ICU Mobility: Move It or Lose It

Advanced ICU Workshop
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Catherine “Terri” Hough, M.D., M.Sc.
Associate Professor of Medicine
Pulmonary and Critical Care Medicine
Medical Director, MICU, Harborview Medical Center
University of Washington

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  – Patient-Centered Outcomes Research Institute
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What are the typical priorities of ICU care?
• Airway
• Breathing
• Circulation
  – Resuscitation, transfusion, pH/electrolyte correction
• Identify and treat cause of illness
  – Antibiotics, hemostasis, surgery
• Treatment of symptoms
  – Pain
  – Dyspnea
What are not typical priorities of ICU care?

- Mental health
- Cognitive function
- Physical function and independence

Reflections of ARDS survivors

- All patients reported disability that interfered with basic activities of daily living
- Nearly all reported that weakness was central to post-ICU experience
  - “When I tried to hold a cup, I spilled it in the bed. I could not brush my own teeth. I could not comb my hair, and I wasn’t able to pick up the covers and move them”
  - “…just could hardly move. I would try to walk across the room, but had to sit down I was so tired. I’d rest on a chair, then on a couch somewhere else. It took forever to get anything done.”

Post-intensive care syndrome

Survivor (PICS)

- Mental Health
  - Anxiety/ASD
  - PTSD
  - Depression
- Cognitive Impairments
  - Executive Function
  - Memory
  - Attention
  - Visuospatial
  - Mental Processing Speed
- Physical Impairments
  - Pulmonary
  - Neurocognitive
  - Physical Function

Cox CCM 2009

Needham DM Crit Care Med 2012
Objectives

- Introduce mechanisms and risk factors for loss of physical function in the ICU
- Describe safety and benefits of mobility
- Review current mobility practice
- Future directions for promotion of ICU mobility

Why might critically ill patients have physical functional impairment?

Functional decline is common before ICU, too

Ferrante L. JAMA 2015
But being critically ill makes it worse.

What happens to nerves and muscles during critical illness?

- At risk for multiple organ dysfunction
  - Endotoxin
  - Inflammation
  - Oxidant injury
- Metabolic derangements
- Inactivity
- Exposure to toxins, drugs

Muscle atrophy happens quickly in ICU
Respiratory muscles are also affected

- Phrenic nerve conduction studies
  - Abnormal in 48 of 52 (92%) of patients tested
- Diaphragm atrophies on mechanical ventilation
  - Marked atrophy develops within 1 week

ICU-acquired weakness is common

- Study of 200+ medical and surgical ICU patients
  - On MV>7 days
  - Strength tested when awakened
- ICUAW Definition: average strength >4 in 12 muscle groups
  - 5: full strength
  - 4: sub-maximal resistance
  - 3: oppose gravity
  - 2: move w/o gravity
  - 1: twitch
  - 0: no movement
- 25% of assessed patients met criteria for weakness
  - Over 100 could not be assessed

Description of patients with ICUAW

- Proximal muscles weaker than distal
  - Weak patients could not even lift limbs off bed
- Electrophysiologic testing of weak patients
  - All had evidence of critical illness neuropathy
  - Involvement of motor and sensory nerves
- Muscle biopsies of those weak on day 14
  - All patients had muscle atrophy, some with necrosis
  - All had evidence of critical illness myopathy
  - Type II fiber atrophy with myosin loss
Weak patients have worse outcomes

- Increased duration of mechanical ventilation
  - Time of ventilation increases by 1-3 weeks
  - Most significant predictor of prolonged MV
- Longer ICU and hospital stay
- More likely to need re-intubation
- Less likely to go home at hospital discharge
- More likely to die in the hospital
- Experience delays in rehabilitation
  - Take longer to regain strength, walk, work
- Prolonged impairment in HRQOL and physical function


Risk factors for ICUAW

- Critical illness itself is a risk factor
  - Sepsis, SIRS and multiple organ failure
- ICU medications may be risk factors
  - Neuromuscular blockade and steroids commonly implicated
    - NMBAs not significantly associated in recent ARDS RCT
    - Steroids not significantly associated with neuromyopathy in steroid RCT for late ARDS
      - But likely associated with acute myopathy?
      - May protect against neuropathy if glucose is controlled?
- Interesting new reports need confirmation
  - Red blood cell transfusion, fluid overload
  - Duration of bed rest

Papazian NEM 1010; Hough ICM 2009; Fan ICM 2013; Parsons CC 2013

Immobility is bad for the whole body

- Effects on muscle
  - Atrophy with disproportionate decrease in strength
  - Loss of mitochondria and oxidative capacity
- Effects on inflammation
  - Increased inflammatory activity in muscle and systemic
  - Increases neutrophil migration to the lung
- Effects on metabolism
  - Increased insulin resistance
  - Decreased protein synthesis and fatty acid metabolism
- Cardiovascular effects
  - Baroreceptor dysfunction with orthostatic intolerance
  - Decreased contractile strength of myocardium

Evidence supporting safety and efficacy of ICU mobility

Safety of ICU mobility

• Prospective cohort study
  – 8 bed RICU
  – Included all patients with ≥ 4 days MV
  – 3 criteria to begin activity (guidelines)
    • Neurologic (response to verbal stimulus)
    • Respiratory (FIO2 ≤ 0.6 and PEEP ≤ 10)
    • Circulatory (no orthostasis or vasoressors)
  
  • Intervention: progressive increase in activity
    – Sit on bed, sit in chair, ambulate (twice daily)
  
  • Team: PT, RT, RN and critical care technician
  
  • Outcome: Ambulation > 100 ft at ICU d/c

Intubated patients were able to participate

• Enrolled: 103 patients
  – Nearly all transferred from other ICUs (med, surg)
  – Mean time to transfer: 10.5 days
  – 89% on MV at RICU admission

  • Ambulation occurred by RICU day 3 (mean)
Safety and feasibility

- **Safety**
  - 14 adverse events out of 1449 activity events
    - Fall to knees (5)
    - SBP < 90 (4— all orthostatic)
    - SBP > 200 (1)
    - O₂ desaturation to <80% (3— all rapidly resolved)
    - Removal of nasal feeding tube (1)
- **Feasibility**
  - No change in staffing was needed for protocol
    - RN: patient 1:2
    - RT: patient 1:4
    - PT: no increasing in staffing (Ratio not reported)

Mobility team for early ICU mobility: a QI project

- Prospective cohort study
  - Block allocation design
- Population: MICU patients requiring MV on admission
- Intervention: Mobility Team (RN, PT, NA) initiating progressive protocol within 48 hours of MV
  - Control: RN-PROM, positioning
- Outcome: proportion of hospital survivors receiving PT

Wake Forest Protocol
Mobility protocol increased PT, and associated with improved outcomes

- Mobility protocol increased PT
  - More patients seen in hospital (80% vs. 47%)
  - More sessions (5.5 vs. 4.1 sessions)
  - Patients out of bed sooner (day 8.5 vs. 13.7)
- Mobility protocol improved outcomes
  - Shortened ICU and hospital LOS (1.5, 3.3 days less)
  - Associated with less readmission, better 1 yr survival
- No increase in costs
- No adverse events


RCT of early PT/OT in the medical ICU

- Population:
  - Previously independent MICU patients requiring ≤ 72 hours mechanical ventilation
- Intervention: Early exercise and mobilization
  - Control: Daily interruption of sedation with “usual PT/OT”
- Primary outcome: Independent functional status at hospital discharge
  - Independent performance of 6 ADLs
  - Ability to walk independently
- Additional outcomes: delirium, duration of MV

Schweickert WD. Lancet 2009

Results: Intervention group received therapy sooner

<table>
<thead>
<tr>
<th></th>
<th>Intervention N=49</th>
<th>Control N=55</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initiation of therapy</td>
<td>1.5 days after MV</td>
<td>7.4 days after MV</td>
</tr>
<tr>
<td>Daily time of therapy (on MV)</td>
<td>0.32 hours</td>
<td>0.0 hours</td>
</tr>
<tr>
<td>Daily time of therapy (off MV)</td>
<td>0.21 hours</td>
<td>0.19 hours</td>
</tr>
<tr>
<td>Survivors receiving therapy</td>
<td>100%</td>
<td>95%</td>
</tr>
</tbody>
</table>

Schweickert WD. Lancet 2009
Early therapy improved hospital outcomes

<table>
<thead>
<tr>
<th></th>
<th>Intervention N=49</th>
<th>Control N=55</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Independent at discharge</td>
<td>29/49 (59%)</td>
<td>19/55 (35%)</td>
<td>&lt;0.02</td>
</tr>
<tr>
<td>Distance walked at discharge</td>
<td>33 m [0-91]</td>
<td>0 m [0-30]</td>
<td>&lt;0.004</td>
</tr>
<tr>
<td>ICU delirium</td>
<td>2 days [0-6]</td>
<td>4 days [2-8]</td>
<td>&lt;0.03</td>
</tr>
<tr>
<td>ICU-acquired weakness</td>
<td>31%</td>
<td>49%</td>
<td>&lt;0.09</td>
</tr>
<tr>
<td>Duration of MV</td>
<td>3.4 days [2.3-7.3]</td>
<td>6.1 days [4.0-9.6]</td>
<td>&lt;0.02</td>
</tr>
<tr>
<td>Hospital LOS</td>
<td>13.5 days [8-23]</td>
<td>12.9 days [9-20]</td>
<td>&lt;0.03</td>
</tr>
<tr>
<td>Hospital mortality</td>
<td>18%</td>
<td>25%</td>
<td>&lt;0.53</td>
</tr>
</tbody>
</table>

ICU mobility has become a recommended practice

- Society for Critical Care Medicine
  - www.iculiberation.org
- Institute for Healthcare Improvement
- Agency for Healthcare Research and Quality
- Proposed new bundle: ABCDE
  - Awakening
  - Breathing
  - Choosing lowest sedation
  - Delirium prevention
  - Early mobility
    - Nice study submitted to Annals of ATS suggesting that mobility efforts are futile if not preceded by A-B-C-D

Algorithm for ICU mobility: safety

Exclusion Criteria:
- Significant dose of vasopressors for hemodynamic stability (maintain MAP >60)
- Mechanically ventilated with FiO2 >0.8 and/or PEEP >12, or acutely worsening respiratory failure
- Neuromuscular paralysis
- Currently in an acute neurological event (CVA, SAH, ICH)
- Unstable spine or extremity fractures
- Grave prognosis, transitioning to comfort care
- Open abdomen, at risk for dehiscence
- Active bleeding process
- Bed rest order

Consult with ICU/RF and assess ability to tolerate and participate in mobility

NO? Proceed!

YES?

Engel H. CCM 2013; www.iculiberation.org
Algorithm for ICU mobility: mental status

Does the patient open eyes to verbal or manual stimulation (+1 ≥ RASS ≥ -2)?

**YES? Proceed!**

- Sedation-related medication
- Attempt to decrease sedation via
  - Discontinuing continuous infusion
  - Changing from continuous infusion to “as needed” bolus doses
  - Using anti-psychotic medication for treatment of hyperactive delirium
- Reassess after 24 hours

[would also suggest ascertainment of baseline mental and functional status]

Engel H. CCM 2013; www.iculiberation.org

Algorithm for ICU mobility: bed/edge of bed

**Bed level assessment**
1. Orient the patient and perform CAM-ICU
2. Assess baseline vital signs
3. Bed exercises (passive, active, active assisted, resisted range of motion exercises to all extremities)

Does the patient appropriately attend to the tasks?

**NO?** Limit to bed level

**YES? Proceed!**

**Sitting assessment**
4. Dangle the patient at the edge of the bed

Does the patient meet all of the following?
- Remaining alert and oriented
- Demonstrating trunk control
- Vital signs within acceptable parameters

**NO?** Limit to bed level or edge of bed; use chair position for orthostatic training

**YES? Proceed!**

Engel H. CCM 2013; www.iculiberation.org

Algorithm for ICU mobility: bed/edge of bed

**Standing assessment**
5. Perform sit-to-stand and statics standing at the bedside

Does the patient meet all of the following?
- Remaining alert and oriented
- Demonstrating trunk control
- Vital signs within acceptable parameters

**NO?** Limit to edge of bed or standing at bedside

**YES? Proceed!**

6. Proceed with standing activities, transferring to chair and gait training

Engel H. CCM 2013; www.iculiberation.org
What do we know about mobility practice?

Survey of 47 hospitals across the state

Methods and results of survey

- Telephone survey of RN managers of MICU’s caring for mechanically ventilated patients in 2013
  - Assessing perception of mobility practice and process at 47 WA hospitals with ICUs and patients on MV
- Occurrence
  - 45 hospitals reported ongoing physical activity in ICU
- Higher level mobility (edge or out of bed)
  - 23 hospitals reported getting patients out of bed to sit, stand or walk
- Severity of illness
  - 24 hospitals reported delivery of physical activity to patients on mechanical ventilation and vasopressors
Higher level mobility not routine for mechanically ventilated patients in WA hospitals

Protocols and hospital characteristics associated with higher reports of mobility for ventilated patients

<table>
<thead>
<tr>
<th>Protocols and hospital characteristics</th>
<th>High-Level Activity</th>
<th>OR</th>
<th>95% CI</th>
<th>PValue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total hospitals (n = 38)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hospital volume &gt; 20,000</td>
<td>16 (72.7)</td>
<td>5.30</td>
<td>1.34–18.48</td>
<td>0.008</td>
</tr>
<tr>
<td>ICU volume &gt; 5,000</td>
<td>15 (68.2)</td>
<td>5.76</td>
<td>1.51–17.91</td>
<td>0.006</td>
</tr>
<tr>
<td>Part of a larger hospital network, n (%)</td>
<td>13 (59.1)</td>
<td>2.57</td>
<td>0.89–8.21</td>
<td>0.11</td>
</tr>
<tr>
<td>Academic-ICI, n (%)</td>
<td>11 (54.5)</td>
<td>4.40</td>
<td>1.33–15.33</td>
<td>0.02</td>
</tr>
<tr>
<td>Intermediate ICU, n (%)</td>
<td>4 (19.6)</td>
<td>0.51</td>
<td>0.01–24.94</td>
<td>0.94</td>
</tr>
<tr>
<td>Advanced care providers in ICU, n (%)</td>
<td>17 (77.3)</td>
<td>4.38</td>
<td>1.24–14.92</td>
<td>0.02</td>
</tr>
<tr>
<td>Computerized order entry, n (%)</td>
<td>17 (77.3)</td>
<td>1.32</td>
<td>0.37–4.79</td>
<td>0.68</td>
</tr>
<tr>
<td>Written protocol for ICU activity, n (%)</td>
<td>14 (63.4)</td>
<td>3.04</td>
<td>1.09–8.18</td>
<td>0.02</td>
</tr>
</tbody>
</table>

Definition of abbreviations: CI = confidence interval, ICU = intensive care unit, OR = odds ratio.

Single day point prevalence study in Australia/New Zealand of all ICU patients in 38 hospitals

Figure 2. Ventilatory status of patients in the intensive care unit for > 48 hours
No ventilated patients got out of bed (of 200!)

Severity of illness did not explain low mobility

Table 4. Safety criteria for sitting out of bed

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Sat out of bed</th>
<th>Walked</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within SOFA and RASS parameters (n = 125*)</td>
<td>Yes 69</td>
<td>No 56</td>
</tr>
<tr>
<td>Not within SOFA and RASS parameters (n = 266*)</td>
<td>Yes 59</td>
<td>No 207</td>
</tr>
<tr>
<td>Total</td>
<td>128</td>
<td>263</td>
</tr>
</tbody>
</table>

Safety criteria: Not on vasopressors
P/F > 300 if on ventilator (or >200 if not)
RASS at least -1

Single day study in 116 German hospitals

- Population
  - Patients receiving mechanical ventilation on study day (9/28/11)
- Data Collection
  - Survey of clinicians caring for eligible patients
  - Collected patient, ICU and hospital data
- 783 patients were included
  - 408 with endotracheal tubes (52%)
  - 309 with tracheotomy tubes (40%)
  - 66 with non-invasive ventilation (8%)
Only 2% of patients with ETTs got out of bed

<table>
<thead>
<tr>
<th>Level of Mobilisation</th>
<th>Remaining in bed (%)</th>
<th>Independent (on request) (%)</th>
<th>Full Range (≥ 120°) (%)</th>
<th>No mobilisation (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sitting in bed</td>
<td>90 (70)</td>
<td>37 (23)</td>
<td>180 (135)</td>
<td>31 (85)</td>
</tr>
<tr>
<td>Seated on edge of bed</td>
<td>90 (70)</td>
<td>37 (23)</td>
<td>180 (135)</td>
<td>31 (85)</td>
</tr>
<tr>
<td>Seated in chair</td>
<td>75 (70)</td>
<td>37 (23)</td>
<td>180 (135)</td>
<td>31 (85)</td>
</tr>
<tr>
<td>Turning in bed</td>
<td>90 (70)</td>
<td>37 (23)</td>
<td>180 (135)</td>
<td>31 (85)</td>
</tr>
<tr>
<td>Mobile out of bed</td>
<td>90 (70)</td>
<td>37 (23)</td>
<td>180 (135)</td>
<td>31 (85)</td>
</tr>
<tr>
<td>Active mobile</td>
<td>90 (70)</td>
<td>37 (23)</td>
<td>180 (135)</td>
<td>31 (85)</td>
</tr>
</tbody>
</table>

Nydahl P. Crit Care Med 2013

ARDS Network point prevalence study

• Population
  – Patients with acute or resolving respiratory failure
  – In ICU on January 15th or February 4th, 2014
  – 17 academic and community ARDS Network hospitals

• Data Collection:
  – In-person of all mobility events during the day
    - by PT/OT or RN, including passive and active mobility
  – Chart abstraction
    - Mobility events over 24 hours
    - Severity of illness
    - Level of sedation

Hough, Jolley and ARDS Network MP3 Committee (upcoming ATS presentation)

Results: Demographics

<table>
<thead>
<tr>
<th>Participants</th>
<th>787</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospitals</td>
<td>17</td>
</tr>
<tr>
<td>ICUs</td>
<td>37</td>
</tr>
<tr>
<td>ICU per hospital (median, IQR)</td>
<td>1 (1-3)</td>
</tr>
<tr>
<td>Age</td>
<td>56 (24%)</td>
</tr>
<tr>
<td>Female</td>
<td>313 (40%)</td>
</tr>
</tbody>
</table>

ICU type:

- Medical: 396 (51%)
- Surgical: 368 (99%)
- Neurology/Neurosurgical: 388 (70%)
- Cardiothoracic: 58 (1%)
- Burns: 21 (3%)
- Trauma: 92 (15%)

Hough, Jolley and ARDS Network MP3 Committee
Results: markers of severity of illness

<table>
<thead>
<tr>
<th>Ventilation status</th>
<th>Ventilated</th>
<th>566 (72%)</th>
<th>ETT</th>
<th>437 (56%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tracheostomy</td>
<td>82 (10%)</td>
<td>Non-invasive</td>
<td>47 (6%)</td>
</tr>
<tr>
<td></td>
<td>Not ventilated</td>
<td>231 (30%)</td>
<td>FO2 &gt; 60%</td>
<td>78 (10%)</td>
</tr>
<tr>
<td></td>
<td>PEEP &gt; 10 cmH2O</td>
<td>56 (7%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Vasoactive infusions</th>
<th>Any</th>
<th>173 (22%)</th>
<th>Vasopressors</th>
<th>56 (7%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>None</td>
<td>614 (79%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Hemodialysis | Intermittent | 63 (8%) | Continuous | 49 (6%) |

<table>
<thead>
<tr>
<th>Level of consciousness</th>
<th>Coma</th>
<th>97 (12%)</th>
<th>Not documented</th>
<th>133 (17%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Benzodiazepine or propofol infusion</td>
<td>216 (27%)</td>
<td>Benzodiazepine</td>
<td>68 (9%)</td>
</tr>
<tr>
<td></td>
<td>Propofol</td>
<td>163 (21%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

64% of patients had activity events

<table>
<thead>
<tr>
<th>Number of patients with events</th>
<th>506 (64%)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Total number of events</th>
<th>788</th>
</tr>
</thead>
<tbody>
<tr>
<td>Events per patient (range)</td>
<td>1 to 8</td>
</tr>
<tr>
<td>Events performed by one clinician</td>
<td>637 (81%)</td>
</tr>
<tr>
<td>Events performed by two clinicians</td>
<td>133 (17%)</td>
</tr>
<tr>
<td>Events performed by 3+ clinicians</td>
<td>18 (2%)</td>
</tr>
</tbody>
</table>

Most activity events performed by a solo RN

| RN alone | 57% |
| PT alone | 17% |
| OT alone | 5% |
| Ha or Tech | 2% |
| RN/RN | 2% |
| RN/PT | 9% |
| RN/OT | 2% |
| RN/HA or Tech | 2% |
| PT/OT | 5% |
Nearly 1/3 of patients seen by PT and/or OT

<table>
<thead>
<tr>
<th>All (n=787)</th>
<th>MV (n=566)</th>
<th>No MV (n=221)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PT</td>
<td>208 (26%)</td>
<td>119 (21%)</td>
</tr>
<tr>
<td>OT</td>
<td>84 (11%)</td>
<td>46 (8%)</td>
</tr>
<tr>
<td>PT or OT</td>
<td>247 (31%)</td>
<td>144 (25%)</td>
</tr>
</tbody>
</table>

Proportion of MV patients seen by PT/OT highly variable across study sites

Results: Highest level of therapy provided

<table>
<thead>
<tr>
<th>All (n=787)</th>
<th>MV (n=566)</th>
<th>No MV (n=221)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No activity</td>
<td>281 (36%)</td>
<td>230 (41%)</td>
</tr>
<tr>
<td>Range of motion</td>
<td>202 (26%)</td>
<td>188 (33%)</td>
</tr>
<tr>
<td>Passively moved to chair</td>
<td>38 (5%)</td>
<td>21 (4%)</td>
</tr>
<tr>
<td>Bed exercises, chair position</td>
<td>53 (7%)</td>
<td>40 (7%)</td>
</tr>
<tr>
<td>Sit at edge of bed</td>
<td>53 (7%)</td>
<td>31 (5%)</td>
</tr>
<tr>
<td>Stand</td>
<td>22 (3%)</td>
<td>13 (2%)</td>
</tr>
<tr>
<td>Stand and move to chair</td>
<td>46 (6%)</td>
<td>17 (3%)</td>
</tr>
<tr>
<td>March in place</td>
<td>33 (4%)</td>
<td>5 (1%)</td>
</tr>
<tr>
<td>Walk</td>
<td>77 (10%)</td>
<td>23 (4%)</td>
</tr>
</tbody>
</table>

Hough, Jolley and ARDS Network MP3 Committee
Route of mechanical ventilation associated with activity

Proportion of MV patients achieving sit at edge of bed, stand, march or walk is highly variable across sites

Factors associated with out of bed mobility

*Vasopressor use, benzodiazepine bolus use, presence of an invasive catheter, possible contraindication to mobility, unknown delirium status, RASS >2, ICU type age, and weight not significant in model.
Only 7 reported adverse events in 788 activity sessions

<table>
<thead>
<tr>
<th>Adverse event</th>
<th>Mobility provided at time of AE</th>
<th>Clinician</th>
</tr>
</thead>
<tbody>
<tr>
<td>New arrhythmia</td>
<td>Chair/no stand, Stand</td>
<td>RN</td>
</tr>
<tr>
<td>New arrhythmia</td>
<td>Sit/exercise in bed, Bed to chair w/stand</td>
<td>PT</td>
</tr>
<tr>
<td>New arrhythmia</td>
<td>ROM</td>
<td>RN</td>
</tr>
<tr>
<td>SaO2&lt;85</td>
<td>Turning in bed</td>
<td>RN</td>
</tr>
<tr>
<td>SaO2&lt;85</td>
<td>Chair/no stand</td>
<td>PT + RN</td>
</tr>
<tr>
<td>MAP&lt;55</td>
<td>ROM</td>
<td>RN</td>
</tr>
<tr>
<td>ETT dislodged</td>
<td>ROM, Chair/no stand</td>
<td>RN</td>
</tr>
</tbody>
</table>

Hough, Jolley and ARDS Network MP3 Committee

Future directions

Understanding and overcoming local barriers

- Nursing time: 73
- Sedation: 71
- Physical therapist time: 67
- Delirium: 61
- Respiratory therapist time: 54
- Patient safety: 43
- Spine precautions: 34
- Access to equipment: 24.4
- Staff safety: 18
- Patient in procedure: 18
- Cost: 16
- No therapy despite MD order: 12
- Mobility not important: 12

Figure 1: Physician reported barriers to early mobilization of critically ill patients (n=91, % reporting agree).

Jolley SE. BMC Anesth 2014
Understanding and overcoming local barriers

<table>
<thead>
<tr>
<th>Risk of self-injury</th>
<th>71</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excess work stress</td>
<td>65</td>
</tr>
<tr>
<td>Nursing time</td>
<td>53</td>
</tr>
<tr>
<td>Nursing staffing</td>
<td>47</td>
</tr>
<tr>
<td>Prolonged work day</td>
<td>47</td>
</tr>
<tr>
<td>Over-extension of usual work</td>
<td>47</td>
</tr>
</tbody>
</table>

Figure 2: Nursing reported barriers to early mobilization of critically ill patients (n = 11, % reporting agree).

Jolley SE. BMC Anesth 2014

Improving the state of the science

- RCTs of ICU mobility
  - Moss R01
    - 4 weeks of daily physical therapy
    - Outcome: Physical Functional Performance at 1,3,6 months
  - Morris R01
    - Daily therapy by RN/PT/NA team, ICU through hospital discharge
    - Outcome: hospital length of stay
- RCTs of Neuromuscular Electrical Stimulation
  - Needham
    - 60 minutes of NMES to three lower extremity muscle groups
    - Outcome: lower extremity strength at hospital discharge
  - Parry
    - Combination of NMES and cycling
    - Outcomes: muscle mass, strength and physical function

Incorporating mobility into quality metrics

Carrothers KM. Crit Care Med 2013
Conclusions

- Impairment in physical function is common after critical illness
- ICU mobility is safe and beneficial for patients
- Few ICU patients are currently receiving optimal mobility
  - Especially patients on mechanical ventilation
- Working together, we can improve our patients’ outcomes by prioritizing mobility

Thank you!