Managing the Patient with ICU-Acquired Weakness:
*When the Rubber Hits the Road*

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Jason Seltzer, PT, DPT
Financial Disclosures

- The speakers have no financial disclosures.
Learning Objectives

- Describe etiology, risk factors, and defining clinical presentation of ICU-acquired weakness and post intensive care syndrome
- Identify appropriate, evidence-based interventions from ICU admission through hospital discharge
- Explain how utilizing functional outcome measures in the treatment of critically ill patients demonstrates best clinical practice throughout the continuum of care
- Demonstrate how rehabilitative service’s presence in a multidisciplinary ICU model contributes towards a value based measurement system
Audience Polling
1. How many years of experience?
   A. Student
   B. 0-2 years
   C. 3-5 years
   D. 5+ years
2. How many of you
   A. Have an ICU early rehab program at their hospital?
   B. Are starting an ICU early rehab program?
   C. Are considering starting an ICU early rehab program?
3. How many of you work in the following hospital setting?

A. Community
B. Teaching
C. Tertiary
D. Non-acute care
4. Who consistently uses ICU-specific outcome measures to look for and track ICUAW?

5. Does your hospital have formalized training for clinical skills specific to physical therapy in the ICU?
ICU mobility is safe!


Wang, *Crit Care*, 2014

Fields, *JACPT*, 2015

Perme, *Cardiopulm PTJ*, 2012
Damluji, *JCC*, 2013
What is the prevalence in USA of PT/OT mobility for adult ICU patients with acute respiratory failure on mechanical ventilation?

- 42 ICUs across 17 ARDS Network hospitals
- **Results**
  - Mobility with endotracheal tube: 32% of patient days
  - Mobility in absence of mechanical ventilation: 48% of patient days
What’s happening to our ICU survivors who don’t receiving adequate therapy during their ICU and hospital stay?
“My day to day life is anything but normal. I want to be able to cook, clean and do the gardening, walk to the shops… recovery has been reasonable”
“I often wake up terrified because I had dreams of being in the unit with all the sounds and noises of machines. Even when I’m awake and with people, many things remind me of the unit, people talking, and images from the TV”
“I’m happy being back home, but I feel that my kids do not need me anymore. They used to take my opinion in every aspect of their lives, I can’t find this anymore. Now they consult their mother, and act as if I’m still in the hospital”
• Over 5 million patients are admitted annually to ICUs in the United States
• Increase in survival rate of critical illness
• More than 50% of survivors will suffer from some component of Post Intensive Care Syndrome (PICS)
• 114/138 (83%) of patients reported ≥1 hospital readmission
• In years 3-5, 22% hospitalization with ICU admission
  – 40% of which required mechanical ventilation
• 25% required SNF (16% in first year)
• 48% required SAR (35% in first year)
• Physical function was predictive of readmission
Developed term “Post Intensive Care Syndrome”

“New or worsening impairments in physical, cognitive, or mental health status arising after critical illness and persisting beyond acute care hospitalization”
Recognizing PICS

• Present throughout the continuum of care
  - Hospital ward
  - Rehabilitation facilities
  - Home
  - Outpatient

• Often unrecognized or lost to transfer or follow up and labeled "new baseline"

• No single cause or treatment

Needham Crit Care Med 2012
Risk Factors for Developing PICS

Pre-existing conditions

ICU related risk factors

Modifiable risk factors

PICS
Risk Factors For Developing PICS

Pre-existing Conditions:

- Neuromuscular disorders
- Dementia
- Psychiatric illness
- Comorbid conditions
- Cardiac arrest
- Age
Risk Factors For Developing PICS

Pre-existing Conditions:

- Neuromuscular disorders
- Dementia
- Psychiatric illness
- Comorbid conditions
- Cardiac arrest
- Age
Risk Factors For Developing PICS

ICU factors:

- Mechanical ventilation
- Sepsis and systemic inflammatory response syndrome
- Renal replacement therapy
- ARDS

- Hypoxemia
- Protein catabolism
- Critical illness hyperglycemia and insulin intolerance
- Neuromuscular blocking agents
Risk Factors For Developing PICS

Modifiable Risk Factors:

• Bed rest and immobility
• Delirium
• Use of Benzodiazepine
• Inadequate pain control

• Sleep obstruction
• Malnutrition
• Loss of control and dignity
• Inability to communicate
Clinical Manifestations of PICS

- Physical
- Mental
- Cognitive
Physical Impairments in PICS: Respiratory Function

- Impaired spirometry
- Decreased lung volume and diffusion capacity

<table>
<thead>
<tr>
<th></th>
<th>3 Months</th>
<th>5 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>FVC</td>
<td>72%</td>
<td>84%</td>
</tr>
<tr>
<td>FEV1</td>
<td>75%</td>
<td>83%</td>
</tr>
<tr>
<td>DLCO</td>
<td>63%</td>
<td>80%</td>
</tr>
</tbody>
</table>

% predicted

Physical Impairment in PICS: ICU Acquired Weakness

• Critical Illness Myopathy and Polyneuropathy
  – 46% of patients sepsis, multi-organ failure, or prolonged mechanical ventilation

• 33% of all patients on ventilators

• 50% of all patients admitted with severe sepsis

• Up to 50% of patients with ICU LOS > 7 days
Physical Impairment in PICS: Physical Function

- Impaired ADLs/ IADLs

<table>
<thead>
<tr>
<th></th>
<th>3 months</th>
<th>12 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients with impairments</td>
<td>32%</td>
<td>27%</td>
</tr>
<tr>
<td>Of those fully independent at ICU admission</td>
<td>27%</td>
<td>22%</td>
</tr>
</tbody>
</table>

- Decreased exercise capacity

<table>
<thead>
<tr>
<th></th>
<th>1 year</th>
<th>5 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 MWT (predicted)</td>
<td>66%</td>
<td>76%</td>
</tr>
</tbody>
</table>

Jackson Lancet Respir Med 2014
Cognitive Impairment in PICS

- Memory
- Attention
- Executive function
- Mental processing speed
- Visuo-spatial ability
74% of patients experienced a median 4 days of delirium

Duration of delirium independently associated with worse global cognition

RBANS at 12 month follow up similar to moderate TBI in 34%, mild Alzheimer’s in 26%
Mental Health in PICS

• Depression
  – 37% of patients report >mild depression at 3 month post ICU discharge

• Post Traumatic Stress Disorder
  – Symptoms occurred in 35% of patients over a 2 year period

• Anxiety
Risk factors for development of PTSD

• Prior depression
• ICU LOS
• Duration of sepsis
• Administration of high dose opiates in ICU
Impact of PICS on family

• Increased care giver burden - physical and financial assistance
  - 22% were in need of care assistance at 12 months
  - 78% of this care provided by family member
  - 26% of patients required >50 hours per week of assistance

• Psychological effects on family members

• Loss of the role of spouse, parent or child
Societal Effects of Critical Illness

• Between 2000 and 2005, annual critical care medicine costs increased from $56.6 billion to $81.7 billion

• $18,847–$148,454 spent on healthcare utilization for year 1 post discharge

• 52% of survivors unable to return to work within 1 year of ICU discharge

• Approximately 1/4 unable to return within 5 years

Lone Crit Care Med 2013
Where do we go from here?
Continuum of Care

- Diagnosing ICUAW
- Baseline and Weekly Measurements
- Interventions
- Maintaining Care Outside of ICU
Diagnosing ICUAW
ICU Acquired Weakness (ICUAW)

“Presence of clinically detectable weakness in ICU patients with no possible etiology other than critical illness” Hashem, Parker, Needham, 2016

- Recovery of weakness takes weeks to months to recover, with some patients with deficits 2 years after ICU discharge

Hermans & Van den Berghe, 2015
• **Risk Factors for ICUAW**
  – High severity of illness at admit
  – Sepsis
  – Multi-organ failure
  – Prolonged immobilization
  – Hyperglycemia
  – Older age
Clinical signs of ICUAW

- Axonal neuropathy
- Primary myopathy
- Combination of both
Clinical Diagnosis of ICUAW

- Painful stimulation → absent limb response yet normal grimacing (Isolated Myopathy)
- If appropriate for reliable sensory examination for light touch and pin (Polyneuropathy)
- Diminished to absent DTR
Diagnosing ICUAW

- Medical Research Council (MRC) sum score
- Handgrip strength
- EMG
- NCV
- Ultrasound
MRC Sum Score

Volitional muscle strength test

**Scoring**

- 0: No visible/palpable contraction
- 1: Movement through complete ROM against gravity
- 2: Movement through complete ROM against gravity and moderate resistance
- 3: Movement through complete ROM against gravity and maximal resistance
- 4: Movement through complete ROM against gravity and maximal resistance
- 5: Movement through complete ROM against gravity and maximal resistance

MRC Score – Testing

- Manual muscle testing to 3 muscle groups in each extremity, bilaterally
  - Wrist extension, elbow flexion, shoulder abduction
  - Dorsiflexion, knee extension, hip flexion

- ICU-acquired weakness: score of <48/60
Assessment of Limb Muscle Strength in Critically Ill Patients: A Systematic Review

Goele Vanpee, MSc, PT\textsuperscript{1,2}; Greet Hermans, PhD, MD\textsuperscript{3}; Johan Segers, MSc, PT\textsuperscript{1,2}; Rik Gosselink, PhD, PT\textsuperscript{1,2}

- MRC score inter-rater reliability
  - ICC 0.8-0.99
• Diagnosing ICUAW with handgrip dynamometry
  – Sensitivity: 0.88
  – Specificity: 0.8
Handgrip Strength

Testing
• Elbow at 90°
• 2-3 sec hold
• 3 attempts

ICU-AW: Men <11, women <7 kg-force

Electrophysiological studies

- Nerve conduction studies
- Needle EMG
- Neuromuscular junction testing
Peripheral Motor Nerve Stimulation

Compound Muscle Action Potential (CMAP)
Peripheral Sensory Nerve Stimulation

Sensory Nerve Action Potential (SNAP)
Diagnosing ICUAW

- CMAP and SNAP in addition to NCV
  - axonal sensory-motor polyneuropathy, such as CIP, in which decreased CMAP and SNAP amplitudes are measured while nerve conduction velocity is normal
Diagnosing ICUAW

• Needle EMG:
  - Awake and alert patients
  - Done at rest, mild contraction and maximal voluntary contraction
  - Short duration and low amplitude Motor Unit Potentials (MUP) → Myopathy
  - Long duration, polyphasic high amplitude MUP → Neuropathy
Diagnosing ICUAW

Neuromuscular Junction Studies:
- Repetitive Nerve Stimulation
- Single Fiber EMG
- Done mainly to rule out NM junction disorders
Limitations to EP testing:

• Tissue edema
• Electrical interference
• Inability to contract voluntarily
• Need for specialists for interpretation
• Preexisting illness such as DM, effects of chemotherapeutic agents
Diagnosing ICUAW

- Direct Muscle Stimulation (DMS) to differentiate CIP and CIM
- CMAP amplitude should be normal in CIP with DMS
- CMAP diminished in CIM
EMG Characteristics of ICUAW

Zorowitz; ICU acquired weakness – A rehabilitation perspective of diagnosis, treatment and functional management; Chest 2016
Diagnosing ICUAW

Biopsy:

• Nerve biopsy – distal axonal degeneration of both sensory & motor fibers with no demyelination/inflammation in CIP

• Muscle biopsy – acute necrosis, regeneration, type II fiber atrophy, selective loss of thick myosin filaments in CIM
Diagnosing ICUAW

- **Muscle biopsy**
  - Depicts the architecture of the muscle
  - Differentiate CIM from CIP
  - Part of gold standard
  - Expensive
  - Invasive, painful
  - Needs expertise for testing & interpretation
Diagnostic Ultrasound

- Depicts gross muscle architecture
- Noninvasive and comfortable for the patient
- Does not require patient participation
- Inexpensive once ultrasound machine is obtained
- Good interrater reliability

Jolley et al; ICU-Acquired Weakness; Chest; 2016
Differential Diagnosis

Bilateral or paramedian brain or brainstem lesions

- Trauma
- Infarction
- Hemorrhage
- Infectious and noninfectious encephalitides
- Abscess
- Central pontine myelinolysis
Spinal cord disorders

- Trauma
- Nontraumatic compressive myelopathies
- Spinal cord infarction
- Immune-mediated myelopathies (transverse myelitis, neuromyelitis optica)
- Infective myelopathies (eg, HIV, West Nile virus)
Anterior horn cell disorders

- Motor neuron disease
- Poliomyelitis
- West Nile virus infection
- Hopkins syndrome (acute post-asthmatic amyotrophy)
Polyradiculopathies

- Carcinomatous
- HIV-associated
Peripheral nervous disorders

- Guillain-Barré syndrome
- Diphtheritic neuropathy
- Lymphoma-associated neuropathy
- Vasculitic neuropathy
- Porphyric neuropathy
- Paraneoplastic neuropathy
- Critical illness polyneuropathy
Neuromuscular junction disorders

- Myasthenia gravis
- Lambert-Eaton myasthenic syndrome
- Neuromuscular-blocking drugs
- Botulism
Muscle disorders

- Rhabdomyolysis
- Disuse myopathy
- Cachexia
- Infectious and inflammatory myopathies
- Mitochondrial myopathies
- Drug-induced and toxic myopathies
- Critical illness myopathy
- Decompensation of congenital myopathies (eg, myotonic dystrophy, Duchenne muscular dystrophy, adult onset acid maltase deficiency)
Diagnosing ICUAW

Baseline and Weekly Measurements
When should outcomes assessments be performed?

- Initial eval in ICU or upon awakening
- Weekly while in ICU
- ICU discharge
- Weekly while in hospital
- Hospital or therapy service discharge
- ICU stay
- ICU d/c
- Hospital floor stay
Baseline Measurements of Strength

- MRC-SS
- Hand grip testing
- Handheld dynamometry
Handheld Dynamometry

Testing

• Supine
• 3 attempts
• 1 min rest breaks
• Tested HHD to hand grip, elbow flex, and knee extension

• Inter-rater consistency (ICC) 0.78 to 0.95
• Test-retest agreement (ICC): 0.82 to 0.92
Baseline Functional Outcomes Assessment in ICU

- Functional Status Score for ICU (FSS-ICU)
- Physical Function in Independence Test-Scored (PFIT-s)
- Johns Hopkins Highest Level of Mobility (JH-HLM)
- Manchester Mobility Score (MMS)
- Acute Care Index of Function (ACIF)
# Functional Status Score for the Intensive Care Unit (FSS-ICU)

**Assessment of 5 functional tasks**
- Rolling
- Supine to sit
- Sitting edge of bed
- Sit to stand
- Ambulation

Max score = 35

<table>
<thead>
<tr>
<th>Score</th>
<th>Level of Independence</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Complete Independence; No assistance needed</td>
</tr>
<tr>
<td>6</td>
<td>Modified Independence; No assistance needed</td>
</tr>
<tr>
<td>5</td>
<td>Supervision; Requires cueing but no assistance needed</td>
</tr>
<tr>
<td>4</td>
<td>Minimal Assistance; Patient performs independently</td>
</tr>
<tr>
<td>3</td>
<td>Moderate Assistance; Patient performs with some assistance</td>
</tr>
<tr>
<td>2</td>
<td>Maximal Assistance; Patient performs with significant assistance</td>
</tr>
<tr>
<td>1</td>
<td>Dependent; Task is performed, but patient is unable to assist</td>
</tr>
<tr>
<td>0</td>
<td>Unable to perform due to weakness</td>
</tr>
</tbody>
</table>

• Intra-Rater Reliability
  – Single Measures: 0.985
  – Average Measures: 0.992
  Ragavan VK, et.al. *JACPT*;7(3):93-100

• ICC and concurrent construct validity
  – Good to Excellent
  Huang M, et. al.. *Crit Care Med*. (2016)
FSS-ICU Video
Physical Function in ICU Test-Scored (PFIT-s)

- Assesses physical function abilities in ICU patients by measuring
  - Endurance
  - Strength
  - Cardiovascular capacity
  - Functional level

PFIT-s

- Inter-rater reliability: 0.99-1.0
- Higher score at admit predictive of:
  - MRC score ≥48/60
  - Discharge home
  - Reduced LOS at rehab

Denehy, et al., *PTJ*, 2013
ICU Mobility Scale (IMS)
• Predictive validity
  – Discharge home (OR 1.16 to 1.54, p≤0.03)
  – Survival to 90 days (OR 1.38, p=0.001)

Manchester Mobility Score (MMS)

- Measures highest level of mobility
  - Passive/active movement in bed
  - Sitting edge of bed
  - Dependent lift to chair
  - Standing
  - Transfer with assistance
  - Transfer without assistance
  - Ambulate or navigate wheelchair >30 meters
• Inter-rater reliability: kappa=1
• Construct validity: r=0.88 (p<0.001)
  – Barthel Index

Acute Care Index of Function (ACIF)

• Scale assessing:
  – Mental status
  – Bed mobility
  – Transfers
  – Mobility (gait or wheelchair navigation)
Now validated for use in ICU

- Inter-rater reliability: ICC = 0.94
- Intra-rater reliability: ICC = 0.81 to 0.94
- Construct Validity: $r = 0.84$
  - ICU mobility scale

When should outcomes assessments be performed?

- Initial eval in ICU or upon awakening
- Weekly while in ICU
- Weekly while in hospital
- Hospital or therapy service discharge
- ICU stay
- ICU d/c
- Hospital floor stay
- ICU d/c
Outcomes Assessments to Use Across Continuum of Care

- MRC-SS
- Handgrip testing
- Handheld dynamometry
- Activity Measure for Post-Acute Care (AM-PAC)
- Johns Hopkins Highest Level of Mobility (JH-HLM)
- deMorton Mobility Index (DEMMI)
de Morton Mobility Index (DEMMI)

15 point scale assessing mobility from bridging to jumping

DEMNI

• Inter-rater reliability
  – 0.93 at ICU admission
  – 0.97 at ICU discharge

• Intra-rater reliability
  – 0.68 at ICU admission

• Moderate to strong convergent validity
  – Barthel Index, Katz ADL, MRC SS

Sommers J, et.al. PTJ; 96(9):1-9.
AM-PAC – 6 Clicks/ AM-PAC 2.0
Inpatient short forms

• Basic Mobility
  - used by PT/RN

• Basic Activity
  - used by OT/RN
Who selects item responses?
For all AM-PAC Inpatient ‘6 Clicks’ Short Forms, clinicians select the best response for each item.

What if the activity described in the item was not observed?
Clinicians can use clinical judgment to score an item when an activity was not directly observed.

What if the patient’s status fluctuates throughout the day?
Select responses based upon what you observe when you evaluate the patient.
Use the following criteria

<table>
<thead>
<tr>
<th>Total</th>
<th>Requires total assistance or cannot do it all</th>
</tr>
</thead>
<tbody>
<tr>
<td>A lot</td>
<td>Requires a lot of help (max to moderate assistance). <em>Can use assistive devices</em></td>
</tr>
<tr>
<td>A little</td>
<td>Requires a little help (minimal assistance-supervision). <em>Can use assistive devices</em></td>
</tr>
<tr>
<td>None</td>
<td>Does not require any help and does the activity independently. <em>Can use assistive devices</em></td>
</tr>
</tbody>
</table>
AM-PAC – Basic mobility

How much help does the patient currently need…

1. Turning from your back to your side while in a flat bed without using bedrails?
2. Moving from lying on your back to sitting on the side of a flat bed without using bedrails?
3. Moving to and from a bed to a chair (including a wheelchair)?
4. Standing up from a chair using your arms
5. To walk in hospital room?
6. Climbing 3-5 steps with a railing?
AM-PAC 6 Clicks

- The ICCs for the overall reliability of Basic mobility = .849
  Daily activity = .783
- Minimal detectable changes (MDC90) were 4.72 and 5.49, for Basic Mobility and Daily Activity scores, respectively

Passek et al., Activity and Basic Mobility Short Forms
Validity of the AM-PAC "6-Clicks" Inpatient Daily Activity and Basic mobility short forms. PHYS THER. Published online November 14, 2013
Johns Hopkins – Highest Level of Mobility (JH-HLM)

Summary of Outcome Measures

- Perform at ICU baseline, weekly, discharge
- Strength and functional assessments
Diagnosing ICUAW
Baseline and Weekly Measurements
Interventions
**Prevention of ICUAW**

- Aggressive treatment of sepsis
- Early mobilization
- Insulin management to prevent hyperglycemia
What innovative interventions can we provide to ICU patients?

- Neuromuscular electrical stimulation
- Supine cycle ergometry
- Interactive video games
- Inspiratory Muscle Training
- Mobility aides
  - Tilt bed/Arjo Combilizer
  - SARA Plus
NMES

• Benefits
  – Good option for patients too ill or sedated to perform active movement or mobility

• Drawbacks
  – Exact dosing to achieve benefit is unclear
  – Time-consuming
  – Contractions difficult to elicit in patients with ICUAW
Neuromuscular Electrical Stimulation (NMES)

- NMES to unilateral quads 2x/day in ICU sedated patients
- Results
  - No muscle atrophy in stimulated leg
  - 7-9% muscle atrophy in control leg (p<0.05)

Supine Cycle Ergometry

• Passive or active cycling performed in supine
• Great for use with:
  – Patients too lethargic for mobility
  – Patients too medically unstable for mobility
Supine Cycle Ergometry

Early exercise in critically ill patients enhances short-term functional recovery*

Chris Burtin, PT, MSc; Beatrix Clerckx, PT; Christophe Robbeets, PT; Patrick Ferdinande, MD, PhD; Daniel Langer, PT, MSc; Thierry Troosters, PT, PhD; Greet Hermans, MD; Marc Decramer, MD, PhD; Rik Gosselink, PT, PhD

- Control and intervention group rec’d daily ROM
- Intervention group performed 20 min/day of cycling
- Outcomes: At hospital discharge, intervention group 6MWD, quad force, and SF-36 were statistically significantly better than control group
Functional Electrical Stimulation during Supine Cycle Ergometry

- Emerging data on the topic
- May provide more benefit to patients too weak to actively cycle or contract muscles
• 8 patients on MV performed daily FES while in ICU
• Physical Function in Intensive Care Test score was higher among cycling group
• FES cycling safe and feasible
Tilt Bed

- Not a lot of supporting literature
- Best used for patients too weak to perform standing trials
• 23 ICU patients on mechanical vent
• Tilting to $30^\circ$, $45^\circ$, $60^\circ$, $75^\circ$, and $90^\circ$; 30 min total time
• Resulted in increased GCS and RASS during tilting trials
Feasibility and observed safety of interactive video games for physical rehabilitation in the intensive care unit: a case series

Michelle E. Kho PT, PhD a, *, Abdulla Damluji MBChB, MPH b, Jennifer M. Zanni PT, MSPT, ScD a, c, Dale M. Needham MD, PhD a, d
Arjo Comobilizer

Mobility Technology
Intervention:
- IMST performed 5 days/week
- 4 sets of 6-10 breaths, 2 minutes of rest between sets
- Resistance set at highest pressure patient could open valve >75% of attempts
- Control group received sham treatment
- All subjects participated in progressive breathing trials

<table>
<thead>
<tr>
<th></th>
<th>IMST (n=35)</th>
<th>Sham (n=34)</th>
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<tbody>
<tr>
<td>Treatment sessions</td>
<td>9.7 ± 4.0</td>
<td>11.0 ± 4.8</td>
</tr>
<tr>
<td>Pre training MIP</td>
<td>-44.4 ± 18.4</td>
<td>-43.5 ± 17.8</td>
</tr>
<tr>
<td>Post training MIP</td>
<td>-54.1 ± 17.8</td>
<td>45.1 ± 19.5</td>
</tr>
<tr>
<td>Weaning success</td>
<td>25 (71%)</td>
<td>16 (47%)</td>
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</table>
## Early Mobility Culture in the Intensive Care Units at The Johns Hopkins Hospital

<table>
<thead>
<tr>
<th>ICU</th>
<th>MICU</th>
<th>SICU</th>
<th>WICU</th>
<th>NCCU</th>
<th>CCU</th>
<th>CVSICU</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Orders Generation</strong></td>
<td>Program coordinator screening</td>
<td>AMPAC/HLM Surgical pathway</td>
<td>Surgical pathway</td>
<td>AMPAC/HLM Surgical pathway</td>
<td>AMPAC/HLM</td>
<td>Surgical pathway</td>
</tr>
<tr>
<td><strong>Provider Practice</strong></td>
<td>Consistent</td>
<td>Attending specific</td>
<td>Consistent</td>
<td>Attending specific</td>
<td>Attending specific</td>
<td>Attending specific</td>
</tr>
<tr>
<td><strong>Delivery of Care</strong></td>
<td>Dedicated PT for daily therapy</td>
<td>Scheduled frequency</td>
<td>Scheduled frequency Low priority</td>
<td>Scheduled frequency</td>
<td>Scheduled frequency</td>
<td>Scheduled frequency</td>
</tr>
<tr>
<td><strong>Nursing Culture</strong></td>
<td>Nurses assist</td>
<td>Rehab facilitated</td>
<td>Primary mobilizers</td>
<td>Mobility algorithm</td>
<td>Nurses assist</td>
<td>Aggressive mobility</td>
</tr>
<tr>
<td><strong>Mobility Champion</strong></td>
<td>Physician Physical Therapy</td>
<td>Nursing Physical Therapy</td>
<td>Nursing Leadership</td>
<td>Multidisciplinary</td>
<td>Multidisciplinary</td>
<td>Nursing</td>
</tr>
</tbody>
</table>
“Formal comparison of a patient’s functional ability prior to hospitalization with their current status at all transitions in level of care within institutions”

Right Patient
Right Provider
Right Time
Project Emerge
Early, goal-directed mobilisation in the surgical intensive care unit: a randomised controlled trial

Intervention:
1. Mobilization goal set during daily rounds
2. Goal implementation across shifts facilitated by inter-professional closed loop communication

<table>
<thead>
<tr>
<th></th>
<th>Intervention (n=104)</th>
<th>Control (n=96)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean SOMS in ICU</td>
<td>2.2</td>
<td>1.5</td>
</tr>
<tr>
<td>ICU LOS</td>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td>Functionally independent at hospital discharge</td>
<td>44</td>
<td>25</td>
</tr>
</tbody>
</table>
What Happens After ICU Discharge?

• What unit or service is patient being discharged to?

• What is current mobility culture in your ICU and hospital?

• How is therapy staffing allocated?
• Median distance ambulated on last ICU day of 150 feet
• 49/ 72 patients with PT consult
• Activity level ↓ in 55% of patients on first day on hospital ward from day of ICU discharge
• Structured QI to ↑ patient mobility and ↓ LOS
• Ramp up vs Post QI results
  – Increased ambulation from 43% to 70%
  – Positive change in JHH-HLM scores from 32% to 45%
  – Decreased adjusted median LOS by 1.1 days in patients with ELOS>7 days
  – No increase in injurious falls compared to pre QI
Functional Outcome Measures to Guide Clinical Decision Making

- Conversation with team to identify value in consult
- Communicate *when* and *where* Rehabilitation consult most appropriate
- Educate on importance of activity and mobility in ALL patients

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<thead>
<tr>
<th>Patient Name</th>
<th>Unit</th>
<th>AM-PAC IP Mob Raw</th>
<th>AM-PAC IP Act Raw</th>
<th>JHH HLM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Funk, Fred</td>
<td>JHH ZAYED 3W</td>
<td>24</td>
<td>24</td>
<td>Walk 250+ feet (8)</td>
</tr>
<tr>
<td>Rehab, Octopus</td>
<td>JHH BLOOMBERG 5S</td>
<td>20</td>
<td>21</td>
<td>Walk 10+ steps (6)</td>
</tr>
</tbody>
</table>
35 extra visits
Multidisciplinary Rounds

- Rehabilitation
- Charge RN
- Social work
- Respiratory Therapy
- Provider
- PESS/ nutrition
- Customer service representative
- Resource utilization
Engage Team

- Identify Mobility champions
- Bedside nurse
- Nurse educators and managers
- Communicate with Fellow's and Resident's
  - Make them aware of daily function
- Identify mid-level providers
- Involve RT's in decision making
Tying it all together: Patient case
Patient Case

52 y/o female: works full time, goes to gym weekly, loves going to Donny Osmond concerts

- **SOB dx as PNA**
- **No resolution of symptoms**
- **Admitted to OSH with PTX, necrotizing PNA, ARDS**
- **Develops sepsis, AKI, and broncho-pulmonary fistula**
Patient Case

HD 8
- Patient awake

HD 15
- Trach placed, remains on vent

HD 16-50
- Starts trach collar trials
- Continues trach collar trials, therapy

Diagnosing ICUAW
Baseline and Weekly Measurements
Interventions
Maintaining Care Outside of ICU
Patient Case

HD 8
Patient awake

Baseline:
MRC: 12/60
Hand grip: 0 kg
FSS-ICU: 1/35
AMPAC: 6/24
HLM: 2

Interventions:
Sits EOB with max A
Supine strengthening
Supine cycle ergometry

HD 15
Trach placed, remains on vent

Weekly:
MRC: 12/60
Hand grip: 0 kg
FSS-ICU: 3/35
AMPAC: 8/24
HLM: 3

ICUAW

Interventions:
Sits EOB with max A
Supine strengthening
Supine cycle ergometry

HD 16-50
Continues trach collar trials, therapy

Weekly:
MRC: 22/60
Hand grip: 3 kg
FSS-ICU: 6/35
AMPAC: 8/24
HLM: 5

Interventions:
Tilt Table
Dependent transfer to chair
Stand with max A of 2
Patient Case

HD 50-80

Remains in ICU

Weekly:
MRC: 30/60
Hand grip: 8 kg
FSS-ICU: 13/35
AMPAC: 10/24
HLM: 5

Progressing duration/
number of stands
Progressing time on tilt table/
trach collar

HD 81-89

DC to floor

Weekly:
MRC: 31/60
Hand grip: 10 kg
AMPAC: 10/24
HLM: 5

No FSS-ICU
PT 5x/week
on floor
Maintaining Care
Outside of ICU

HD 90

DC to rehab

Discharge:
MRC: 31/60
Hand grip: 12 kg
AMPAC: 11/24
HLM: 7

Standing with mod A
Able to walk with mod A of 2
After discharge:

- 4 weeks at vent rehab and then 3 weeks at acute inpatient rehab → decannulated, goes home with rolling walker
- Returns to driving 6 months after discharge, independent walking
- Returns to work part-time 11 months after discharge
Patient Case

Take-aways

• Weekly assessments displayed minor improvements that mobility level of assistance did not
• Variety of therapeutic interventions helped improve patient strength and mobility
• Intensive therapy from a multi-disciplinary team was needed for success
• Lasting impairments 1 year after discharge still persisted, despite intensive therapy regimen in ICU
Questions?