3 may assist in assessing the impact of various therapies



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Note: **VILI risk** must take into account corresponding EEP associated with these regions

UCSF

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UCSF

Expiratory Pause Hold: Assess PEEPi and Heterogeneity of dynamic hyperinflation and time constant distribution

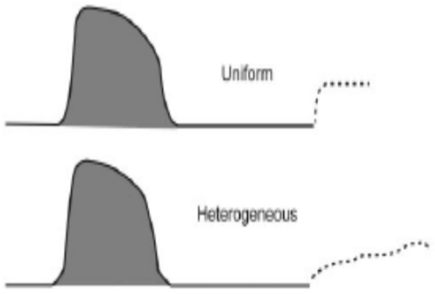
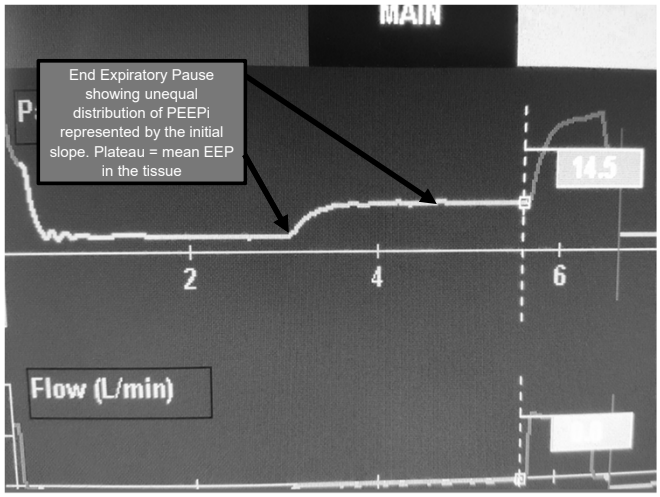


Fig. 6. Characteristic post-occlusion airway pressure signatures of homogeneously and non-homogeneously distributed auto-PEEP.



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Always keep in mind that:

PEEPi and trapped volume are a function of lung tissue with fully or partially communicating airways.

Overdistended, functionally non-communicating alveolar segments will likely compress tissue with partially or fully functioning airways

Therefore, P2 and Pplat (P3) may be the most sensitive signifiers of global overdistention

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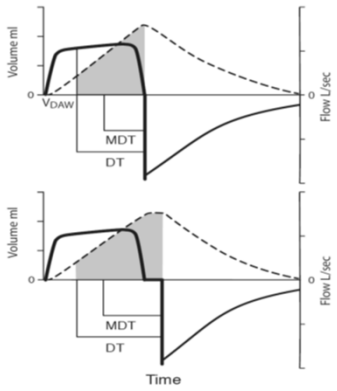
18

Effect of inspiratory flow pattern and pause on alveolar gas diffusion time (DT): mean diffusion time (MDT): without, and with an end-inspiratory hold.



Constant flow pattern: successive portions of delivered V_T have progressively less time to participate in gas exchange.

End-inspiratory pause causes a proximal shift in the fresh-gas: respiratory zone interface which enhances CO_2 excretion.

High peak constant flow may enhance CO_2 excretion.

Sudden flow transients at the airway opening → high frequency oscillations appear to resonate down to the respiratory zone and enhance gas mixing.*

3) Square Wave w/ Pause more effective on CO_2 excretion that Decreasing Ramp +Pause **

* Astrom E, Intensive Care Med 2008)
** Aboab J. Crit Care 2012

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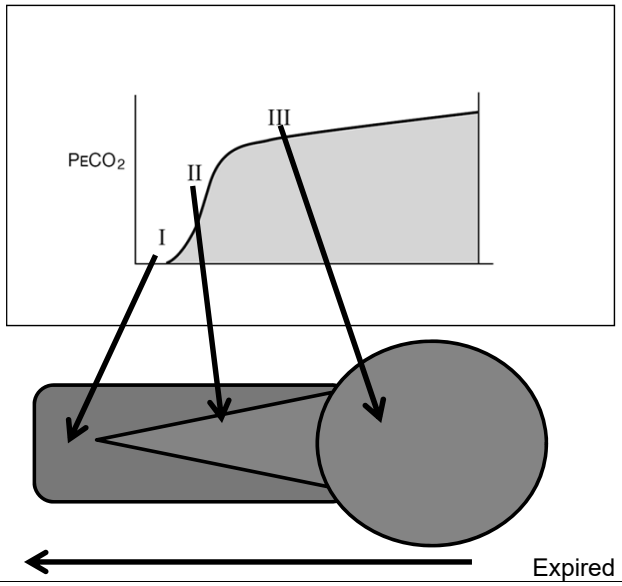
UCSF

19

Dead-Space Ventilation (Part 1): Fowler's idealized 2-compartment model (single alveolus + single airway) to explain volumetric Capnographic curve



Phase 1: Pure airway dead-space

Phase 2: Transition: airway + alveolar gas (**Slope ~ expiratory time constant** distribution)

Phase 3: Alveolar Plateau (Slope ~ V/Q distribution)

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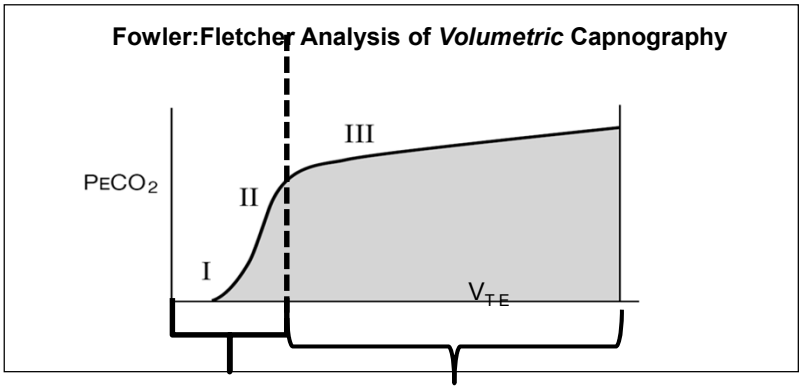
Dead-Space Ventilation (Part 2): Partitioning airway dead-space (bulk flow) from V/Q mismatch



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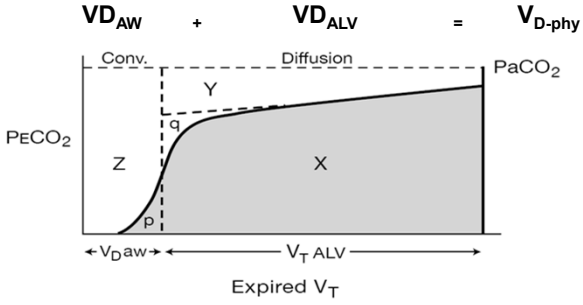
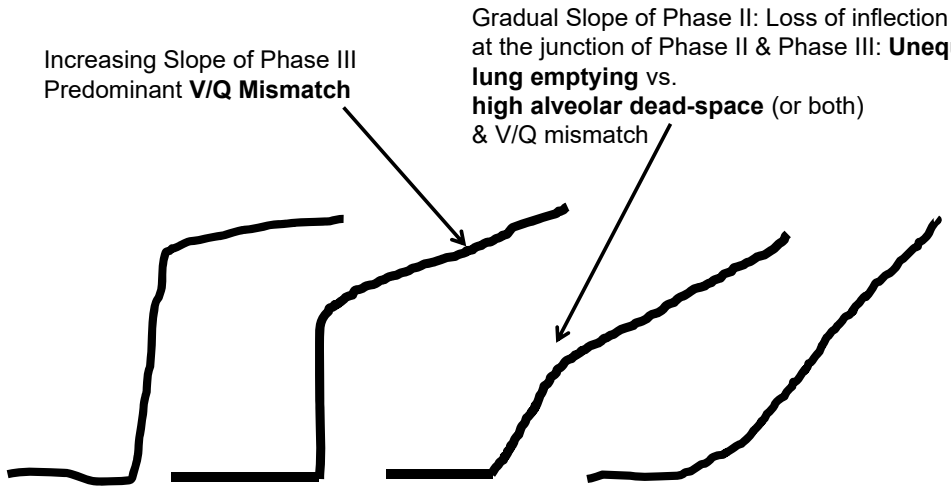
Dead-Space Ventilation (Part 3): Calculating Physiologic and Alveolar Components



22

Gross Analysis of Abnormal Volumetric Curves



Monitor gross changes in curve shape & V_D/V_T in response to therapy

Note: measured alveolar V_D is inaccurate when Phase II is abnormal

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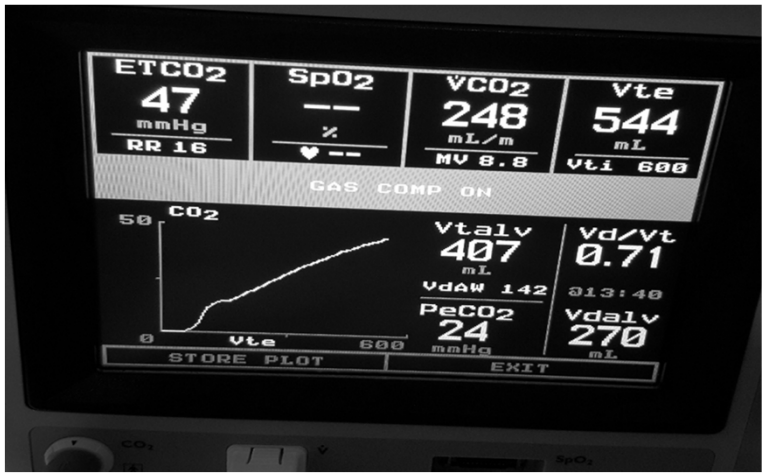
Sample Curve of Severely Abnormal Tracing: Fusion of Phase II and Phase III in a Patient with Status Asthmaticus



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Summary

- Dynamic hyperinflation: $EELV \cong \frac{V_E \, x \, Tau \, exp}{Texp}$
- Avoid V_T > 8 mL/kg (if possible), Tinsp < 0.8sec, Do not prolong Texp beyond point that exp flow falls below ~ 5L/min, Max set Rate ~ 15, target I:E ~ 1:4
- Monitor (If available w/ Vent Graphics): PEEPi, P2, P3 (Pplat) and Pdrive
- If pt requires NMB/deep sedation: monitor end-inspiratory volume
- V_D/V_T and Volumetric curve morphology provides important information to assess and guide therapy.
- All these variables need to be weighed and synthesized to form a gestalt that should assistant in managing pts with status asthmaticus

Words of Wisdom

"The ability to survive critical illness depends heavily upon clinicians' ability to pay meticulous attention to details."

Charles L Daley MD

Former Associate Professor of Pulmonary and Critical Care Medicine

UCSF at San Francisco General Hospital

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BREAK AND EXHIBITS

Friday, October 4, 2019 – 9:40 a.m. – 10:00 a.m.

PADIS (Pain, Agitation/Sedation, Delirium, Immobility, and Sleep) SCCM Guidelines Update, ICU Metrics, and Mobility Strategies – Part I

Juliana Barr, MD
Stanford University

Friday, October 4, 2019 – 10:00 a.m. – 10:30 a.m.

Dr. Barr is currently an Associate Professor of Anesthesia in the Medical Center Line at Stanford, and a Staff Anesthesiologist and Intensivist at the VA Palo Alto Medical Center. She has a Bachelors of Science Degree in Biomedical Engineering from the University of Southern California, and received her MD degree from Johns Hopkins. She is board certified in internal medicine, anesthesiology, and critical care medicine. After completing a post-doctoral research fellowship in clinical pharmacology at Stanford, Dr. Barr joined the Stanford faculty in the Department of Anesthesia and became a staff anesthesiologist and intensivist at the VA Palo Alto Health Care System in 1992. Dr. Barr's research interests include the mathematical modeling of the clinical pharmacology of sedatives and opioids commonly administered to ICU patients, and ICU outcomes research. Dr. Barr has published over 50 peer-reviewed manuscripts and book chapters. Dr. Barr has over 25 years of experience in critical care leadership, innovation, quality improvement, education, and research. She is passionate about improving the lives of critically ill patients.

ICU Liberation and PADIS Guidelines Updates

Juliana Barr, MD, FCCM

Staff Anesthesiologist and Intensivist,
VA Palo Alto Health Care System

Associate Professor,
Anesthesiology, Perioperative, and Pain Medicine
Stanford University School of Medicine

1

Faculty Disclosures:

- *Lead Author*, SCCM's ICU Pain, Agitation, and Delirium Guidelines[1]
- *Standing Member*, SCCM ICU Liberation Committee
- *Faculty,* SCCM's ABCDEF Bundle Collaborative
- *Advisory Board Member*, Medasense Biometrics, Ltd.
- *Scientific Advisor,* Masimo Inc.
- All VAPAHCS patient photos were obtained with written permission.

[1]Barr J, et al. Crit Care Med 2013 41(1):263-306

2

Learning Objectives:

To be able to describe:

- The significance of poorly managed pain, agitation, and delirium in adult ICU patients.
- What's new in the SCCM's 2018 ICU PADIS Guidelines.
- How the ICU Liberation (ABCDEF) Bundle can improve ICU patient outcomes and reduce health care costs.

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ICU Liberation

Why you should care…

Improves Patient Outcomes!

↓ *Pain*

↑ *Family Engagement*

↓ *Deep Sedation*

ABCDEF Bundle

↑ *Mobility*

↓ *Delirium*

↓ *Mechanical Ventilation*

We reduced ICU costs by 24%, and hospital costs by 32% with the Bundle!!

Reduces Healthcare Costs!

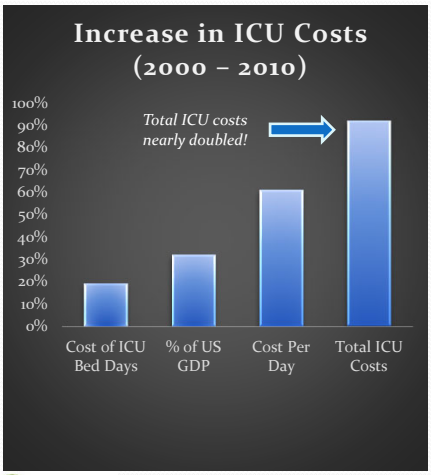
Pun BT, et al. Crit Care Med. 2018 Oct 18. [Epub ahead of print]
Hsieh SJ, et al. Crit Care Med 2019; 47:885-893

4

Adult Critical Care Medicine in the United States

5

The Costs of ICU Care



- 5.7 million ICU admissions/yr
- 20% of acute care admissions
- >30% of adults → ICU < 12 mo
- 4.1% of national health care expenditures

http://www.sccm.org/Communications/Pages/CriticalCareStats.aspx

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Common Preventable Harms in the ICU

Preventable Harm	Incidence
Medication errors[1]	8.1-2,344 MEs/1,000 pt days
Delirium[8]	60-80% MV pts., 20-50% of non-MV pts.
Hospital Acquired Weakness[9]	33-82% in MV pts.

1 in 5 ICU patients are

Adverse Events increase ICU costs by $5-7 billion a year!

45% of ALS are preventable!

Rothschild JM, et al. Crit Care Med 2005; 33: 1694-1700
Kaushal R. Crit Care Med 2007; 35: 2479–2483.

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Improving ICU Outcomes and Reducing ICU Costs

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ICU Liberation

Improving ICU Outcomes and Reducing ICU Costs

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ICU Pain, Agitation, Delirium (PAD) Management

Versed

Propofol

Haldol

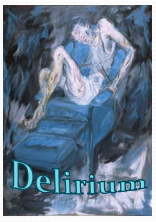
Atypicals

Fentanyl

Dilaudid

DEX

DEEP SEDATION



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Deep Sedation and ICU Outcomes

ICU Pain, Agitation, Delirium → Deep Sedation + Mech. Vent. → ↑ immobility, delirium → ↑ weakness, cognitive dysfunction, VAE, HAPU → ↑ LOS, mortality, costs

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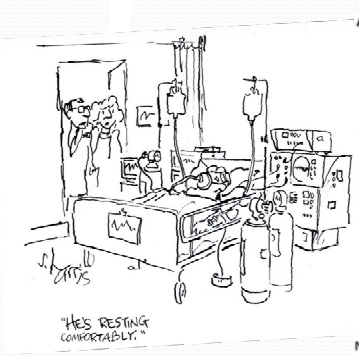
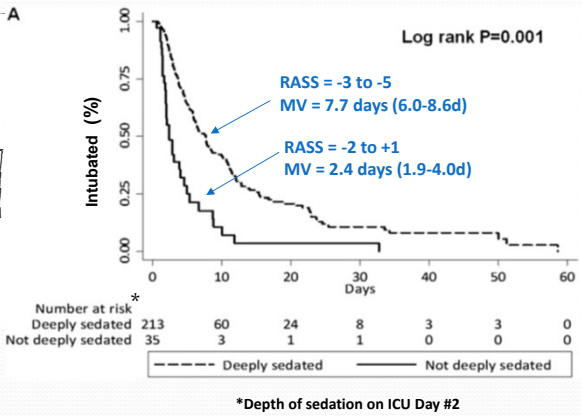
Deep Sedation → Prolongs MV





*Depth of sedation on ICU Day #2

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Shehabi Y, et al. *AJRCCM* 2012; 186:724–731

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Post Intensive Care Syndrome

ICU Survivors with PICS:

- *Unable to return to their previous life…*
  - ↑ Physical disability
  - ↓ Executive function
  - ↑ Dementia
  - ↑ Depression, PTSD
  - ↑ Chronic pain
- *Worse long-term outcomes…*
  - ↓ QOL scores
  - ↑ SNF placement
  - ↑ Hospital readmission rates
  - ↑ 1 year Mortality

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Needham DM, et al. Crit Care Med. 2012 Feb;40(2):502-9.

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ICU Care → Downstream Effects

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2013 ICU PAD Guidelines

Clinical Practice Guidelines for the Management of Pain, Agitation, and Delirium in Adult Patients in the Intensive Care Unit

Juliana Barr, MD, FCCM; Gilles L. Fraser, PharmD, FCCM; Kathleen Puntillo, RN, PhD, FAAN, FCCM; E. Wesley Ely, MD, MPH, FACP, FCCM; Céline Gélinas, RN, PhD; Joseph F. Dasta, MSc, FCCM, FCCP; Judy E. Davidson, DNP, RN; John W. Devlin, PharmD, FCCM, FCCP; John P. Kress, MD; Aaron M. Joffe, DO; Douglas B. Coursin, MD; Daniel L. Herr, MD, MS, FCCM; Avery Tung, MD; Bryce R. H. Robinson, MD, FACS; Dorrie K. Fontaine, PhD, RN, FAAN; Michael A. Ramsay, MD; Richard R. Riker, MD, FCCM; Curtis N. Sessler, MD, FCCP, FCCM; Brenda Pun, MSN, RN, ACNP; Yoanna Skrobik, MD, FRCP; Roman Jaeschke, MD

Barr J, et al. Crit Care Med 2013 41(1):263-306

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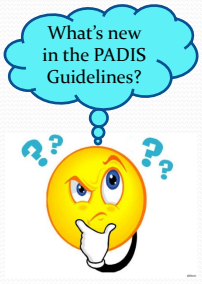
2018 ICU PADIS Guidelines



Online Special Article

Clinical Practice Guidelines for the Prevention and Management of Pain, Agitation/Sedation, Delirium, Immobility, and Sleep Disruption in Adult Patients in the ICU

John W. Devlin, PharmD, FCCM (Chair)[1,2]; Yoanna Skrobik, MD, FRCP(c), MSc, FCCM (Vice-Chair)[3,4]; Céline Gélinas, RN, PhD[5]; Dale M. Needham, MD, PhD[6]; Arjen J. C. Slooter, MD, PhD[7]; Pratik P. Pandharipande, MD, MSCI, FCCM[8]; Paula L. Watson, MD[9]; Gerald L. Weinhouse, MD[10]; Mark E. Nunnally, MD, FCCM[11,12,13,14]; Bram Rochwerg, MD, MSc[15,16]; Michele C. Balas, RN, PhD, FCCM, FAAN[17,18]; Mark van den Boogaard, RN, PhD[19]; Karen J. Bosma, MD[20,21]; Nathaniel E. Brummel, MD, MSCI[22,23]; Gerald Chanques, MD, PhD[24,25]; Linda Denehy, PT, PhD[26]; Xavier Drouot, MD, PhD[27,28]; Gilles L. Fraser, PharmD, MCCM[29]; Jocelyn E. Harris, OT, PhD[30]; Aaron M. Joffe, DO, FCCM[31]; Michelle E. Kho, PT, PhD[32]; John P. Kress, MD[33]; Julie A. Lanphere, DO[34]; Sharon McKinley, RN, PhD[35]; Karin J. Neufeld, MD, MPH[36]; Margaret A. Pisani, MD, MPH[37]; Jean-Francois Payen, MD, PhD[27]; Brenda T. Pun, RN, DNP[38]; Kathleen A. Puntillo, RN, PhD, FCCM[39]; Richard R. Riker, MD, FCCM[40]; Bryce R. H. Robinson, MD, MS, FACS, FCCM[41]; Yahya Shehabi, MD, PhD, FCICM[42]; Paul M. Szumita, PharmD, FCCM[43]; Chris Winkelman, RN, PhD, FCCM[44]; John E. Centofanti, MD, MSc[45]; Carrie Price, MLS[46]; Sina Nikayin, MD[47]; Cheryl J. Misak, PhD[48]; Pamela D. Flood, MD[49]; Ken Kiedrowski, MA[48]; Waleed Alhazzani, MD, MSc (Methodology Chair)[50,49]

Devlin, et al. Crit Care Med 2018; 46:e825–e873

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2018 PADIS Guidelines

Pain Recommendations

- Routinely assess pain in all ICU patients → *NRS, CPOT or BPS*
- Analgosedation protocols → *treat pain first, then sedate.*
- Multimodal pain management protocols → ↓*opioid use, side effects (i.e., use acetaminophen, ketamine (post-surgical), but not lidocaine, NSAIDs).*
- Neuropathic pain rx → *gabapentin, carbamazepine, pregabalin + opioids.*
- CT Surgery pts. → *neuropathic pain meds + opioids.*
- Pre-procedural opioid rx. → ↓*procedural pain.*
- Adjunctive pain rx. → *massage, music therapy, cold rx., relaxation therapy.*

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Devlin, et al. Crit Care Med 2018; 46:e825–e873

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2018 PADIS Guidelines

Agitation/Sedation Recommendations

- Routinely assess sedation in all ICU patients → *RASS, SAS.*
- Target light, rather than deep sedation → *MV patients.*
- Use either Dexmedetomidine or Propofol for sedation → *avoid benzodiazepines.*

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Devlin, et al. Crit Care Med 2018; 46:e825–e873

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2018 PADIS Guidelines

Delirium Recommendations

- Routinely assess all ICU patients for delirium → *CAM-ICU, ICDSC.*
- Use a multi-component, non-pharmacologic delirium management program → ↓ *delirium risk factors, incidence, duration (e.g., avoid deep sedation, reorientation, sleep, vent weaning, mobilization, family engagement).*
- Pharmacologic treatment of ICU delirium:
  - Do not routinely use antipsychotics (*haldol, atypicals*) or statins to prevent or treat ICU delirium.
  - Use antipsychotics only to manage severe symptoms of delirium (*i.e., agitation, distress*).
  - Use dexmedetomidine to treat hyperactive delirium in MV pts.

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Devlin, et al. Crit Care Med 2018; 46:e825–e873

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2018 PADIS Guidelines

Immobility Recommendations

- Routinely perform early rehabilitation or mobilization of ICU patients (including MV pts.)→ *feasible, safe, & cost-effective; reduces MV duration in vent patients.*

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Devlin, et al. Crit Care Med 2018; 46:e825–e873

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2018 PADIS Guidelines

Sleep Recommendations

- Use a multi-component sleep-promoting protocol to improve sleep in ICU patients:
  - *control environmental light/noise, cluster care activities at night;*
  - *use eyeshades, earplugs, and relaxing music at night;*
  - *promote daytime wakefulness;*
  - *avoid sedatives, deliriogenic meds.*
- No recommendation on the use of sleep-promoting medications (*i.e., melatonin, dexmedetomidine, propofol*) → *limited evidence.*
- *Use AC mode of MV at night in vent patients (vs PCV or PSV).*
- *Use NIV at night in OSA patients.*

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Devlin, et al. Crit Care Med 2018; 46:e825–e873

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ICU PADIS Guidelines

Summary Recommendations

1. Perform *pain*, *sedation*, and *delirium* assessments using *validated tools*.
2. Develop structured pain, sedation, & delirium management protocols:
   - *treat pain first, then sedate*
   - *avoid deep sedation and benzodiazepines*
   - *use non-pharmacologic delirium management strategies >> drugs*
3. Link PAD management → *ventilator weaning protocols (SAT/SBT trials).*
4. Promote *early mobilization* of all ICU patients.
5. Promote *normal sleep-wake cycles* in patients.
6. Engage ICU patients and families in care processes.

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Barr J, et al. Crit Care Med 2013 41(1):263-306
Devlin, et al. Crit Care Med 2018; 46:e825–e873

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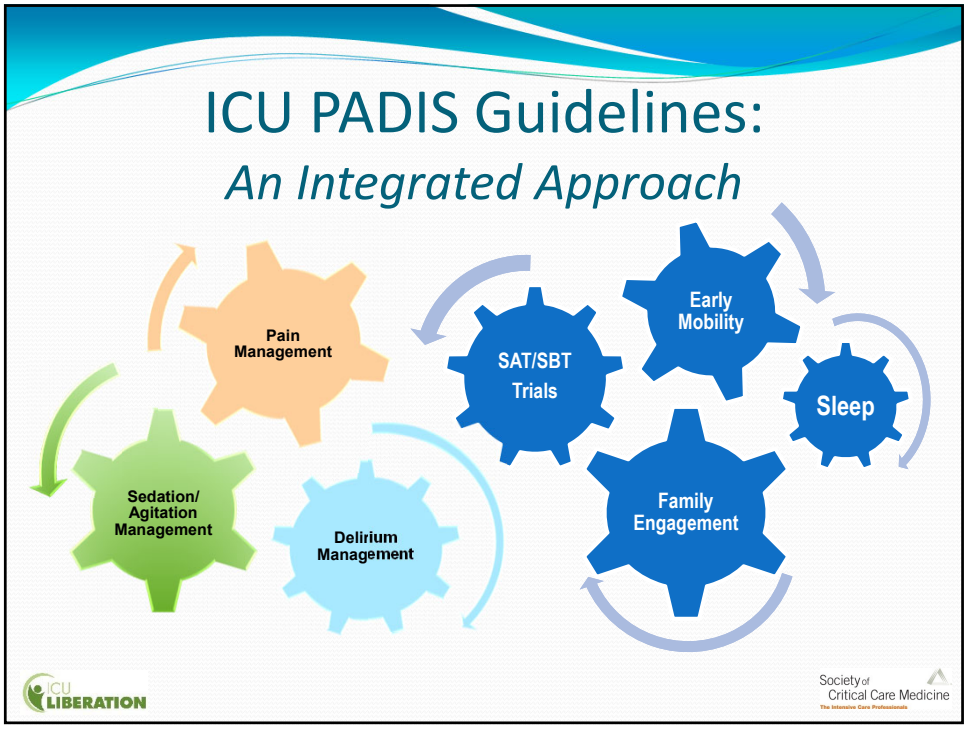
ICU PADIS Guidelines:
An Integrated Approach
Pain Management
SAT/SBT Trials
Early Mobility
Sleep
Family Engagement
Delirium Management
Sedation/ Agitation Management
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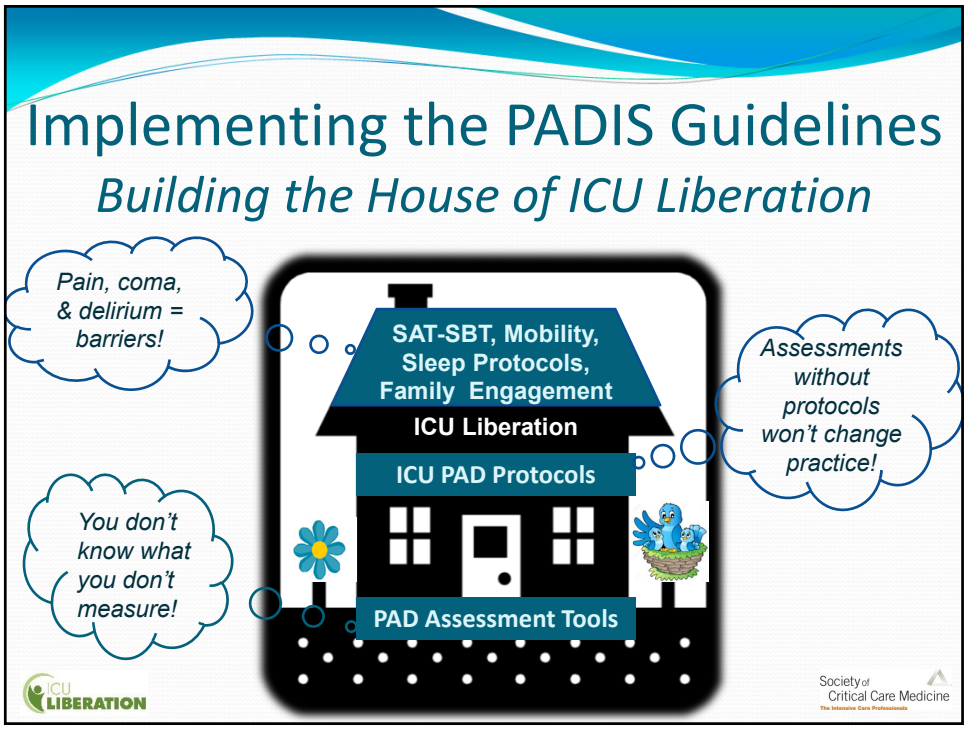
Implementing the PADIS Guidelines
Building the House of ICU Liberation
Pain, coma, & delirium = barriers!
SAT-SBT, Mobility, Sleep Protocols, Family Engagement
ICU Liberation
ICU PAD Protocols
PAD Assessment Tools
Assessments without protocols won't change practice!
You don't know what you don't measure!
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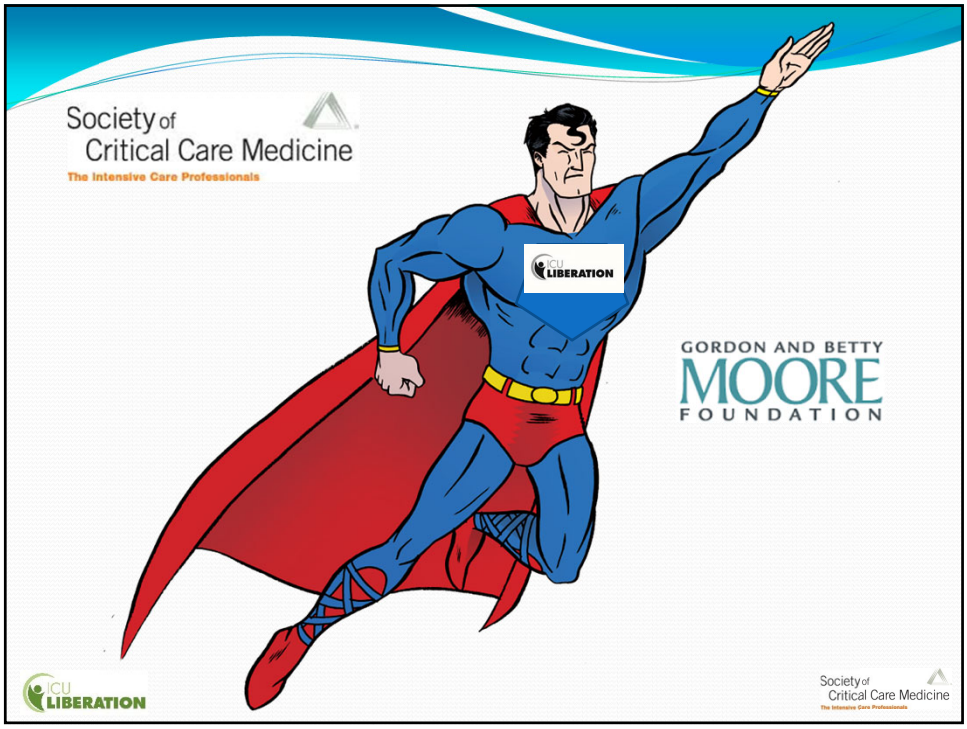
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ICU LIBERATION
GORDON AND BETTY
MOORE
FOUNDATION
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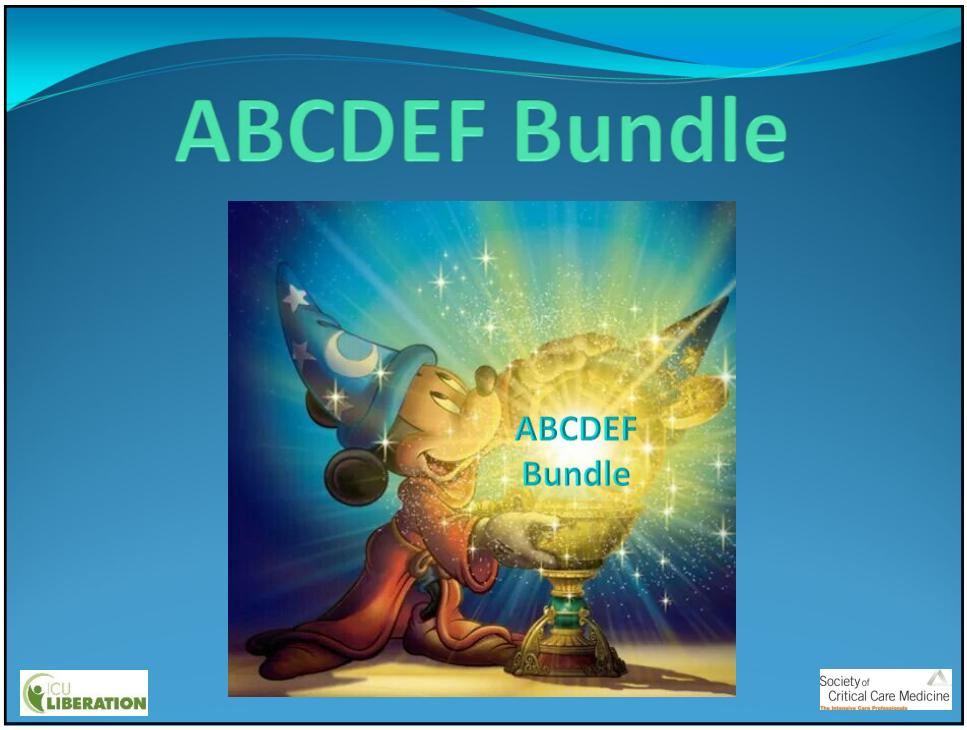
ABCDEF Bundle
ABCDEF
Bundle
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ABCDEF Bundle

- ✓ A – Assess, Prevent and Manage Pain
- ✓ B – Both SATs and SBTs
- ✓ C – Choice of Sedation
- ✓ D – Delirium: Assess, Prevent and Manage
- ✓ E – Early Mobility and Exercise
- ✓ F – Family Engagement and Empowerment

*www.iculiberation.org

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ABCDEF Bundle

(G = Good Sleep)

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Where does the Bundle end?

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ICU Liberation Bundle

Why a bundle ??

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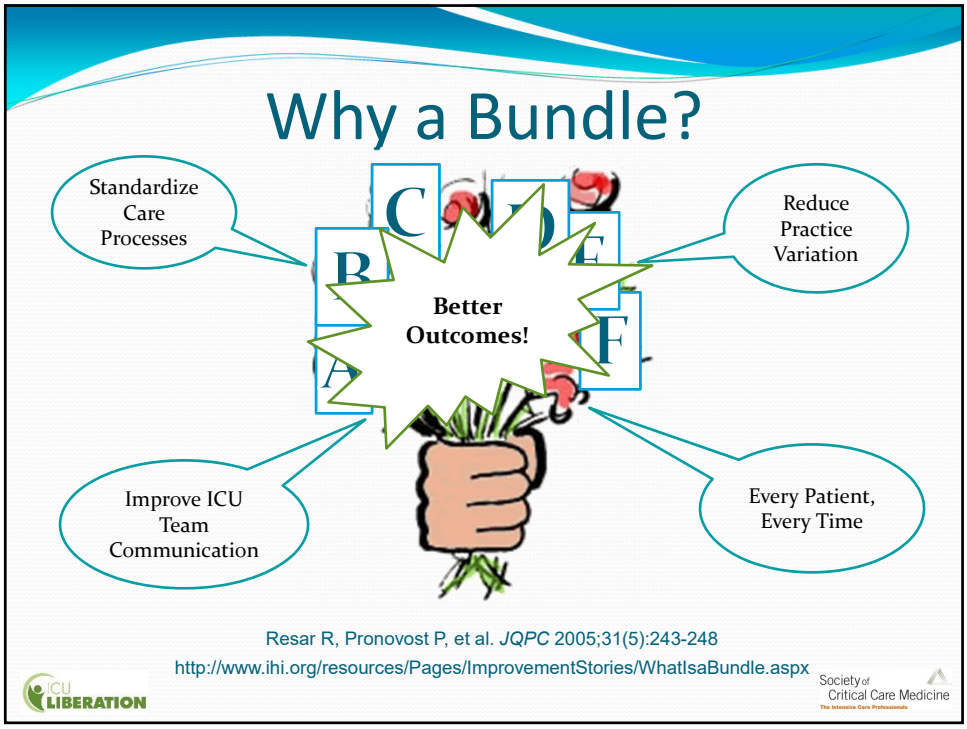
Why a Bundle?
Standardize Care Processes
Reduce Practice Variation
Better Outcomes!
Improve ICU Team Communication
Every Patient, Every Time
Resar R, Pronovost P, et al. JQPC 2005;31(5):243-248
http://www.ihi.org/resources/Pages/ImprovementStories/WhatIsaBundle.aspx
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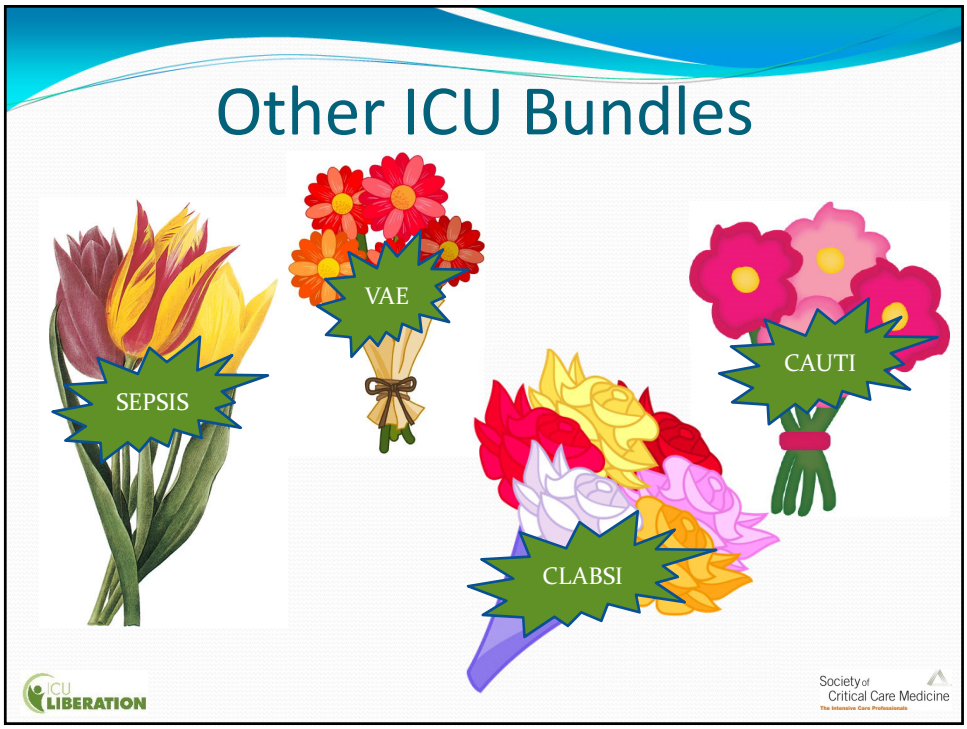
Other ICU Bundles
VAE
SEPSIS
CAUTI
CLABSI
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ICU Liberation Bundle

Every ICU Patient, Every Day!

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ICU Liberation Bundle Objectives

- *Optimize ICU pain management*
- *Avoid deep sedation of ICU patients*
- *Reduce ICU delirium prevalence*
- *Shorten the duration of mechanical ventilation*
- *Prevent ICU acquired weakness*
- *Promote sleep in ICU patients*
- *Increase ICU patient and family involvement*
- *Improve ICU patient outcomes*
- *Reduce health care costs*

*www.iculiberation.org

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Optimize ICU Pain Management

- Pain Monitoring:
  - Assess pain Q 2hr, prn
  - Use valid, reliable pain assessment tools:
    - Self-report → NRS
    - Can't self-report → CPOT, BPS
- Goals: Treat pain *first* before sedating pts.
- Pain Management:
  - Multimodal approach→ ↓*opioid use, side effects*
  - Gabapentin, carbamazepine, pregabalin → *neuropathic pain*
  - Regional anesthesia (epidurals) → *postop. pain, rib fractures*

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Barr J, et al. *Crit Care Med* 2013 41(1):263-306

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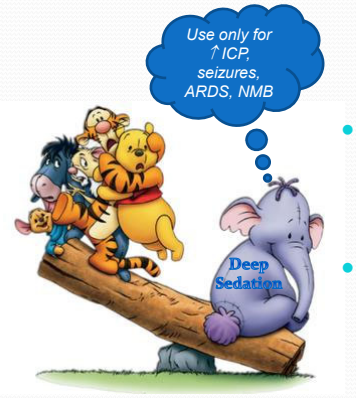
Avoid Deep Sedation



- Sedation Monitoring:
  - *Assess sedation depth Q2hr, prn*
  - *Use valid, reliable sedation assessment tools:*
    - RASS (-5 to +4)
    - SAS (1 to 7)
- Sedation Goals: *Target light sedation*
  - Definition: *able to perform a variety of simple commands (i.e., RASS = 0 to -2, SAS = 3 to 4)*
  - Exceptions: *↑ICP, status epilepticus, ARDS, NMB*
- Sedation Management: *↓sedative exposure*
  - IV sedative bolus dosing prn
  - IV sedative infusions → *propofol, DEX*
    - Targeted sedation strategy (**TSS**)→ *constant light sedation*
    - Daily sedative interruption (**DSI**) → *interrupt sedation daily*

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Barr J, et al. *Crit Care Med* 2013; 41(1):263-306
Shehabi Y, et al. *AJRCCM* 2012;186(8):724-731
Hager DN, et al. *Crit Care Med* 2013;41(6):1435-1442

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ICU Delirium Management Strategies

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Medications Used to Treat Refractory ICU Delirium

Sedatives

- Benzodiazepines:
  - Midazolam
  - Lorazepam
- Propofol
- Dexmedetomidine*

For treating hyperactive delirium
In mechanically ventilated patients!

Antipsychotics

- Haloperidol
- Atypical antipsychotics:
  - Risperidone
  - Ziprasidone
  - Quetiapine
  - Olanzapine

*Reade, et al. JAMA 2016 Apr 12;315(14):1460-8
Skrobik Y, et al. AJRCCM 2018 May 1;197(9):1147-1156

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Antipsychotics and ICU Delirium

- Design:
  - Multicenter , prospective, double-blind, placebo-controlled RCT (16 hospitals)
  - Comparing haldol vs. ziprasidone vs. placebo treatment for ICU delirium (≤14d)
- Enrollment: 566 MV Medical/Surgical ICU patients with delirium
  - Hypoactive delirium: 89%
  - Hyperactive delirium: 11%
- Outcome Measures:
  - Primary: delirium and coma-free days (DCFD)
  - Secondary: MV duration, ICU/hospital LOS, 30d/90d survival
  - Safety: extra pyramidal symptoms, arrhythmias, excessive sedation

MIND USA | Modifying the Impact of ICU-Associated Neurological Dysfunction

Girard TD, et al. NEJM 2018 Oct 22 [Epub ahead of print]

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Antipsychotics and ICU Delirium

Outcomes	Placebo	Haldol	Ziprasidone	*P* Value
DCFD	8.5 d	7.9 d	8.7 d	NS
MV duration	3 d	2 d	3 d	NS
ICU LOS	5 d	5 d	6 d	NS
Hospital LOS	13 d	13 d	12 d	NS
30d mortality	50%	50%	53%	NS
90d mortality	63%	73%	65%	NS

MIND USA | Modifying the Impact of ICU-Associated Neurological Dysfunction

No significant differences in treatment effectiveness or other outcomes!!!

Girard TD, et al. NEJM 2018 Oct 22 [Epub ahead of print]

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Non-Pharmacologic ICU Delirium Management Strategies

Blair JG, et al. J Intensive Care Med. 2018

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Eliminate Deliriogenic Medications

1. Sedatives → *benzodiazepines >> propofol, DEX*
2. Opioids → *MSO4, meperidine*
3. Anticholinergics → *H2 blockers, atropine, diphenhydramine, amiodarone, ophthalmic medications*
4. Corticosteroids → *dexamethasone, methylprednisolone, hydrocortisone*
5. Antibiotics → *quinalones, cefepime*

Hayhurst CJ, et al. *Anesthesiology* 2016; 125(6):1299-41.
Devlin JW, et al. (2012) In Papadopoulos J, et al. (Eds) *Drug-Induced Coma and Delirium*. In Drug-induced complications in the critically ill patient (pp 107-16). Mount Prospect, IL: SCCM.

42

Use SAT-SBT Protocols

Hasten Ventilator Weaning

www.iculiberation.org

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Use SAT-SBT Protocols

Hasten Ventilator Weaning

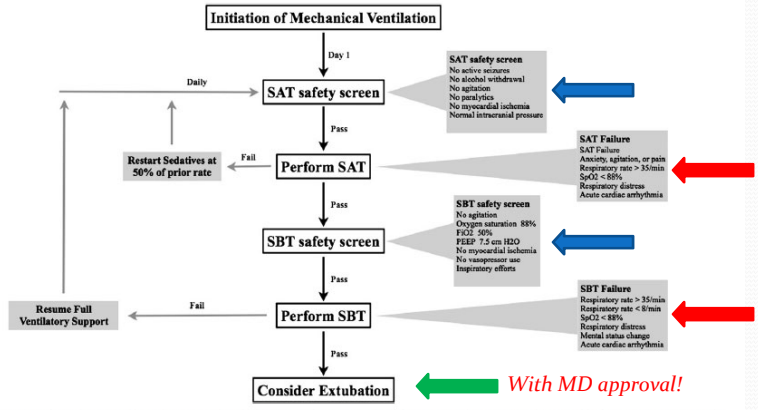

Fig. 2. Overview of a wake-up and breathe protocol. Includes criteria for passing the safety screens that were implemented before spontaneous awakening trials and spontaneous breathing trials. Also includes criteria for failing a spontaneous awakening trial or spontaneous breathing trial.

Girard T, et al. *Lancet* 2008; 371:126-34.

44

Mobilize ICU Patients Early

- ICU Acquired Weakness*:
  - Multifactorial syndrome → myopathy &/or polyneuropathy
  - Risk factors: sepsis, inflammation, MOSF, MV, ↑BG, steroids, NMB agents >48h, F>M, immobility
  - Incidence: 25% – 100%
  - Outcomes**: ↑ risk of MV wean failure (30%), ICU mortality (30%), hospital mortality (31%); ↑ 1 yr mortality; *50% of pts. fail to return to previous level of function!*

*Kress JP, et al. *NEJM* 2014; 370(17):1626-1635
**Hermans G, et al. *AJRCCM* 2014; 190(4):410-420
**Needham DM, et al. *BMJ* (Clinical research ed) 2013; 346:f1532
**Herridge MS, et al. *NEJM* 2003; 348(8):683-693.

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Mobilize ICU Patients Early

"Mobility is Medicine"
- Heidi Engel, PT, UCSF

↓ Delirium, Weakness, LOS
↑ Functional status at d/c

Schweickert WD, et al. *Lancet* 2009; 373(9678):1874-1882
Morris PE, et al. *Crit Care Med* 2008; 36(8):2238-2243
Needham DM, et al. *Topics in Stroke Rehab* 2010; 17(4):271-281.

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Mobilize ICU Patients Early

Deep Sedation → **Analgosedation**

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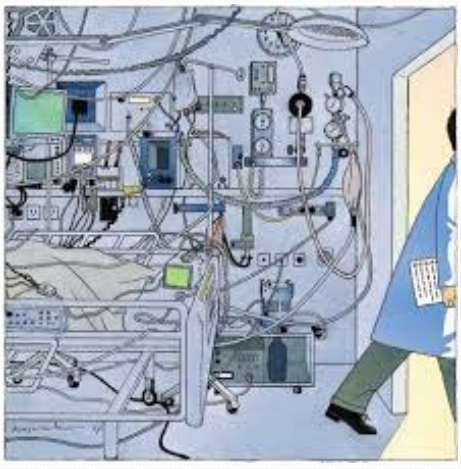
Remove Lines and Tubes



http://www.icudelirium.org/delirium/management.html

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Remove Lines and Tubes

CHECKLIST ICU Trial

DAILY CHECKLIST

Date: □□/□□/□□□□

Item	Status			Actions / remarks
Is nutrition adequate?	☐Yes	☐No	☐NA/CI	
Venous thromboembolism prophylaxis ordered?	☐Yes	☐No	☐NA/CI	
Head of bed is at 30° or more?	☐Yes	☐No	☐NA/CI	
Does the patient meets criteria for new severe sepsis/septic shock?	☐Yes	☐No	☐NA/CI	
Is there indication to start, adjust or stop antibiotics?	☐Yes	☐No	☐NA/CI	
Is it possible to remove the central line?	☐Yes	☐No	☐NA/CI	
Is it possible to remove Foley?	☐Yes	☐No	☐NA/CI	
Is analgesia adequate?	☐Yes	☐No	☐NA/CI	
Is it possible to reduce sedatives?	☐Yes	☐No	☐NA/CI	
Is it possible a spontaneous breathing trial?	☐Yes	☐No	☐NA/CI	
What is the PaO_2/FiO_2? What is the tidal volume per Kg of predicted body weight?				

Intensivist signature:_____

Chen Y, et al. *Am J Crit Care* 2013;22(2):105-114
Halm MA. *Am J Crit Care* 2008; 17(6):577-580

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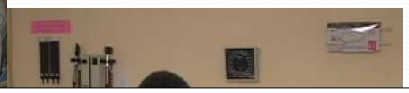
Avoid Restraints



Delirium as detected by the CAM-ICU predicts restraint use among mechanically ventilated medical patients*

Scott T. Micek, Pharm D; Nitin J. Anand, MD; Brad R. Laible, Pharm D; William D. Shannon, PhD; Marin H. Kollef, MD

Micek ST, et al. *Crit Care Med* 2005; 33:1260 –1265

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Avoid Restraints

Research **Open Access**

Risk factors for delirium in intensive care patients: a prospective cohort study

Bart Van Rompaey[1,2], Monique M Elseviers[1], Marieke J Schuurmans[3], Lillie M Shortridge-Baggett[4], Steven Truijen[2] and Leo Bossaert[5,6]

"The use of physical restraints before the onset of delirium showed a very high risk [of ICU delirium]."
(Odds Ratio of 33.84!!!)

Van Rompaey B. *Intensive and Critical Care Nursing* 2008; 24:98—107

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Avoid Restraints

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Reorient ICU Patients

TABLE I.—*The modified five Ws and one H scale used by health care staff at least one time per nurse shift.*

Who?	Who are you? Who is the nurse/physician?
What?	What happened?
When?	When did it happen and what is the date?
Where?	Where are you/we?
Why?	Why did it happen?
How?	How did it happen? And what is the illness progression?

- N = 314 med-surg ICU patients *(excluded neuro, psych pts.)*
- DSI → CAM-ICU assessments BID *(RASS = -3 to +3)*
- Intervention group: *daily reorientation (5Ws + H), stimulation (wall clock, reading, favorite music), hearing aids/eyeglasses prn during DSI, minimal light, noise at night.*
- Results: *delirium incidence ↓ (35% → 22%, P=0.02)*

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Colombo R, et al. *Minerva Anestesiol* 2012; 78:1026-33

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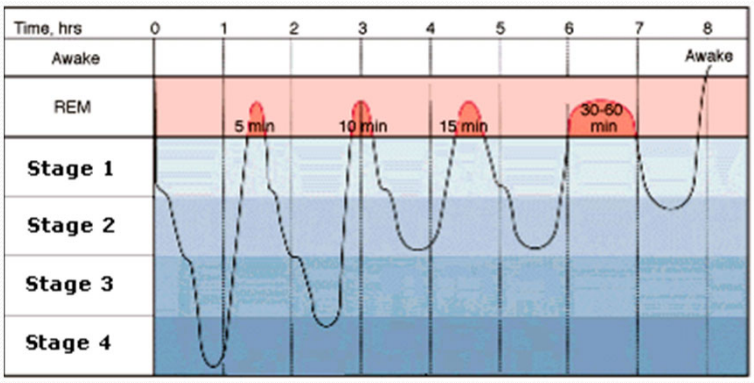
Promote Normal Sleep-Wake Cycles



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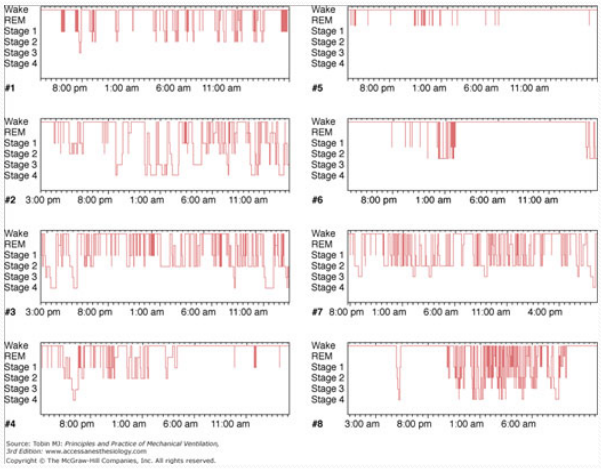
ICU Patient Sleep-Wake Cycles



Cooper AB, et al. *CHEST* 2000; 117(3):809-18.

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Sleep Deprivation in ICU Patients

Causes:

- Round-the-clock stimuli (*e.g., noise, light, patient interactions*)
- Pain
- Medications (*e.g., sedatives, opioids*)
- Mechanical ventilation
- Underlying acute illness
- Delirium

Kaplow R. *CCCNA* 2016; 28(2):169-182

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ICU Nighttime Care Interactions

N = 50 ICU pts., 147 nights

Table 4 Types of care interactions with patients during each hour from 7 PM to 6 AM

Care Interaction	7 PM	8 PM	9 PM	10 PM	11 PM	12 AM	1 AM	2 AM	3 AM	4 AM	5 AM	6 AM
Measuring vital signs	109	144	119	144	112	142	113	138	107	141	107	136
Measuring vital signs via arterial catheters	42	48	41	48	41	48	39	46	37	48	40	45
Assessing intake/output	90	118	95	126	95	111	96	115	93	117	95	129
Assessing intake/output via catheter	84	100	84	104	86	97	87	99	84	101	86	102
Giving medications	25	52	34	121	50	98	44	61	27	45	34	120
Assessing patient	38	97	19	40	16	87	17	40	11	61	21	54
Turning patient	6	37	22	43	18	32	15	37	7	32	11	33
Checking ventilator	11	41	26	23	14	46	18	20	2	36	30	14
Administering medications via ventilator	2	36	20	6	3	31	13	18	0	24	19	23
Obtaining blood samples	5	39	18	14	6	19	6	13	4	9	17	27
Bathing patient	0	0	2	3	4	9	6	12	1	20	23	12

Values are numbers of interactions.

Average of 42.6 interactions/night; only 6% of nights with no interactions x 2-3 hr!

Tamburri LM, et al. *AJCC* 2004; 13:102-115

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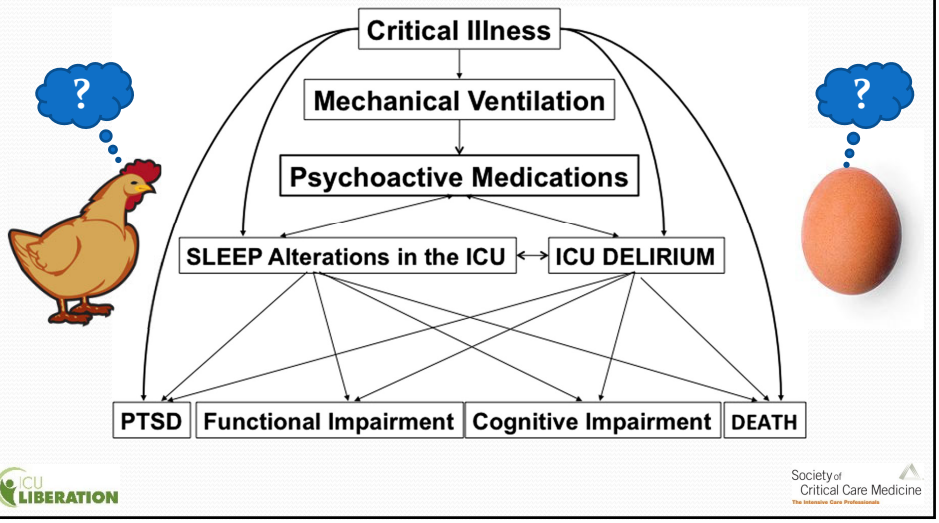
Sleep Deprivation and ICU Delirium



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ICU Sleep Hygiene Programs

1. Protect nighttime sleeping period: (*i.e., 2200 hr – 0600 hr*)
   - minimize, cluster patient care activities.
   - ↓ light, noise inside/outside patient's room.
   - use patient earplugs, eye masks.
   - employ relaxation techniques (*music, massage*).
   - avoid sedatives, caffeine.
2. Increase daytime activity:
   - ↑ mobility.
   - open window shades, turn on room lights.
   - avoid daytime napping!
3. Sleep medications: Melatonin qhs?

ICU sleep hygiene programs ↓incidence, duration of ICU delirium >50%

Alway A, et al. *AACN* 2013;22(4):357-360
Van Rompaey B, et al. *Critical Care* 2012;16(3):R73
Kamdar BB, et al. *Anaesthesia* 2014;69(6):527-531
Patel J, et al. *Anaesthesia* 2014;69(6):540-549.
Shaw R. AJCC 2016; 25(2):181-4.
Baumgartner L. CCM 46(1):454, Jan 2018

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Engage ICU Patients and Families

- ↑ ICU family participation → *ICU rounds, 24hr visiting, resuscitations.*
- ↑ ICU family support → *education, assisting with pt. care, ICU diaries.*
- ↑ ICU family communication → *routine conferences, provider education.*
- ↑ Palliative Care involvement → *ICU patients with poor prognosis.*
- ↓ Family /Staff Goals-of-Care conflicts → *Ethics, Social Work, Spiritual.*
- ↑ Patient-Centered Care Policies → *sleep hygiene, EOL management .*

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

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Engage ICU Patients and Families

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How Family Engagement Can Facilitate ICU Liberation

- Help with patient communication.
- Reorient patients.
- Connect them to the outside world.
- Identify favorite music, TV shows.
- Bring their glasses, hearing aids.
- Help with bathing, grooming.
- Familiarize the ICU environment.
- Help to calm agitated patients.
- Identify sleep aids.
- Be an exercise coach.

https://www.icudelirium.org/patients-and-families/overview

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ICU Liberation Bundle Implementation

ICU Inter-professional Collaboration, Communication, & Care Coordination

Wheelan SA, et al. Am J Crit Care 2003;12:527-34
Balas MC, et al. Crit Care Med. 2013 September; 41(9 0 1): S116–S127.

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ICU Liberation Bundle Implementation

Organizational Requirements

- Adequate, stable ICU staffing levels
- Workplace culture of safety, respect
- Bundle-related checklists, flow sheets, order sets
- Collaborative work environment → *daily ICU IPT Rounds*
- Patient & family centered care → *decision making*
- Real-time CQI → *data-driven performance assessment*
- Leadership engagement → *Executive Sponsorship*

Picture your hospital CEO here!

Every ICU patient, every day!

Donovan AL, *et al.* Crit Care Med 2018; 46: ePub ahead of print.
Balas MC, *et al.* Crit Care Med 2013;41:S116-27.
Costa DK, *et al.* Research in Nursing & Health 2014; 37:326-335.

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ICU Liberation Bundle Implementation

Benefits of Leadership Engagement

- Allocate resources → *staff, $$, equipment*
- Align Bundle → *organizational values, QI goals*
- Make the business case for the Bundle
- Spread the Bundle across the organization

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ICU Liberation Bundle

What's the evidence??

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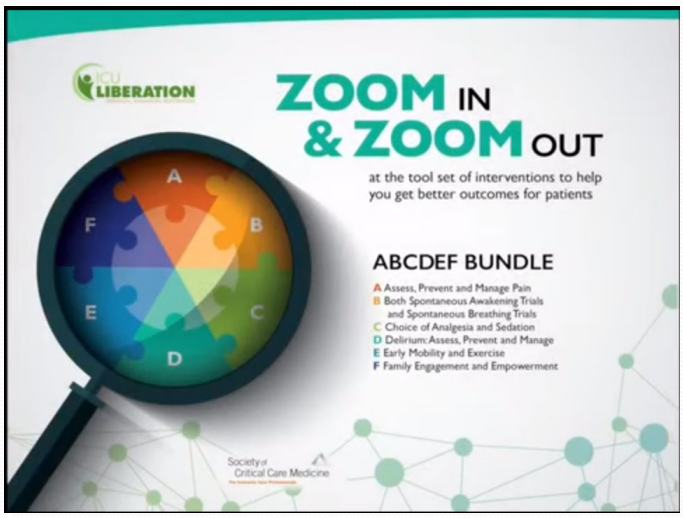
ICU Liberation Collaborative



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ICU Liberation Collaborative

ABCDEF Bundle Team
VA Palo Alto Health Care System
Palo Alto, CA

- Goal: *Implement the ABCDEF Bundle over 20 months (2015-2017).*
- ICUs: *77 U.S. ICUs (69 adult, 8 pediatric), 3 Regions (SE, MW, West)*
- Tools: *meetings, webinars, list serve, REDCAP database.*
- QI strategies: *↑Bundle adoption, compliance, improve ICU outcomes.*
- Enrollment: *Total N = 17,069 ICU pts.*
  - Pre-Bundle: *1,982 pts. (6 mo.)*
  - Post-Bundle: *15,087 pts. (14 mo.)*

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Caring for Critically Ill Patients with the ABCDEF Bundle:

Results of the ICU Liberation Collaborative in Over 15,000 Adults

Pun BT, Balas MC, Barnes-Daly MA, Thompson JL, Aldrich M, **Barr J**, Byrum D, Carson SS, Devlin JW, Engel HJ, Esbrook CL, Hargett KD, Harmon L, Hielsburg C, Jackson JC, Kelly TL, Kumar V, Millner L, Morse A, Perme CS, Posa PJ, Puntillo KA, Schweickert WD, Stollings JL, Tan A, McGowan LD, Ely EW.

Pun BT, et al. Crit Care Med. 2018 Oct 18. [Epub ahead of print]

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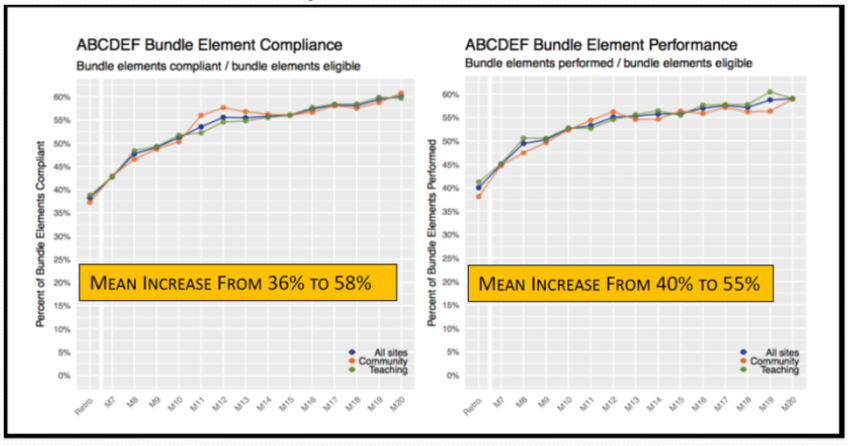
ICU Liberation Collaborative

Bundle Compliance & Performance



Pun BT, et al. Crit Care Med. 2018 Oct 18. [Epub ahead of print]

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Complete Bundle Performance vs. Patient Outcomes

Outcome	Likelihood[4]	95% CI	*P* Value
Mechanical Ventilation[1]	AOR, 0.28	0.22 – 0.36	<0.0001
Coma[1]	AOR, 0.35	0.22 – 0.56	<0.0001
Delirium[1]	AOR, 0.60	0.49 – 0.72	<0.0001
Restraint Use[1]	AOR, 0.37	0.30 – 0.46	<0.0001
Significant Pain[1]	AOR, 1.03	0.88 – 1.21	0.7000
ICU Discharge[2]	AHR, 1.17	1.05 – 1.30	<0.004
Hospital Discharge[2]	AHR, 1.19	1.01 – 1.40	<0.033
Hospital Death[2]	AHR, 0.32	0.17 - 0.62	<0.001
ICU Readmission[3]	AOR, 0.54	0.37 – 0.79	<0.001
SNF Discharge[3]	AOR, 0.64	0.51 – 0.80	<0.001

N = 15,226 (ICU LOS = 24h – 7d)
[1]Likelihood of MV, coma, delirium, or restraint use the following day.
[2]Likelihood of ICU or hospital discharge or death within 7d observation period.
[3]Survived to hospital discharge.
[4]Covariates: age, sex, race, ethnicity, BMI, pre-admit residency, baseline mobility, admit diagnosis, hospital type, ICU type, ICU medications, comfort care, MV, coma, delirium.

Pun BT, et al. Crit Care Med. 2018 Oct 18. [Epub ahead of print]

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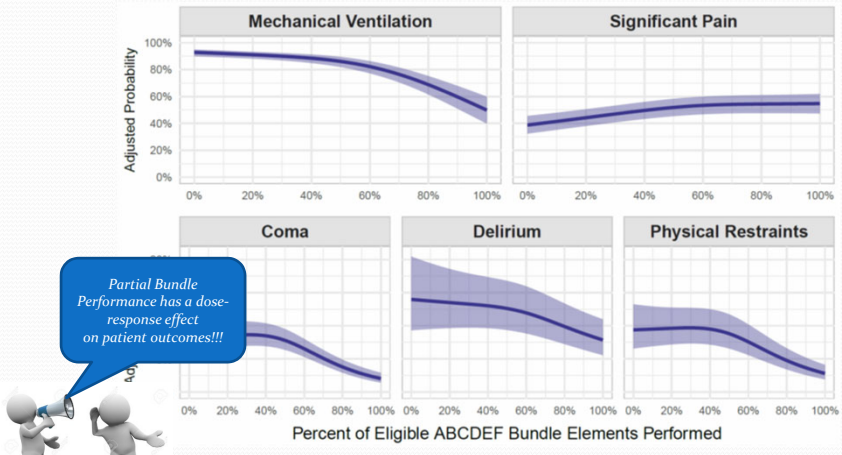
Proportional Bundle Performance vs. Patient Outcomes



Pun BT, et al. Crit Care Med. 2018 Oct 18. [Epub ahead of print]

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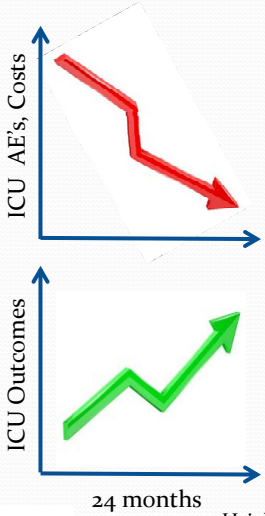
ICU Liberation Bundle Cost Savings



↑ Patient mobility rates → *stand (65%), walk (54%)* (*P* < 0.001)

↓ HAPU rate → *39% to 23%* (*P* < 0.001)

↓ Restraint use → *30% to 26%* (*P* < 0.001)

↓ Duration of MV → ↓*22%* (*P* < 0.001)

↓ ICU LOS → ↓*10%* (*P* = 0.028)

↓ Hospital LOS → ↓*8%* (*P* = 0.006)

↓ ICU Costs → ↓*24%* (*P* = 0.034)

↓ Hospital Costs → ↓*30%* (*P* = 0.007)

Hsieh SJ, et al. Crit Care Med 2019; 47:885-893.

**Bundle implementation did not include A and F elements*

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Standard ICU Care - Post-Bundle Implementation

- ICU care → ↑*interdisciplinary, pt-centered*
- ↓ Opioid, sedative use → *pts. awake, pain free*
- ↑ delirium awareness → *hypoactive delirium*
- ↑ Non-pharm delirium rx→ ↓*antipsychotics*
- ↑ Daily SAT/SBT assessments → ↑*MV weaning*
- ↑ pts. awake, alert, active → *participate in care*
- ↑ family presence, engagement → *ICU rounds*

We saved our hospital over $6 million last year!!!

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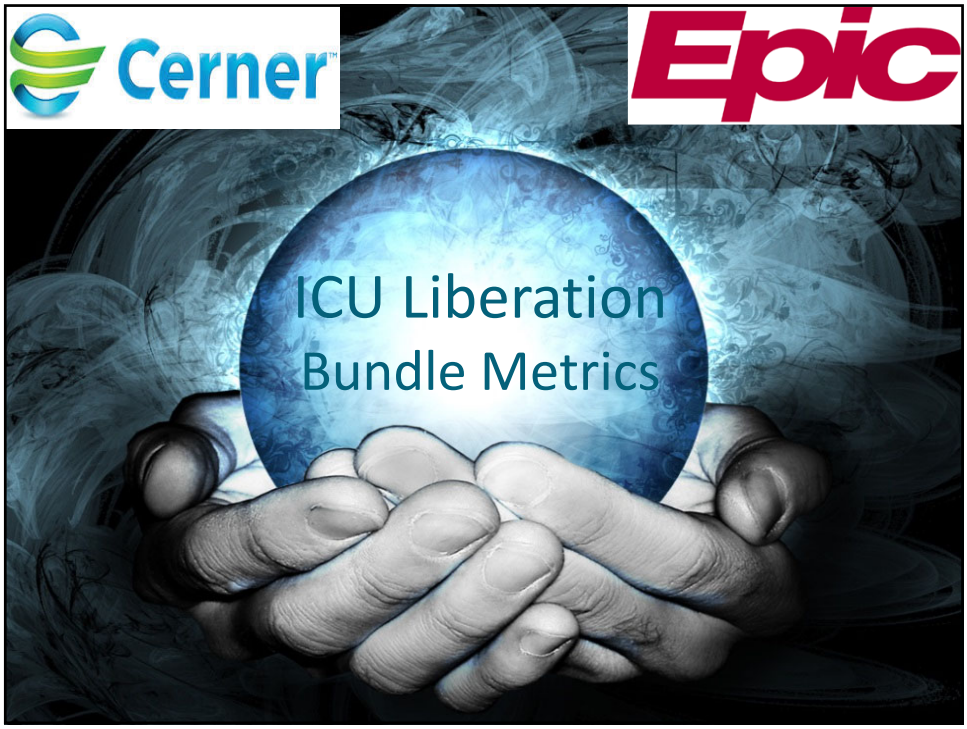

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ICU Liberation Bundle Takeaways

- The ICU Liberation Bundle:
  - ↓ *preventable harms*
  - ↑ *patient safety*
  - ↑ *ICU outcomes*
  - ↓ *costs of ICU care*
- Bundle implementation is facilitated by:
  - ✓ *improving ICU team communication, collaboration → IPT rounds, bundle checklists*
  - ✓ *integration of Bundle metrics into the EHR*
  - ✓ *measuring Bundle compliance, performance and outcomes*
  - ✓ *executive sponsorship of the Bundle*

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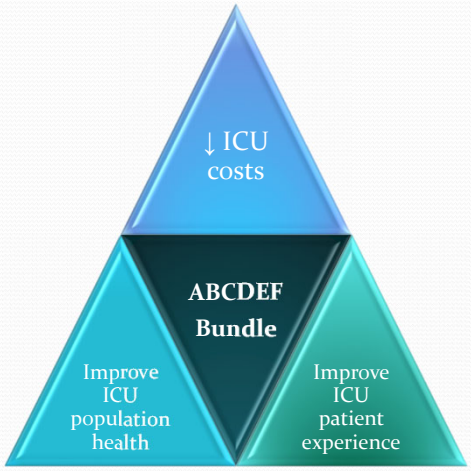
Achieving the Triple Aim in ICU Care



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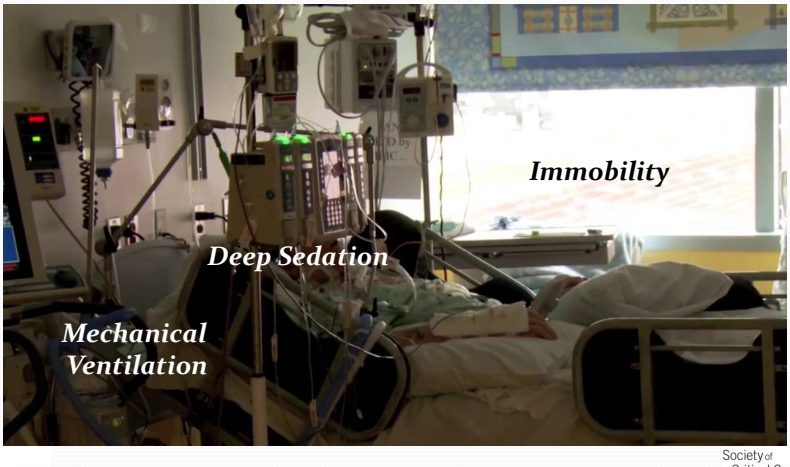
Redefining ICU Care



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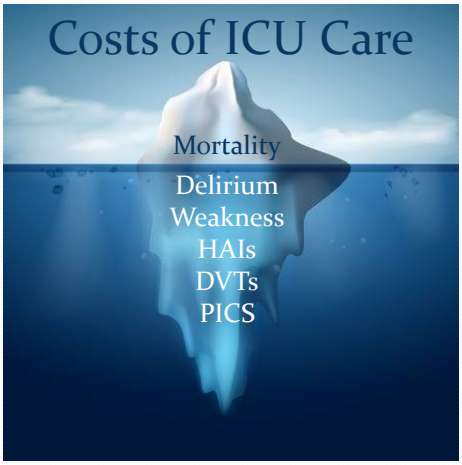
Reducing ICU Harm



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ICU Liberation

Improving ICU Outcomes

Not just surviving, but thriving!

thrive

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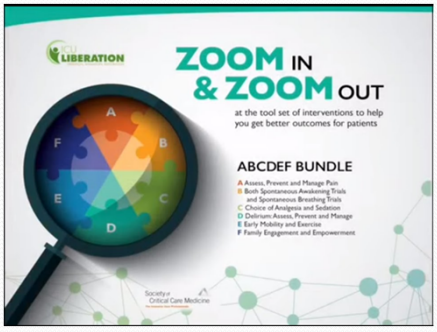
Thank You!



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The ABCDEF Bundle

Changing the lives of people we will never meet!

Questions?

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PADIS Updates, ICU Metrics, Mobility Strategies Part II

Javier Lorenzo, MD
Stanford University

Friday, October 4, 2019 – 10:30 a.m. – 11:00 a.m.

Dr. Javier Lorenzo received his medical degree, and completed residency and fellowship in Stanford University. He is currently the Associate Division Chief of the Anesthesia Critical Care Medicine Division in the Department of Anesthesia, Pain and Perioperative Medicine in Stanford Medical School. His clinical interest includes quality and process improvement, medical education, and clinical informatics.

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A chapter of the American Thoracic Society

Early Mobility in the ICU

Javier Lorenzo, M.D.
Clinical Assistant Professor
Department of Anesthesiology, Pain and Perioperative Medicine
Stanford University

1

Disclosures:

- No financial conflicts or disclosures
- Reviewer for Critical Care Medicine
- All pictures/videos are presented with written permission

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Learning Objectives:

- The significance of immobility in critically ill patients.
- To understand the evidence of improved outcomes with early mobility in the critically ill.
- The role of early mobility as part of the ICU Liberation Bundle (ABCDEFG Bundle)
- Apply strategies to improve mobility/rehab efforts by examining barriers described in the literature.
- Examine emerging technology that aid in the measurement of activity metrics such as type, frequency and duration.

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2013 & 2018 PADIS Guidelines:

Clinical Pract
of Pain, Agita
in

Juliana Barr, MD, FCCM; G
FCCM; E. Wesley Ely, MD,
FCCM, FCCP; Judy E. David
MD; Aaron M. Joffe, DO; D
MD; Bryce R. H. Robinson,
MD; Richard R. Riker, MD,
ACNP; Yoanna Skrobik, MD

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RN,

Online Special Article

Clinical Practice Guidelines for the Prevention and Management of Pain, Agitation/Sedation, Delirium, Immobility, and Sleep Disruption in Adult Patients in the ICU

John W. Devlin, PharmD, FCCM (Chair)[1,2]; Yoanna Skrobik, MD, FRCP(c), MSc, FCCM (Vice-Chair)[3,4]; Céline Gélinas, RN, PhD[5]; Dale M. Needham, MD, PhD[6]; Arjen J. C. Slooter, MD, PhD[7]; Pratik P. Pandharipande, MD, MSCI, FCCM[8]; Paula L. Watson, MD[9]; Gerald L. Weinhouse, MD[10]; Mark E. Nunnally, MD, FCCM[11,12,13,14]; Bram Rochwerg, MD, MSc[15,16]; Michele C. Balas, RN, PhD, FCCM, FAAN[17,18]; Mark van den Boogaard, RN, PhD[19]; Karen J. Bosma, MD[20,21]; Nathaniel E. Brummel, MD, MSCI[22,23]; Gerald Chanques, MD, PhD[24,25]; Linda Denehy, PT, PhD[26]; Xavier Drouot, MD, PhD[27,28]; Gilles L. Fraser, PharmD, MCCM[29]; Jocelyn E. Harris, OT, PhD[30]; Aaron M. Joffe, DO, FCCM[31]; Michelle E. Kho, PT, PhD[32]; John P. Kress, MD[33]; Julie A. Lanphere, DO[33]; Sharon McKinley, RN, PhD[34]; Karin J. Neufeld, MD, MPH[35]; Margaret A. Pisani, MD, MPH[36]; Jean-Francois Payen, MD, PhD[37]; Brenda T. Pun, RN, DNP[33]; Kathleen A. Puntillo, RN, PhD, FCCM[38]; Richard R. Riker, MD, FCCM[39]; Bryce R. H. Robinson, MD, MS, FACS, FCCM[40]; Yahya Shehabi, MD, PhD, FCICM[41]; Paul M. Szumita, PharmD, FCCM[42]; Chris Winkelman, RN, PhD, FCCM[43]; John E. Centofanti, MD, MSc[43]; Carrie Price, MLS[44]; Sina Nikayin, MD[45]; Cheryl J. Misak, PhD[46]; Pamela D. Flood, MD[47]; Ken Kiedrowski, MA[48]; Waleed Alhazzani, MD, MSc (Methodology Chair)[16,49]

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Barr J, et al. Crit Care Med 2013 41(1):263-306
Devlin, et al. Crit Care Med 2018; 46:e825–e873

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ABCDEFG Bundle

- ✓ A – Assess, Prevent and Manage Pain
- ✓ B – Both SATs and SBTs
- ✓ C – Choice of Sedation
- ✓ D – Delirium: Assess, Prevent and Manage
- ✓ E – Early Mobility and Exercise
- ✓ F – Family Engagement and Empowerment
- ✓ G – Good Sleep

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*www.iculiberation.org

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FINAL APPROACH / INFO YOU CAN USE

American Airlines

Tips for a fit flight

Maintaining good health while flying requires special considerations. Here, Herbert DuPont, M.D., director of the Center for Infectious Diseases at The University of Texas School of Public Health and a specialist in travel medicine, shares some tips for staying healthy while in the air.

Dress comfortably. Wear clothes that won't cut off circulation. Compression of the blood vessels in the legs can cause clots. Drink water to stay hydrated.

If you have heart or lung disease, check with your doctor about taking a long-distance flight because the altitude can affect circulation and breathing. For flights six hours or more, wear compression stockings to help prevent blood clotting.

At times, lower humidity levels can make the air on board feel dry. The dryness makes blood more concentrated and can promote a deep vein thrombosis (DVT) and its complications. To combat dehydration and dryness, keep drinking water.

For pregnant travelers, walk often, as pregnant women are much more susceptible to clotting disorders. Drink water to stay hydrated as well.

NUT ALLERGY?

Although we don't serve peanuts, we do serve other nut products (such as warmed nuts) and there may be trace elements of unspecified nut ingredient, including peanut oil, in meals and snacks we serve. If customers can bring peanuts or other nuts on board, we can't accommodate requests to serve different foods or to provide nut buffer zones. Our planes are cleaned regularly, but can't guarantee the removal of nut allergens on surfaces or in the air filters. Because of this, we can't guarantee you won't be exposed to peanuts or other tree nuts during flight, and we strongly encourage those with allergies to take all necessary medical precautions before flying.

ADDITIONAL ALLERGEN INFORMATION

Additional allergen information is available for our customers departing EU countries. Please ask your flight attendant for more details.

It is possible to fly when you have a respiratory condition such as chronic obstructive pulmonary disease (COPD), but the issue of flying with lung or heart disease relates to the severity of the disease. Those with mild forms of the disease should do fine. If oxygen is required intermittently by people with lung or heart disease, flights that are six hours or more should be avoided unless arrangements can be made with the carrier to receive oxygen during flight.

Before you travel, talk to your doctor about any concerns you may have. Also, when you book your flight, let American Airlines know about any needs for services (such as a wheelchair or a portable oxygen concentrator) that you may have, and the airline will help coordinate assistance with your request. Please also visit the COPD Foundation website at **www.copdfoundation.org** for more information about traveling with COPD.

DVT FACTS

A deep vein thrombosis (DVT) is a blood clot that develops in a deep vein. Sometimes clots can break away and travel through the bloodstream to vital organs and can cause severe injury or death. Possible risk factors include prolonged physical immobility, blood-clotting disorders, family history, cancer, obesity, heart disease, pregnancy, recent major surgery, smoking or age.

Symptoms could include pain or swelling and redness of the affected area.

While preventive measures are still uncertain, passengers can wear loose clothing, regularly change leg positions. When possible, walk, avoid crossing legs at the ankles or knees, or wear graduated-compression stockings to help reduce risk. Keeping hydrated and performing exercises can also help.

MISSED A FLIGHT? LET US HELP.

You're sorry to get you on your way as quickly. Review your flights and options on our mobile app. Click the boarding pass in your itinerary, select new flight options, and we'll send you your new boarding pass. The mobile app is the best way to get flight updates and information about changes in your itinerary.

AA.COM FLIGHT CHANGE

Access the rebooking tool on your flight has changed, you will see new flight options, and be able to select one.

SELF-SERVE KIOSKS

Scan your old boarding pass or enter your record locator. If you have been rebooked, you will see your new itinerary and be able to select new flight options.

NOTIFICATIONS

To ensure you're receiving notifications on the AA.com rebooking tool, you must have enabled. If you provided a cell phone number or email address when you checked in or made your reservation, we'll send you a link directly to our rebooking tool.

DISABILITY ASSISTANCE

Please ask an American Airlines representative if you need assistance traveling as a disability (including traveling in a wheelchair). To give feedback on the service you received, call American at 1-800-882-3434.

SMOKING/TOBACCO POLICY

The following are prohibited at all times on board the aircraft: smokeless tobacco products and devices such as electronic cigarettes, and the charging of electronic cigarettes and other related devices.

EASY SEAT EXERCISES

Four ways to beat stiffness on long flights

ANKLE CIRCLES | FOOT PUMPS | KNEE LIFTS | KNEE TO CHEST

AMERICAN WAY

CALIFORNIA THORACIC SOCIETY
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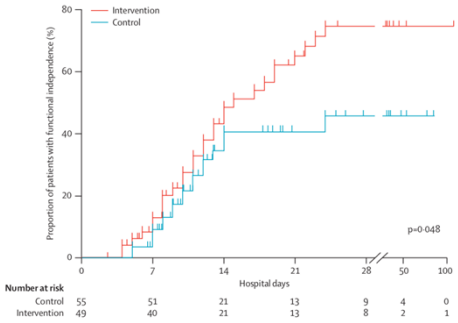
American Way Magazine. (page 114)

6

Early physical and occupational therapy in mechanically ventilated, critically ill patients: a randomised controlled trial

William D Schweickert, Mark C Pohlman, Anne S Pohlman, Celerina Nigos, Amy J Pawlik, Cheryl L Esbrook, Linda Spears, Megan Miller, Mietka Franczyk, Deanna Deprizio, Gregory A Schmidt, Amy Bowman, Rhonda Barr, Kathryn E McCallister, Jesse B Hall, John P Kress



	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 (8·5–19·8)	0·93
Hospital mortality	9 (18%)	14 (25%)	0·53

Data are n (%), median (IQR), or mean (SD). ICU=intensive care unit. *Ventilator-free days from study day 1 to day 28. Barthel Index scale 0–100, APACHE II scale 0–71.

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Lancet 2009; 373: 1874–82

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What is considered mobility/rehab?

- From PADIS 2018 update:
  - "set of interventions designed to optimize functioning and reduce disability in individuals with a health condition"
- Transfer bed to chair without standing:
  - hoist, passive lift, or side lift to the chair w/out standing
- Sitting in bed/exercises in bed:
  - Active rolling, bridging, exercises
  - Active movement from supine to sitting
  - Use of cycle ergometer*
  - Moving out of bed over the edge of bed

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Devlin, et al. Crit Care Med 2018; 46:e825–e873
PLoS One. 2013; 8(9): e74182

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ICU Acquired Weakness (ICUAW)

"Clinically identified weakness that develops during an ICU admission with no other known cause except the acute illness or its treatment"

- Symmetrical & flaccid weakness of the limbs (proximal > distal) Facial and ocular muscle sparing. NO demyelination
- Risk Factors: sepsis, inflammation, MOSF, MV, ↑BG, steroids, NMB agents >48h, F>M, immobility
- Dose response to length of mechanical ventilation[1,2,3]
  - Incidence first 24 hrs of critical illnes: 11%
  - Incidence if intubated 5-7 days: 25% - 60%
  - Incidence if intubated >10 days: ~67% - 100%

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1. Crit Care Med. 2009;37:3047–53.
2.JAMA. 2002;288:2859–67.
3.Anesthesiology. 2013;119:389–97.

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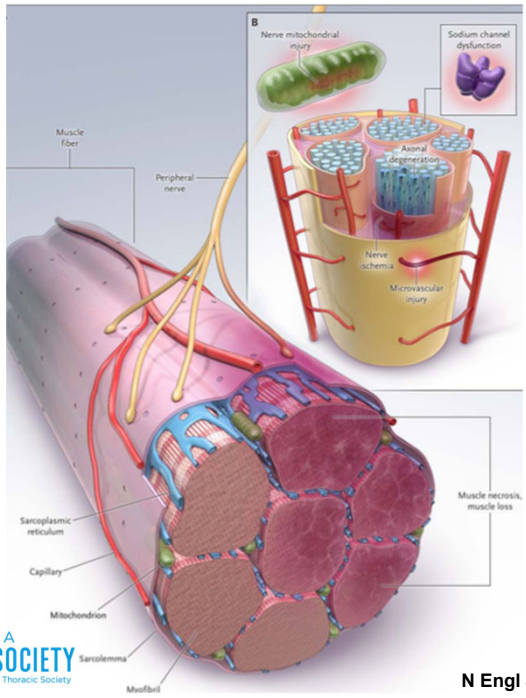

CIP: the pathological finding is axonal degeneration[1]

CIM: muscle atrophy, muscled membrane inexcitability, oxidative stress, mitochondrial dysfunction. Increased breakdown and decreased synthesis.

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N Engl J Med 2014;370:1626-35.

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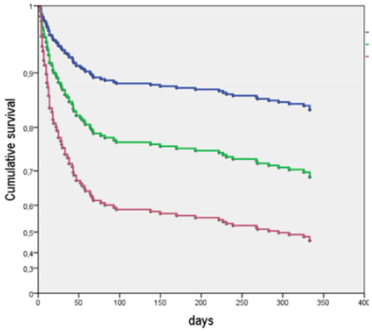
Acute Outcomes and 1-Year Mortality of Intensive Care Unit–acquired Weakness

A Cohort Study and Propensity-matched Analysis

Greet Hermans[1,2], Helena Van Mechelen[2], Beatrix Clerckx[2,3], Tine Vanhullebusch[2], Dieter Mesotten[2,3], Alexander Wilmer[1], Michael P. Casaer[2,3], Philippe Meersseman[1], Yves Debaveye[2,3], Sophie Van Cromphaut[2,3], Pieter J. Wouters[2,3], Rik Gosselink[4], and Greet Van den Berghe[2,3]

- Prospectively planned sub-analysis of the EPaNIC trial
- Weakness = MRC sum score < 48
- 1:1 propensity matched analysis
- Weak patients had worse in-hospital morbidity and generated more hospital cost
- A higher mortality 1 year after ICU admission



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Am J Respir Crit Care Med Vol 190, Iss 4, pp 410–420

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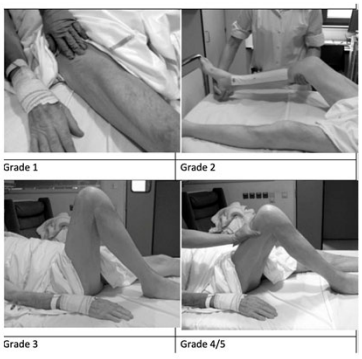
Medical Research Council Score (MRC)

Upper Limbs	Wrist Flexion
	Forearm Flexion
	Shoulder Abduction
Lower Limbs	Ankle Dorsiflexion
	Knee Extension
	Hip Flexion



Grade 0	No contraction visible or palpable
Grade 1	Flicker of contraction visible or palpable, although no limb movement
Grade 2	Movement with gravity eliminated over almost full range of motion
Grade 3	Movement against gravity over almost full range of motion
Grade 4	Movement against moderate resistance over full range of motion
Grade 5	Normal power

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Crit Care Med 2007; 35(9): 2007-14.

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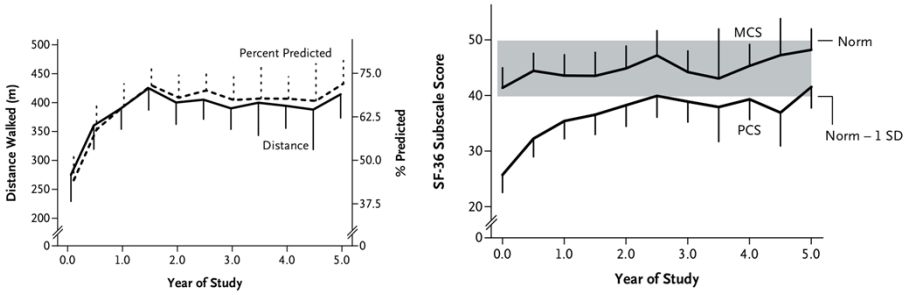
Functional Disability 5 Years after Acute Respiratory Distress Syndrome

Margaret S. Herridge, M.D., M.P.H., Catherine M. Tansey, M.Sc., Andrea Matté, B.Sc., George Tomlinson, Ph.D., Natalia Diaz-Granados, M.Sc., Andrew Cooper, M.D., Cameron B. Guest, M.D., C. David Mazer, M.D., Sangeeta Mehta, M.D., Thomas E. Stewart, M.D., Paul Kudlow, B.Sc., Deborah Cook, M.D., Arthur S. Slutsky, M.D., and Angela M. Cheung, M.D., Ph.D., for the Canadian Critical Care Trials Group

- a prospective, longitudinal cohort study of 109 patients with ARDS
- generalized weakness and fatigue were chief complaints and still present in many *survivors at 5 yrs.*



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N Engl J Med 2011;364:1293-304

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Outcomes in Mobility Trials:

- Acute Care Index of Function (ACIF)
- Physical Function ICU Test (PFIT)
- Short Physical Performance Battery (SPPB)
- Barthel Index scores
- Modified Rankin Score (mRS)
- Functional Independence Measure (FIM)
- SF-36 (Short Form Health Survey)
- % of patients returning to independent ADLs
- Walking distance at the time of discharge

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How might it work?

- Improvement in skeletal muscle function
- Prevention of immobility --> greatest risk factor for ICUAW
- Preventing or lessening the impact of ICUAW that can last weeks, months and years!
- Better glycemic control
- Decreasing Delirium
- Decreasing length of mechanical ventilation

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Morris PE. Crit Care Med. 2008
Lancet 2009; 373: 1874–82

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Is it Safe to Mobilize the Critically Ill?

- 2018 PADIS Statement[1]:
  - "Serious safety events or harms do not occur commonly during physical rehabilitation or mobilization."
- Serious Events:
  - A change in physiologic status – usually transient and self resolved
  - An injury that required attention
- 15 events in 12,200 events across 13 studies examined
- Expert consensus statement with easy to use safety risk scores[2]

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1. Devlin, et al. Crit Care Med 2018; 46:e825–e873
2. Crit Care 2014;18(6):658

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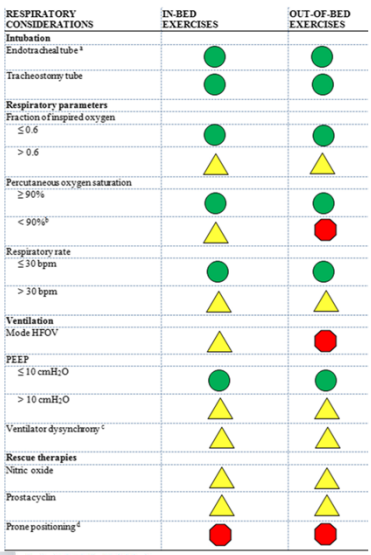
Low risk Potential risk Significant potential risk



Respiratory Considerations	In-Bed Exercises	Out-of-Bed Exercises
Intubation		
Endotracheal tube [a]	●	●
Tracheostomy tube	●	●
Respiratory parameters		
Fraction of inspired oxygen		
≤ 0.6	●	●
> 0.6	▲	▲
Percutaneous oxygen saturation		
≥ 90%	●	●
< 90% [b]	▲	■
Respiratory rate		
≤ 30 bpm	●	●
> 30 bpm	▲	▲
Ventilation		
Mode HFOV	▲	■
PEEP		
≤ 10 cmH2O	●	●
> 10 cmH2O	▲	▲
Ventilator dyssynchrony [c]	▲	▲
Rescue therapies		
Nitric oxide	▲	▲
Prostacyclin	▲	▲
Prone positioning [d]	■	■

Cardiovascular Considerations	In-Bed Exercises	Out-of-Bed Exercises
Blood pressure		
Intravenous antihypertensive therapy for hypertensive emergency [a]	■	■
MAP [b]:		
Below target range and causing symptoms	▲	■
Below target range despite support (vasoactive and/or mechanical)	▲	■
Greater than lower limit of target range while receiving no support or low level support	●	●
Greater than lower limit of target range while receiving moderate level support	▲	▲
Greater than lower limit of target range on high level support	▲	■
Known or suspected severe pulmonary hypertension	▲	▲
Continuous renal replacement therapy (including femoral dialysis catheters)	●	●
Venous and arterial femoral catheters	●	●
Femoral sheaths	▲	■

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Crit Care 2014;18(6):658

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Barriers to Mobilizing the Critically Ill

- At the patient level: *not very modifiable*
  - When to start:
    - Stability in cardiovascular, resp and neurologic status
  - When to stop:
    - New cardiovascular, resp or neurologic instability. Fall, medical device removal, patient distress. *(use judgement)*
- Clinician level and ICU Contextual Barriers identified[1,2]
- Vasoactive infusions or mechanical ventilation **are not** barriers to initiating rehabilitation/mobility!

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1. Crit Care Med 2018; 46:e825–e873
2. CHEST 2017; 152(2):304-311

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Mobilize Patients Early

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Equipment and Storage Issues.

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Patient Related:
Lack of patient cooperation
Patient instability/safety concerns
Patient status (diarrhea/agitation)

Protocol Related:
Unavailable or cumbersome
Unclear protocol criteria
Lack of confidence in screening and evidence
Who is responsible?

Clinician Related:
Lack of knowledge
Staff safety concerns
Perception that rest equals healing
Reluctance to follow protocol
Perceived workload
Safety of tubes/catheter
Lack of buy-in
Lack in agreement

ICU/Unit Related:
Safety Culture
Interprofessional team care coordination
Physical environment, equipment, resources
Staff turnover
Competing Priorities
Scheduling conflicts
Low prioritization and perceived importance

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CHEST 2017; 152(2):304-311

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Barriers		Strategies
Patient	Severity of Illness ("too sick")	- Interprofessional meetings/ PT screening - Stepwise approach to mobility - Adjust FIO2, PEEP, or other ventilator settings for mobilization
	Patient refusal/ - motivation	- Adjust treatment plan with patient input/ Family Engagement
	ICU devices and equipment	- Use portable monitors/ secure application of equipment and lines
Structural	Limited staff, time constraints	- Additional PT/OT, technician staffing - Financial modeling of economic benefits - Independent mobility team
	Inadequate staff training	- Therapists dedicated to ICU - Stable leadership, interprofessional champion
Cultural	Lack of mobility culture	- Promotion of mobility programs - Goal sharing/ Identifying barriers
	Lack of support or staff buy-in	- Education, regular team meetings - Culture promoting quality improvement
	No patient/family knowledge	- Media engagement and education
Process	Lack of planning and coordination	- Interprofessional planning and coordination of procedures - Daily goal sheets with reminder - Mobility champion
	Missing/delayed daily screening for eligibility	- Mobility team/ automatic therapy order - Coordinators for in-/exclusion (NOT PT)

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Ann Am Thorac Soc Vol 13, No 5, pp 724–730,

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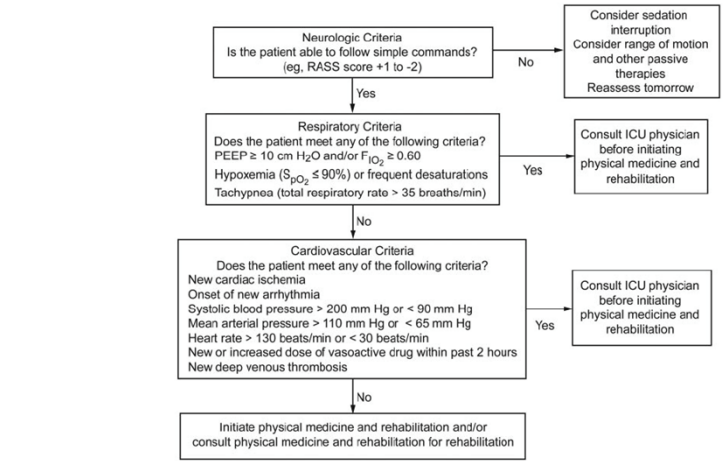
Daily screening algorithm to evaluate for appropriateness for physical rehabilitation.



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Korupolu R, Gifford J, Needham D. Early mobilization of critically ill patients: reducing neuromuscular complications after intensive care. Contemp Crit Care 2009;6(9):1-11

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ICU Mobility Action Plan High Level *(v2/9 JFEL/DBAN) (JL addition on 2/10)*

Focus Area	Concern/Current State	Proposed Action	Barriers	Responsible Party	Status
Mobility Program Framework	- Primarily rehab-driven model for all mobility interventions - Mobility not a daily focus for all ICU personnel	- Delineate low (nsg) vs high (rehab) mobility levels; **not** mutually exclusive - Address mobility at rounds	* Education * Objective scale (high vs. low)	- JF (Rehab) -E2/E29 PCMs - ICU Physicians	✓ Logarithm created; needs nursing review, approval and ownership - Need physician champion
Rehab Practice	- Rehab clinicians require RCPs/RNs to suction during mobility	- Change policy: allow physical therapists to suction	* Education * Competency	- JF/KS/DB (Rehab) - Karsten (Resp)	-In progress; Respiratory able to do small groups
SHC Policy	- Nursing presence required to mobilize patient out of room	- Create Rehab policy requiring ACLS and Nursing agreement	* Rehab policy change * ACLS certification for PTs	- DB (Rehab)	-In progress; 2 therapists each month
EMR/Order Sets	- Default ICU activity order: 'bedrest'	- Modify ICU admit order set to default to 'activity as tolerated'	* Provider education /approval * EPIC resources	- ICU Providers - Nancy Fleck (IT)	✓ NF reviewing proposed request
	- Lack of clarity related to patient's mobility level	- Post Highest Level Mobility (HLM) form bedside	* Education * Form created	- JF/KS/DB (Rehab)	✓ Form drafted/rolled out
	- Lack of risk adjusted LOS data - Unable to report volume of mobility	- Build comprehensive baseline ICU Report	* Dashboard * EPIC resources	- DB (Nsg) - IT Report Staff	- Long term EPIC project; not essential for short term
Equipment	- Limited equipment available: • Wheelchairs • Patient chairs • Commodes • Mobility equipment	- Recommended purchases: ___ wheelchairs ___ patient chairs ___ commodes Sara Plus $7,700 Motto bike $10,000	* Limited storage area * Cost * Staff education * Responsibility for use	- ICU and Rehab - Facilities - JD (Rehab)	**See Detail below** - Demo unit capital request
Rehab Staffing	- Limited rehab staffing designated to ICU - Little/no rehab staffing on weekends	- Designate primary PT E2/E29 - Designate single rehab aide for E2 and E29	* Rehab Staffing	- JD/JF/KS/DB (Rehab)	✓ E2 PT designated ✓ E29 PT rotation (VC first) ✓ Mid Jan aides in place - w/e rehab positions req
Sedation/ Delirium	- Current practices negatively impact patient's ability to participate in mobility -Targeted sedation practices not optimal -Increased reliance on infusions vs. intermittent boluses -Lack of activity/rehab goals during rounds	- Review/revise current practice - Integration of key clinical variables during rounds (Target/Actual RASS, CAM-ICU, HLOM achieved)	* Provider agreement on Best Practices indicated * Access to staff/equipment * Poor understand of benefit	-ICU Providers/CQI	-New MD/RN Rounding to daily address targeted sedation/delirium/mobility - RASS target more visible on RN and MD EPIC window

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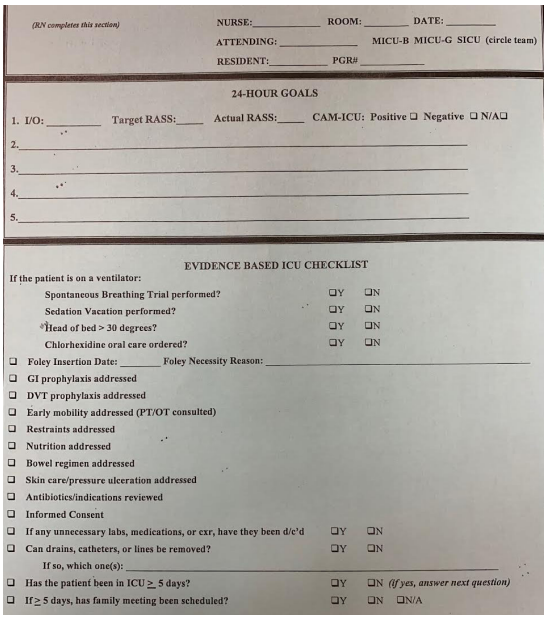

(RN completes this section)

NURSE:_____ ROOM: _____ DATE: _____

ATTENDING: _____ MICU-B MICU-G SICU (circle team)

RESIDENT:_____ PGR# _____

24-HOUR GOALS

1. I/O: _____ Target RASS:____ Actual RASS:____ CAM-ICU: Positive ❑ Negative ❑ N/A❑
2. _____
3. _____
4. _____
5. _____

EVIDENCE BASED ICU CHECKLIST

If the patient is on a ventilator:

- Spontaneous Breathing Trial performed? ❑Y ❑N
- Sedation Vacation performed? ❑Y ❑N
- Head of bed > 30 degrees? ❑Y ❑N
- Chlorhexidine oral care ordered? ❑Y ❑N

❑ Foley Insertion Date: _____ Foley Necessity Reason: _____

❑ GI prophylaxis addressed

❑ DVT prophylaxis addressed

❑ Early mobility addressed (PT/OT consulted)

❑ Restraints addressed

❑ Nutrition addressed

❑ Bowel regimen addressed

❑ Skin care/pressure ulceration addressed

❑ Antibiotics/indications reviewed

❑ Informed Consent

❑ If any unnecessary labs, medications, or exr, have they been d/c'd ❑Y ❑N

❑ Can drains, catheters, or lines be removed? ❑Y ❑N

If so, which one(s): _____

❑ Has the patient been in ICU ≥ 5 days? ❑Y ❑N *(If yes, answer next question)*

❑ If ≥ 5 days, has family meeting been scheduled? ❑Y ❑N ❑N/A

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Is all mobility helpful?

Efficacy and safety of very early mobilisation within 24 h of stroke onset (AVERT): a randomised controlled trial

*The AVERT Trial Collaboration group**

- A parallel-group, single-blind, randomized controlled trial at 56 acute stroke units in 5 countries.
- Pts ≥ n18 yrs with ischemic or hemorrhagic stroke, first or recurrent,
- Usual stroke-unit care vs. very early mobilization + usual care.
- Primary outcome was a favorable outcome 3 months after stroke (mRS 0–2)
- 2104 patients randomized
- Intervention included 3 crucial elements:
  - 1. begin within 24 h of stroke onset
  - 2. focus on sitting, standing, and walking (ie, out-of-bed) activity
  - 3. Result in at least three additional out-of-bed sessions to usual care.

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Lancet 2015; 386: 46–55

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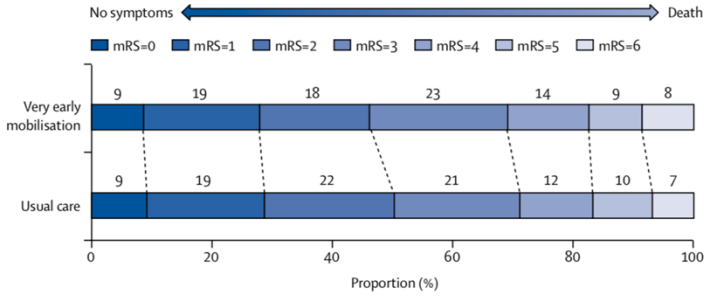
AVERT Trial:



Fewer patients in the very early mobilization group had a favorable outcome than those in the usual care group (n=480 [46%] *vs* n=525 [50%] [OR] 0·73, 95% CI 0·59–0·90; p=0·004)

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Lancet 2015; 386: 46–55

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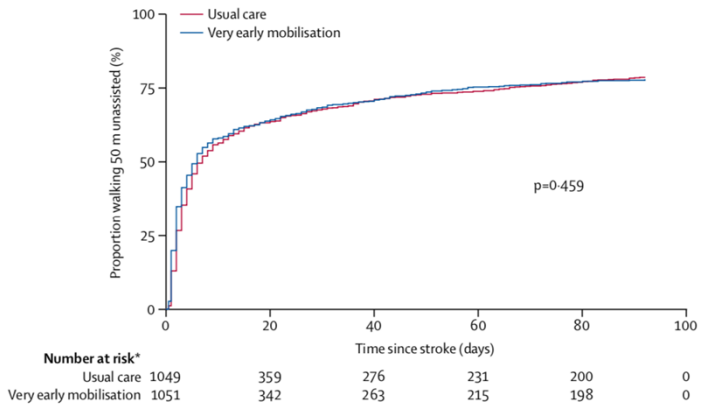
AVERT Trial:



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Lancet 2015; 386: 46–55

28

Cochrane Library

Cochrane Database of Systematic Reviews

Early intervention (mobilization or active exercise) for critically ill adults in the intensive care unit (Review)

- High risk of bias (limited blinding)
- Only 4 trials included
- The description of intervention type, dose, intensity and frequency in the standard care control group was poor

"There is insufficient evidence on the effect of early mobilization of critically ill people in the ICU on physical function or performance, adverse events, muscle strength and health-related quality of life at this time."

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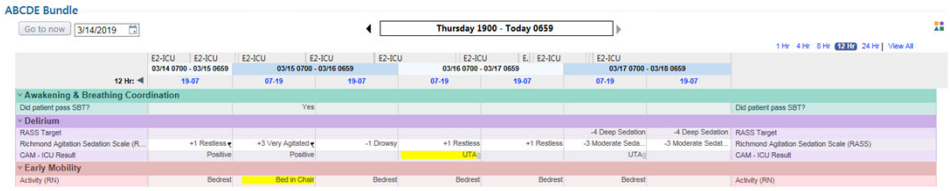
Cochrane Database Syst Rev. 2018 Mar 27;3

29

Can be capture/quantify mobility?



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npj | Digital Medicine

www.nature.com/npjdigitalmed

BRIEF COMMUNICATION OPEN

A computer vision system for deep learning-based detection of patient mobilization activities in the ICU

Serena Yeung[1], Francesca Rinaldo[2,3], Jeffrey Jopling[2,3], Bingbin Liu[1], Rishab Mehra[1], N. Lance Downing[2,4], Michelle Guo[1], Gabriel M. Bianconi[1], Alexandre Alahi[1,5], Julia Lee[2], Brandi Campbell[6], Kayla Deru[6], William Beninati[6], Li Fei-Fei[1] and Arnold Milstein[2]

- The impact of the type, frequency, duration of mobilization techniques is unknown.
- Computer Vision Technology (*CVT*) offers an alternative approach by passively capturing data from the clinical environment with machine-learning algorithms to detect and quantify activities.

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Activity Examples

Getting Out of Bed

Getting Out of Chair

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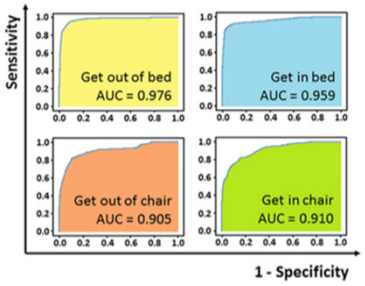
Deep Learning-based Detection of Patient Mobility

Activity	Specificity	Sensitivity
Get out of bed	92.86	93.33
Get in bed	92.49	90.84
Get out of chair	87.32	82.89
Get in chair	84.18	81.73



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Sources: Yeung S, Rinaldo F et al. *npj Dig Med*, 2019.

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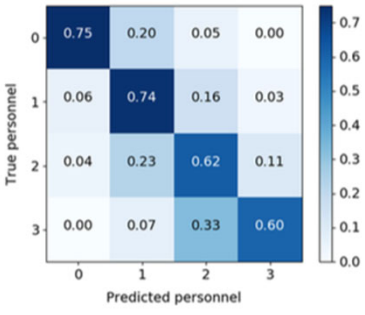
Algorithm Performance for Quantifying Healthcare Personnel



- CVT did a good job at identifying 4 basic mobility activities:
  - Out of bed > Out of chair.
  - As the # of personnel increases < sensitive
- Can help refine mobility protocols, multidisciplinary staffing and workload, etc.
- Algorithms can be portable --> taken to other institutions
- Applied to other health care related activities
  - Suctioning Frequency
  - Agitation monitoring
  - Patient Turns Q 2hr

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Sources: Yeung S, Rinaldo F et al. *npj Dig Med*, 2019.

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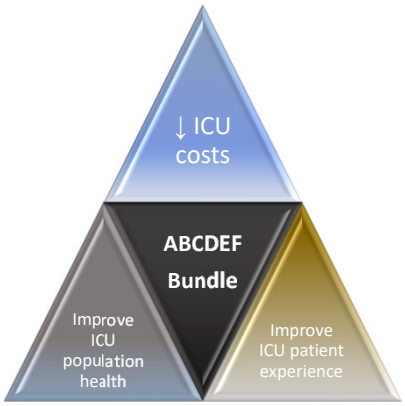
Mobility Takeaways

- Mobilizing the Critically ill:
  - *↓ preventable harms, ↑ ICU outcomes, ↓ costs of ICU care*
  - *It is safe and should be considered therapy*
  - *Coordination of ICU team communication and collaboration*



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Thank you!

ICU LIBERATION

Society of Critical Care Medicine
The Intensive Care Professionals

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- Kayambu G, et al. Early physical rehabilitation in intensive care patients with sepsis syndromes: a pilot randomised controlled trial. Intensive Care Medicine 2015;41:865-74. [PUBMED: 25851383]
- Morris PE, et al. Standardized rehabilitation and hospital length of stay among patients with acute respiratory failure: a randomized clinical trial. JAMA 2016;315(4):2694-702. [PUBMED: 27367766]
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PADIS: ABCDEF bundle +G(ood Sleep)

Biren B. Kamdar, MD, MBA, MHS
University of California San Diego

Friday, October 4, 2019 – 11:00 a.m. – 11:30 a.m.

Biren Kamdar is an assistant professor and health services researcher at the University of California, San Diego. He completed his medical school and internal medicine residency at Vanderbilt, where he developed an interest in delirium in the ICU. During his pulmonary/critical care fellowship at Johns Hopkins University, Biren received an NIH F32 award to evaluate a 201-day sleep-promoting intervention in the medical ICU. After fellowship, Biren was at UCLA for 5 years, where he was awarded a UCLA CTSI KL2 award. Last year, Biren moved to UC San Diego where he was awarded the prestigious K76 Paul B. Beeson Emerging Leaders Career Development Award from the National Institutes on Aging.

Biren's career passion involves developing, refining, and evaluating commonsense multicomponent interventions to improve sleep-wake rhythms, mobility, delirium, and other important outcomes in critically ill patients.

UC San Diego

1

UC San Diego Health

PADIS: ABCDEF Bundle + G(ood Sleep): Improving Sleep in the ICU

Biren Kamdar, MD, MBA, MHS
Assistant Professor, Division of Pulmonary Critical Care and Sleep Medicine
University of California, San Diego (UCSD)
California Thoracic Society 2019 Southern California Meeting, Irvine, CA
October 4, 2019

2

Faculty Disclosures:

- *Conflicts of interest: None*
- *Funding from NIH/NIA:*
  - NIA Paul B. Beeson Emerging Leaders Career Development Award in Aging (PI)
  - NIA STTR R42 (Co-Investigator)

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Learning Objectives

At the conclusion of this session, the participant:

1) Will better understand causes and consequences of sleep-wake disruption in the ICU.

2) Will gain knowledge on strategies to improve sleep in the ICU.

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Patient Perceptions of ICU Sleep

- ***39%*** recalled not being able to sleep
- ***40%*** recalled being awakened at night
- ***35%*** recalled having trouble falling asleep
- Significantly **poorer sleep in ICU vs. home**
- **Disruptive:** Noise > Diagnostic tests > Nurse interventions > Light
- **MICU** worse than CCU and SICU
- Sleep deprivation / not being able to sleep:

  Top 3 **major source of stress/anxiety in the ICU**

Rotondi et al. CCM 2002; 30:746-752.
Freedman et al. *AJRCCM* 1999;159:1155-1162.

5

Poor Sleep in ICU: Rising Awareness

ORIGINAL RESEARCH

Perceptions and Practices Regarding Sleep in the Intensive Care Unit
A Survey of 1,223 Critical Care Providers

Annals ATS 2016:1370-77.

Biren B. Kamdar[1]*, Melissa P. Knauert[2]*, Shirley F. Jones[3], Elizabeth C. Parsons[4], Sairam Parthasarathy[5], and Margaret A. Pisani[2]; for the Sleep in the ICU (SLEEPii) Task Force

Survey of 1,223 ICU Practitioners (59% RN, 39% MD):

75% **believe their patients experience poor sleep**
88% **believe poor sleep affects patient recovery**
97% **believe poor sleep is assoc. with ICU delirium**

6

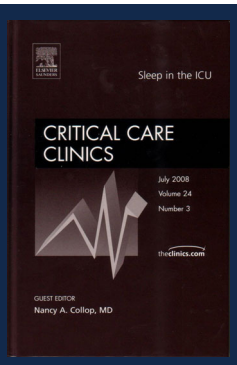
Sleep in the ICU Gaining Attention

CHEST Postgraduate Education Corner
Sleep in the ICU
CONTEMPORARY REVIEWS IN SLEEP MEDICINE
CHEST / 136 / 1 / JULY, 2009

Sleep and critical care
Jagdeep S. Bijwadia and Muhammad S. Ejaz
Current Opinion in Critical Care 2009, 15:25–29

Sleep in the Critically ill Patient
Gerald L. Weinhouse, MD[1]; Richard J. Schwab, MD[2]
SLEEP, Vol. 29, No. 5, 2006

CONTEMPORARY CRITICAL CARE
VOLUME 7 • NUMBER 1
June 2009
Sleep in the Intensive Care Unit



7

Sleep in the ICU Gaining Attention

Sleep Deprivation in Critical Illness: Its Role in Physical and Psychological Recovery
Biren B. Kamdar, MD, MBA[1], Dale M. Needham, MD, PhD[1,2], and Nancy A. Collop, MD[3]
J Intensive Care Med 2012

Sleep in intensive care units
Curr Resp Care Rep 2014
Vipin Malik • Sairam Parthasarathy

Sleep Disturbances and Fatigue in Critically Ill Patients
AACN Adv Crit Care Nurse 2011
Ellyn E. Matthews, RN, PhD, AOCN

Promoting sleep in critically ill patients
Sleep deprivation can lead to delirium and death.
Nursing2015: Critical Care 2015
By Lauren M. King, MSN, RN, ANP-BC, ACHPN; Kathleen B. Bailey, MSN, RN, AG-ACNP; Biren B. Kamdar, MD, MBA, MHS

CONCISE CLINICAL REVIEW

Sleep in the Intensive Care Unit
Am J Resp Crit Care Med 2015
Margaret A. Pisani[1], Randall S. Friese[2], Brian K. Gehlbach[3], Richard J. Schwab[4], Gerald L. Weinhouse[5], and Shirley F. Jones[6]

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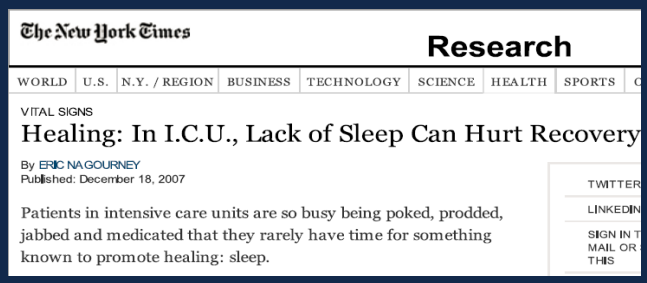
Sleep in the ICU Gaining Attention


The New York Times

Research

WORLD | U.S. | N.Y. / REGION | BUSINESS | TECHNOLOGY | SCIENCE | HEALTH | SPORTS

VITAL SIGNS

Healing: In I.C.U., Lack of Sleep Can Hurt Recovery

By ERIC NAGOURNEY
Published: December 18, 2007

Patients in intensive care units are so busy being poked, prodded, jabbed and medicated that they rarely have time for something known to promote healing: sleep.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ICU Patients Not Getting Enough Sleep

HealthDay

By Robert Preidt
Mar. 23

THURSDAY, Dec. 27 (HealthDay News) --

Recommend


The San Diego Union-Tribune

Noisy hospitals need Rx for quiet as patients rest

By LAURAN NEERGAARD, AP Medical Writer

JUNE 11, 2012, 2:23 PM | WASHINGTON

Anyone who's had a hospital stay knows the beeping monitors, the pagers and phones, the hallway chatter, the roommate, even the squeaky laundry carts all make


thebmj

VIEWS AND REVIEWS

BMJ April 2016

The intensive care unit was so noisy I couldn't sleep

Now researching the issue, **Lisa Hinton** experienced the pandemonium at first hand

Lisa Hinton, senior qualitative researcher, Health Experiences Research Group

Nuffield Department of Primary Care Health Sciences, University of Oxford

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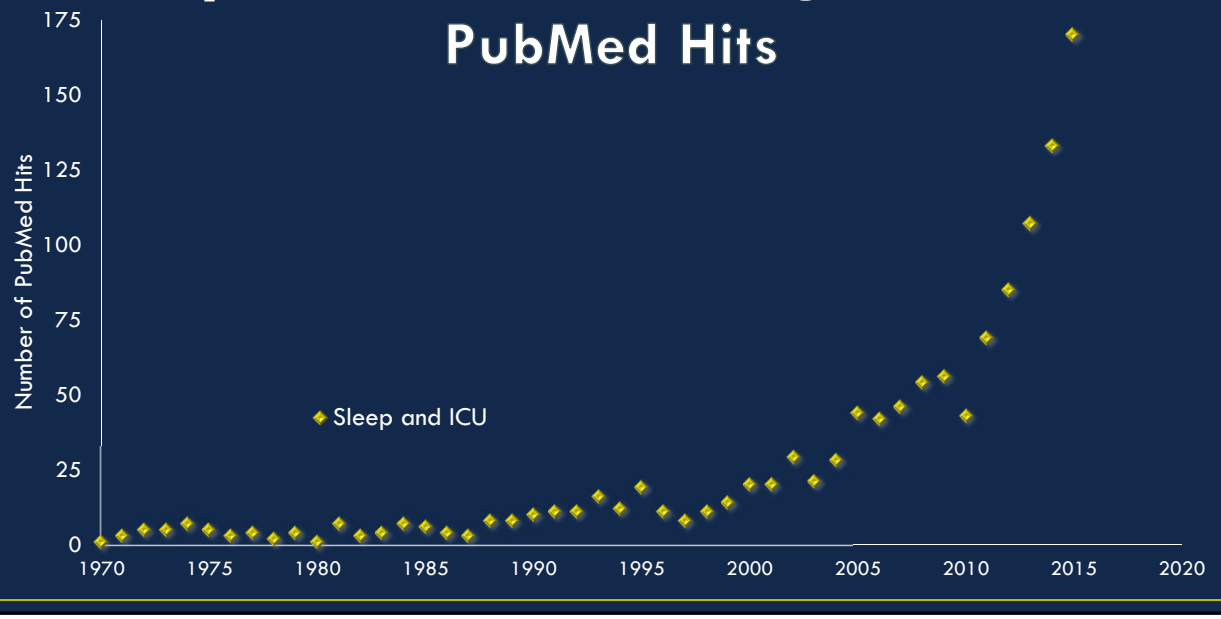
Sleep and ICU Gaining Attention



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Sleep-Delirium in ICU Gaining Attention

Sleep and delirium in ICU patients: a review of mechanisms and manifestations

Milagros L. Figueroa-Ramos, Carmen Mabel Arroyo-Novoa, Kathrn A. Lee, Geraldine Padilla, Kathleen A. Puntillo *Intensive Care Med* 2009

Bench-to-bedside review: Delirium in ICU patients - importance of sleep deprivation

Gerald L Weinhouse[1], Richard J Schwab[2], Paula L Watson[3], Namrata Patil[4], Bernardino Vaccaro[5], Pratik Pandharipande[6] and E Wesley Ely[7] *Critical Care* 2009

REVIEW

The intensive care delirium research agenda: a multinational, interprofessional perspective

Pratik P. Pandharipande[1*], E. Wesley Ely[2], Rakesh C. Arora[3], Michele C. Balas[4], Gabriel Heras La Calle[6], Colm Cunningham[7], John W. Devlin[8,9], Julius Elefante Alasdair M. MacLullich[12], José R. Maldonado[13], Alessandro Morandi[14], Dale M. Louise Rose[17,18], Jorge I. F. Salluh[19], Tarek Sharshar[20,21], Yahya Shehabi[22,23], Yoanna Skrobik, Arjen J. C. Slooter and Heidi A. B. Smith[26]

What are some of the top study areas/trials to be done in the next 10 years?

6. Large RCTs that are needed in ICU patients:

(a) Safety and efficacy of antipsychotic medications on delirium and long-term outcomes

(b) Safety and efficacy of sleep optimization (non-pharmacological or pharmacological) on delirium and long-term outcomes

(b) Safety and efficacy of sleep optimization (non-pharmacological or pharmacological) on delirium and long-term outcomes

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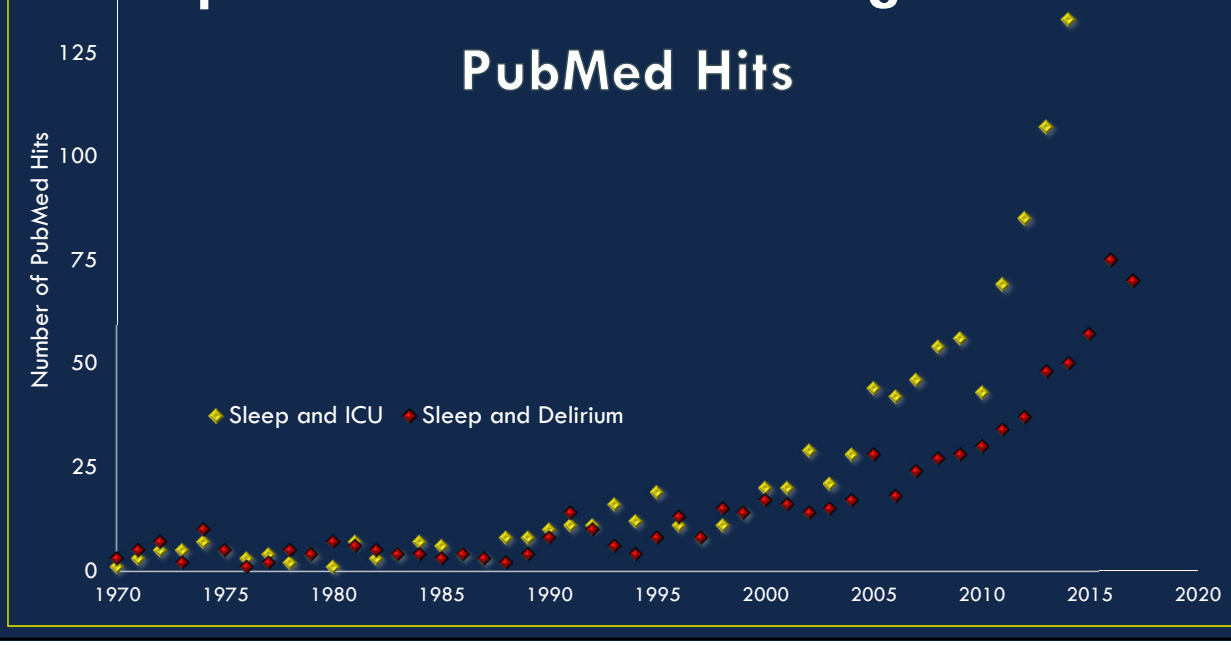
Sleep-Delirium in ICU Gaining Attention



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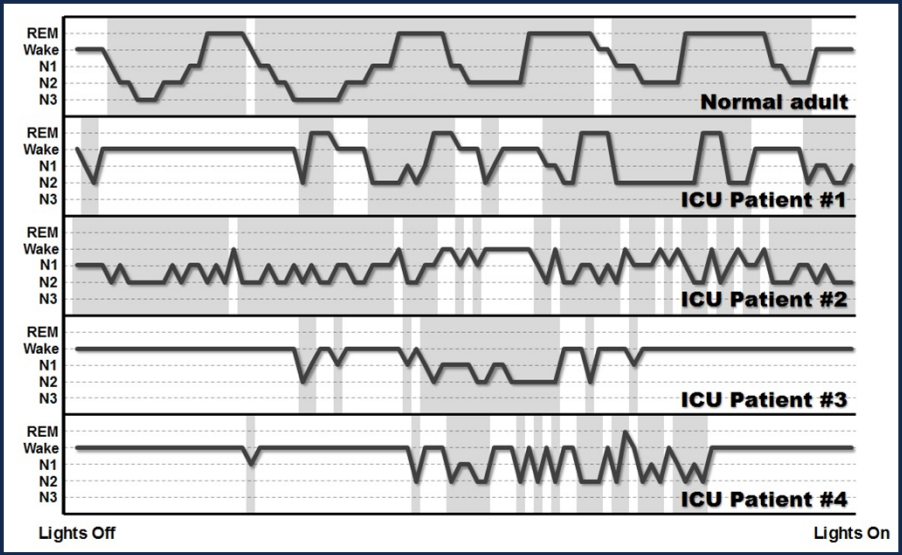
Poor sleep in the ICU



Knauert Malik Kamdar *SRCCM* 2014;35:582-592.

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Poor sleep in the ICU

Abnormal Sleep/Wake Cycles and the Effect of Environmental Noise on Sleep Disruption in the Intensive Care Unit

AJRCCM 2001;163:451-457.

NEIL S. FREEDMAN, JOOST GAZENDAM, LACHELLE LEVAN, ALLAN I. PACK, and RICHARD J. SCHWAB

Penn Center for Sleep Disorders, Pulmonary, Allergy and Critical Care Division, Department of Medicine and the Center for Sleep and Respiratory Neurobiology, University of Pennsylvania Medical Center, Philadelphia, Pennsylvania

22 MICU patients, 24-48 hr noise/sleep recording

- ***~41*** **distinct sleep periods during each 24 hr period**
- ***~15*** **minutes: Avg length of each sleep period**
- ***57%*** **of sleep occurred from 6am to 10pm**

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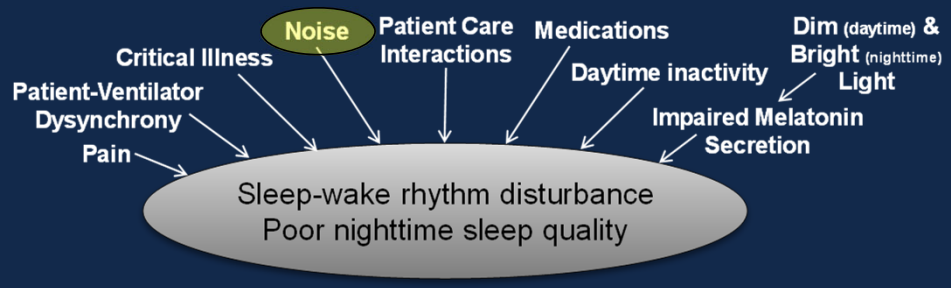
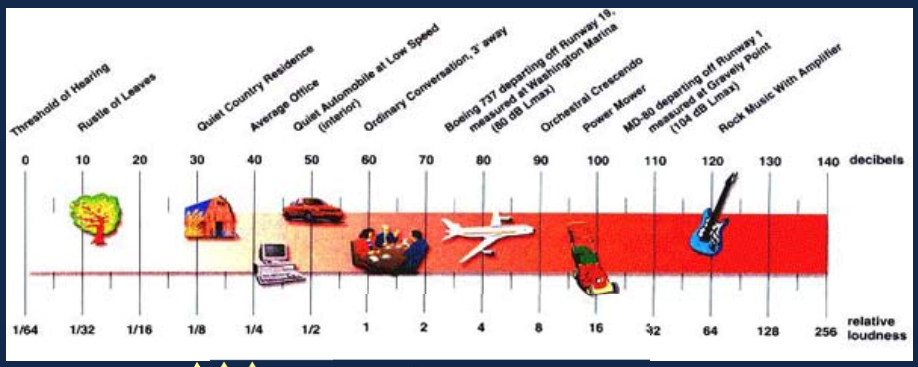
Causes of ICU sleep-wake disruption



Kamdar, Needham, Collop. *JICM* 2012;27(2):97-111.

15

How Noisy are ICUs?



Washington Metropolitan Airport Authority.

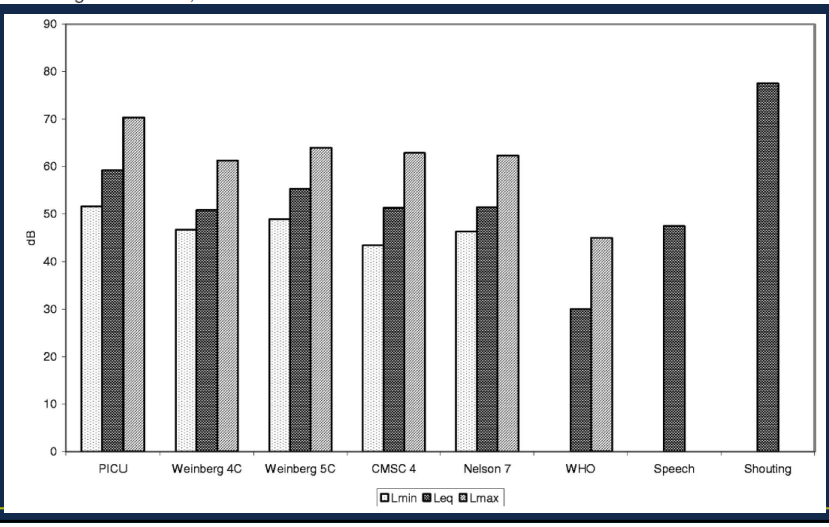
16

How Noisy are ICUs?

Noise levels in Johns Hopkins Hospital

Ilene J. Busch-Vishniac,[a] James E. West, Colin Barnhill, Tyrone Hunter, Douglas Orellana, and Ram Chivukula

J Acoust Soc Am. 2005



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ICU Noise and Sleep

Abnormal Sleep/Wake Cycles and the Effect of Environmental Noise on Sleep Disruption in the Intensive Care Unit

AJRCCM 2001;163:451-457.

NEIL S. FREEDMAN, JOOST GAZENDAM, LACHELLE LEVAN, ALLAN I. PACK, and RICHARD J. SCHWAB

Penn Center for Sleep Disorders, Pulmonary, Allergy and Critical Care Division, Department of Medicine and the Center for Sleep and Respiratory Neurobiology, University of Pennsylvania Medical Center, Philadelphia, Pennsylvania

22 MICU patients, 24-48 hr noise/sleep recording

- *~41* distinct sleep periods during each 24 hr period
- *~15* minutes: Avg length of each sleep period
- *57%* of sleep occurred from 6am to 10pm
- *17%* of sleep arousals due to noise
- *26%* of awakenings due to noise

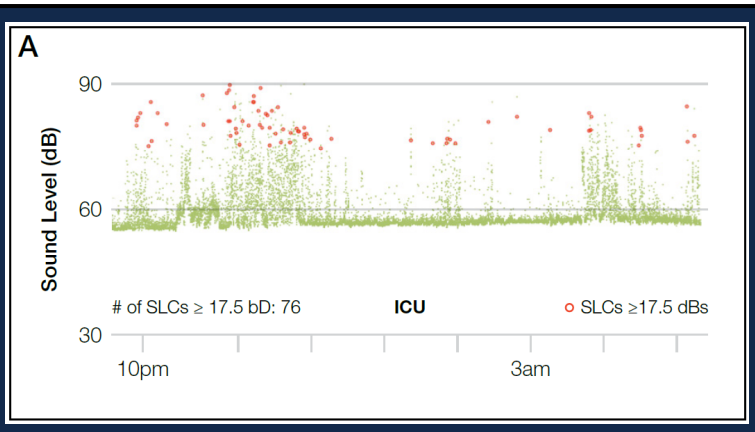
18

Sound Level Changes Worse than Avg. Sound

ORIGINAL RESEARCH *J Hosp Med* Sept 2017

Sound and Light Levels Are Similarly Disruptive in ICU and non-ICU Wards

Stuti J. Jaiswal, MD, PhD[1, 2*], Solana Garcia[1], Robert L. Owens, MD[3]



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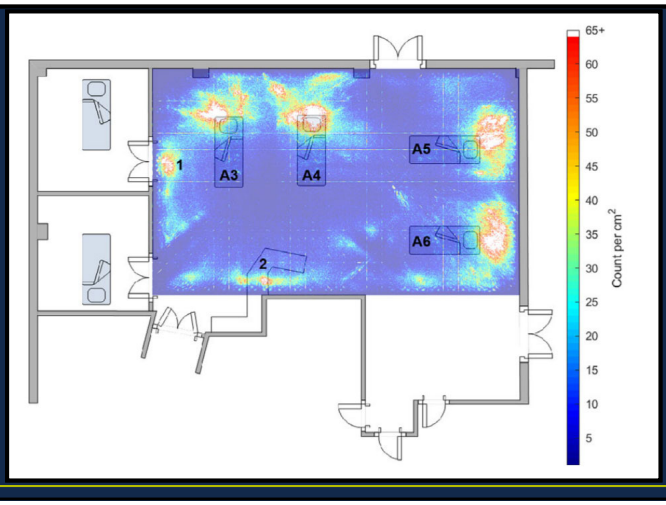
Disruptive Noise Worst at the Head of the Bed

Mapping sources of noise in an intensive care unit

J. L. Darbyshire,[1] M. Müller-Trapet,[2] J. Cheer,[3] F. M. Fazi[4] and J. D. Young[5] *Anaesthesia* April 2019



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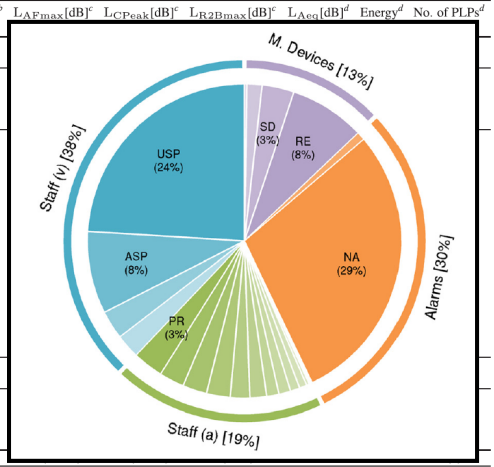
Many Sources of Sound are Modifiable

Analysis of the soundscape in an intensive care unit based on the annotation of an audio recording[a)] *J Acoust Soc Am.* Apr 2014

Category[a]	Noise source	Acronym	Duration[b] min (%)[e]	Occurrence[b] no. (%)	L_{AFmax}[dB][c]	L_{CPeak}[dB][c]	L_{R2Bmax}[dB][c]	L_{Aeq}[dB][d]	Energy[d]	No. of PLPs[d]
Patient (v)	Patient-involved SPeech	PSP	36 (3)	724 (3)						
	Patient's Non-Verbal Sound	PNVS	8 (1)	212 (1)						
Staff (v)	Unavoidable SPeech	USP	▸124 (9)	1254 (5)						
	Avoidable SPeech	ASP	60 (4)	953 (3)						
	UnIntelligible SPeech	UISP	▸239 (17)	▸3342 (12)						
	Others' Non-Verbal Sound	ONVS	9 (1)	513 (2)						
Staff (a)	FootSteps	FS	▸102 (7)	1965 (7)						
	General Movement	GM	1 (0)	26 (0)						
	Water Sound	WS	5 (0)	59 (0)						
	Plastic Ripping	PR	39 (3)	893 (3)						
	Paper Noise	PN	2 (0)	69 (0)						
	Bed Clinking / bed rail	BC	12 (1)	542 (2)						
	DRaWer	DRW	3 (0)	155 (1)						
	Mouse Clicking	MC	29 (2)	1263 (5)						
	Rubbish Bin	RB	4 (0)	337 (1)						
	Dropped OBject	DOB	1 (0)	85 (0)						
	CupBoard Door opening / closing	CBD	8 (1)	671 (2)						
	Unidentified Thump	UT	23 (2)	▸3278 (12)						
	Telephone Ringing	TR	7 (1)	275 (1)						
	Metallic Object Scrapping	MOS	41 (3)	2100 (8)						
	Non-Metallic Object Scrapping	NMOS	41 (3)	▸2160 (8)						
Alarms	Nearby Alarm	NA	97 (7)	▸2755 (10)						
	Remote Alarm	RA	▸110 (8)	▸3622 (13)						
M. Devices	Respiratory Equipment noise	RE	▸98 (7)	1 (0)						
	Compressed Air	CA	16 (1)	8 (0)						
	noise from Suctioning Device	SD	14 (1)	77 (0)						
	noise from other Medical Equipments	ME	5 (0)	31 (0)						
Unidentified	Other Unidentifiable Sound	OUS	1 (0)	51 (0)						
	Overall[f]		842 (58)	27421 (100)	50 (40-85)	69 (63-106)	6 (-3-42)	56	57	100	1479 (100)



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Different Sounds Have Different Effects

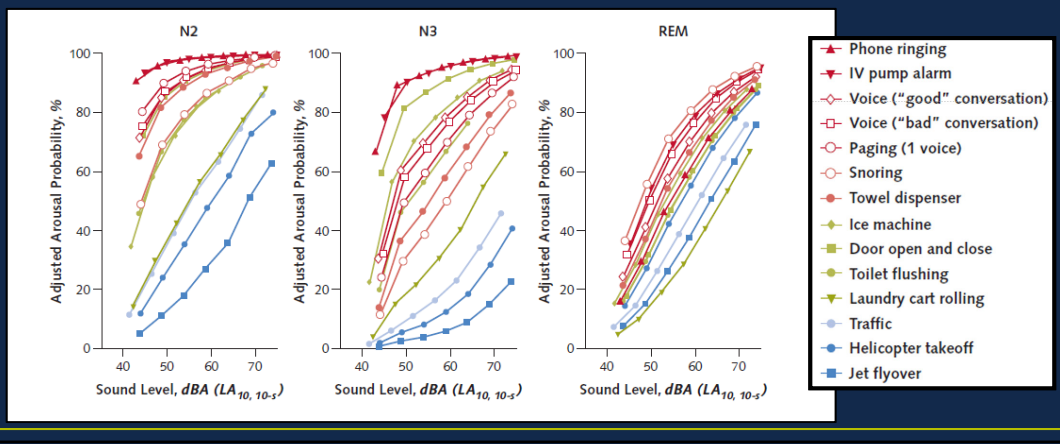
ORIGINAL RESEARCH | **Annals of Internal Medicine**

Sleep Disruption due to Hospital Noises

A Prospective Evaluation

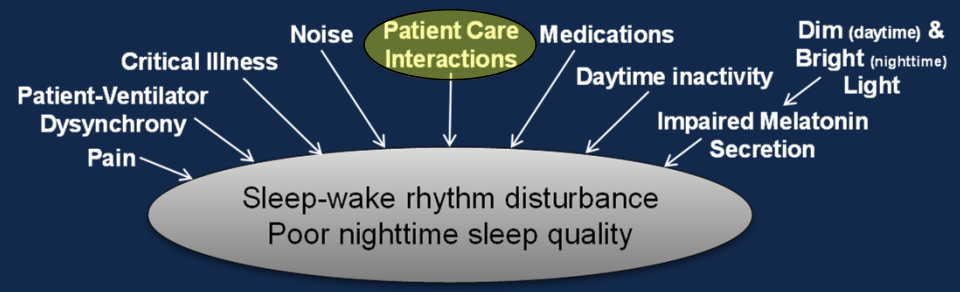
August 2012

Orfeu M. Buxton, PhD*; Jeffrey M. Ellenbogen, MD*; Wei Wang, PhD; Andy Carballeira, BM; Shawn O'Connor, BS; Dan Cooper, BS; Ankit J. Gordhandas, SB; Scott M. McKinney, BA; and Jo M. Solet, PhD



22

Causes of ICU sleep-wake disruption



Kamdar, Needham, Collop. *JICM* 2012;27(2):97-111.

23

Nighttime Interactions Are Frequent in ICU

NOCTURNAL CARE INTERACTIONS WITH PATIENTS IN CRITICAL CARE UNITS

Am J Crit Care 2004;13:102-112

By Linda M. Tamburri, RN, MS, CNS, C, CCRN, Roseann DiBrienza, RN, MS, CNS, C, CCRN, Rochelle Zozula, PhD, ABSM, and Nancy S. Redeker, RN, PhD, CS. From Robert Wood Johnson University Hospital, New Brunswick,

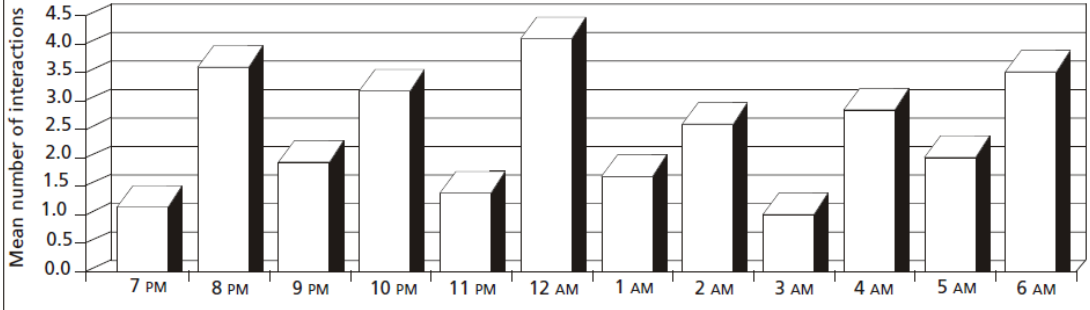
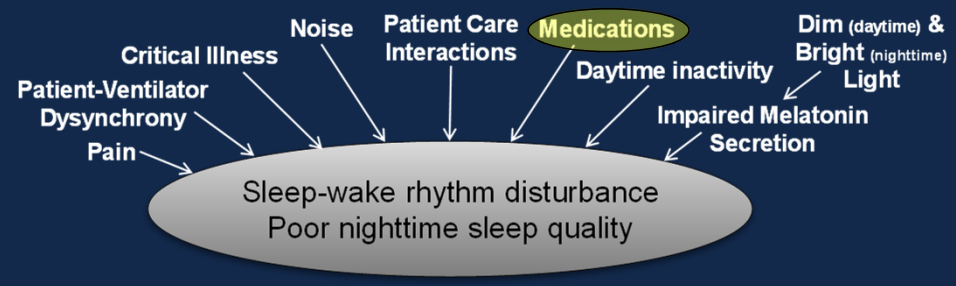


Figure 1 Mean number of nocturnal care interactions each hour per patient across all units.

24

Causes of ICU sleep-wake disruption



Kamdar, Needham, Collop. *JICM* 2012;27(2):97-111.

25

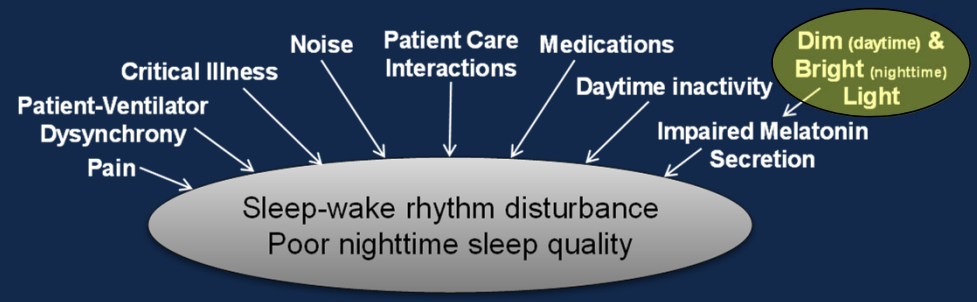
Common ICU Medications and Sleep

Medication	Mechanism	Side Effects	Sleep Effects
Dexmedetomidine	a2-Agonist	bradycardia, hypotension	↑N2 with sleep spindles, ?↑N3/SWS, ↓REM, ↑SE, ↓SL
Propofol	GABA receptor agonist	bradycardia, hypotension, propofol infusion syndrome, respiratory depression	↓REM, ↓SL, ↑TST, ↓W
Opiates	CNS opioid receptor agonist	dependency, delirium-inducing, hypotension, respiratory depression, withdrawal	↓N3, ↓REM, ↓TST, ↑W
Melatonin and Melatonin Receptor Agonists	Melatonin 1 and 2 receptor agonist	dizziness, hallucinations, nausea, vivid dreams	↑SE, ↓SL, ↑ TST
Atypical Antipsychotics	$5HT_2$, D_2–receptor antagonist	dizziness, extrapyramidal symptoms, neuroleptic malignant syndrome, orthostatic hypotension	↑N3, ↑REM, ↑SE, ↓SL, ↑TST, ↓W
Typical Antipsychotics	Dopamine receptor antagonist	anticholinergic effects, extrapyramidal symptoms, neuroleptic malignant syndrome, QT prolongation, tardive dyskinesia	↑N2, ↑N3, ↑SE, ↓SL, ↑TST, ↓W
Trazodone	Serotonin reuptake inhibitor, 5-HT1A,1C,2, H1 receptor antagonist	anticholinergic syndrome, arrhythmias, orthostatic hypotension	↑N3, ↑↓REM, ?↑SE, ↓SL
Antihistamines	H1-receptor antagonist	anticholinergic syndrome, dizziness, impaired coordination	? ↑N3, ↓REM, ?↑SE, ↓SL
Benzodiazepines	GABA receptor agonist	dependency, delirium-inducing, dizziness, hypotension, withdrawal	↓N3, ↓REM, ↓SL, ↑TST, ↓W
Non-Benzodiazepine Hypnotics	GABA receptor agonist	daytime somnolence, dizziness, confusion	↓N2, ↓N3, ↑↓REM, ↓SL ↑TST, ↓W

Dorsch, Martin, Malhotra, Owens, Kamdar. *SRCCM* In press.

26

Causes of ICU sleep-wake disruption



Kamdar, Needham, Collop. *JICM* 2012;27(2):97-111.

27

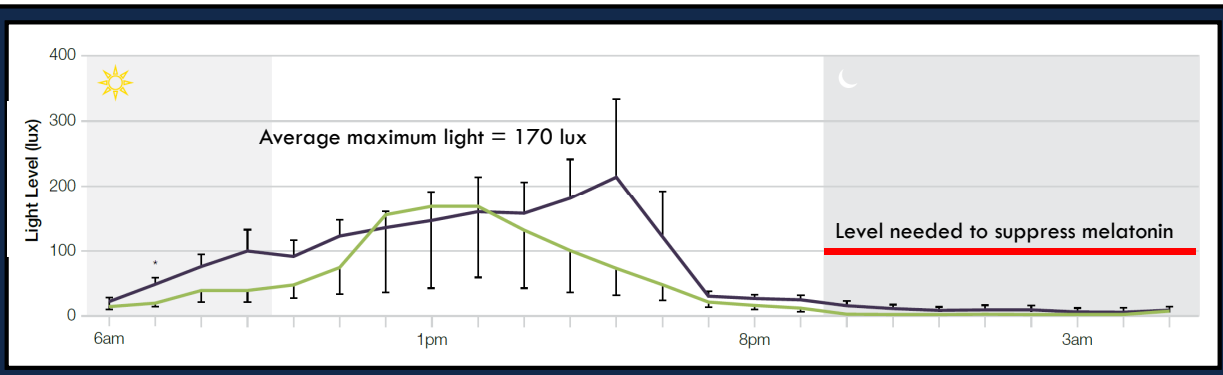
Daytime Light is Insufficient

1000 lux = minimum for entrainment

Sound and Light Levels Are Similarly Disruptive in ICU and non-ICU Wards

Stuti J. Jaiswal, MD, PhD[1, 2*], Solana Garcia[1], Robert L. Owens, MD[3]

J Hosp Med Sept 2017



28

Very Little Window Light Reaches ICU Patients

RESEARCH Open Access

Light and the outcome of the critically ill: an observational cohort study

Ricardo A Castro[1,2], Derek C Angus[1], Seo Yeon Hong[1], Chingwen Lee[1], Lisa A Weissfeld[1], Gilles Clermont[1] and Matthew R Rosengart[1,3*]

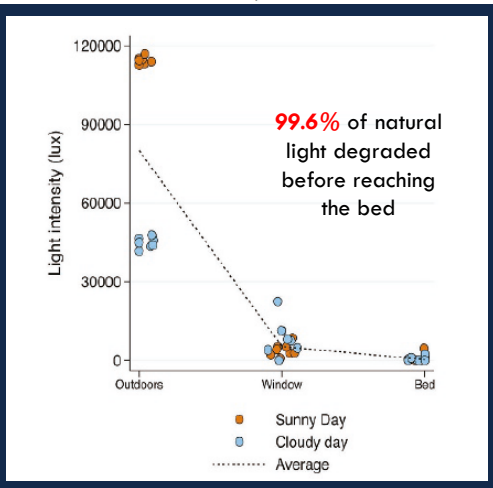
Crit Care 2012

29

Very Little Window Light Reaches ICU Patients

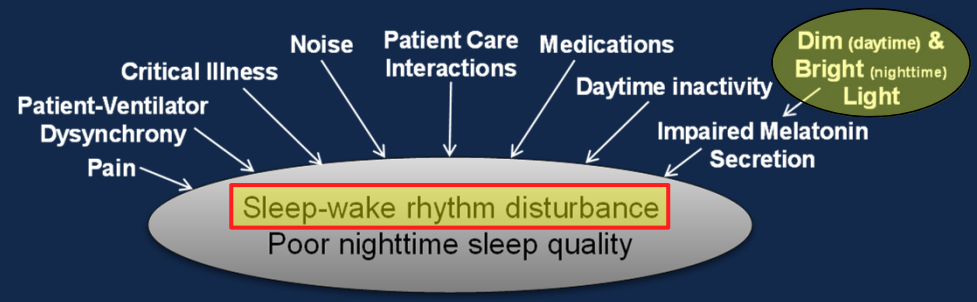
RESEARCH Open Access

Light and the outcome of the critically ill: an observational cohort study *Crit Care* 2012



30

Causes of ICU sleep-wake disruption

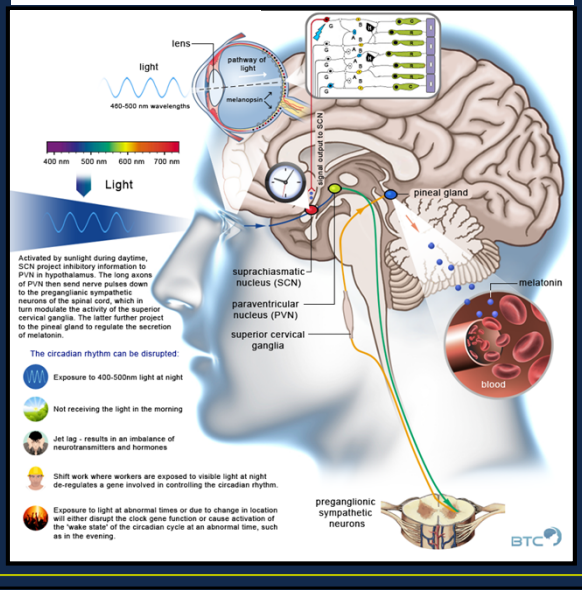


Kamdar, Needham, Collop. *JICM* 2012;27(2):97-111.

31

Sleep Disruption and Delirium

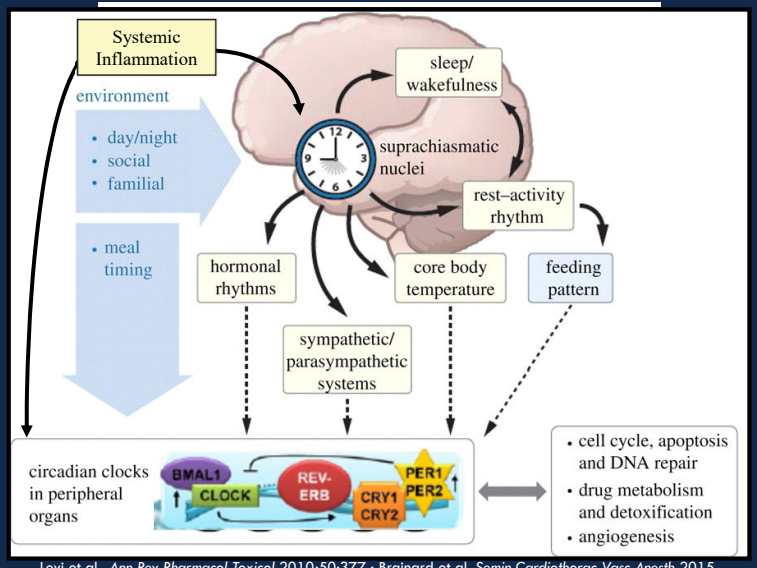
The Circadian Link



32

Sleep-Wake Disruption in ICU

The Circadian Link

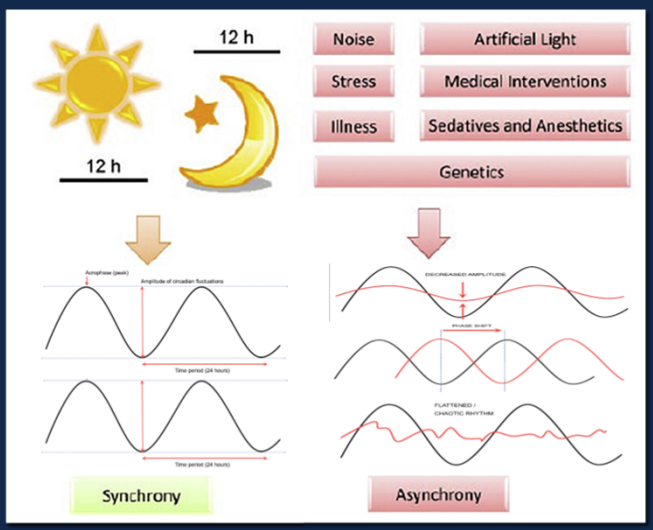


Levi et al.. *Ann Rev Pharmacol Toxicol* 2010;50:377.; Brainard et al. *Semin Cardiothorac Vasc Anesth* 2015.

33

Sleep-Wake Disruption in ICU

The Circadian Link

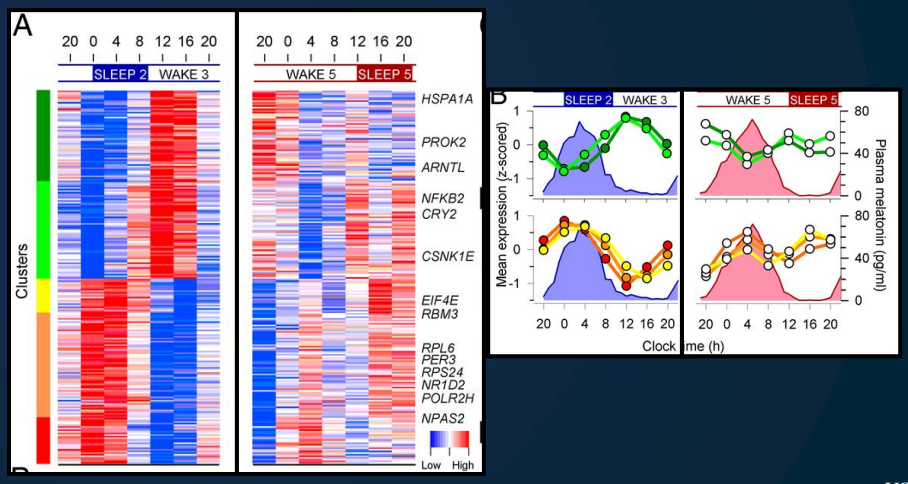


Brainard et al. *Semin Cardiothorac Vasc Anesth* 2015; McKenna Reiss Martin *J Intensive Care Soc* 2017.

34

Sleep-Wake Disruption in ICU

The Circadian Link



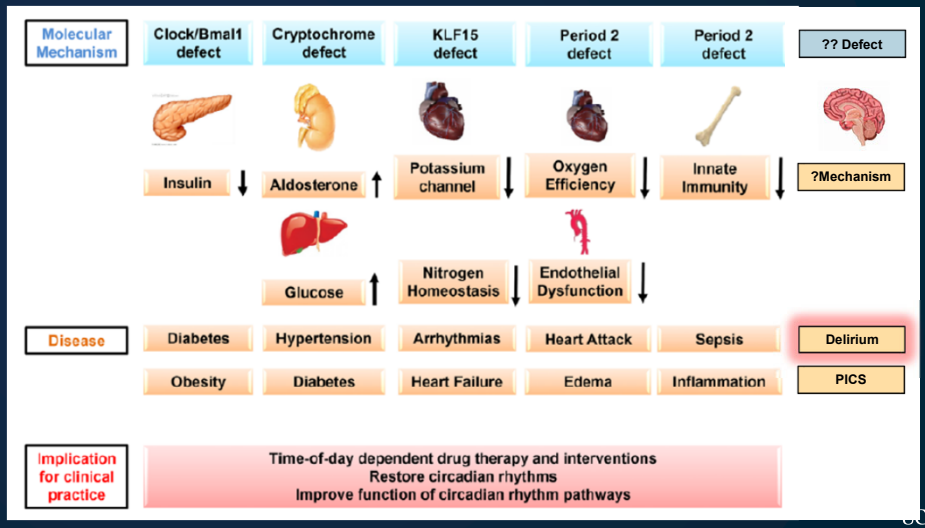
Simon N. Archer et al. *PNAS* 2014;111:E682-E691

UC San Diego Health

35

Sleep-Wake Disruption in ICU

The Circadian Link



Brainard et al. *Semin Cardiothorac Vasc Anesth* 2015.

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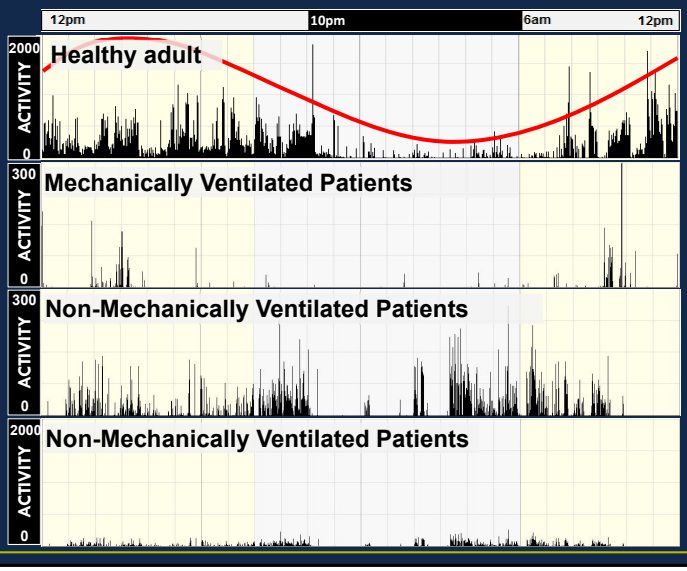
Sleep-Wake Disruption in ICU:

The Circadian Link



BB Kamdar, DJ Kadden, S Vangala, DA Elashoff, MK Ong, JL Martin, DM Needham *AJCC* July 2017.

37

The significance of circadian rhythms and dysrhythmias in critical illness
Helen T McKenna[1,2,3], Irwin KM Reiss[4] and Daniel S Martin[1,3,5]
jics *J Int Care Society* 2017

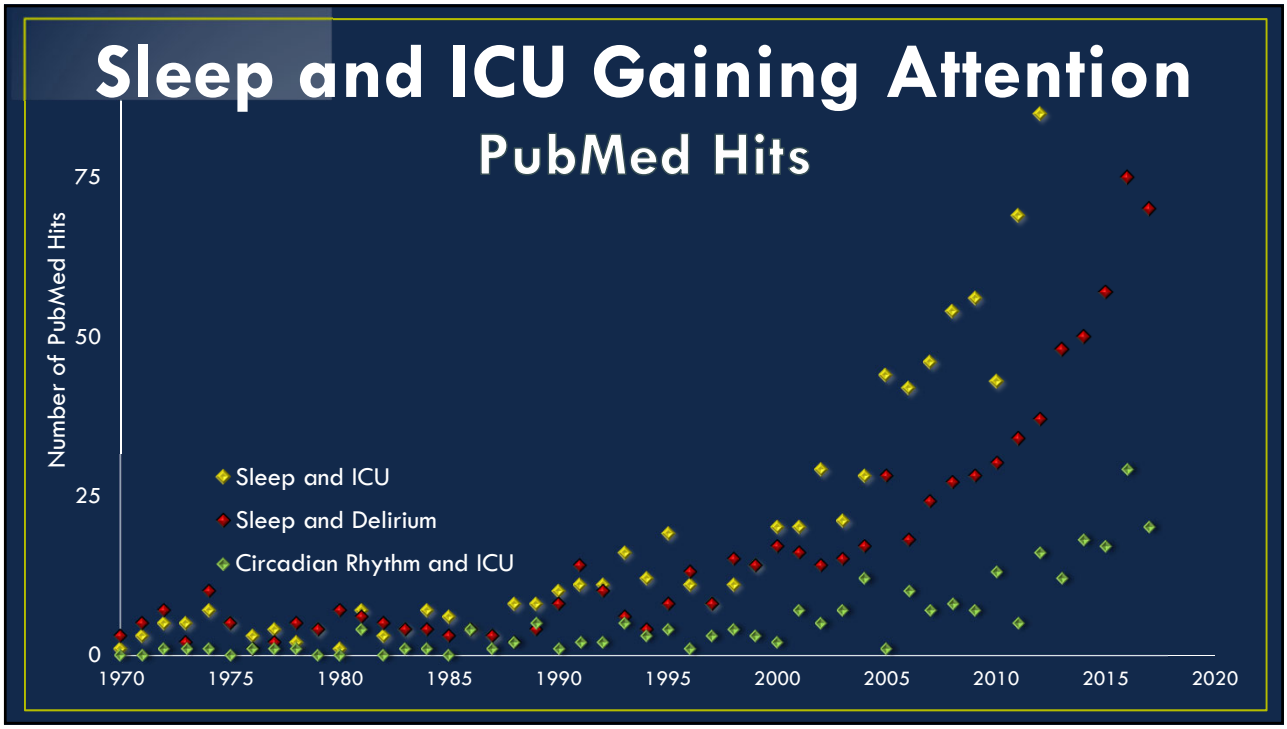
REVIEW Open Access
'Chronomics' in ICU: circadian aspects of immune response and therapeutic perspectives in the critically ill
Vasilios Papaioannou[1,2*], Alexandre Mebazaa[1], Benoît Plaud[1] and Matthieu Legrand[1]
Intensive Care Med 2014

Circadian Dysrhythmias in the Intensive Care Unit
Martha E. Billings, MD, MSc[a,*], Nathaniel F. Watson, MD, MSc[b]
CrossMark CRITICAL CARE CLINICS 2015

Circadian Rhythm Disruption in the Critically Ill: An Opportunity for Improving Outcomes*
Mark A. Oldham, MD; Hochang B. Lee, MD; Paul H. Desan, MD, PhD, FAPM
Crit Care Med 2015

Circadian Rhythms in Anesthesia and Critical Care Medicine: Potential Importance of Circadian Disruptions
Jason Brainard, MD[1], Merit Gobel, BS[1], Karsten Bartels, MD[1], Benjamin Scott, MD[1], Michael Koeppen, MD[1,2], and Tobias Eckle, MD, PhD[1]
Sem Cardiothorac Vasc Anesth 2015

38


Sleep and ICU Gaining Attention
PubMed Hits
Number of PubMed Hits
75
50
25
0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Sleep and ICU
Sleep and Delirium
Circadian Rhythm and ICU

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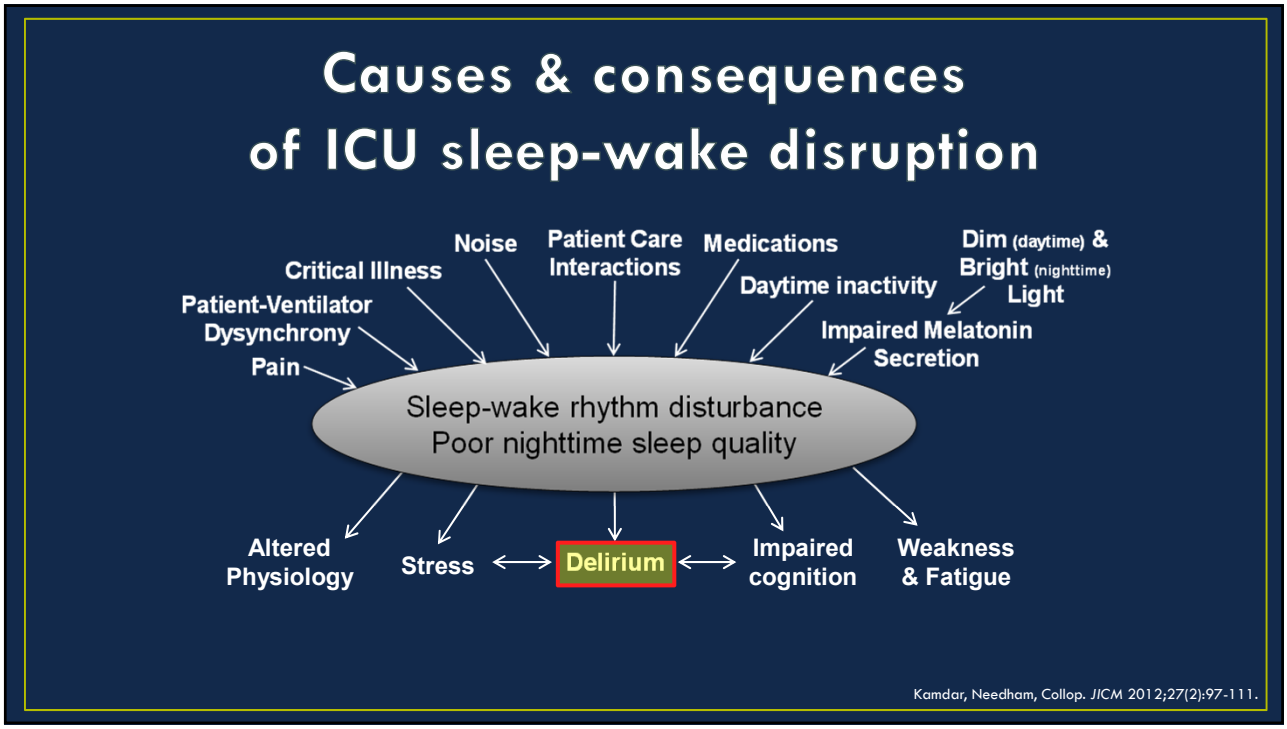

Causes & consequences
of ICU sleep-wake disruption
Noise
Patient Care Interactions
Medications
Dim (daytime) & Bright (nighttime) Light
Critical Illness
Daytime inactivity
Patient-Ventilator Dysynchrony
Impaired Melatonin Secretion
Pain
Sleep-wake rhythm disturbance
Poor nighttime sleep quality
Altered Physiology
Stress
Delirium
Impaired cognition
Weakness & Fatigue
Kamdar, Needham, Collop. JICM 2012;27(2):97-111.

40

Sleep and Delirium in the ICU

Is there evidence linking sleep with delirium?

How about in the ICU?

41

One of the first ever sleep-delirium studies

Arch Gen Psychiat
Vol 15, July 1966

Psychiatric and EEG Observations on a Case of Prolonged (264 Hours) Wakefulness

GEORGE GULEVICH, MD; WILLIAM DEMENT, MD; AND LAVERNE JOHNSON, PhD, SAN DIEGO, CALIF

Randy Gardner

264 hours of continuous wakefulness

- **90 hours: Hallucinations**
- **Day 4-5: "Waking dreams", memory lapses, heightened suspiciousness, feelings of resentment**

Gulevich, Dement, Johnson. *Arch Gen Psych* 1966;15:29-35.

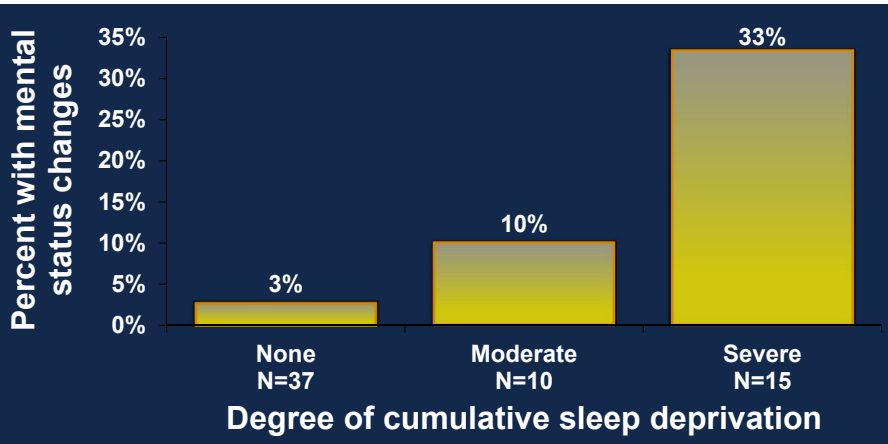
42

Sleep loss and delirium

The correlation between sleep deprivation and the intensive care unit syndrome

Mary Clayman Helton, RN, MSN, Susan Huffman Gordon, RN, MSN, Susan Lambert Nunnery, RN, MSN *Chapel Hill, N.C.*

HEART&LUNG
The Journal of Acute and Critical Care



Helton et al. *Heart Lung* 1980;9(3):464.

43

43

Sleep loss and delirium

Sleep disturbances in the critically ill patients: role of delirium and sedative agents

A. C. TROMPEO [1], Y. VIDI [1], M. D. LOCANE [1], A. BRAGHIROLI [2], L. MASCIA [1], K. BOSMA [1], V. M. RANIERI [1]

MINERVA ANESTESIOLOGICA

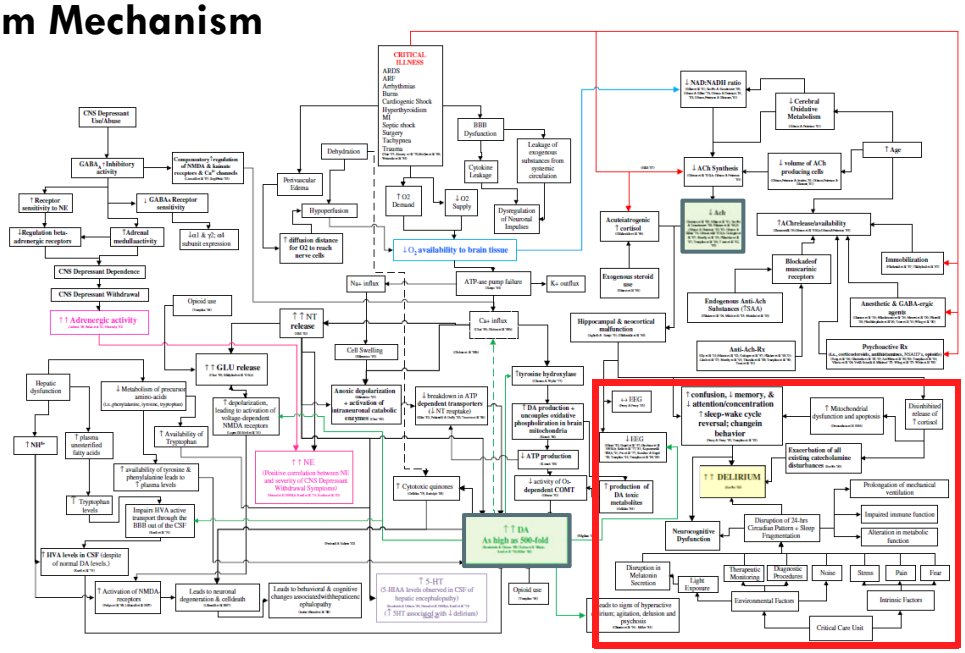
- 29 mechanically ventilated patients in a surgical ICU
- Twice-daily CAM-ICU delirium assessment
- PSG performed once sometime after ICU day 2
- Strata: **REM <6%** vs. **REM ≥6%** total sleep time
- Delirium in 11/15 (73%) of REM <6% vs. 1/14 (7%) of REM ≥6%
  - **Multivariable OR = 34.5 (95% CI, 3.9-330.2)**

Trompeo et al. *Minerva Anest* 2011;6:604.

44

44

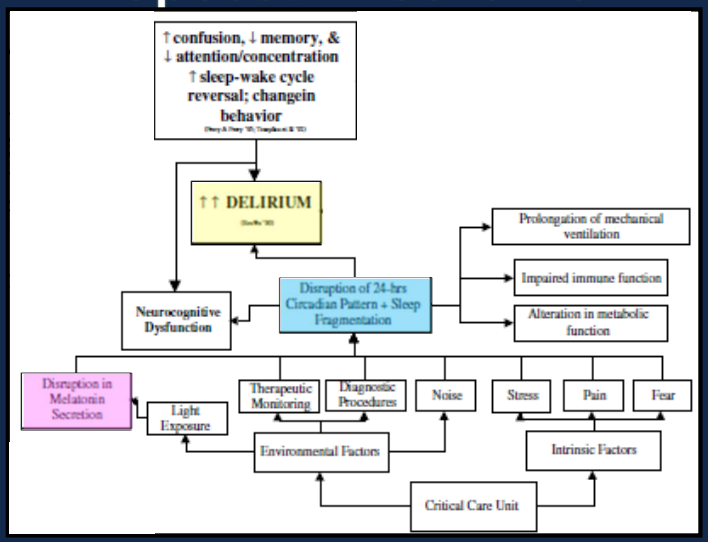
Delirium Mechanism



Maldonado ***Crit Care Clin*** 2008:789–856.

45

Sleep and Delirium Proposed Mechanism



Maldonado ***Crit Care Clin*** 2008:789–856.

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UC San Diego Health

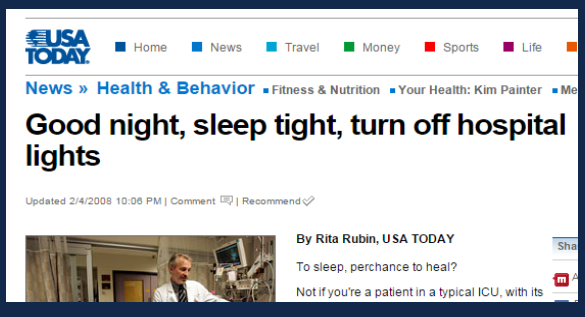
PADIS: ABCDEF bundle + G(ood sleep): Improving Sleep in the ICU

CALIFORNIA THORACIC SOCIETY
A chapter of the American Thoracic Society

Biren Kamdar, MD, MBA, MHS
Assistant Professor, Division of Pulmonary Critical Care and Sleep Medicine
University of California, San Diego (UCSD)
California Thoracic Society 2019 Southern California Meeting, Irvine, CA
October 4, 2019

47

ICU Sleep Improvement Gaining Attention


USA TODAY Home News Travel Money Sports Life
News » Health & Behavior Fitness & Nutrition Your Health: Kim Painter
Good night, sleep tight, turn off hospital lights
Updated 2/4/2008 10:06 PM | Comment | Recommend
By Rita Rubin, USA TODAY
To sleep, perchance to heal?
Not if you're a patient in a typical ICU, with its


Science News ... from universities, journals, and other research organizations
Physicians Seek To Improve The Quality Of Sleep In ICU
ScienceDaily (Dec. 10, 2007) — The sleep patterns of patients in the intensive care unit are so superficial that they barely spend any time in the restorative stages of sleep that aid in healing, UT Southwestern Medical Center physicians have found.
See Also:
Health & Medicine
"Current clinical-care protocols routinely and severely deprive critically ill patients of sleep at a time when the need for adequate rest is


May 12, 2015
HUFFPOST HEALTHY LIVING
Edition: U.S.
FRONT PAGE WOMEN TASTE GOOD NEWS PARENTS STYLE POST50 RELIGION WEDDINGS HUFFPOST LIVE ALL SECTIONS
Sleep Could Ease Delirium In ICU Patients, Study Finds
Posted: 02/22/2013 7:03 am EST | Updated: 02/22/2013 7:03 am EST

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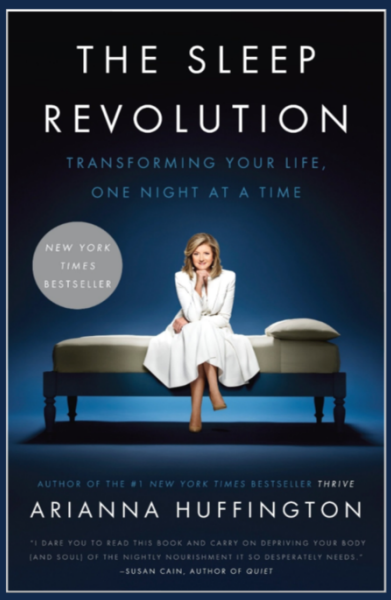
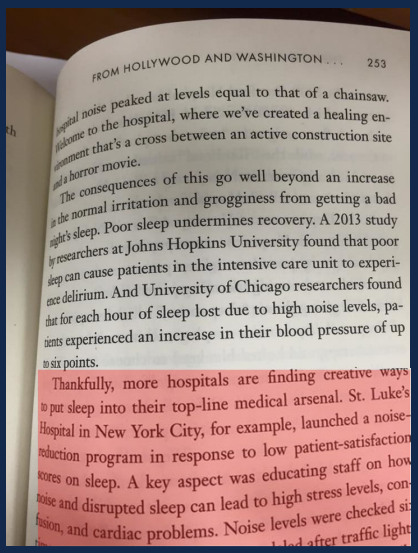
ICU Sleep Improvement Gaining Attention




FROM HOLLYWOOD AND WASHINGTON . . . 253

hospital noise peaked at levels equal to that of a chainsaw. Welcome to the hospital, where we've created a healing environment that's a cross between an active construction site and a horror movie.

The consequences of this go well beyond an increase in the normal irritation and grogginess from getting a bad night's sleep. Poor sleep undermines recovery. A 2013 study by researchers at Johns Hopkins University found that poor sleep can cause patients in the intensive care unit to experience delirium. And University of Chicago researchers found that for each hour of sleep lost due to high noise levels, patients experienced an increase in their blood pressure of up to six points.

Thankfully, more hospitals are finding creative ways to put sleep into their top-line medical arsenal. St. Luke's Hospital in New York City, for example, launched a noise-reduction program in response to low patient-satisfaction scores on sleep. A key aspect was educating staff on how noise and disrupted sleep can lead to high stress levels, confusion, and cardiac problems. Noise levels were checked si

lled after traffic light

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ICU Sleep Improvement Gaining Attention

Lights out: Some children's hospitals take steps to ensure a good night's sleep

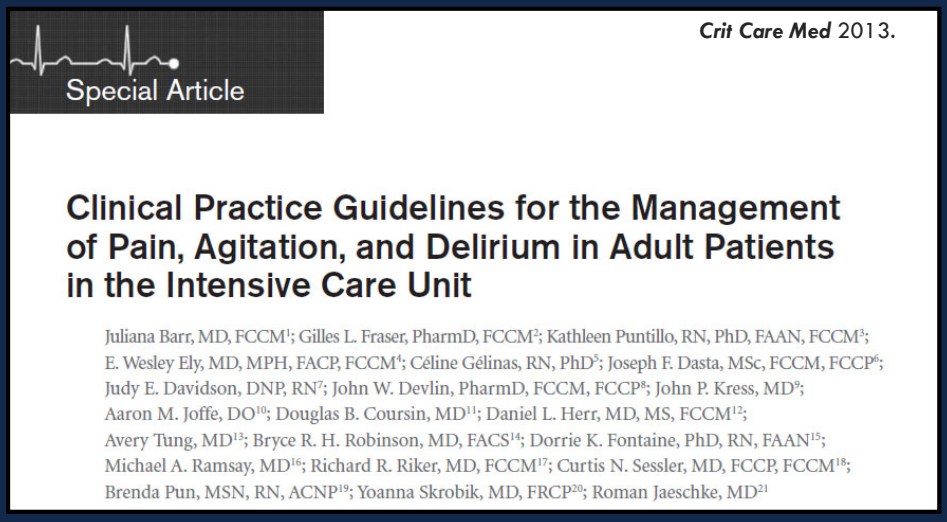
Shefali Luthra, Kaiser Health News Published 5:55 p.m. ET May 28, 2016

CONNECT | TWEET | LINKEDIN | COMMENT | EMAIL | MORE

BALTIMORE -- At home, parents try to keep their children on a regular sleep schedule, with the evening bedtime transition marked by rituals like reading stories, flipping on night-lights and getting tucked in with favorite stuffed animals.

50

Improving the Quality of Sleep in the ICU



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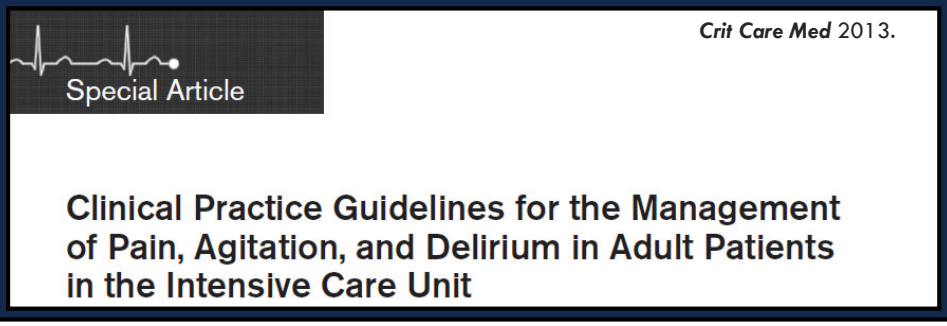
Improving the Quality of Sleep in the ICU



Society of Critical Care Medicine
Clinical Practice Guideline Recommendation

"We recommend promoting sleep in adult ICU patients by optimizing patients' environments, using strategies to control light and noise, clustering patient care activities, and decreasing stimuli at night to protect patients' sleep cycles"

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Sleep in the ICU Gaining Attention

Clinical Practice Guidelines for the Prevention and Management of Pain, Agitation/Sedation, Delirium, Immobility, and Sleep Disruption in Adult Patients in the ICU

Crit Care Med Sept 2018.

John W. Devlin, PharmD, FCCM (Chair)[1,2]; Yoanna Skrobik, MD, FRCP(c), MSc, FCCM (Vice-Chair)[3,4]; Céline Gélinas, RN, PhD[5]; Dale M. Needham, MD, PhD[6]; Arjen J. C. Slooter, MD, PhD[7]; Pratik P. Pandharipande, MD, MSCI, FCCM[8]; Paula L. Watson, MD[9]; Gerald L. Weinhouse, MD[10]; Mark E. Nunnally, MD, FCCM[11,12,13,14]; Bram Rochwerg, MD, MSc[15,16]; Michele C. Balas, RN, PhD, FCCM, FAAN[17,18]; Mark van den Boogaard, RN, PhD[19]; Karen J. Bosma, MD[20,21]; Nathaniel E. Brummel, MD, MSCI[22,23]; Gerald Chanques, MD, PhD[24,25]; Linda Denehy, PT, PhD[26]; Xavier Drouot, MD, PhD[27,28]; Gilles L. Fraser, PharmD, MCCM[29]; Jocelyn E. Harris, OT, PhD[30]; Aaron M. Joffe, DO, FCCM[31]; Michelle E. Kho, PT, PhD[30]; John P. Kress, MD[32]; Julie A. Lanphere, DO[33]; Sharon McKinley, RN, PhD[34]; Karin J. Neufeld, MD, MPH[35]; Margaret A. Pisani, MD, MPH[36]; Jean-Francois Payen, MD, PhD[37]; Brenda T. Pun, RN, DNP[23]; Kathleen A. Puntillo, RN, PhD, FCCM[38]; Richard R. Riker, MD, FCCM[29]; Bryce R. H. Robinson, MD, MS, FACS, FCCM[39]; Yahya Shehabi, MD, PhD, FCICM[40]; Paul M. Szumita, PharmD, FCCM[41]; Chris Winkelman, RN, PhD, FCCM[42]; John E. Centofanti, MD, MSc[43]; Carrie Price, MLS[44]; Sina Nikayin, MD[45]; Cheryl J. Misak, PhD[46]; Pamela D. Flood, MD[47]; Ken Kiedrowski, MA[48]; Waleed Alhazzani, MD, MSc (Methodology Chair)[16,49]

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Sleep in the ICU Gaining Attention

Clinical Practice Guidelines for the Prevention and Management of Pain, Agitation/Sedation, Delirium, Immobility, and Sleep Disruption in Adult Patients in the ICU

Crit Care Med Sept 2018.

Ventilator Mode.

Question: Should assist-control ventilation be used at night (vs pressure support ventilation) to improve sleep in critically ill adults?

Recommendation: We suggest using assist-control ventilation at night (vs pressure support ventilation) for improving sleep in critically ill adults (conditional recommendation, low quality of evidence).

NIV-Dedicated Ventilator.

Question: Among critically ill adults requiring NIV, should an NIV-dedicated ventilator (vs a standard ICU ventilator with NIV capacity) be used to improve sleep?

Recommendation: We suggest using either an NIV-dedicated ventilator or a standard ICU ventilator for critically ill adults requiring NIV to improve sleep (conditional recommendation, very low quality of evidence).

Aromatherapy/Acupressure/Music

Question: Should aromatherapy, acupressure, or music be used at night (vs not using it) to improve sleep in critically ill adults?

Recommendation: We suggest not using aromatherapy, acupressure, or music at night to improve sleep in critically ill adults (conditional recommendation, low quality of evidence [aromatherapy and acupressure]; very low quality of evidence [music]).

Noise and Light Reduction

Question: Should noise and light reduction strategies (vs not using these strategies) be used at night to improve sleep in critically ill adults?

Recommendation: We suggest using noise and light reduction strategies to improve sleep in critically ill adults (conditional recommendation, low quality of evidence).

Sleep-Promoting Protocol

Question: Should a sleep-promoting protocol be used to improve sleep in critically ill adults?

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

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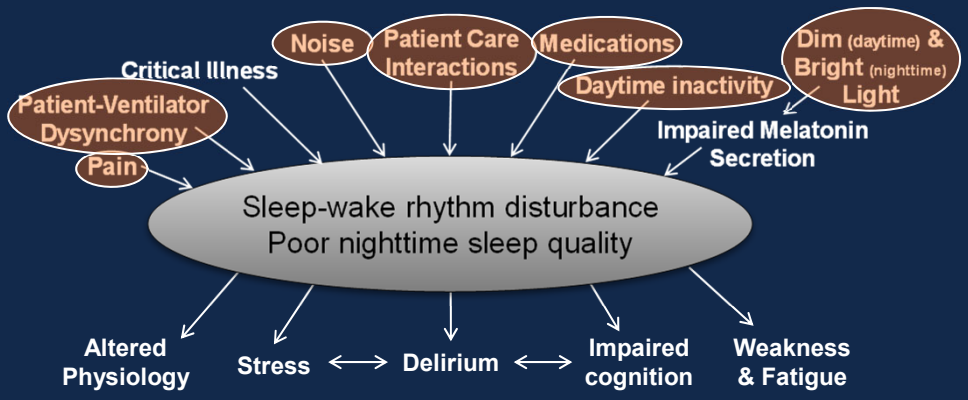
Sleep in the ICU Gaining Attention

Clinical Practice Guidelines for the Prevention and Management of Pain, Agitation/Sedation, Delirium, Immobility, and Sleep Disruption in Adult Patients in the ICU
Crit Care Med Sept 2018.

Concluding Comments on Sleep: Studies to date are consistent in demonstrating that critically ill patients sleep poorly as a result of both patient and ICU factors. The importance of improving sleep in this population may be unproven by RCT but is intuitive and, at least, could be considered an important comfort measure that would improve patients' ICU quality of life if not other outcomes. Although only a select few intervention studies have been published, available data suggest that a multicomponent protocolized approach to improving sleep that favors nonpharmacologic measures may offer our patients their best chance for a better night's sleep. Future research needs to focus on improved methods for measuring sleep and on implementing interventions targeting patient-centered outcomes. Sleep habits are highly variable among healthy individuals; therefore, a more individualized approach should be considered.

55

Causes & consequences of ICU sleep-wake disruption



Kamdar, Needham, Collop. *JICM* 2012;27(2):97-111.

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Inpatient sleep improvement

Early studies – no delirium outcome

Study	Intervention	Outcome
Williamson *AJCC* 1992	Ocean sounds in post-op CABG patients (*N*=60)	Improved sleep quality scores
Richards *AJCC* 1998	RCT of music, relaxation, & massage in CCU (*N*=69)	Increased efficiency, N3, REM, TST
Wallace *AJCC* 1999	Earplugs in simulated ICU (*N*=6)	Increased REM sleep
Walder *CCM* 2000	SICU-wide noise & light reduction guideline (*N*=17)	Decreased noise and light
Olson *AJCC* 2001	Quiet time protocol in NCCU (*N*=843)	Decreased noise and light, increased sleep
Richardson *DCCN* 2003	Relaxation and imagery in multiple ICUs (*N*=36)	Improved subjective sleep scores

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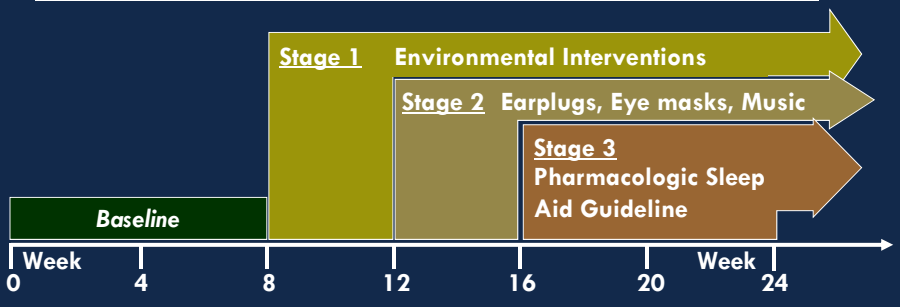
Sleep improvement in the ICU

Multicomponent ICU Sleep Intervention Bundle

The Effect of A Quality Improvement Intervention on Perceived Sleep Quality and Cognition in A Medical ICU

Critical Care Med 2013;41:800-808

Biren B. Kamdar, MD, MBA, MHS[1,2]; Lauren M. King, RN, MSN[1,3]; Nancy A. Collop, MD[4]; Sruthi Sakamuri, BS[5]; Elizabeth Colantuoni, PhD[1,6]; Karin J. Neufeld, MD, MPH[1,7]; O. Joseph Bienvenu, MD, PhD[1,7]; Annette M. Rowden, PharmD[8]; Pegah Touradji, PhD[1,9,10]; Roy G. Brower, MD[2]; Dale M. Needham, MD, PhD[1,2,10]

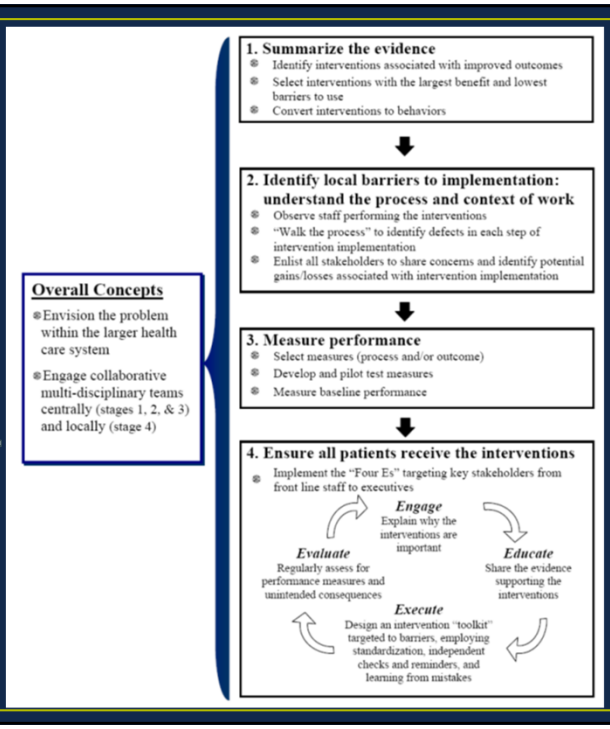


58

Key starting point

Model for Quality Improvement

Pronovost, Berenholz, Needham. BMJ 2008.



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Quality Improvement Model: Step 1

1. Summarize the evidence

- Identify interventions associated with improved outcomes
- Select interventions with the largest benefit and lowest barriers to use
- Convert interventions to behaviors

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1. Summarize the evidence

- Identify interventions associated with improved outcomes
- Select interventions with the largest benefit and lowest barriers to use
- Convert interventions to behaviors

- **Nighttime noise and light reduction**
- **Minimize unnecessary nighttime patient care interactions**
- **Daytime light and activity**
- **Non-pharmacologic & pharmacologic sleep aids**

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Quality Improvement Model: Step 2

2. Identify local barriers to implementation: understand the process and context of work

- Observe staff performing the interventions
- "Walk the process" to identify defects in each step of intervention implementation
- Enlist all stakeholders to share concerns and identify potential gains/losses associated with intervention implementation

Understanding barriers specific to the project is key to designing the correct KT intervention (Shojania Health Affairs 2005)

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2. Identify local barriers to implementation: understand the process and context of work

"Walk the process" to identify defects in each step of intervention implementation

Enlist all stakeholders to share concerns and identify potential gains/losses associated with intervention implementation

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2. Identify local barriers to implementation: understand the process and context of work

HOW DO WE MINIMIZE OVERHEAD PAGES?

CONCERNS RAISED DURING BRAINSTORMING

- **Clerk barriers**
  - "Why would clerks care about this?"– **lack of buy-in/motivation**
  - "Too many" night-shift clerks – **no consistency**
  - Clerks have "too many other checklists" – **poor compliance**
  - Overhead paging is "necessary" – **work-flow disruption**
- **Logistical barriers**
  - Each page transmits to all in-room telephone intercoms anyway – **lack of effectiveness**
  - Individual Hill-Rom nurse pagers "do not work" – **no reasonable alternative**

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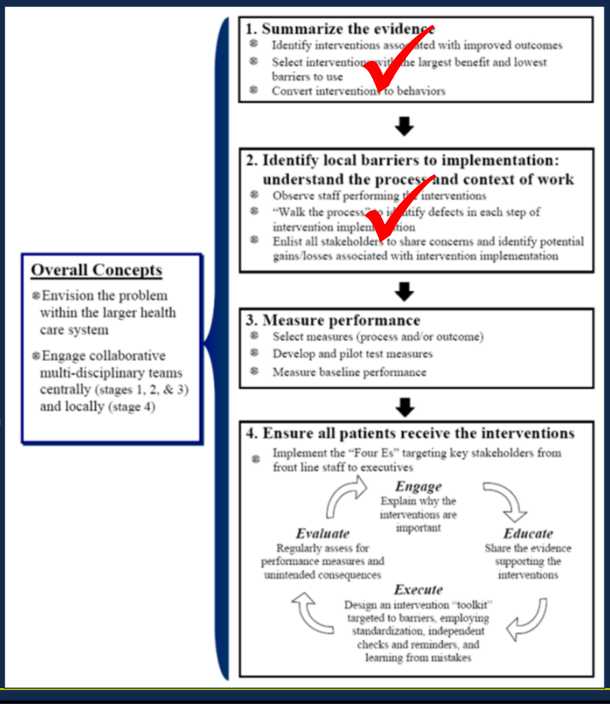
Model for Quality Improvement

Pronovost, Berenholz, Needham. BMJ 2008.



66

Quality Improvement: Step 3

3. Measure performance

- Select measures (process and/or outcome)
- Develop and pilot test measures
- Measure baseline performance

Process:

■ Avoid overhead pages AFTER 10pm.
Estimated # of pages after 10pm (goal is 0 pages):
☐$_0$ no pages
☐$_1$ 1-3
☐$_2$ 4-7
☐$_3$ 8-14
☐$_4$ 15+
} Reason for frequent pages (multiple admissions, codes, consults, etc.): _____

→ Added to MANDATORY daily clerk checklist

Pilot Test: Checklist completed by night shift clerk

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Quality Improvement: Step 4

4. Ensure all patients receive the interventions

- Implement the "Four Es" targeting key stakeholders from front line staff to executives

Engage
Explain why the interventions are important

Educate
Share the evidence supporting the interventions

Execute
Design an intervention "toolkit" targeted to barriers, employing standardization, independent checks and reminders, and learning from mistakes

Evaluate
Regularly assess for performance measures and unintended consequences

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4. Ensure all patients receive the interventions

- Implement the "Four Es" targeting key stakeholders from front line staff to executives

Engage
Explain why the interventions are important

Educate
Share the evidence supporting the interventions

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4. Ensure all patients receive the interventions

- Implement the "Four Es" targeting key stakeholders from front line staff to executives

Evaluate
Regularly assess for performance measures and unintended consequences

Execute
Design an intervention "toolkit" targeted to barriers, employing standardization, independent checks and reminders, and learning from mistakes

- Avoid overhead pages AFTER 10pm.

Estimated # of pages after 10pm (goal is 0 pages):

- ☐0 no pages
- ☐1 1-3
- ☐2 4-7
- ☐3 8-14
- ☐4 15+

} Reason for frequent pages (multiple admissions, codes, consults, etc.):

☐ Verify # of pages w/ charge RN; RN signature:___

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4. Ensure all patients receive the interventions

- Implement the "Four Es" targeting key stakeholders from front line staff to executives

Engage
Explain why the interventions are important

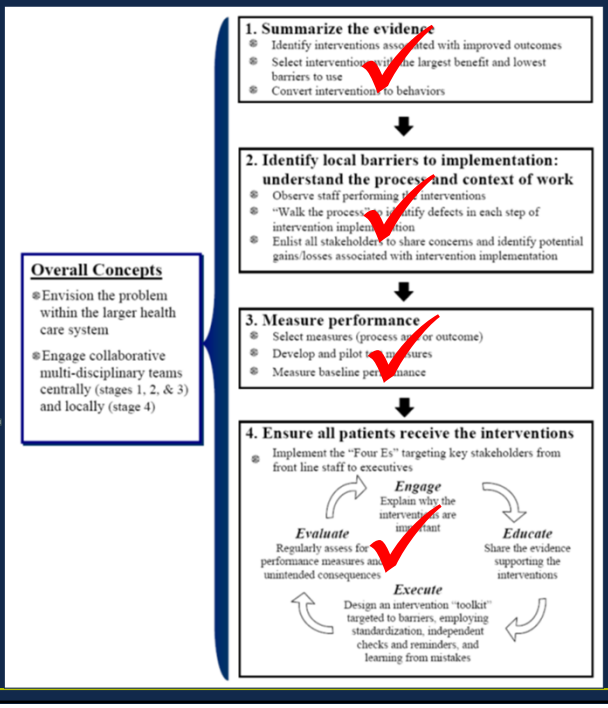
Evaluate
Regularly assess for performance measures and unintended consequences

Educate
Share the evidence supporting the interventions

71

Model for Quality Improvement

Pronovost, Berenholz, Needham. BMJ 2008.



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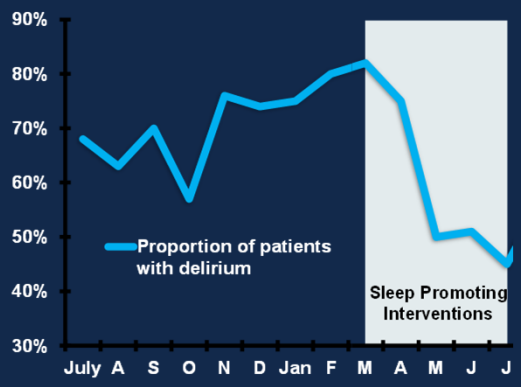
Sleep improvement in the ICU

Bundled ICU sleep intervention

The Effect of A Quality Improvement Intervention on Perceived Sleep Quality and Cognition in A Medical ICU

Critical Care Med 2013;41:800-808



n=110 Baseline
n=175 Sleep QI

20% *reduction in incidence of delirium/coma*
(OR = 0.49, p=0.02)

5% *improvement in daily delirium/coma-free status*
(OR = 1.64, p=0.03)

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Sleep improvement in the ICU

Bundled ICU sleep intervention

The effect of a multicomponent multidisciplinary bundle of interventions on sleep and delirium in medical and surgical intensive care patients*

Anaesthesia 2014, 69, 540–549

J. Patel,[1] J. Baldwin,[2] P. Bunting[3] and S. Laha[3]

1 Medical Student, University of Manchester, Manchester, UK
2 Research Nurse, Critical Care Unit, 3 Consultant, Department of Anaesthesia and Critical Care Medicine, Royal Preston Hospital, Lancashire Teaching Hospitals NHS Trust, Preston, UK

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Bundled ICU sleep intervention

The effect of a multicomponent multidisciplinary bundle of interventions on sleep and delirium in medical and surgical intensive care patients*

Anaesthesia 2014, 69, 540–549

24-day Pre-Intervention Period (June 2012)

Outcomes:	***Sleep:***	Richards-Campbell Sleep Questionnaire (RCSQ)
		Sleep in the ICU Questionnaire
		Total Sleep Time (hourly nurse assessment)
		Number of Staff Interruptions
	Delirium:	CAM-ICU
	Other:	24 hour light and sound

21-day "Break"

26-day Intervention Period (July-August 2012)

Intervention:	ICU-wide and patient-centered noise and light reduction
	Earplugs and eye masks
Outcomes:	Same as pre-intervention

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Bundled ICU sleep intervention

The effect of a multicomponent multidisciplinary bundle of interventions on sleep and delirium in medical and surgical intensive care patients*

Anaesthesia 2014, 69, 540–549

Outcome	Pre-QI (N=167, n=30)	Post-QI (N=171, n=29)	*P* Value
Sleep efficiency (RCSQ), mean (SD)	61±4	76±2	<0.001
Sleep quality, median (IQR)	4 [3-5]	7 [7-8]	<0.001
Noise, dB, mean (SD)	69±4	62±9	0.002
Light, lux, mean (SD)	594±88	301±54	0.003
Staff interactions, mean (SD)	34±4	23±7	0.045
Delirium incidence, n (%)	**55 (33%)**	**24 (14%)**	**<0.001**
	Unadjusted OR = 0.33 (95% CI 0.19-0.57)		**<0.001**
Delirium duration, d, mean (SD)	**3.4±1.4**	**1.2±0.9**	**0.02**

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The Impact of Interventions to Improve Sleep on Delirium in the ICU: A Systematic Review and Research Framework

Critical Care Med 2016;2231-2240

Alexander H. Flannery, PharmD, BCCCP, BCPS[1,2]; Douglas R. Oyler, PharmD, BCCCP[1,2]; Gerald L. Weinhouse, MD[3]

- 488 citations, **10 studies evaluated**
- **Interventions:**
  - Multi-component bundles (n=4)
  - Earplugs only (n=1)
  - Light therapy (n=2)
  - Pharmacological intervention (n=3)
- Reduction in **delirium** in 6 of 10
- Only 1 study demonstrated improved sleep **AND** delirium
- **Conclusion:** Heterogeneous studies, mostly weak data

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ICU Sleep Improvement Resources

Non-pharmacological interventions for sleep promotion in the intensive care unit (Review)

Hu RF, Jiang XY, Chen J, Zeng Z, Chen XY, Li Y, Huining X, Evans DJW

Cochrane Library

Cochrane Database 2015.

The Impact of Interventions to Improve Sleep on Delirium in the ICU: A Systematic Review and Research Framework

Crit Care Med Dec 2016.

Alexander H. Flannery, PharmD, BCCCP, BCPS[1,2]; Douglas R. Oyler, PharmD, BCCCP[1,2]; Gerald L. Weinhouse, MD[3]

Pharmacological interventions to improve sleep in hospitalised adults: a systematic review

BMJ Open

Salmaan Kanji,[1,2] Alexandru Mera,[3] Brian Hutton,[2,4] Lisa Burry,[5] Erin Rosenberg,[6] Erika MacDonald,[2,7] Vanessa Luks[8]

BMJ 2016.

USING MUSIC TO PROMOTE SLEEP FOR HOSPITALIZED ADULTS

By Rebecca Shaw, RN-BC, BSN, BSW, MA

Am J Crit Care March 2016.

A Meta-analysis of Sleep-promoting Interventions During Critical Illness

Am J Med 2015.

THE AMERICAN JOURNAL of MEDICINE®

Chithra Poongkunran, MD,[a] Santosh G. John, MD,[a] Arun S. Kannan, MD,[a] Safal Shetty, MD,[a,b] Christian Bime, MD,[a,b,c] Sairam Parthasarathy, MD[a,b,c]

[a]Department of Medicine, University of Arizona, Tucson; [b]Division of Pulmonary, Critical Care, and Sleep Medicine, University of Arizona, Tucson; [c]Arizona Respiratory Center, University of Arizona, Tucson.

UC San Diego Health

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ICU (G)ood Sleep Intervention Team

Key Principles

- Rigorous QI methods
- Multidisciplinary team
- Engage any/all stakeholders/experts
- Know the literature
- Meaningful outcomes
- Audit and feedback
- Start small, aim big
- Set frequent deadlines

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Thank you!

@SleepICU @AmerDelirium
@ICURehab @ICURecovery

ICUdelirium.org
ICUliberation.org

AMERICAN DELIRIUM SOCIETY

American Delirium Society
2020 Annual Conference
Indianapolis, June 14-16, 2020

UC San Diego Health

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PADIS Panel Discussion

Juliana Barr, MD
Javier Lorenzo, MD
Biren B. Kamdar, MD, MBA, MHS

Friday, October 4, 2019 – 11:30 a.m. – 12:00 p.m.

LUNCH AND EXHIBITS

Friday, October 4, 2019 – 12:00 p.m. – 1:00 p.m.

The Post-Intensive Care Syndrome (PICS)

Marc Moss, MD
University of Colorado
Past-ATS President

Friday, October 4, 2019 – 1:00 p.m. – 1:30 p.m.

Marc Moss is the Roger S. Mitchell Professor of Medicine, Vice Chair of Clinical Research for the Department of Medicine, and Interim Head of the Division of Pulmonary Sciences and Critical Care Medicine at the University of Colorado School of Medicine. Dr. Moss has a longstanding interest in critical care-related research and he has held continuous NIH funding as a Principal Investigator for over 19 consecutive years. More specifically, Dr. Moss's research interests include identifying new treatment modalities for patients with the Acute Respiratory Distress Syndrome (ARDS), exploring the diagnosis and treatment of neuromuscular dysfunction in critically ill patients who require mechanical ventilation, and studying burnout syndrome, posttraumatic stress disorder, and wellness in critical care healthcare professionals, specifically ICU nurses. Dr. Moss' research on wellness is funded by the NIH and he recently received funding from the National Endowment of the Arts. Dr. Moss is the principal investigator for the Colorado center in the NHLBI sponsored Prevention and Early Treatment of Acute Lung Injury (PETAL) network. Based on his expertise in clinical/translational research and mentoring, Dr. Moss served as the Program Director for the Education, Training, and Career Development Core of the Colorado Clinical Translational Sciences Institute (CCTSI) from 2008-2016. More recently, he served as the President of the American Thoracic Society from 2017-2018.

The Post-Intensive Care Syndrome (PICS)

Marc Moss, M.D.

Roger S. Mitchell Professor of Medicine
Interim Head
Division of Pulmonary Sciences & Critical Care Medicine
University of Colorado School of Medicine

1

1

No Disclosures

The presenter has advised that the following presentation will NOT include discussion on any commercial products or service and that there are NO financial interests or relationships with any of the Commercial Supporters of this year's Congress.

Thank Linda Denehy and Terri Hough for help with preparing the presentation

2

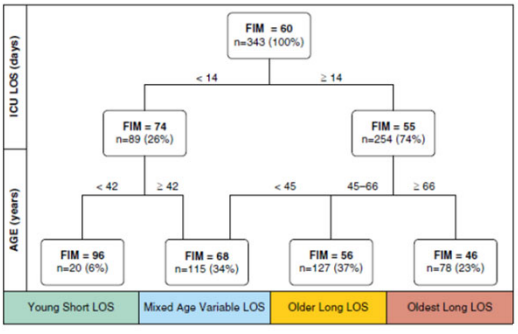
What problems do patients have when they leave the ICU?

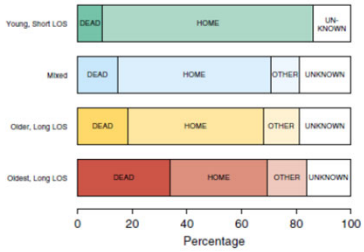
- Physical:
  - Consequences of ICU acquired weakness
  - Difficulties performing activities of daily living
- Cognitive:
  - Difficulty with executive function activities
  - Unable to return to work
- Mental Impairments:
  - Depression
  - Anxiety
  - Post traumatic stress disorder
- Collectively called Post ICU Syndrome: PICS

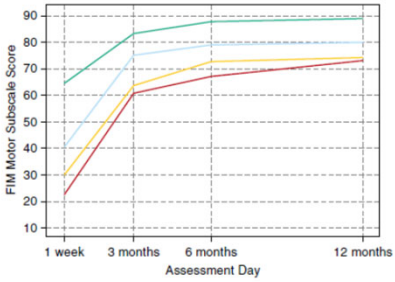
3

RECOVER: Risk stratify patient?

- 391 ICU patients ≥ 7 days of MV
  - Functional independence measures (FIM) at 7 days
  - Followed patients for one year (83%)





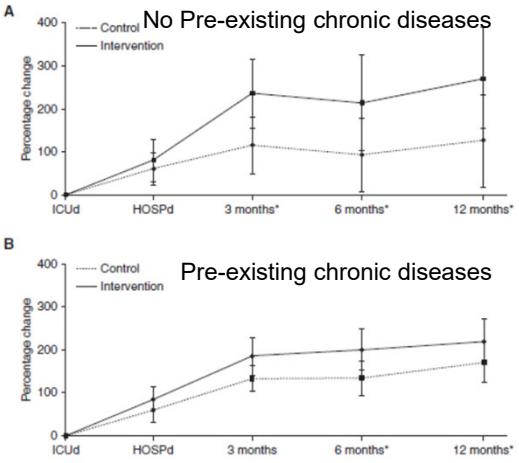


Herridge. AJRCCM 2016; 194:831-844.

4

The role of co-morbidity

- Secondary analysis of clinical trial
  - 150 patients
  - Outcome = 6MWT
  - No difference
- Stratified by:
  - Pre-existing chronic diseases



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Physical Therapy after ICU discharge RECOVER trial

- 240 patients discharged from an ICU
  - Required at least 48 hours of mechanical ventilation
  - PTs provided respiratory treatment within 24 hours of ICU admission
  - ICU team provided exercises and early mobility as indicated
- Usual care group (at time of ICU discharge):
  - PT, OT, SLP, nutrition care (ward based multidisciplinary team)
- Intervention group (at time of ICU discharge):
  - PT, OT, SLP, nutrition care: frequency 2-3 fold, individualized goal setting, coordinated and delivered by a dedicated rehabilitation practitioner.
    - Supplemented by care from 3 multi-skilled dedicated rehab assistants
- Outcome:
  - Rivermead Mobility Index at 3 months.

JAMA Intern Med.2015;175(6):901-910.

6

Differences between intervention arms

- > 90% of patients in both groups received some PT after ICU discharge.
- Frequency of therapy increased 2-3 fold across multiple domains
- Patients in ICU for 11 days before randomized
  - Median duration of MV of 8-9 days.

Hospital Discharge Outcome				
Post-ICU hospital length of stay, d (119/119)[c]	10 (6 to 23)	11 (6 to 22)	0 (−2 to 2)[b]	.90
RMI (84/83)[d]	8 (5 to 10)	8 (6 to 11)	−0.7 (−1.7 to 0.4)[b]	.20
Handgrip strength, kg (82/82)[e]	15.0 (9.7 to 22.6)	14.7 (10.0 to 22.0)	1.1 (−1.3 to 3.6)[b]	.36
VAS symptom score, median (IQR) (83/80)[f]				
Breathlessness	2.8 (1.1 to 5.3)	2.5 (1.0 to 5.0)	0.2 (−0.5 to 1.0)	.49
Fatigue	5.0 (3.2 to 6.7)	5.1 (2.7 to 7.2)	0.0 (−0.9 to 0.9)	.96
Appetite	4.1 (1.7 to 6.7)	5.0 (1.9 to 7.6)	−0.4 (−1.6 to 0.4)	.33
Pain	2.6 (0.7 to 5.2)	2.3 (0.8 to 4.7)	0.0 (−0.6 to 0.8)	.89
Joint stiffness	3.6 (1.1 to 6.2)	3.3 (1.1 to 4.9)	0.5 (−0.3 to 1.5)	.21
Destination, % (116/118)[g]				
Own residence	72	76	NA	NA
Rehabilitation hospital/facility	13	13	NA	NA
Other acute care nonstudy hospital	7	6	NA	NA
Other	6	3	NA	NA
Died	2	2	NA	NA

Stage of Patient Journey	Treatment Group: Usual Care (n = 120)	Treatment Group: Intervention (n = 120)
ICU Discharge		
Provision of ICU recovery manual, No. (%)	120 (100)	120 (100)
Structured discussion with ICU consultant, No. (%)	0	68 (56.7)
Provision of lay summary of illness, No. (%)	0	114 (95.0)
Ward-Based Rehabilitation		
Patients receiving therapy types at least once during ward stay, No. (%)		
PT	111 (92.5)	118 (98.3)
Dietetics	80 (66.7)	114 (95.0)
OT	39 (32.5)	52 (43.3)
SLT	19 (15.8)	23 (19.2)
Hospital treatment, median rate per week (IQR) [range]		
Transfers	1 (0-2) [0-6]	2 (1-4) [0-14]
Walking	2 (1-3) [0-7]	4 (2-6) [0-21]
Exercises	0 (0-1) [0-5]	2 (1-4) [0-14]
Balance work	0 (0-0) [0-5]	1 (0-2) [0-7]
Stairs	0 (0-1) [0-3]	1 (0-1) [0-7]
Mobility advice	0 (0-1) [0-7]	1 (0-2) [0-7]
Calorie and protein requirement calculated	0 (0-0) [0-2]	0 (0-1) [0-7]
Actual calorie and protein intake calculated	0 (0-0) [0-3]	3 (2-4) [0-14]
Total No. of treatments during hospital stay, median (IQR) [range]		
Transfers	2 (0-5) [0-23]	4 (1-8) [0-39]
Walking	3 (1-6) [0-22]	6 (3-12) [0-48]
Exercises	0 (0-2) [0-33]	4 (2-9) [0-70]
Balance work	0 (0-0) [0-23]	1 (0-3) [0-23]
Stairs	0 (0-1) [0-7]	1 (0-2) [0-21]
Mobility advice	0 (0-1) [0-10]	1 (0-3) [0-22]
Calorie and protein requirement calculated	0 (0-1) [0-9]	1 (0-2) [0-10]
Actual calorie and protein intake calculated	0 (0-1) [0-8]	5 (2-11) [0-54]
Hospital discharge, No. (%)		
Offered ICU visit before hospital discharge	0	90 (75.0)
Visited ICU	2 (1.7)	17 (14.2)
Structured status summary sent to general practitioner/family physician	0	116 (96.7)

7

RECOVER Trial: Results

- Similar trajectory of recovery between the two groups
- No difference HRQoL, anxiety, depression, or PTSD.
  - Though these symptoms were prevalent in both groups.

Outcome (No. of Patients With Evaluable Data in Usual Care/Intervention Groups)	Treatment Group: Usual Care	Treatment Group: Intervention	Difference Scores, Mean (95% CI)	*P* Value
RMI at 3 mo (110/118)[a]	13 (10 to 14)	13 (10 to 14)	−0.2 (−1.3 to 0.9)[b]	.71
3-mo Outcome				
Death, No. (%) (110/118)[h]	6 (5)	6 (5)		>.99
SF-12 PCS score, median (IQR) (96/101)[i]	35 (26 to 44)	34 (26 to 44)	−0.1 (−3.3 to 3.1)[b]	.96
SF-12 MCS score, median (IQR) (96/101)[i]	47 (33 to 56)	45 (34 to 54)	0.2 (−3.4 to 3.8)[b]	.91
HADS Anxiety score (87/98)[j]				
Median (IQR)	6 (3 to 10)	7 (3 to 11)	0.2 (−1.6 to 1.4)[b]	.73
≥8, %	36	46		
HADS Depression score (87/98)[j]				
Median (IQR)	7 (4 to 10)	7 (4 to 9)	0.5 (−0.7 to 1.6)[b]	.44
≥8, %	45	37		
DTS score (78/82)[k]				
Median (IQR)	10 (2 to 22)	11 (0 to 31)	0 (−4 to 3)[b]	.83
≥27, %	23	29		
2-m Timed Up & Go test score, median (IQR), s (84/91)[l]	10.3 (7.4 to 14.2)	10.4 (8.0 to 13.3)	0.1 (−1.2 to 1.6)[b]	.86
Hand grip strength, median (IQR), kg (89/98)[m]	19.7 (13.0 to 28.2)	17.9 (13.4 to 24.7)	1.6 (−1.0 to 4.2)[b]	.23

8

REVIVE trial: Study design

- 60 patients ventilated for ≥ 96 hours
  - 6 hospitals in Northern Ireland
  - Planned to be discharged home
- 6 week intervention following hospital discharge
  - 2 supervised and 1 unsupervised exercise sessions/week
  - One hour session:
    - Warm up period
    - Arm, leg, and whole body conditioning and strengthening
    - Aerobic exercise 10-30 minutes
    - Cool down period
  - Delivered by a trained physiotherapist
- Standard of care: no additional support after hospital discharge
- Primary outcome: SF-36 physical functioning at 6 weeks

McDowell K. Thorax 2016:1–10.

9

REVIVE trial: Results

- Intervention adhered to by 70% (21/30) of participants
  - Participated in > 75% of sessions.
  - Most conducted in the hospital gym
  - High fidelity
- 6 week follow up on 55 participants
  - MCID for SF-36 physical functioning = 3.0 in general population

Outcome measure	Intervention (n=26) Mean (SD) change	Control (n=29) Mean (SD) change	Difference mean change scores (95% CI)	p Value
SF-36*				
Physical functioning	6.8 (10.9)	3.9 (8.2)	3.0 (−2.2 to 8.2)	0.26
Role physical	12.0 (9.8)	5.4 (11.8)	6.6 (0.73 to 12.5)	0.03
Bodily pain	5.2 (9.1) N=25	1.3 (8.5)	3.9 (−0.87 to 8.7)	0.11
General health	0.43 (10.2)	−1.2 (7.8)	1.7 (−3.3 to 6.6)	0.50
Vitality	4.6 (10.1)	2.3 (10.8)	2.3 (−3.4 to 8.0)	0.42
Social functioning	10.7 (13.1) N=25	4.2 (12.3)	6.6 (−0.3 to 13.5)	0.06
Role emotional	8.2 (14.5)	2.5 (16.4)	5.7 (−2.8 to 14.2)	0.18
Mental health	2.8 (12.5) N=25	0.16 (11.7)	2.6 (−3.9 to 9.1)	0.43
Physical component summary	7.0 (7.8) N=25	3.2 (6.7)	3.8 (−0.2 to 7.8)	0.06

10

Practical Trial

- 286 patients recruited after ICU discharge
- Intervention: Nurse lead follow up program
  - Manual based self directed Rehab program
  - Started in the hospital and continued for three months
  - First clinic appointment was at 3 months
  - Clinic appointments: could refer to mental health professional
- Standard of care: followed by GP and hospital specialists as needed
- Main outcome: SF-36 Health related quality of life at 12 months.
  - Postal survey

Cuthbertson, B. BMJ 2009;339:3723

11

Practical Trial

- 143 in each arm
- Over the 12 months
  - Intervention: 13% died
  - Control: 10% died
- 21.7% withdrew from the study or were lost to follow up

	Nurse led clinic	
	3 months	9 months
No of patients who attended clinic	104	94
Mean (SD) time after randomisation to clinic appointment (days)	91.3 (19.5)	270 (20.2)
Relative accompanied patient to clinic	46 (44)	31 (33)
Case review	99 (95)	92 (98)
Discussion of intensive care experiences	104 (100)	92 (98)
Assessment of medical referral	94 (90)	83 (88)
Patients referred for specialist review	25 (25)	16 (17)
Total number of specialist referrals:	34	29
Ear, nose, and throat	4	5
Medical or surgical	8	6
Neurology or neurosurgery	0	1
Sexual medicine or urology	1	2
Physiotherapy or occupational therapy	7	6
Dietician	6	1
Speech therapy	2	1
Other	6	7
Psychological screen	103 (99)	93 (99)
Referral for psychological review	25 (24)	6 (6)
Review of current drug therapy	101 (97)	91 (97)
Changes to current medications	3 (3)	2 (2)
Visit to intensive care unit:		
Offered	87 (84)	48 (51)
Performed	22 (21)	13 (14)
Physiotherapy or occupational therapy assessment requested	7 (7)	5 (5)
Intensive care doctor consulted	15 (14)	15 (16)
Intensive care doctor reviewed case	17 (16)	14 (15)
Review letter to patient's general practitioner	104 (100)	93 (99)

	Intervention		Standard care		Effect size	
SF-36 score at 12 months	No of patients	Mean (SD) score	No of patients	Mean (SD) score	(95% CI)	P value
Intention to treat analysis						
Physical component score	90	42.0 (10.6)	97	40.8 (11.9)	1.1 (−1.9 to 4.2)	0.46
Mental component score	90	47.1 (12.7)	97	46.8 (12.4)	0.4 (−3.0 to 3.7)	0.83
Per protocol analysis						
Physical component score	80	42.3 (10.8)	97	40.8 (11.9)	1.6 (−1.6 to 4.8)	0.33
Mental component score	80	48.5 (11.8)	97	46.8 (12.4)	1.7 (−1.7 to 5.1)	0.33

12

SMOOTH trial

- Multi-center unblended trial of 291 sepsis survivors from 9 German ICUs
  - Excluded cognitive impairment
  - Consented patient and then their PCP
- Usual care provided by PCP: periodic contacts, referral to specialists
- Intervention: PCP and patient training, case management provided by trained nurses, and clinical decision support for PCPs by consultants.
  - Case manager worked with 38-65 patients
  - 60 minute training on sepsis sequelae 8 days after ICU discharge.
  - Monthly telephone contact for 6 months, every three months for 6 months.
    - Monitored symptoms
  - Worked with consulting physicians for clinical decision support
    - Contacted the PCP using a traffic light scheme:
      - Red:: immediate intervention recommended
      - Yellow: intervention should be considered
      - Green: Acceptable clinical status
- Main outcome: Mental health-related quality of life at 6 months after ICU discharge

Schmidt K. JAMA 2016; 315: 2703-2011

13

SMOOTH trial: Results

- 291 patients cared for by 159 intervention PCPs, and 148 control PCPs
- Intervention:
  - 88% of patient received their training
  - 85% of PCPs received their training.
  - gap of 62 days between ICU discharge and PCP training
  - 70.3% of patients received the intervention at a high level of integrity.
  - Major issues: reduced motor function (27%), and pain (27%) rated “red”
- Lost to follow up: 22.7% at 6 months, 28.9% at 12 months
- No difference in mean change MCS scores ay 6 months
  - 3.79 (1.05-6.54) intervention vs. 1.64 (1.22-4.51) control, p = 0.28

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TABLE 1. Overview of Outcomes in Trials Considered for Evaluation of Effectiveness, Significance of Findings, and Study Quality

Author	Study Type	Physical Function	Anxiety	Depression	Posttraumatic Stress Disorder
Inpatient interventions					
Ward-based rehabilitation in acute hospital care					
Somme et al (38)	CCT	–	–	–	–
Outpatient interventions					
Consultation in an ICU follow-up clinic					
Cuthbertson et al (35)	RCT	–	No	No	No
Schandl et al (46)	HCT	–	No	Partly[a]	Yes[a]
Rehabilitation programs/complex aftercare programs					
Jones et al (39)	CCT	Yes	No	No	Partly
Elliott et al (34)	RCT	No	–	–	–
Mixed interventions					
Disease management support service					
Daly et al (42) and Douglas et al (43)	CCT	–	–	–	–
ICU diary (given to patient after ICU discharge)					
Jones et al (36)	RCT	–	–	–	Yes
Garrouste-Orgeas et al (47)	HCT	–	No	No	Yes

Interventions which have substantial effects in post-ICU patients are rare.
Positive effects were seen for ICU-diary interventions for posttraumatic stress disorder.
More interventions for the growing number of ICU survivors are needed.

Mehlhorn J. *Critical Care Medicine* 2014

15

Exercise-based interventions after ICU discharge: Cochrane 2015 review: 6 trials of 483 patients

- Unable to determine an overall effect on functional exercise capacity, or on health-related quality of life, of an exercise-based intervention initiated after ICU discharge for survivors of critical illness.
- Meta-analysis was not appropriate because the number of studies and the quantity of data were insufficient.
- Individual study findings were inconsistent.
- Methodological rigor was lacking across several domains, influencing the quality of the evidence.
- Wide variability was noted in the characteristics of interventions, outcome measures and associated metrics and data reporting.

16

Lack of funding, staff, resources and space

What are the barriers to post-ICU care? (n=164)

Barrier	Frequency reported overall, n (%)
Lack of funding	149 (90.9)
Lack of sufficient staff	128 (78.0)
Resources prioritised to other patient groups/clinical areas	71 (43.3)
Not considered required service at managerial level	66 (40.2)
Lack of available space	50 (30.5)
Insufficient patient numbers to justify	35 (21.3)
Extracontractual (out-of-area) patient caseload	15 (9.1)
Lack of trained staff	13 (7.9)
No evidence	4 (2.4)
Not sure what to include in a programme	2 (1.2)
Other (time constraints)	1 (0.6)

Connolly B. *BMJ Open* 2014

17

BARRIERS FOR ICU FOLLOW UP CLINICS

NO PROOF OF CONCEPT

- ICU and acute care survivors
  - More alike than different
  - Physical, cognitive, mental health, and quality of life impairment common to both
- Maybe post-hospital follow-up isn't ICU specific

NEED TO IDENTIFY ASPECTS OF SURVIVORSHIP UNIQUE TO ICU

Ehlenbach WJ *JAMA* 2009; Davydow DS *Am J Med* 2014; Feemster LC. *Annals ATS* 2014

18

BARRIERS FOR ICU FOLLOW UP CLINICS

NO FUNDING

- Unlikely that clinics will make money
  - May save money if they prevent readmissions
    - 90-day readmissions very common after ICU
      - 46% of survivors of severe sepsis readmitted
    - Early post-discharge care *may* decreased readmits
      - Mixed evidence in geriatrics, surgery

NEED TO PROVIDE EVIDENCE OF VALUE TO STAKEHOLDERS

Prescott HC. JAMA 2015; AHRQ Publication No. 12-05169-EF-1 2012; Brooke BS *JAMA Surg* 2014

19

BARRIERS FOR ICU FOLLOW UP CLINICS

NO STAFF

- Shortage of intensivists and ICU therapists
- May not be best providers for follow-up clinic
  - Intensivists may not be trained in continuity care
  - Proven benefit of ICU therapists *during* critical illness
    - Yet ICUs are often understaffed

NEED TO CONSIDER BEST-SUITED PROVIDERS AND ALTERNATIVE MODELS

20

BARRIERS FOR ICU FOLLOW UP CLINICS

TOO COMPLICATED

- Patients need to follow up with primary care
  - Important to re-establish continuity
  - Post-ICU impairments often began pre-ICU
    - Need continuity to avoid reinventing the wheel
- Multiple specialist follow-up visits common
- Post-ICU follow-up may delay or complicate care

NEED TO INTEGRATE APPROACH WITH PRIMARY AND POST-HOSPITAL CARE

21

BARRIERS FOR ICU FOLLOW UP CLINICS

NO CLINICAL NEED

- Clinics report too few patients, many no-shows
- Patients unable to attend clinic
  - No transport, too ill, ongoing institutionalization, overwhelmed, no resources, no help, fear of return…
- Patients obtaining follow-up care elsewhere
  - Primary, specialty, post-acute care

NEED TO INVESTIGATE NEEDS AND BARRIERS OF PATIENTS WHO DO NOT FOLLOW UP

Modrykamien AM. *Resp Care* 2012

22

BARRIERS FOR ICU FOLLOW UP CLINICS

NO QUICK FIX

- Likely to identify problems with no easy solution
  - Financial hardship
  - Unstable housing
  - Chronic pain
  - Lack of social network, relationship strain
  - Refractory mental illness

NEED TO LEARN IF THERE ARE BENEFITS IN THESE (AND OTHER) TOUGH SITUATIONS

23

BARRIERS FOR ICU FOLLOW UP CLINICS

NOT SCALEABLE

- Most survivors of critical (and acute) illness are cared for in the community
- Models of care dependent on limited resources unlikely to improve public health
  - Specialized therapists, psychologists, intensivists

NEED STRATEGIES FOR BROAD IMPLEMENTATION AND SCREENING OF UNIQUE CARE NEEDS

24

BARRIERS FOR ICU FOLLOW UP CLINICS

NO EVIDENCE

- Do patients benefit?
- Which patients benefit?
- What outcomes are improved?
- What are optimal ingredients, timing and dose?
- Is broad implementation of post-ICU care feasible?
- Is post-ICU care a distinct entity?

NEED TO INCREASE RESEARCH EFFORTS

25

Conclusions

- Improving outcomes after critical illness is a mandate to the critical care community
  - Unknown role for follow-up clinics
  - Education (rehabilitation manuals) and ICU diaries may be a good place to start
- Many barriers to overcome before considering ICU follow up clinics as recommended care
- Research is key
  - Risk stratify patients who benefit from resources
  - Explore additional models of supporting recovery

26

Practical Implementation of PICS Programs

Dina Bates, MD
Scripps Health and
University of California San Diego

Friday, October 4, 2019 – 1:30 p.m. – 2:00 p.m.

Dr. Dina M. Bates received her medical degree from the University of Maryland School of Medicine in 2008. She stayed in Baltimore for another four years to complete her residency in Internal Medicine and a hospitalist year in the Intermediate Care Unit, all at the University of Maryland Medical Center. Dr. Bates then moved across the country to Southern California, where she completed her fellowship in Pulmonary & Critical Care Medicine at UC San Diego Health. Currently, Dr. Bates is on staff at Scripps Mercy Hospital, San Diego.

CALIFORNIA THORACIC SOCIETY
A chapter of the American Thoracic Society

Building a Post-ICU Program

Dina M. Bates, MD
Pulmonary & Critical Care Medicine
Scripps Mercy Hospital
San Diego, CA
October 4, 2019

1

Disclosures

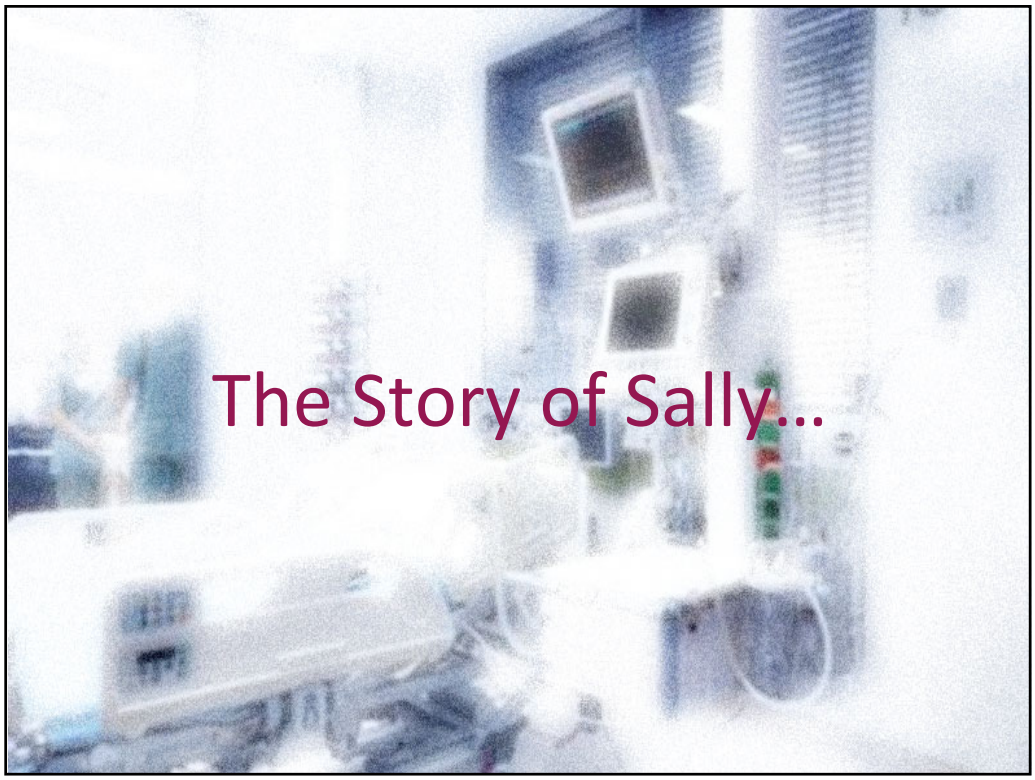
- No conflicts/disclosures

2

Objectives

- Benefits of a Post-ICU Program
- Key Factors
  - Building a team
  - Clinic model
  - Recruitment
    - ICU Diary Program
- Data tracking
- Successes / Challenges
- Summary

3



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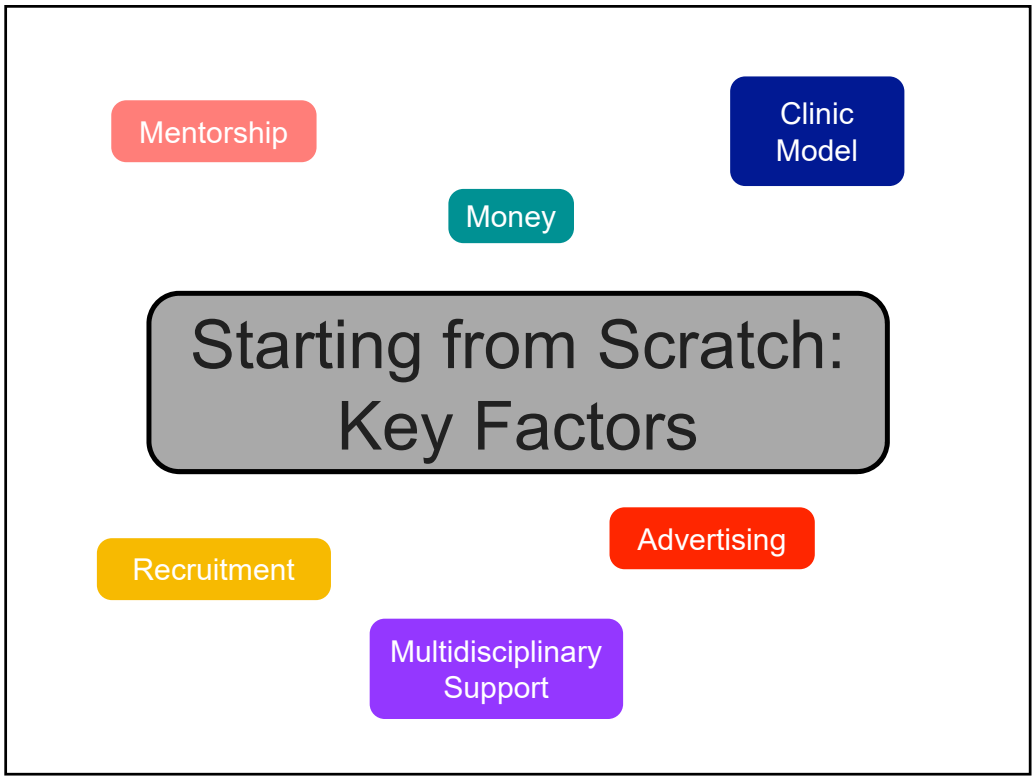
Why start a Post-ICU Program?

- Patients with new comorbidities, new medications, many appointments
  - **Primary care physicians** may be poorly equipped to manage and coordinate post-ICU care
  - **Intensivists** may be best equipped to evaluate these patients post discharge
- Optimize healthcare utilization
  - Reduce readmission rates
- Increase awareness, recognition, and management of **Post-Intensive Care Syndrome (PICS)** and PICS-Family (PICS-F)
  - Decrease sequelae of PICS and PICS-F?
- **Closing the loop**: patient feedback can inform subsequent bedside care
- Reward for the providers
  - Decrease burnout?

5



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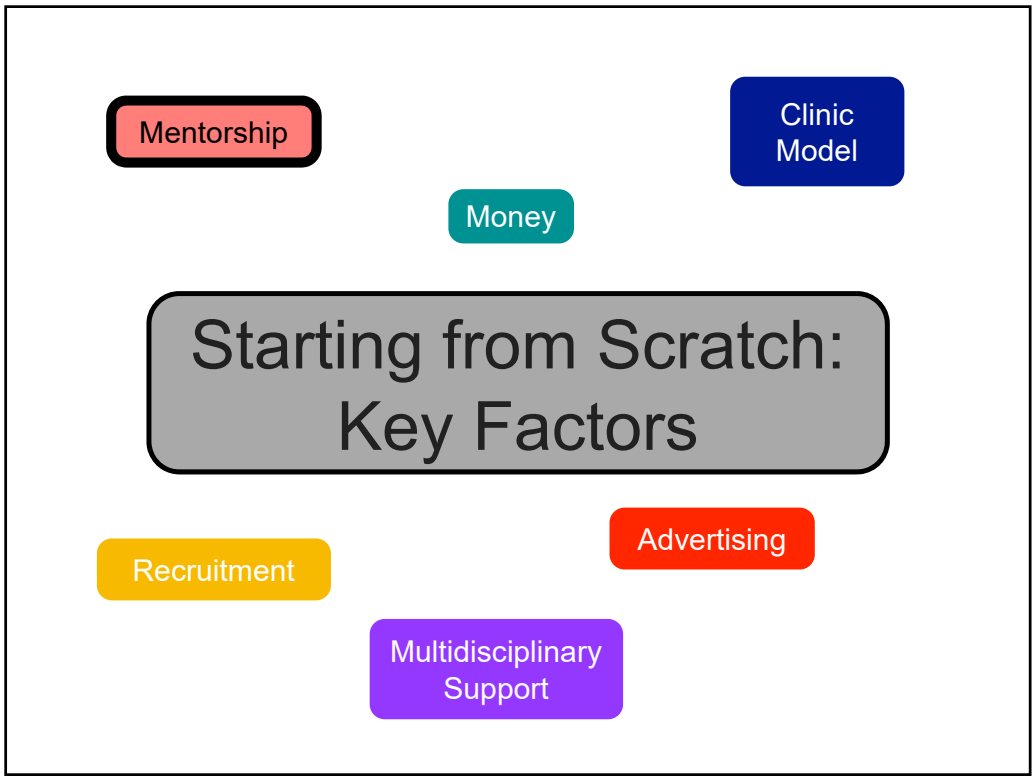

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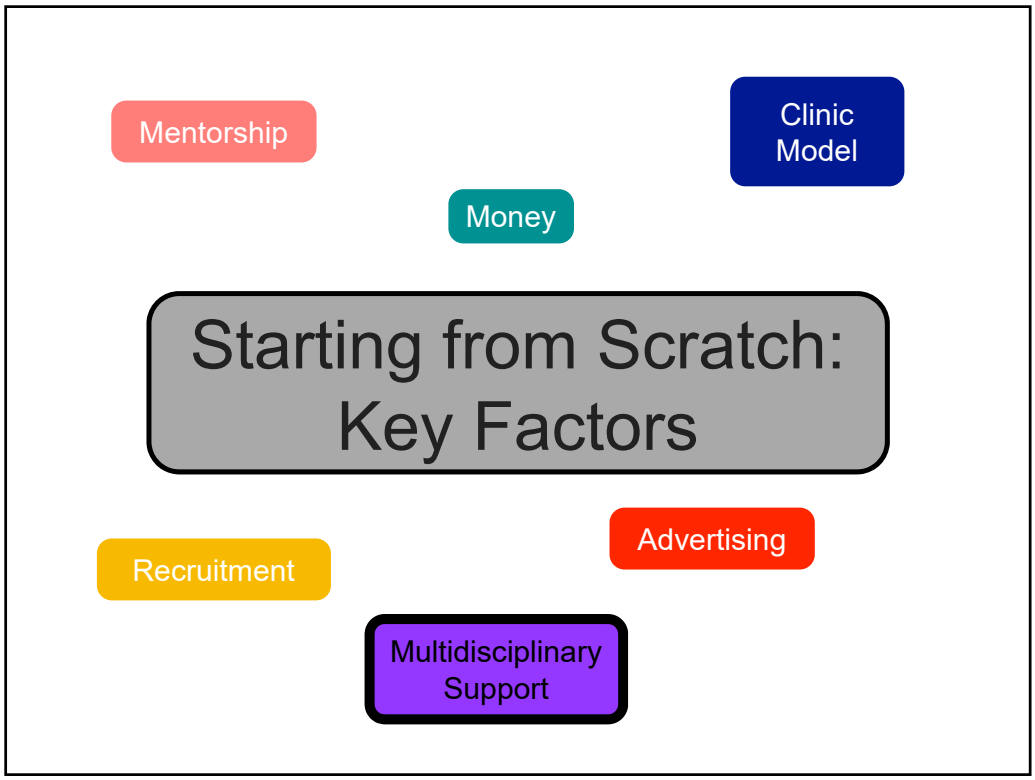
Building your team

- Find a mentor
- Team up with a colleague
- Seek institutional/division support

8



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Multidisciplinary Outreach

- Psychiatry
  - Psychology
    - Neuropsychology
      - Pharmacy
      - Social Work
    - Nutrition
  - Nursing
- PT/OT

10

Multidisciplinary Outreach

- Psychiatry
- **Psychology**
  - Neuropsychology
    - **Pharmacy**
    - Social Work
  - Nutrition
- Nursing
- PT/OT

11

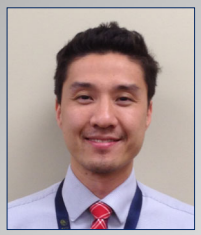
Once you have a team, give it a fancy name!

12

Meet the **ICU Recovery Program** Team!

Dina M. Bates, MD
Assistant Professor
Co-Director, ICU Recovery Program
dbates@ucsd.edu
posticu@ucsd.edu

Emily A. Meier, PhD
Clinical Psychologist
Facilitator, Critical Illness Survivor Support Group



Frank Chu, PharmD
Critical Care Pharmacist
ICU Recovery Clinic

Robert L. Owens, MD
Assistant Professor
Co-Director, ICU Recovery Program

UC San Diego Health System

13

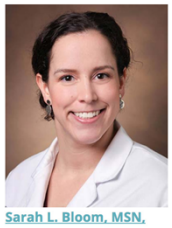
13

The ICU Recovery Center at Vanderbilt

Carla Sevin, MD
ICU Recovery Center Director

James C. Jackson, PsyD
ICU Recovery Center Assistant Director

Joanna L. Stollings, PharmD



Sarah L. Bloom, MSN, AGACNP-BC

Caroline Lassen-Greene, PhD

Olivia Kirkpatrick, MSN, AGACNP

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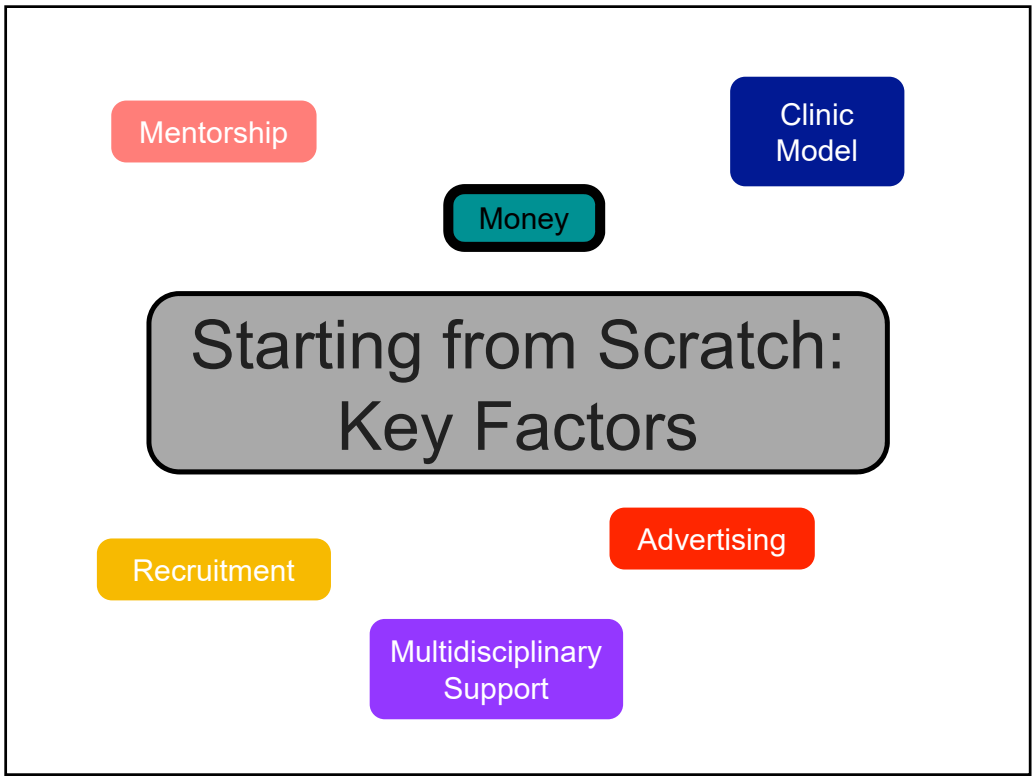

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Gaining momentum

How will your (and your team's) time be **paid**?

- Grants
  - SCCM THRIVE (Peer Support Group)
- Salary Support
  - Faculty Development Award (ICU Diary Project)
- Donations

16

Mentorship

Clinic Model

Money

Starting from Scratch: Key Factors

Advertising

Recruitment

Multidisciplinary Support

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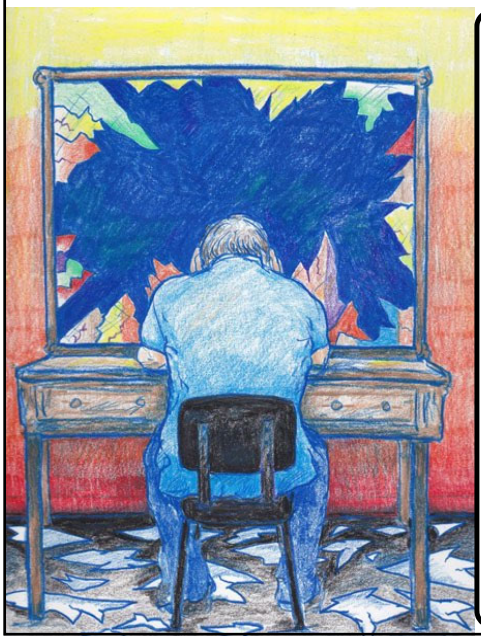
Design your model



PICS Screening

- Cognitive
  - Montreal Cognitive Assessment (MoCA)
- Anxiety
  - Generalized Anxiety Disorder - 7 (GAD-7)
- Depression
  - Patient Health Questionnaire (PHQ-9)
- PTSD
  - Impact of Event Scale, Revised (IES-R)
- Physical Functioning
  - NIH Promis Physical Function - Mobility

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Design your model

1. Medication Reconciliation
   - ICU pharmacist
2. MD evaluation / Plan
   - ICU Diary Debriefing
   - Pulmonary Function Test/6-minute walk test
3. Referrals / Follow-Up
   - 1 month post hospital discharge
   - Every 3 months

- Initial Visit: 90 minutes
- Follow-Up Visit: 45 minutes

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Mentorship

Clinic Model

Money

Starting from Scratch: Key Factors

Advertising

Recruitment

The hardest part!

Multidisciplinary Support

20

Who do you want to target?

Target patient

- Inclusion criteria
- Exclusion criteria

Family members/Caregivers

- Support group
- Include in clinic

21

How do you find them?

- Daily census assessment
- Nursing/MD help
- Utilization of **EMR**
  - Filters
  - Referral order
- ICU presence is mandatory
- Advertising…

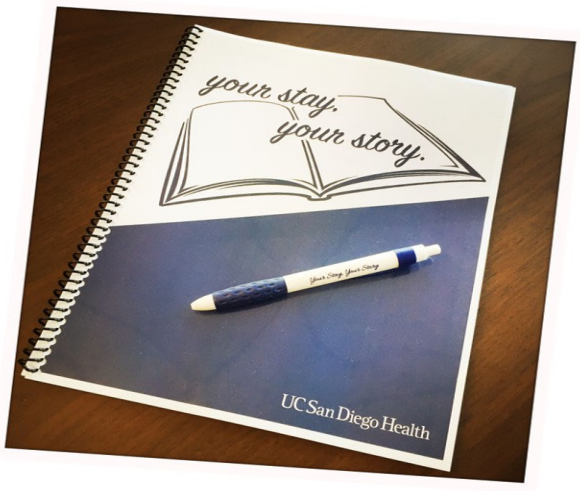
22

Get the word out!

- Website
  - AftertheICU.org (AICU)
- Pamphlets
- Email
- Education of resident/fellows/other departments
- National networking
  - THRIVE Peer Support Collaborative
  - Patient-Centered Outcomes Research Institute (PCORI) Collaborative

23

ICU Diary Pilot Program



- Pioneered and popular in Europe
- Funded collaboration with ICU nurses
- Maintained by families and healthcare providers
- Triggers automatic referral to Post-ICU Clinic

24

Why consider an ICU Diary?

- May benefit **patients** and **families/caregivers**
  - **May decrease symptoms of PTSD**
- Automatic link to your clinic
  - Diary debriefing
- Enhances **communication** and **collaboration** with nurses and healthcare providers
- Incentivizes **THE PATIENTS** to follow-up in clinic
  - Makes the clinic about **THEM!**

25

Critical Illness Survivor Support Group

Society of Critical Care Medicine THRIVE Grant

- Seed money to start a peer support group
- Allowed for psychologist facilitator
- Helped build the program…

(…but too much at once?)

thrive™
ICU PATIENT & FAMILY SUPPORT

26

Organize your data

The clinic generates a large amount of data quickly - make sure you capture it in <u>real time</u>!

- Clinical Electronic Database
- Imperative for future research

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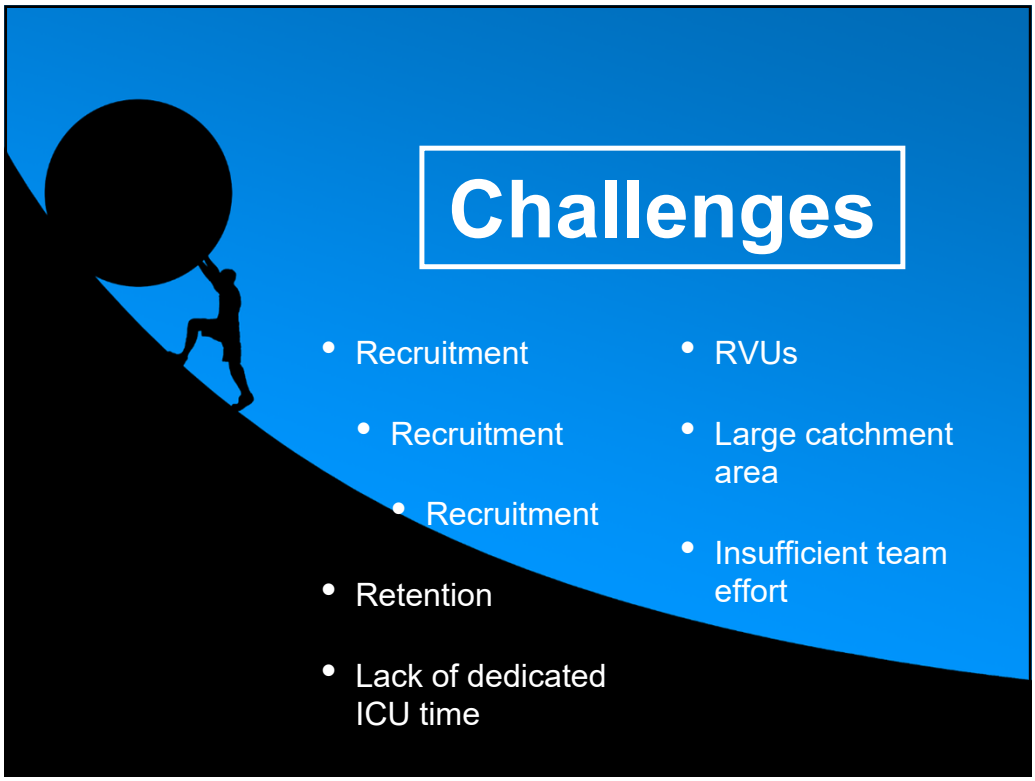

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If I were to do it all over again…

- Team approach
- ICU presence
- Post-ICU consult service
- Dedicated ICU psychologist
- Home visits

30

My advice to you

- Mentorship and team support are key
- **Multidisciplinary diagnosis = multidisciplinary team!!!**
- $$$
- Identify resources and tools to aid with recruitment
  - Approach patient/family before hospital discharge
- Track your data
- Be patient,
  - Be flexible,
    - Be persistent!

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Resources

- AftertheICU.org
- SCCM Thrive: https://www.sccm.org/MyICUCare/THRIVE/Post-intensive-Care-Syndrome
- The ICU Recovery Center at Vanderbilt: https://www.icudelirium.org/the-icu-recovery-center-at-vanderbilt

33

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References

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Thank you!

Contact me:
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516.297.7971

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BREAK AND EXHIBITS

Friday, October 4, 2019 – 2:00 p.m. – 2:20 p.m.

ICU Burnout – Part I: ICU Burnout and Organizational Solutions

Marc Moss, MD
University of Colorado and past-ATS President

Friday, October 4, 2019 – 2:20 p.m. – 2:50 p.m.

Marc Moss is the Roger S. Mitchell Professor of Medicine, Vice Chair of Clinical Research for the Department of Medicine, and Interim Head of the Division of Pulmonary Sciences and Critical Care Medicine at the University of Colorado School of Medicine. Dr. Moss has a longstanding interest in critical care-related research and he has held continuous NIH funding as a Principal Investigator for over 19 consecutive years. More specifically, Dr. Moss's research interests include identifying new treatment modalities for patients with the Acute Respiratory Distress Syndrome (ARDS), exploring the diagnosis and treatment of neuromuscular dysfunction in critically ill patients who require mechanical ventilation, and studying burnout syndrome, posttraumatic stress disorder, and wellness in critical care healthcare professionals, specifically ICU nurses. Dr. Moss' research on wellness is funded by the NIH and he recently received funding from the National Endowment of the Arts. Dr. Moss is the principal investigator for the Colorado center in the NHLBI sponsored Prevention and Early Treatment of Acute Lung Injury (PETAL) network. Based on his expertise in clinical/translational research and mentoring, Dr. Moss served as the Program Director for the Education, Training, and Career Development Core of the Colorado Clinical Translational Sciences Institute (CCTSI) from 2008-2016. More recently, he served as the President of the American Thoracic Society from 2017-2018.

ICU Burnout – Part I: ICU Burnout and Organizational Solutions

Marc Moss, M.D.
Roger S. Mitchell Professor of Medicine
Interim Head
Division of Pulmonary Sciences
& Critical Care Medicine
University of Colorado School of Medicine

1

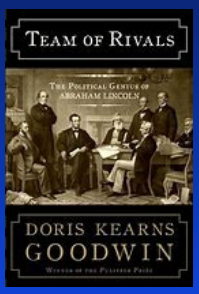
Disclosures and Caveats to the Talk

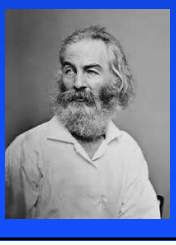
- The following relationships with commercial interests related to this presentation existed during the past 12 months: None
- Research funded by NIH-NCCIH and the National Endowment of the Arts
- Will integrate information about
  - Nurses and doctors
  - Trainees and attendings
  - Critical care and all types of medicine

2

Healthcare professionals always exposed to difficult experiences

- Walt Whitman and Louisa May Alcott
  - Volunteer nurses at army hospital during Civil War
- Whitman: "Feel sick and actually tremble at night, recalling the deaths, operations, and sickening wounds (perhaps full of maggots)."
- Alcott: "Found it difficult from weeping at the sight of several stretchers, each with its legless, armless, or desperately wounded occupants".



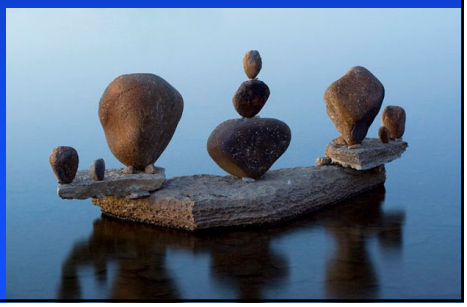


3

Is our profession out of balance?

"With altruistic intent, healthcare professionals may place professional responsibilities above personal responsibilities. Though admired, this may be self-defeating in the long run."

"Role models range from academic superstars with impressive research credentials and international acclaim to committed clinician-teachers who are at the hospital seven days a week…their heroes lead lives that are desperately out of balance."



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Changing healthcare paradigm: What happened?

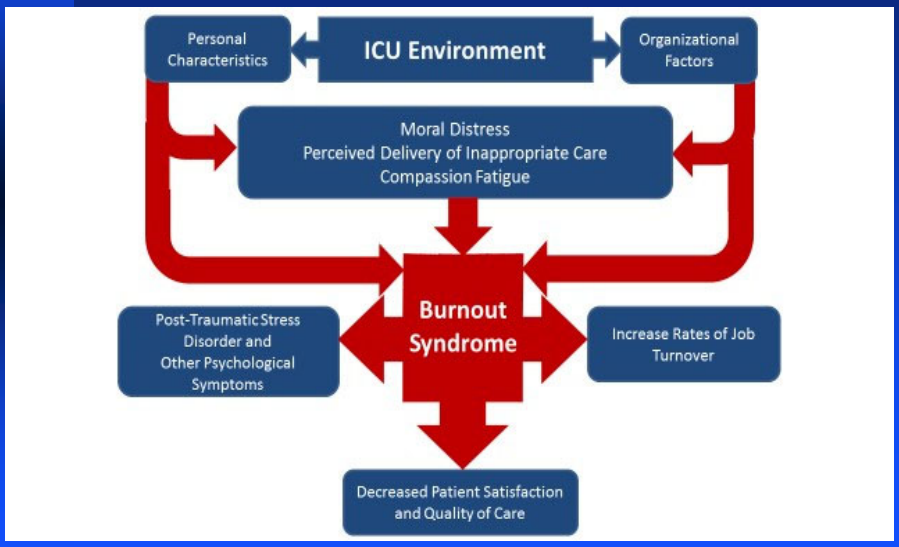
- Less autonomy in work
  - Increase focus on documentation
  - Increase shift work
- Focus on quality measures and cost issues
- Patients are sicker
  - More chronic diseases and critical illness
- Increased patient/family expectations
- Decreased patient trust
  - 1966: 73% Americans has great confidence in medical profession
  - 2012: decreased to 34%

<u>Added stress in academic centers:</u>

- Decreased research funding
- Resident work hour limitations

5

Conceptual Model of Psychological Distress in Healthcare



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Burnout Syndrome (BOS)

- Discrepancy between:
  - Employee expectations and ideals
  - The actual requirements of the position
- Work-related problem
  - Do not start a job with symptoms of burnout
  - Occurs gradually over time
- Best and idealistic employees
  - No prior psych history
  - Ones who care
  - Want to help people

7

Core Components of BOS

- 1. Emotional Exhaustion
  - Devoting excessive time and effort to a task that is not perceived to be beneficial
  - Continuing to care for a patient who has a poor chance of recovery
- 2. Depersonalization
  - Attempt to put distance between oneself and patients/families
  - Dismiss human qualities
  - Negative, callous, cynical, inability to express empathy or grief when a patient dies
- 3. Reduced personal accomplishment
  - Negatively evaluate the worth of one's work
  - Feeling insufficient about abilities

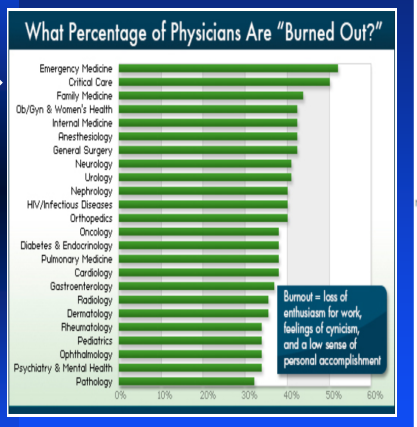
8

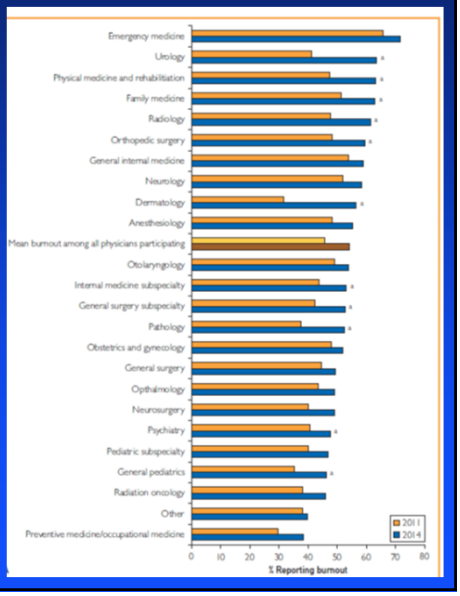
How common is burnout in healthcare professionals?

"The people we rely on to keep us healthy may not be healthy themselves." National Academy of Medicine

9

Critical Care Physicians: Among Highest Burnout Rates





Medscape survey 2013

10

Consequences of Burnout
1. Individual Level

"When burnout was seen as a crisis of wellbeing – affecting healthcare workers personal lives and work satisfaction – it garnered little public sympathy and could be dismissed as the whining of the privileged class"

Epstein and Privieria: Lancet 2016

11

M*A*S*H Video: January 14, 1980
Season 8; Episode 17

12

Post Traumatic Stress Disorder

- Most common psychopathological consequence of trauma
  - Physical/sexual assaults, accidents/disasters
- Acute or chronic exposure
- Direct or indirect trauma
  - Direct events: Verbal abuse from patients, families, or other healthcare workers.

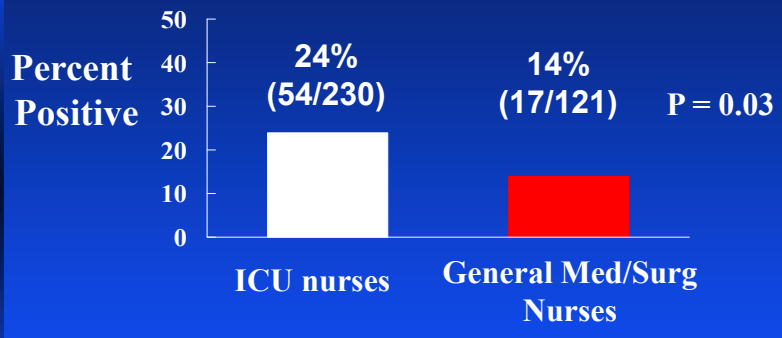
"Speak Up" Merrill DG, JAMA 2017; 317: 2373-4

  - Indirect events: Seeing patients die, performing CPR, massive bleeding, and performing post-mortem care

Shalev, Liberizon, Marmar N Engl J Med 2017; 376:2459-2469.

13

Symptoms of PTSD

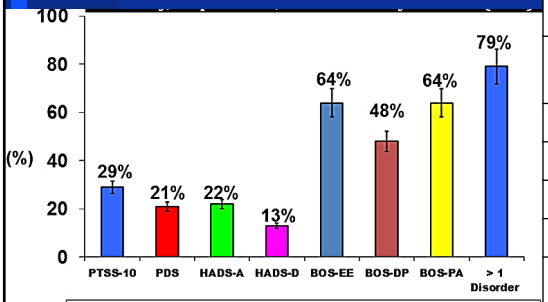


Adjusting for primary hospital, gender, marital status, primary shift, primary responsibility for household income

Being an ICU nurse remained associated with symptoms of PTSD
P = 0.02, OR = 1.45, 95% CI = 1.24-1.72

14

Prevalence of Disorders in ICU Nurses



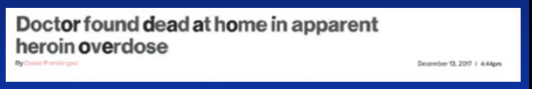
PTSS-10: PTSD symptoms, PDS: PTSD diagnosis, HADS-A: anxiety symptoms, HADS-D: depressive symptoms, BOS-EE: emotional exhaustion, BOS-DP: depersonalization, BOS-PA: personal accomplishment

Post-mortem care
Seeing patients die and involvement with end of life care
Combative patients
Verbal abuse from family members, physicians, and other nurses
Open surgical wounds
Massive bleeding
Trauma related injuries
Performing "futile" care to patients
Performing cardiopulmonary resuscitation
Stress related to feeling over-extended due to inadequate nurse to patient ratios
Stress related to not being able to save a specific patient

15

Other Major Consequences

- Survey of 3500 physicians
  - Due to their choice of profession
    - Workload was too heavy (62%)
    - Family/personal life have suffered (55%)
- Divorce
- Broken relationships
- Substance abuse
- Suicide
  - 400 physicians annually: more than double the general population.


Doctor found dead at home in apparent heroin overdose


Doctor who killed himself at Froedtert had struggled with depression, relationships


The NEW ENGLAND JOURNAL of MEDICINE

Perspective

Kathryn

16

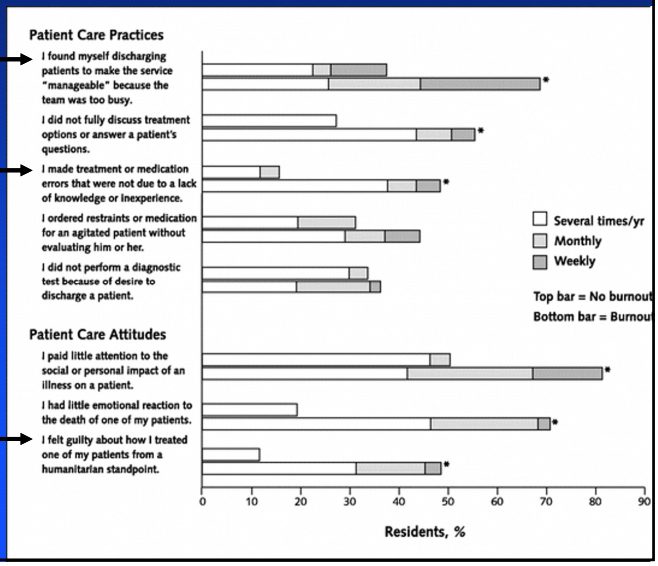
BOS effect on patient care: Diuresing your service?

115 internal medicine residents

Anonymous mailed survey
Questions about patient care practices

Stratified by MBI score: 76% met burnout criteria

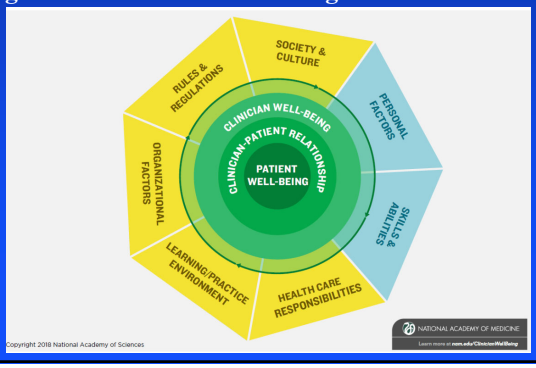
Ann Intern Med 2002; 136: 358-367



17

Different Potential Solutions?

- Address the work environment
  - Shortening length of rotations
  - Changes in workflow: increased time for visits, scribes, voice recognition
  - Improved communication: meetings with hospital leadership,
- Individual-focused interventions
  - Educational curriculum
  - Stress management and self-care training



18

Interventions to prevent and reduce physician burnout: a systematic review and meta-analysis

Colin PWest, Liselotte N Dyrbye, Patricia J Erwin, Tait D Shanafelt

JAMA Internal Medicine | Original Investigation | PHYSICIAN WORK ENVIRONMENT AND WELL-BEING

Controlled Interventions to Reduce Burnout in Physicians
A Systematic Review and Meta-analysis

Maria Panagioti, PhD; Efharis Panagopoulou, PhD; Peter Bower, PhD; George Lewith, MD; Evangelos Kontopantelis, PhD; Carolyn Chew-Graham, MD; Shoba Dawson, PhD; Harm van Marwijk, MD; Keith Geraghty, PhD; Aneez Esmail, MD

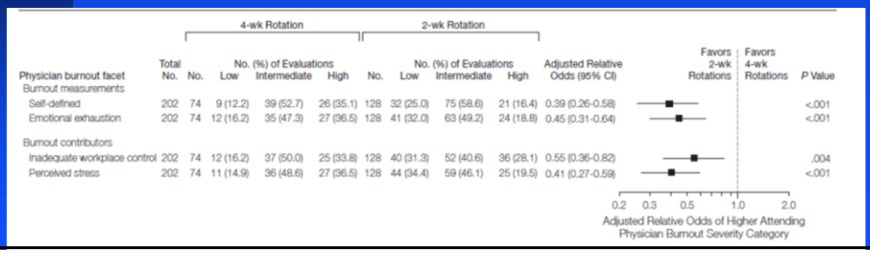
- **Lancet meta-analysis: Nov 2016**
  - **Individual-focused and organizational strategies can result in clinically meaningful reductions in BOS among physicians.**
- **JAMA Internal Medicine meta-analysis: Dec 2016**
  - **Intervention programs were associated with small benefits to reduce physician BOS.**
    - **Boosted by adoption of organization-directed approaches**

19

Duration of attending inpatient rotation

- **RCT of 2 vs 4 week inpatient internal medicine ward**
- **8892 patients cared for during study**
  - **2 week vs. 4 week rotations:**
    - **21.2% vs. 21.5% unplanned revisits (p = 0.97)**
    - **41% vs. 28% rated "less than perfect" by trainees (OR = 2.10)**
    - **82% vs. 69% rated "less than perfect" by medical students (OR = 1.41)**
    - **16% vs 35% reported higher scores on burnout severity**
    - **19% vs. 37% reported higher scores on emotional exhaustion**

JAMA 2012; 308: 2199-2207.



20

Intensivist Staffing Model RCT

- 5 MICU in four academic hospitals with ½ month rotations
- 45 intensivists
  - Continuous schedule (CS): work 15 days in a row
  - Interrupted schedule (IS): weekend coverage by another intensivist
  - Each site conducted the study for 9 months:
    - CS-IS-CS or IS-CS-IS
- Outcomes:
  - 1,900 patients: Hospital LOS and mortality were not different
  - Higher BOS, work-home life imbalance and job distress with CS

Am J Respir Crit Care Med 2011; 184: 803-808

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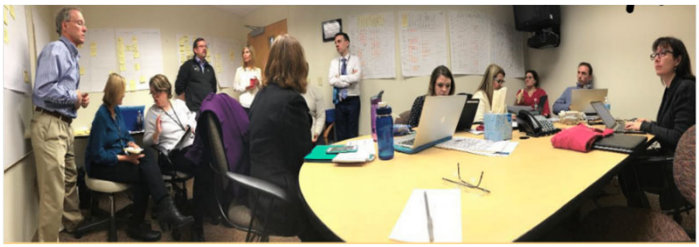
What is Sprint?

- Two weeks of intensive **re-education** and training on EPIC tools and updates
- Workflow **observation** (and improvement as directed by clinical leaders)
- EPIC *Ambulatory* **build** to optimize clinician efficiency
- Positive role modeling of **team work**



uchealth

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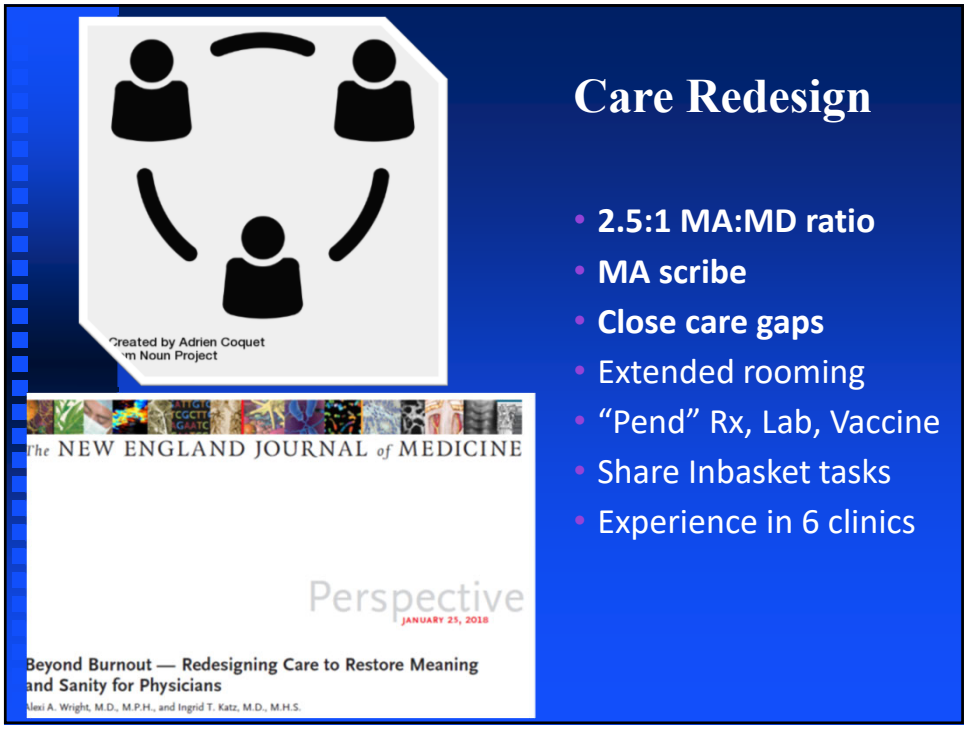
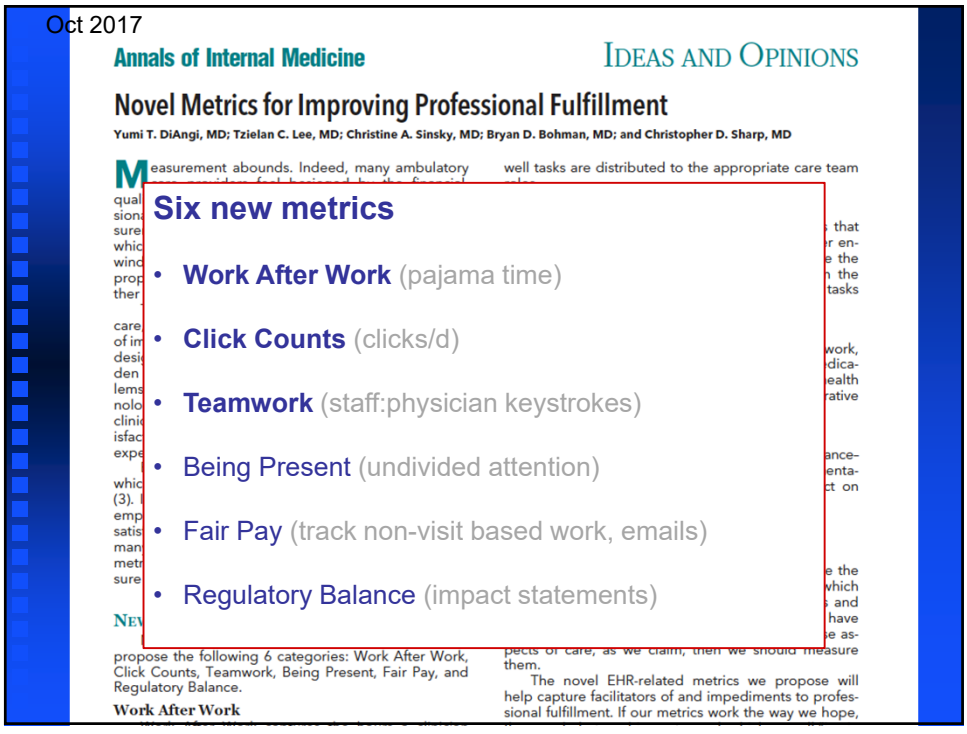

Created by Adrien Coquet
m Noun Project
The NEW ENGLAND JOURNAL of MEDICINE
Perspective
JANUARY 25, 2018
Beyond Burnout — Redesigning Care to Restore Meaning and Sanity for Physicians
Alexi A. Wright, M.D., M.P.H., and Ingrid T. Katz, M.D., M.H.S.
Care Redesign
2.5:1 MA:MD ratio
MA scribe
Close care gaps
Extended rooming
"Pend" Rx, Lab, Vaccine
Share Inbasket tasks
Experience in 6 clinics

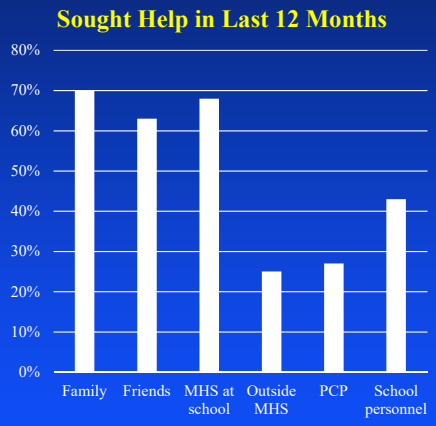
23


Oct 2017
Annals of Internal Medicine
IDEAS AND OPINIONS
Novel Metrics for Improving Professional Fulfillment
Yumi T. DiAngi, MD; Tzielan C. Lee, MD; Christine A. Sinsky, MD; Bryan D. Bohman, MD; and Christopher D. Sharp, MD
Six new metrics
Work After Work (pajama time)
Click Counts (clicks/d)
Teamwork (staff:physician keystrokes)
Being Present (undivided attention)
Fair Pay (track non-visit based work, emails)
Regulatory Balance (impact statements)
propose the following 6 categories: Work After Work, Click Counts, Teamwork, Being Present, Fair Pay, and Regulatory Balance.
Work After Work
well tasks are distributed to the appropriate care team
them.
The novel EHR-related metrics we propose will help capture facilitators of and impediments to professional fulfillment. If our metrics work the way we hope,

24

Barriers to implementation: Requires a Culture Change

- Survey of medical students at 6 schools
  - 52% had symptoms of burnout (454/873)
    - 33% sought help in last 12 months: (154/454)



Academic Medicine 2015; 90: 961-969

25

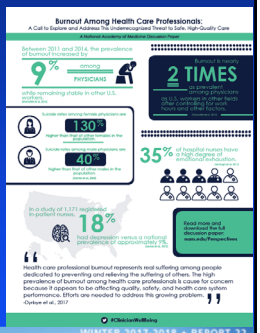
Barriers to implementation: Stigma/Labelling/Discrimination

Item	No. (% of 873)[a]				
	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
It is a sign of personal weakness or inadequacy to receive treatment for emotional or mental health problems.	315 (36.2)	376 (43.2)	89 (10.2)	68 (7.8)	22 (2.5)
Residency directors would pass over my application if they were aware I had an emotional/mental health problem (e.g., depression, anxiety).	26 (3.0)	141 (16.2)	267 (30.6)	342 (39.2)	97 (11.1)
My supervisors (e.g., faculty, residents, deans) would see me in a less favorable way if they believed that I had an emotional/mental health problem.	37 (4.2)	177 (20.3)	193 (22.1)	380 (43.5)	86 (9.9)
Fellow students would see me in a less favorable way if they came to know that I had received treatment for emotional/mental health problems.	32 (3.7)	204 (23.4)	191 (21.9)	344 (39.5)	100 (11.5)
Patients would not want me as their doctor if they were aware I had received treatment for an emotional/mental health problem.	28 (3.2)	193 (22.2)	246 (28.2)	344 (39.5)	60 (6.9)
Mental health care provided by my school/affiliated institution to medical students is truly confidential.	55 (6.4)	124 (14.3)	238 (27.5)	332 (38.3)	117 (13.5)
The dean at my medical school could access my personal medical record if he or she wished to do so.	212 (24.3)	291 (33.4)	143 (16.4)	154 (17.7)	72 (8.3)
Residency program directors at the institution associated with my medical school could access my personal medical record if they wished to do so.	244 (27.9)	314 (36.0)	136 (15.6)	127 (14.5)	52 (6.0)
If I sought care for an emotional/mental health problem it might end up in my academic record.	190 (21.9)	352 (40.5)	155 (17.8)	147 (16.9)	25 (2.9)
If I were to receive treatment for an emotional/mental health problem, I would hide it from people.	12 (1.4)	111 (12.7)	210 (24.1)	417 (47.8)	123 (14.1)

26

At a tipping point?

- National Academy of Medicine:
  - Building a collaborative platform to support and improve clinician well-being and resilience
- Association of American Medical Colleges (AAMC)
  - Breaking the "Culture of Silence"
- AMA, Blue Ridge Group, IHI
  - Well-Being Initiatives
- In a first for U.S. academic medical center, Stanford Medicine hires chief physician wellness officer



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Acknowledgements

All the ICU nurses who participated in our research studies.

Emory University:
Barbara Rothbaum, PhD.

•University of Colorado Denver
•Meredith Mealer, Ph.D.
•David Conrad, MSW
•Rachel Hodapp, MSW

•University of Colorado Boulder
•Sona Dimidjian, Ph.D.

University of Colorado Hospital
Colleen Goode, RN, CNO
Carolyn Sanders, RN, CNO

University of Toronto
Zindel Segal, Ph.D.

Critical Care Societies Collaborative (CCSC)
Curt Sessler, MD
Ruth Kleinpell, Ph.D.
Vicki Goode, RN
David Gozal, MD

NCCIH
AACN

AMERICAN ASSOCIATION of CRITICAL-CARE NURSES

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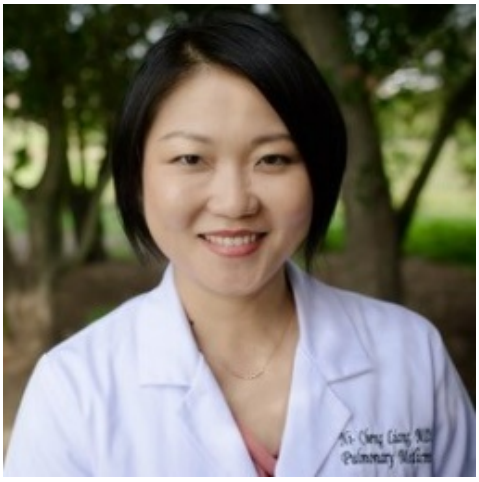
ICU Burnout – Part II: Individual Factors Related to Healthcare Professional Burnout



Ni-Cheng Liang, MD
Coastal Pulmonary Associates
and
University of California San Diego

Friday, October 4, 2019 – 2:50 p.m. – 3:20 p.m.

Dr. Ni-Cheng Liang is the Director of Pulmonary Integrative Medicine at Coastal Pulmonary Associates affiliated with the Scripps Health Network. She also serves as a Voluntary Assistant Professor of Medicine at the University of California San Diego School of Medicine while volunteering for the UCSD Student-Run Free Clinic for underserved patients. She is passionate about promoting healthcare professional wellness, and has developed curricula while teaching mindfulness to patients, healthcare administrators, professionals and their students. She has given local, regional, and national experiential presentations on physician wellness and mindfulness since 2012, and most recently for the 2019 American Thoracic Society International Conference. She was awarded the 2019 American Lung Association San Diego Lung Health Provider of the Year and Outstanding Mothers Award.

ICU Burnout – Part II: Individual Factors Related to Healthcare Professional Burnout

By Ni-Cheng Liang, MD
Director of Pulmonary Integrative Medicine
Coastal Pulmonary Associates
Scripps Health Partner
Voluntary Assistant Professor of Medicine
UC San Diego School of Medicine

Scripps
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Conflicts of interest:
CEO of Ni-Cheng Liang, M.D., Inc

2

31 y.o. female physician…

What are her risk factors for burnout?

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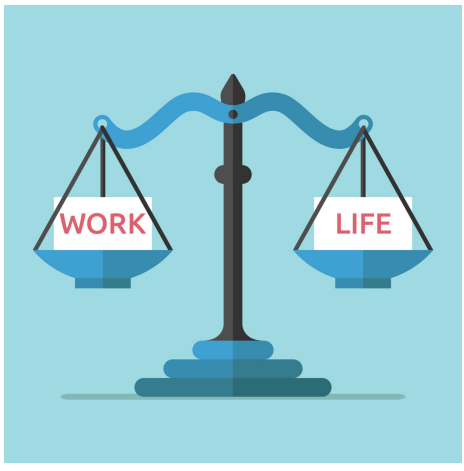
3

Nailed it!



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World Medical Association Declaration of Geneva

The Physician's Pledge

Adopted by the 2nd General Assembly of the World Medical Association, Geneva, Switzerland, September 1948
and amended by the 22nd World Medical Assembly, Sydney, Australia, August 1968
and the 35th World Medical Assembly, Venice, Italy, October 1983
and the 46th WMA General Assembly, Stockholm, Sweden, September 1994
and editorially revised by the 170th WMA Council Session, Divonne-les-Bains, France, May 2005
and the 173rd WMA Council Session, Divonne-les-Bains, France, May 2006
and the WMA General Assembly, Chicago, United States, October 2017

AS A MEMBER OF THE MEDICAL PROFESSION:

I WILL ATTEND TO my own health, well-being, and abilities in order to provide care of the highest standard;

I WILL NOT PERMIT considerations of age, disease or disability, creed, ethnic origin, gender, nationality, political affiliation, race, sexual orientation, social standing, or any other factor to intervene between my duty and my patient;

I WILL RESPECT the secrets that are confided in me, even after the patient has died;

I WILL PRACTISE my profession with conscience and dignity and in accordance with good medical practice;

I WILL FOSTER the honour and noble traditions of the medical profession;

I WILL GIVE to my teachers, colleagues, and students the respect and gratitude that is their due;

I WILL SHARE my medical knowledge for the benefit of the patient and the advancement of healthcare;

I WILL ATTEND TO my own health, well-being, and abilities in order to provide care of the highest standard;

I WILL NOT USE my medical knowledge to violate human rights and civil liberties, even under threat;

I MAKE THESE PROMISES solemnly, freely, and upon my honour.

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Medscape

National Physician Burnout, Depression & Suicide Report

2019

ⓘ If you are suicidal and need emergency help, call **911** immediately or **1-800-273-8255**.

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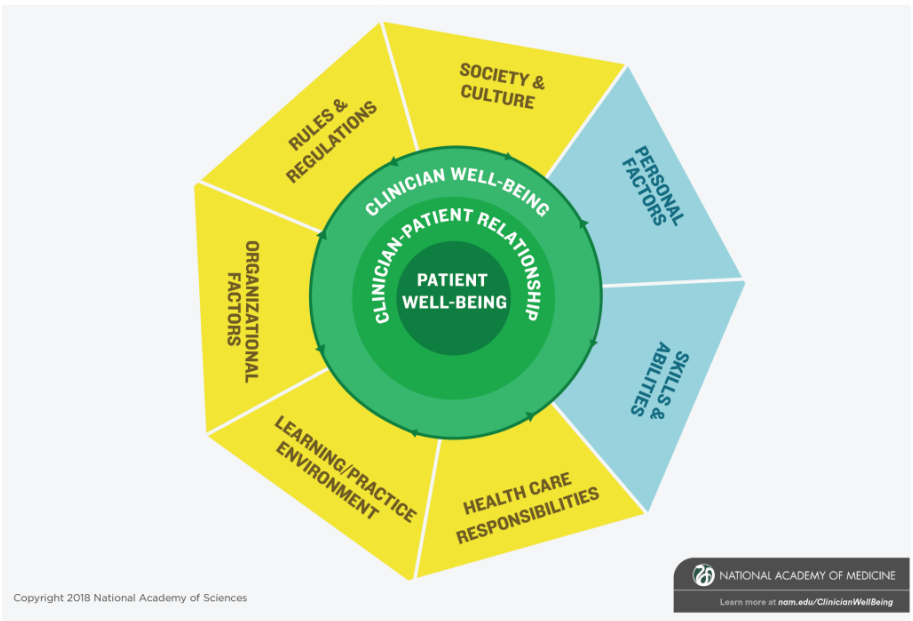
6

”The system is what needs to change so we can promote thriving and well-being for our healthcare professionals.”

-Lotte Dyrbye, MD MHPE

7



8

What affects clinician well-being and resilience?

INDIVIDUAL FACTORS

PERSONAL FACTORS

- Access to a personal mentor
- Inclusion and connectivity
- Family dynamics
- Financial stressors/economic vitality
- Flexibility and ability to respond to change
- Level of engagement/connection to meaning and purpose in work
- Personality traits
- Personal values, ethics and morals
- Physical, mental, and spiritual well-being
- Relationships and social support
- Sense of meaning
- Work-life integration

SKILLS & ABILITIES

- Clinical Competency level/experience
- Communication skills
- Coping skills
- Delegation
- Empathy
- Management and leadership
- Mastering new technologies or proficient use of technology
- Optimizing work flow
- Organizational skills
- Resilience skills/practices
- Teamwork skills

NATIONAL ACADEMY OF MEDICINE
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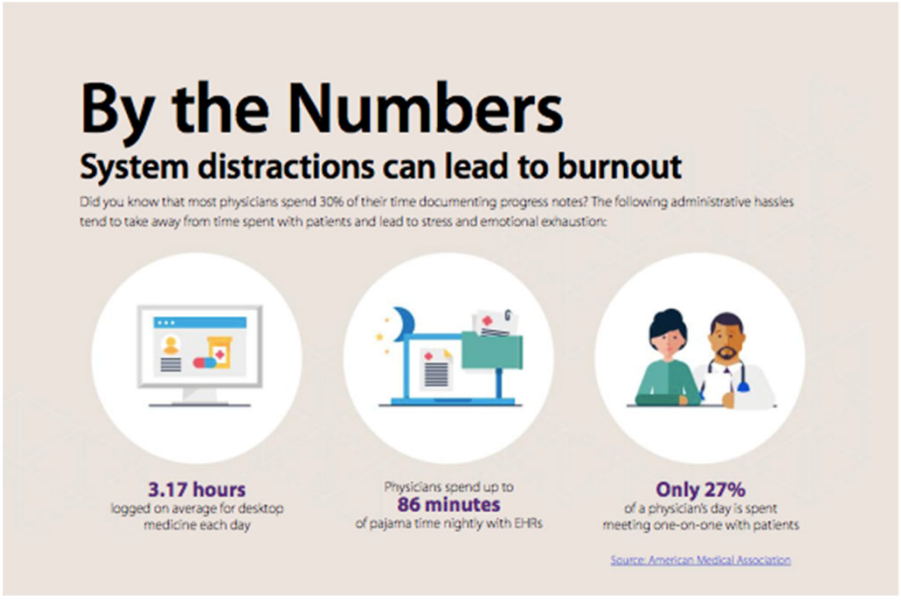

AMA Moving Medicine Summer 2019

10

AMERICAN THORACIC SOCIETY DOCUMENTS

A Critical Care Societies Collaborative Statement: Burnout Syndrome in Critical Care Health-care Professionals

A Call for Action

Marc Moss, Vicki S. Good, David Gozal, Ruth Kleinpell, and Curtis N. Sessler

THIS OFFICIAL STATEMENT OF THE AMERICAN ASSOCIATION OF CRITICAL-CARE NURSES (AACN), THE AMERICAN COLLEGE OF CHEST PHYSICIANS (CHEST), THE AMERICAN THORACIC SOCIETY (ATS), AND THE SOCIETY OF CRITICAL CARE MEDICINE (SCCM) WAS APPROVED BY THE AACN, SEPTEMBER 2015; CHEST, OCTOBER 2015; THE ATS, NOVEMBER 2015; AND THE SCCM, SEPTEMBER 2015

AJRCCM Volume 194
Number 1
July 1 2016

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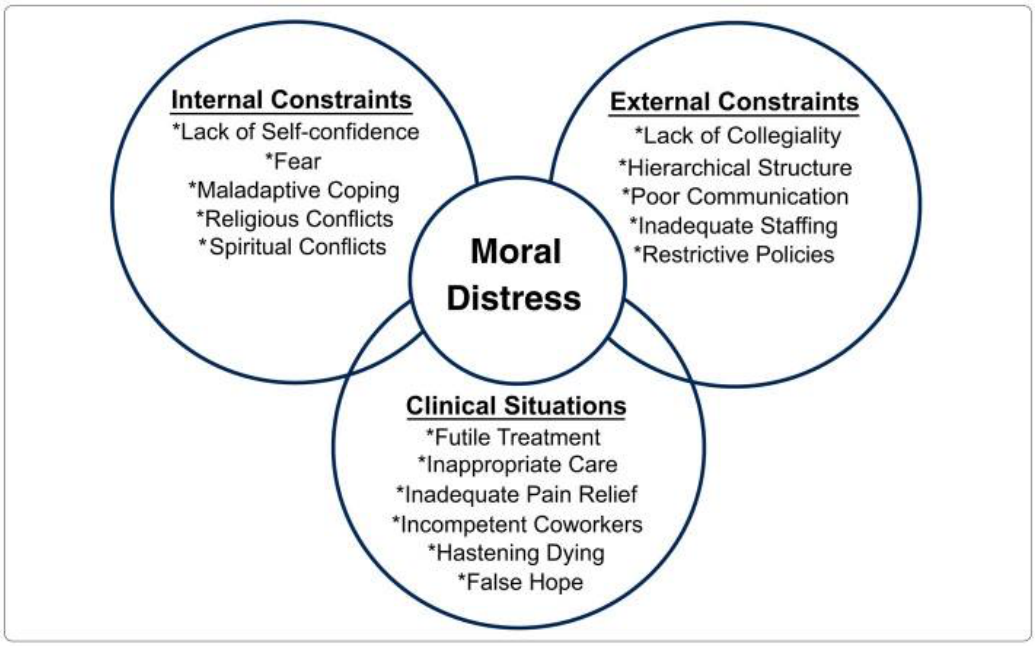

Mealer, M.&Moss, M. Intensive Care Med (2016) 42: 1615.
https://doi.org/10.1007/s00134-016-4441-1

12

Table 2. Potential Interventions to Prevent and Treat Burnout Syndrome in the ICU

Environmental interventions
• Promoting healthy work environment
Communication training; appropriate staffing; meaningful recognition
• ICU self-scheduling/time off
• Limit the maximum number of days worked consecutively
• Support groups
• Cognitive-behavioral therapy
Team-based interventions
• Team debriefings
• Use of structured communication tools
• Team-building and interpersonal skills training
Practitioner-focused interventions
• Stress reduction training
• Relaxation techniques
• Time management
• Assertiveness training
• Meditation
• Work-life balance measures: hobbies, family, and social activities
• Self-care measures: ensuring adequate rest, exercise, healthy eating habits
Interventions to mitigate risk factors
• Palliative care consultations
• Ethics consultations
• Establishing goals of care for every ICU patient
• Family care conferencing within 72 h of ICU admission

AJRCCM Volume 194
Number 1
July 1 2016

DrNi-ChengLiang

13

Personal Factors that Affect Burnout

- Unbalanced work-life integration
- Career fit/Career stage
- Demographics with increased risk
- Relationships and social support

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What do you do for your well-being?

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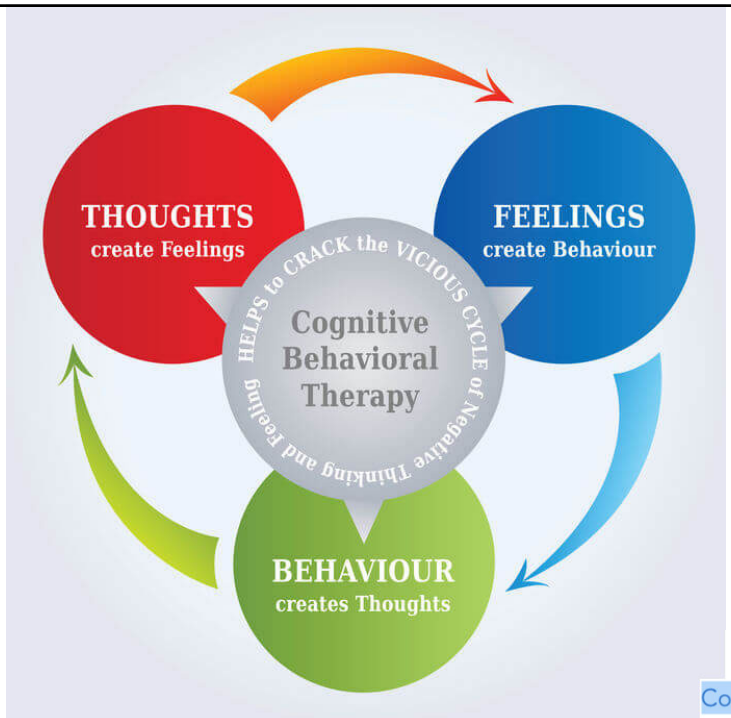

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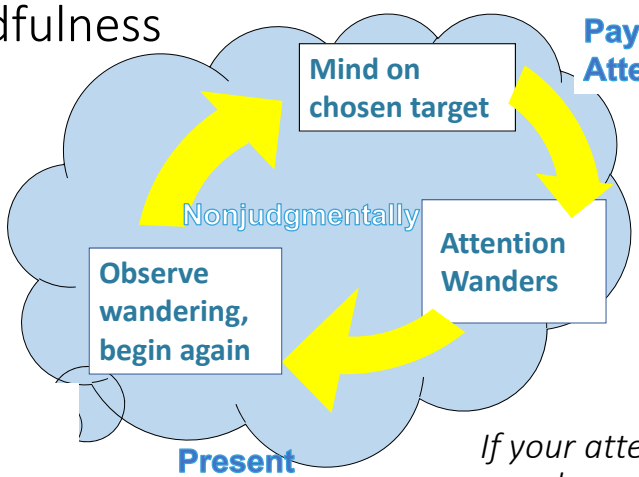
Practicing Mindfulness



If your attention wanders a hundred times, simply bring it back a hundred times.

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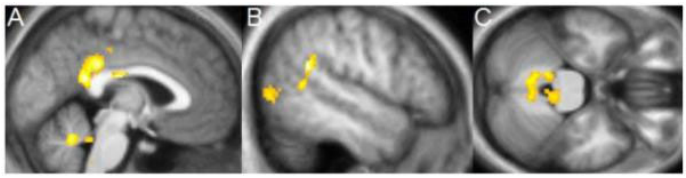
Structural brain changes with mindfulness practice!



Increased gray matter:

- Left hippocampus
- Temporo-parietal junction

Compassion and empathy

Decreased gray matter:

- Amygdala

Fight or flight

Hölzel BK, Carmody J, Vangel M, et al. Mindfulness practice leads to increases in regional brain gray matter density. Psychiatry Res. 2011; 191(1):36-43.

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Mindfulness Training Reduces Burnout in ICU Healthcare Workers

- N= 32, intensivists, nurses, nursing assistants
- Mindfulness workshop
- 8-week training program with specifically designed short guided practices supported by a virtual community based on a WhatsApp group
- A weekly proposal in audio and text format and daily reminders with stimulating messages of practice
- Results: decrease in emotional exhaustion and an increase in self-compassion

@DrNi-ChengLiang

Med Intensiva. 2019 May;43(4):207-216.

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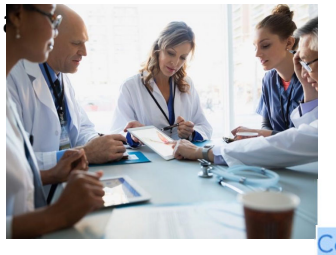
19

Small-Group Curriculum Reduces Burnout

- 19 biweekly discussion groups: mindfulness, reflection, shared experience, learning for 9 months
- PROTECTED TIME: 1 hour of PAID time every other week
- Improvements in meaning, engagement, and reduced depersonalization
- Sustained results for 1 year



DrNi-ChengLiang

JAMA Intern Med. 2014 Apr;174(4):527-33.

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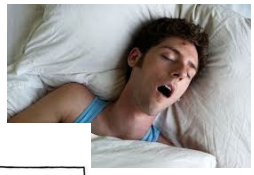
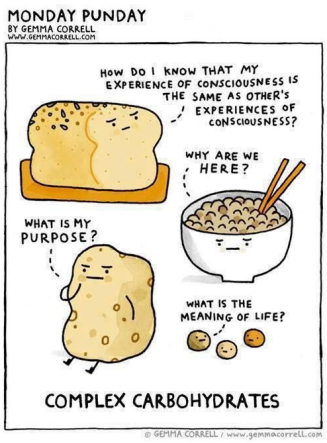
Increase Resilience: Prioritize your health





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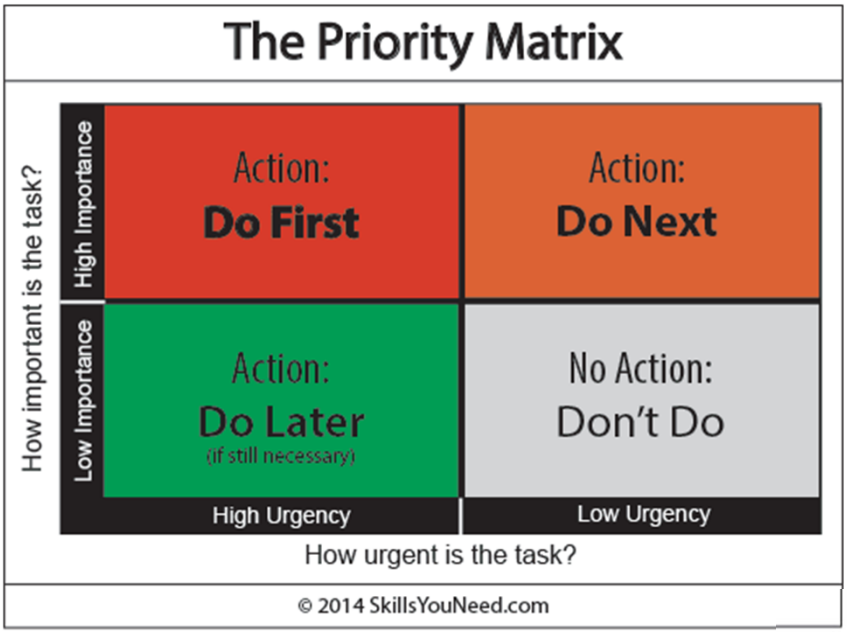

http://www.skillsyouneed.com/ps/time-management.html

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10 Item Zero Burnout Survey (Mini-Z)

- Via AMA
- Extra-curricular meetings (5-6pm)→ sending home physicians with a meal for themselves and their family
- Getting rid of the stigma
  - The mental health of healthcare professionals
- Exposure to the humanities
  - UNMC orchestra
  - Acapella group

AMA Moving Medicine Magazine Summer 2019

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The AMA STEPS Forward™ collection of practice improvement strategies offer expert-driven guidance that allow physicians and their staff to successfully implement meaningful and transformative change in their practice. The modules can help prevent physician burnout, create the Organizational Foundation for Joy in Medicine™, create a strong team culture and improve practice efficiency.

The modules below are example of modules written by Dr. Sinksy and our STEPS Forward physician faculty:

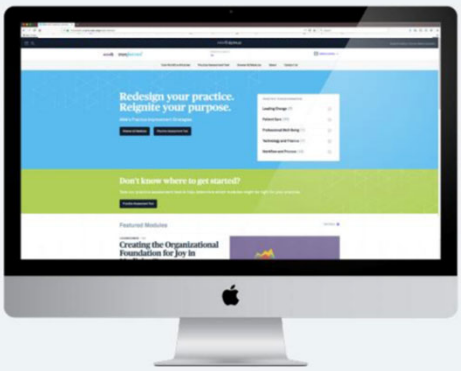
WORKFLOW AND PROCESS
"Pre-Visit Laboratory Testing: Save Time and Improve Care."

TREATMENT ADHERENCE
"Annual Prescription Renewal: Save Time and Improve Medication Adherence."

WORKFLOW AND PROCESS
"Expanded Rooming and Discharge Protocols: Streamline Your Patient Visit Workflow."

WORKFLOW AND PROCESS
"EHR In-Basket Restructuring for Improved Efficiency: Efficiently manage your in-basket to provide better, more timely patient care."

WORKFLOW AND PROCESS
"Team Documentation: Improve Efficiency, Workflow, and Patient Care."



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Mobile Wellness for Healthcare Providers by Ni-Cheng Liang, MD

- Password: Ucsdmindfulness

Introduction - https://vimeo.com/217714368/4b81df773b
Movement Practice – https://vimeo.com/230642078/845b267b29
Awareness of Breath - https://vimeo.com/218659897/aabf02cb81
Body Scan Practice - https://vimeo.com/218660073/8716691201
Rain Practice - https://vimeo.com/218660664/b6cb686b62
Loving Kindness Practice - https://vimeo.com/230641996/68c8d24d81
Walking Practice - https://vimeo.com/230642005/430316f376
Pause for Self Compassion - https://vimeo.com/230642071/4d04fdd39a

- Made possible by the Kaiser Teaching Award from the UCSD Academy of Clinician Scholars

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Incorporating mindfulness

- Your feet, your hands, stethoscope breaths
- Take Mindfulness Based Stress Reduction
- UCSD Center for Mindfulness website:
  Consider trying some of the guided meditations free on the website on your own
  - http://health.ucsd.edu/specialties/mindfulness/programs/mbsr/Pages/audio.aspx
- U of Rochester Mindful Practice Programs https://www.urmc.rochester.edu/family-medicine/mindful-practice.aspx

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Summary

- The culture and systems of healthcare in the US need to change to prioritize healthcare professional wellness which in turn will promote a culture of safety and quality of care for patients
- Healthcare professionals are at an increased risk of burnout and suicide compared to the general public.
- Some individual risk factors for burnout can be mitigated
- Cognitive behavioral therapy and mindfulness are proven methods to reduce burnout

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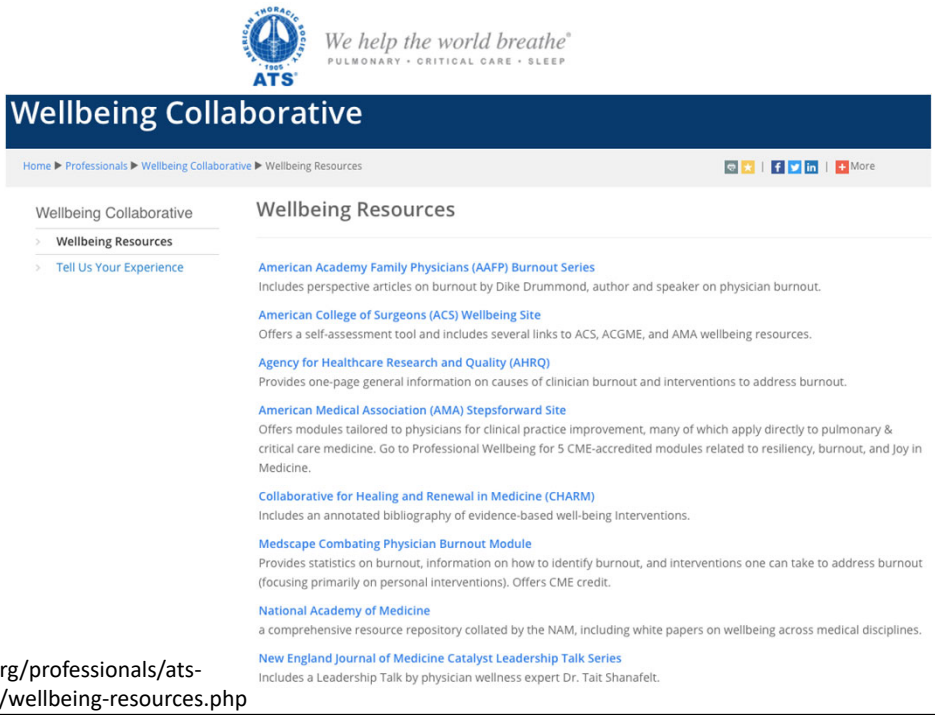

https://www.thoracic.org/professionals/ats-wellbeing-collaborative/wellbeing-resources.php

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Let's continue the dialogue!

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Coastal Pulmonary Associates
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ICS and ICU Burnout:
Faculty Panel Discussion

Marc Moss, MD
Ni-Cheng Liang, MD
Dina Bates, MD

Friday, October 4, 2019 – 3:20 p.m. – 3:50 p.m.

CLOSING, POST TEST AND BREAK

George Su, MD
UC San Francisco

Friday, October 4, 2019 – 3:50 p.m. – 4:10 p.m.

MEET THE PROFESSORS:

Dr. Light, Dr. Moss, Dr. Barr and Dr. Leard;
Fellows, residents, students,
early career physicians

Moderators: Shazia Jamil, MD: Scripps Clinic and University of California San Diego; Nicholas Kolaitis, MD, University of California San Francisco; and Angela Wang, MD, Scripps Clinic

Friday, October 4, 2019 – 4:10 p.m. – 5:00 p.m.