Early Progressive Mobility: Strategies for Successful & Safe Achievement to Impact Short and Long Term Patient Outcomes

Kathleen Vollman MSN, RN, CCNS, FCCM, FAAN
Clinical Nurse Specialist/Educator/Consultant
ADVANCING NURSING LLC
kvollman@comcast.net
www.vollman.com

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Disclosures

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Learning Objectives
At the completion of this activity, the participant will be able to:

1. Describe the impact of immobility on the skeletal, cardiovascular and pulmonary systems.

2. Discuss key in bed and out of bed mobility research findings.

3. Describe strategies to facilitate progressive mobility for the acute & critically ill patient.

Notes on Hospitals: 1859

“It may seem a strange principle to enunciate as the very first requirement in a Hospital that it should do the sick no harm.”

Florence Nightingale

Advocacy = Safety
Protect The Patient From Bad Things Happening on Your Watch

Implement Interventional Patient Hygiene

Interventional Patient Hygiene

- Hygiene…the science and practice of the establishment and maintenance of health
- Interventional Patient Hygiene….nursing action plan directly focused on fortifying the patients host defense through proactive use of evidence based hygiene care strategies

Incontinence Associated Dermatitis Prevention Program

Hand Hygiene

Comprehensive Oral Care Plan

Catheter Care

Bathing & Assessment

Pressure Ulcer Prevention
INTERVENTIONAL PATIENT HYGIENE (IPH)

Oral Care/Mobility

VAP/HAP

Catheter Care

VAP

CA-UTI

CLA-BSI

Skin Care/Bathing/Mobility

HAND

Patient

HYGIENE

SSI

HASI


Achieving the Use of the Evidence

Factors Impacting the ability to Achieve Quality Nursing Outcomes at the Point of Care

Skills & Knowledge

Resources & System

Value

Attitude & Accountability

Bed Rest: Potentially Harmful

Methodology

- Systematic review of the literature
- 39 trials of bed rest for 15 different conditions
- 5777 patients

Results

- 24 trials investigating bed rest following a medical procedure
  - No outcomes improve significantly/ 8 worsened
- 15 trials looking at bed rest as a primary treatment
  - No outcomes improved significantly/ 9 worsened

The Effects of Immobility/Supine Position on Respiratory Function

- Decreased Respiratory Motion
  - Abdomen influence on diaphragm motion
  - Atelectasis
- Increased Dependent Edema
  - Fluid accumulation in the dependent regions
  - Compression atelectasis
- Decreased Movement of Secretions
  - Impaired ability to clear tracheobronchial secretions
  - Normal mechanism dysfunctional in supine position


Hospital Acquired Pneumonia (HAP) and Ventilator-Associated Pneumonia (VAP)

- VAP crude mortality approximately 10-40%.
- HAP crude mortality 15-18%/ #1 HAI
- Pooled mean ranges 0.5 (Ped CVICU) to 4.4 (Burn ICU) per 1000 ventilator days
- HAP rates 5-15 per 1000 patient days
- Est cost $30,000-$40,000 per VAP
- Increase LOS up to 4-14 days
- Annual cost $2 billion dollars.

Rello J. Chest. 2002;121:2115-2121
ATS Guidelines for Healthcare Acquired Pneumonia 2006
The Effects of Immobility on Cardiovascular Function

• Fluid Shift
  – Fluid shift from upright to sitting…500cc shift from the lower extremities to the thoracic cavity
  – ↓ of plasma volume of 8-10% that occurs in the first 3 days of bedrest
  – Stabilizes at 15-20% volume loss by the 4th week of bedrest


The Effects of Immobility on Cardiovascular Function

• Cardiac Effects
  – ↑ workload (fluid shift)
  – ↑ resting heart rate & ↓ cardiac output

• Cardiac Deconditioning & Decreased Maximum Oxygen Uptake
  – Falls 23% after 3 weeks of strict bedrest with no change in peripheral oxygen extraction

• Orthostatic Intolerance
  – Deteriorates rapidly with bed rest
  – Occurs within 1-2 days with maximum effect at 3 weeks
  – Results from decreased autonomic tone & fluid shifts

Melada, G.A., et. al. Space and Environmental Medicine, August 1976
The Effects of Immobility on Integumentary System

Pressure Ulcer (PU) Facts

- 4th leading preventable medical error in the United States
- 2.5 million patients are treated annually in Acute Care
- NDNQI data base: critical care 7%  Med-Surg: 1-3.3%
- Incidence in acute care 4.5% (Hill-Rom 2011 Pressure Ulcer Prevalence Study)
- Most severe pressure ulcer: sacrum (44.8%) or the heels (24.2%)
- 60,000 persons die from pressure ulcer complications each yr
- ↑LOS ~ 3x longer
- National health care cost $10.5-17.8 billion dollars for 2010

Neurological Dysfunction

- Multicenter RCT - medical-surgical ICU’s
- 821 patients with ARF or Shock
- Evaluated in-hospital delirium and cognitive impact 3-12 months post d/c

Results

- 74% of patients developed delirium during hospital stay
- 3 months: 40% had global cognition scores 1.5 SD below population mean, 26% had scores 2 SD below population mean
- 12 months: 34%, 24% global cognition scores below the mean


Facts About Neurocognitive Impairments

- Up to 78% of ICU survivors experience neurocognitive impairments
- 46% neurocognitive impairment prevalence at 1 year
- 25% neurocognitive impairment prevalence at 6 years

Hopkins RO, et al. CHEST. 2006;130:869-878.
Skeletal Muscle Deconditioning

- Skeletal muscle strength reduces 4-5% every week of bed rest (1-1.5% per day)
- Without activity the muscle loses protein
- Healthy individuals on 5 days of strict bed rest develop insulin resistance and microvascular dysfunction
- Muscle groups that lose strength most quickly related to immobilization are those that maintain posture, transferring positions & ambulation 2 types of muscle atrophy
- Muscle atrophy in mechanically ventilated patients contribute to fatigue of the diaphragm and challenges with weaning.
- One day of bed rest requires two weeks of reconditioning to restore baseline muscle strength

Skeletal Muscle Deconditioning

Facts About Functional Impairments

- Up to 25% of ICU patients on mechanical ventilation > 7 days experience ICU acquired weakness
- Only 49% ARDS survivors return to work at 1 year
- ICU pts. up to 5 Years experience severe weakness, deficits in self-care & ambulation, poor quality of life, hospital readmission and death

References:
Candow DG, Chilibick PD J Gerontol, 2005:60A:148-155
Homburg NM., Arterioscler Thromb Vasc Biol, 2007;27(12):2650-2656

Outcomes of A Progressive Mobility Program

- ↓ incidence of VAP
- ↓ time on the ventilator
- ↓ days of sedation
- ↓ incidence of skin injury
- ↓ delirium
- ↑ ambulatory distance
- Improved function

Thomsen GE, et al. CCM 2008;36;1119-1124
Winkelman C et al, CCN,2010;30:36-60

WITHOUT EFFECTIVE SEDATION & DELIRIUM MANAGEMENT MOBILITY PROGRAMS WILL LIKELY FAIL

Wake up & breathe, lower sedation use, demonstrates 14% absolute survival advantage, 4 day reduction in LOS & no difference in incidence of PTSD, depression or cognitive decline & less likely to report functional decline 1 yr post follow up.

Jackson JC. et al. Am J Respir Crit Care Med; 2010;182:183-191
ABCDE Bundle Reduces Ventilation, Delirium & ↑OOB

- Eighteen-month, prospective, cohort, before-after study
- 5 adult ICU's, 1 step down, 1 oncology unit
- Compared 296 patients (146 pre-bundle) & 150 post bundle
- Intervention: ABCDE
- Measured:
  - For mechanical ventilation patients (187) examined ventilator free days
  - All patients examined incidence of delirium, mortality, time to discharge and compliance with the bundle

Balas M et al Crit Care Med, 2014; online
ABCDE Bundle Reduces Ventilation, Delirium & ↑OOB

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Without ABCDE N=93</th>
<th>With ABCDE N=94</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Received a spontaneous awakening trial</td>
<td>53%</td>
<td>71%</td>
<td>.0372</td>
</tr>
<tr>
<td>Received a spontaneous breathing trial</td>
<td>71%</td>
<td>84%</td>
<td>.0290</td>
</tr>
<tr>
<td>Got out of bed at least once</td>
<td>47%</td>
<td>61%</td>
<td>.0675</td>
</tr>
<tr>
<td>Days spent breathing without ventilator</td>
<td>21 days</td>
<td>24 days</td>
<td>.0371</td>
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<tr>
<td>Experienced delirium</td>
<td>75%</td>
<td>66%</td>
<td>.1623</td>
</tr>
<tr>
<td>Length of delirium</td>
<td>2 days</td>
<td>1 day</td>
<td>.00437</td>
</tr>
<tr>
<td>Died in the ICU</td>
<td>25.8%</td>
<td>14.9%</td>
<td>.0913</td>
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<tr>
<td>Self extubated</td>
<td>6.5%</td>
<td>5.3%</td>
<td>.7421</td>
</tr>
</tbody>
</table>

Balas M. Presented Jan 20, 2013 SCCM

---

<table>
<thead>
<tr>
<th>ABCDE Bundle Component Outcome</th>
<th>Pre ABCDE Bundle (n = 146)</th>
<th>Post ABCDE Bundle (n = 150)</th>
<th>Unadjusted p</th>
<th>Adjusted Odds Ratio</th>
<th>Adjusted p</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Awakening and breathing coordination</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ventilator-free days*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean (s)</td>
<td>15 (11.4)</td>
<td>18 (10.6)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median (IQR)</td>
<td>21 (6–25)</td>
<td>24 (7–25)</td>
<td>0.04</td>
<td></td>
<td></td>
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<tr>
<td><strong>Delirium monitoring/manage ment</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delirium anytime, n (%)</td>
<td>91 (62.3)</td>
<td>73 (48.7)</td>
<td>0.02</td>
<td>0.56 (0.33–0.93)</td>
<td>0.03</td>
</tr>
<tr>
<td>Duration of delirium, days, median (IQR)</td>
<td>3 (1–6)</td>
<td>2 (1–4)</td>
<td>0.62</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recent ICU days spent delirious, median (IQR)</td>
<td>50 (30–64.3)</td>
<td>33.3 (18.8–50)</td>
<td>0.003</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coma anytime, n (%)</td>
<td>41 (28.1)</td>
<td>43 (28.7)</td>
<td>0.91</td>
<td>1.00*</td>
<td>0.99</td>
</tr>
<tr>
<td>Coma days, median (IQR)</td>
<td>2 (1–4)</td>
<td>2 (1–5)</td>
<td>0.35</td>
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<tr>
<td>Percent ICU days spent in coma, median (IQR)</td>
<td>25 (18.2–44.4)</td>
<td>25 (12.5–42.9)</td>
<td>0.89</td>
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<td></td>
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<tr>
<td>Richmond Agitation-Sedation Scale Score, mean (s)</td>
<td>0.02 (1.4)</td>
<td>−1.03 (1.2)</td>
<td>0.38</td>
<td></td>
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<tr>
<td><strong>Early exercise/mobility</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Mobilized out of bed anytime in ICU, n (%)</td>
<td>70 (48)</td>
<td>99 (66.0)</td>
<td>0.002</td>
<td>2.11* (1.30–3.46)</td>
<td>0.003</td>
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<tr>
<td><strong>28-day mortality</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hospital mortality ICU and post-ICU, n (%)</td>
<td>29 (19.9)</td>
<td>17 (11.3)</td>
<td>0.04</td>
<td>0.66 (0.28–1.10)</td>
<td>0.09</td>
</tr>
<tr>
<td>ICU mortality, n (%)</td>
<td>24 (16.4)</td>
<td>14 (9.3)</td>
<td>0.07</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time to discharge (d)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>From ICU, median (IQR)</td>
<td>5 (3, 8)</td>
<td>4 (3, 5)</td>
<td>0.21</td>
<td>1.10* (0.89–1.50)</td>
<td>0.27</td>
</tr>
<tr>
<td>From hospital, median (IQR)</td>
<td>13 (9, 15)</td>
<td>11 (9, 13)</td>
<td>0.99</td>
<td>1.01* (0.77–1.31)</td>
<td>0.96</td>
</tr>
</tbody>
</table>

Balas M et al Crit Care Med, 2014; online
Driving Change

- Gap analysis
- Build the Will
- Protocol Development

Structure

- Make it Prescriptive
- Overcoming barriers
- Daily Integration

Process

Outcomes

Early Progressive Mobility

Progressive Mobility:
Planned movement in a sequential manner beginning at a patient's current mobility status and returning them to baseline & includes:

- Head elevation
- Manual turning
- Passive & Active ROM
- Continuous Lateral Rotation Therapy/Prone Positioning
- Movement against gravity
- Physiologic adaptation to an upright/leg down position (Tilt table, Bed Egress)
- Chair position
- Dangling
- Ambulation
The Mobility Initiative

**Objective**
- To create a progressive mobility initiative that will help ICU teams to address key cultural, process and resource opportunities in order to integrate early mobility into daily care practices.

**Methods**
- Multi-center implementation of key clinical interventions
- An evidence-based, user-friendly progressive mobility continuum was developed, lead by the Clinical Nurse Specialist faculty
- Implementation plan: process design, culture work & education
- 130 patients/3120 prospectively collected hourly observations
- Qualitative and quantitative data collected
  - 15 process and 5 outcome metrics
- Results reported as cohort and unit specific data

Determining Readiness

- Perform Initial mobility screen w/in 8 hours of ICU admission & daily

- **Yes**
  - PaO2/FiO2 > 250
  - Peep <10
  - O2 Sat > 90%
  - RR 10-30
  - No new onset cardiac arrhythmias or ischemia
  - HR >60 <120
  - MAP >55 <140
  - SBP >90 <180
  - No new or increasing vasopressor infusion
  - RASS > -3

- **No**
  - Patient is unstable, start at Level I & progress


ROM Active & Passive

- When muscles are immobilize in shorten positions there is remodeling of muscle fibers
- Bed rest entails immobilization of limb extensor muscles in shortened positions
- Passive movement has been shown to enhance ventilation, prevent contractures in patients in high dependency units
- Low resistance multiple repetition muscle training can augment muscle mass & strength

**Recommended 10 repetitions each extremity x2 daily**

Continuous Lateral Rotation Therapy

<table>
<thead>
<tr>
<th>Study or subcategory</th>
<th>Proportion of patients with pneumonia</th>
<th>Odds ratio (fixed)</th>
<th>Weight, %</th>
<th>Odds ratio (fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rotation</td>
<td>Control</td>
<td>95% CI</td>
<td>95% CI</td>
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<tr>
<td>Demarest et al.</td>
<td>1/15</td>
<td>4/14</td>
<td>3.45</td>
<td>0.17 (0.02, 1.72)</td>
</tr>
<tr>
<td>Fink et al.</td>
<td>7/51</td>
<td>19/48</td>
<td>14.55</td>
<td>0.24 (0.09, 0.65)</td>
</tr>
<tr>
<td>Gentiletti et al.</td>
<td>5/27</td>
<td>13/38</td>
<td>7.58</td>
<td>0.44 (0.13, 1.42)</td>
</tr>
<tr>
<td>Kelsey et al.</td>
<td>5/18</td>
<td>13/25</td>
<td>6.77</td>
<td>0.36 (0.16, 1.50)</td>
</tr>
<tr>
<td>Kirschenbaum et al.</td>
<td>3/17</td>
<td>10/20</td>
<td>6.52</td>
<td>0.21 (0.05, 0.98)</td>
</tr>
<tr>
<td>Summer et al.</td>
<td>4/41</td>
<td>7/42</td>
<td>5.38</td>
<td>0.54 (0.15, 2.01)</td>
</tr>
<tr>
<td>Traver et al.</td>
<td>8/44</td>
<td>17/59</td>
<td>10.24</td>
<td>0.55 (0.21, 1.42)</td>
</tr>
<tr>
<td>Whiteman et al.</td>
<td>10/33</td>
<td>14/36</td>
<td>8.04</td>
<td>0.68 (0.25, 1.86)</td>
</tr>
<tr>
<td>Daboisblanc et al.</td>
<td>6/49</td>
<td>11/51</td>
<td>9.05</td>
<td>0.35 (0.12, 1.01)</td>
</tr>
<tr>
<td>Subtotal (95% CI)</td>
<td>46/316</td>
<td>108/233</td>
<td>72.49</td>
<td>0.40 (0.27, 0.58)</td>
</tr>
</tbody>
</table>

CLRT to Prevent VAP

Methodology

- Prospective randomized controlled trial, 3 medical ICUs at a single center
- Eligible if ventilated < 48 hours & free from pneumonia, ALI or in ARDS
- 150 patients with 75 in each group
- 35 CLRT patients allocated to undergo percussion before suctioning
- Measures to prevent VAP were standardized for both groups including HOB

Results: CLRT vs. Control

- VAP: 11% vs. 23% p = .048
- Ventilation duration: 8 ± 5 days vs. 14 ± 23 days, p = .02
- LOS: 25 ± 22 vs. 39 ± 45 days, p = .01
- Mortality: no difference
Systematic Method of Approaching Placement & Removal of Rotational Therapy

Prone Positioning: The New Evidence

- RCT 466 patients with severe ARDS
  - Severe ARDS P/F ratio < 150 mm Hg, with Fio2 0.6, PEEP of at least 5 cm of water, and a Tv to 6 ml per kg of PBW
- Initiation 12-24hrs
- Prone-positioning 16hrs/or supine position
- NMB used 5 days
- Results:
  - Prone 16% mortality, supine 32.8% p< 0.0001
  - No differences in complications except > cardiac arrest in supine position

Manual Turning: Impact on Pneumonia

- **Effect of Post Op Immobilization** (Chulay MA et al, CCM, 1982)
  - RCT: 35 post op CABG patient
  - Compared q 2 turning to supine in first 24 hrs post op
  - Results:
    - no problems with Hemo or O2
    - Patient turned has less fever & 3 day ↓ in ICU LOS

- **Freq of Turning on Pneumonia** (Schallom et al. 2005)
  - Observation: 284 ICU pts for 16/hrs/day x3 days
    - Mean # of observed turns 9.64 vs. 23 possible turns/48 hrs
  - Results: day 4 patients with pneumonia turned average 8.6x vs. 10.62 without pneumonia

Do We Even Achieve the Minimum Mobility Standard… “Q2 Hours”?
Body Position: Clinical Practice vs. Standard

- **Methodology**
  - 74 patients/566 total hours of observation
  - 3 tertiary hospitals
  - Change in body position recorded every 15 minutes
  - Average observation time 7.7 hours
  - Online MD survey
- **Results**
  - 49.3% of observed time no body position change
  - 2.7% had a q 2 hour body position change
  - 80-90% believed q 2 hour position change should occur but only 57% believed it happened in their ICU

Krishnagopalan S. Crit Care Med 2002;30:2588-2592

Positioning Prevalence

- **Methodology**
  - Prospectively recorded, 2 days, 40 ICU’s in the UK
  - Analysis on 393 sets of observations
  - Turn defined as supine position to a right or left side lying
- **Results:**
  - 5 patients prone at any time, 3.8% (day 1) & 5% (day 2) rotating beds
  - Patients on back 46% of observation
  - Left 28.4%
  - Right 25%
  - Head up 97.4%
  - Average time between turns 4.85 hrs (3.3 SD)
  - No significant association between time and age, wt, ht, resp dx, intubation, sedation score, day of wk, nurse/patient ratio, hospital

EBP Recommendations to Achieve Offloading & Reduce Pressure

- Turn & reposition every 2 hours (avoid positioning patients on a pressure ulcer)
  - Repositioning should be undertaken to reduce the duration & magnitude of pressure over vulnerable areas
  - Cushioning devices to maintain alignment /30 ° side-lying & prevent pressure on boney prominences
  - Use lifting device or other aids to reposition & make it easy to achieve the turn
  - Assess whether actual offloading has occurred


Q 2 hr Turning
Current Practice:
Turn & Reposition

- Transfer Device
- Specialty Bed
- Disposable Slide Sheets
- Draw Sheet/Pillows/Layers of Linen
- Lift Device

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REPOSITIONING THE PATIENT

CAREGIVER INJURY
### Number, Incidence Rate, & Median Days Away From Work for Occupational Injuries RN’s with Musculoskeletal Disorders in US, 2003 – 2009

<table>
<thead>
<tr>
<th>Year</th>
<th>Ownership</th>
<th>Occupation</th>
<th>Total Cases</th>
<th>Incidence Rate</th>
<th>Median Days Away From Work</th>
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</thead>
<tbody>
<tr>
<td>2009</td>
<td>private industry</td>
<td>RNs</td>
<td>8,760</td>
<td>51.6</td>
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<td>2010</td>
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<td>RNs</td>
<td>9,260</td>
<td>53.7</td>
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<td>2008</td>
<td>private industry</td>
<td>RNs</td>
<td>8,120</td>
<td>48.4</td>
<td>6</td>
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<tr>
<td></td>
<td>local government</td>
<td>RNs</td>
<td>960</td>
<td>-</td>
<td>5</td>
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<tr>
<td></td>
<td>state government</td>
<td>RNs</td>
<td>540</td>
<td>-</td>
<td>9</td>
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<td>2007</td>
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<td>RNs</td>
<td>8,580</td>
<td>53.4</td>
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<td>RNs</td>
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<td>RNs</td>
<td>10,050</td>
<td>-</td>
<td>6</td>
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</tbody>
</table>

Achieving the Use of the Evidence For Mobility & Moisture

Factors Impacting the ability to Achieve Quality Nursing Outcomes at the Point of Care

Resource & System
- Breathable glide sheet/stays
- Foam Wedges
- Microclimate control
- Reduce layers of linen
- Wick away moisture body pad

Value
Attitude & Accountability

Skills & Knowledge

Comparative Study of Two Methods of Turning & Positioning

- Blocked design with convenience sample of 60 patients
- SOC: pillows/draw sheet
- TAP: breathable glide sheet/foam wedges/wick away pad

- Results:
  - Nurse satisfaction 87% versus 34%
  - 30° turn achieved versus -0-15 in SOC
  - SOC group required more resources

<table>
<thead>
<tr>
<th></th>
<th>SOC</th>
<th>TAP</th>
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<tbody>
<tr>
<td>Time on Product</td>
<td>7 days</td>
<td>7 days</td>
</tr>
<tr>
<td></td>
<td>(1-25)</td>
<td>(1-45)</td>
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<tr>
<td>Age</td>
<td>57.72</td>
<td>57.73</td>
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<td>(18-89)</td>
<td>(23-92)</td>
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<td>Gender</td>
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<td>10 Female</td>
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<td></td>
<td>18 male</td>
<td>20 Male</td>
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<td>Braden</td>
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<td>13.23</td>
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<tr>
<td>Mobility</td>
<td>0-1</td>
<td>0-1</td>
</tr>
<tr>
<td>BMI</td>
<td>20.60</td>
<td>20.97</td>
</tr>
<tr>
<td>PU development</td>
<td>0</td>
<td>1*</td>
</tr>
<tr>
<td>Pulled up in bed</td>
<td>3.29</td>
<td>2.50</td>
</tr>
<tr>
<td>Number to turn</td>
<td>1.97</td>
<td>1.35</td>
</tr>
</tbody>
</table>

Powers J, Presented at 27th Annual Symposium of Advances in Skin and Wound Care, Las Vegas, NV; 10/20-23, 2012
Safe Patient Handling Initiative: Decreases Staff Musculoskeletal Injuries & Patient Pressure Ulcers

Way H  Presented at the 2014 Safe Patient Handling East Conference on March 27, 2014

The Clinical Outcomes of an Early Mobility Protocol: Methods

• Morris, et al, conducted a prospective cohort study at Wake Forest Baptist Medical Center to determine the impact of early mobility therapy on patients who were mechanically ventilated with respiratory failure
• The control group received standard passive ROM and turning (n=165)
• The study group received low-impact mobility (n=165)
  - Therapy initiated within 48 hours of mechanical ventilation
  - Therapy 7 days/week until ICU discharge
  - Mobility team included 1 ICU nurse, 1 physical therapist, and 2 nursing assistants
The Clinical Outcomes of an Early Mobility Protocol: Results

- The early mobility protocol:
  - Shortened time to patient first out of bed (Δ=6.3 days)
  - Hospital LOS (Δ=3.3 days)
  - ICU LOS (Δ=1.4 days)
- 80.0% of patients in the protocol group underwent at least 1 physical therapy session at any time during their hospital stay as compared to 47.7% of patients in the control group
- The direct inpatient costs for the protocol group (including mobility team salaries) were lower than those for the control group
  - Average cost per patient was $41,142 in the protocol group
  - Average cost per patient was $44,302 in the control group

LOS=length of stay

Early Physical and Occupational Therapy in Mechanically Ventilated Patients

- Prospective randomized controlled trial from 2005-2007
- 1161 screen, 104 patients mechanically ventilated < 72hrs, functionally independent at baseline met criteria
- Randomized to early exercise of mobilization during periods of daily interruption of sedation (49 pts) or two daily interruption of sedation with therapy as ordered by the primary care team (55 pts)
- Primary endpoint: number of patients returning to independent functional status at hospital discharge (able to perform activities of daily living and walk independently)

Early Physical and Occupational Therapy in Mechanically Ventilated Patients


- Safe
- Well tolerated
- ↑ functional outcome
- ↓ duration of delirium
- ↑ VFD

Table: Function and muscle strength outcomes according to study group
Neuro Surgical Patients: Mobility Project

Shands at the University of Florida
NeuroIntensive Care Unit PUMP Plus Algorithm

- All patient admitted over 16 month period
- 10 month pre-obs- 6 month post
- 100% Nurse-driven protocol
- One protocol for nurses to follow; all patients
- Mobility goals for patients with or without deconditioning
- Defined steps beyond "chair" to better prepare patients for discharge, earlier
- End point mobility goals similar to outpatient PT goals

---

Evaluate...Post-Project Metrics

<table>
<thead>
<tr>
<th>Outcome Measure</th>
<th>Before Mobility</th>
<th>After Mobility</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>patient days</td>
<td>April 1, 2010-Feb 11, 2011</td>
<td>Feb 11-Jan 31, 2011</td>
<td>0.12</td>
</tr>
<tr>
<td>neurointensive care unit LOS (days)</td>
<td>4.00 ± 3.1</td>
<td>3.46 ± 3.1</td>
<td>&lt;0.004</td>
</tr>
<tr>
<td>days in restraints</td>
<td>2.9 ± 1.9</td>
<td>1.8 ± 0.9</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>hospital-acquired infections</td>
<td>5.5 ± 2.9</td>
<td>2.2 ± 1.0</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>VAP rate†</td>
<td>2.14 ± 0.95</td>
<td>0.0 ± 0</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>% of patients ventilated</td>
<td>39.9 ± 0.9</td>
<td>39.9 ± 0.9</td>
<td>0.96</td>
</tr>
<tr>
<td>ventilator days</td>
<td>25.5 ± 2.9</td>
<td>23.1 ± 7.1</td>
<td>0.39</td>
</tr>
<tr>
<td>VAP bundle compliance (%)</td>
<td>98.5 ± 0.02</td>
<td>95.6 ± 0.07</td>
<td>0.23</td>
</tr>
<tr>
<td>U14 rate†</td>
<td>2.72 ± 1.17</td>
<td>1.07 ± 1.17</td>
<td>0.14</td>
</tr>
<tr>
<td>urinary catheter days</td>
<td>581.5 ± 30</td>
<td>463.4 ± 145</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>urinary catheter line infections</td>
<td>0.30 ± 0.06</td>
<td>1.9 ± 0.09</td>
<td>0.04</td>
</tr>
<tr>
<td>total falls†</td>
<td>100 ± 3.5</td>
<td>10.0 ± 6.3</td>
<td>1.00</td>
</tr>
<tr>
<td>fall rate per 1000 patient days</td>
<td>1.39 ± 0.57</td>
<td>1.31 ± 0.85</td>
<td>0.867</td>
</tr>
<tr>
<td>critical line pulls</td>
<td>0.90 ± 0.53</td>
<td>0.67 ± 0.81</td>
<td>0.63</td>
</tr>
<tr>
<td>line pull rate†</td>
<td>1.10 ± 0.67</td>
<td>0.91 ± 1.12</td>
<td>0.766</td>
</tr>
</tbody>
</table>

* All data represented as mean ± SD unless otherwise noted
† Rates are per 1000 days


Courtesy of J Hester
Evaluate...Post-Project Metrics

Neuro ICU PUMP Plus Compliance

Increased Mobility by 300%

No adverse events

Figs. 2: Graph showing the change in the average number of recorded activities per day before and after implementation of the PUMP® Plus program. *p < 0.05, **p < 0.001, OOB = out of bed.

Early Mobility:
Can We Do It?
Is it Safe?
Challenges to Mobilizing Critically Ill Patients

- Human or Technological Resources
- Knowledge/Priority
- Safety
- Hemodynamic instability

In-Bed Technology
Out of Bed Technology

Current Seating Positioning Challenges

Uncomfortable

- Airway & Epiglottis compressed
- Lack of Body Alignment
- Shear/Friction
- Sacral Pressure
- Frequent repositioning & potential caregiver injury
- Potential fall risk
Repositioning Patients in Chairs: An Improved Method (SPS)

- Study the exertion required for 3 methods of repositioning patients in chairs
- 31 care giver volunteers
- Each one trial of all 3 reposition methods
- Reported perceived exertion using the Borg tool, a validated scale.

![Graph showing exertion levels for different methods]

Method 1: 2 care givers using old method of repositioning
246% greater exertion than SPS

Method 2: 2 caregivers with SPS

Method 3: 1 caregiver with SPS
52% greater exertion than method 2


Progressive Mobility: Use of Technology to In-Bed & Out of Bed Mobility

Journey to tolerating upright position, turning, tilt, sitting, standing and walking and out of bed chair sitting can occur quicker through the use of technology.
Safety

- >1% adverse events during 1449 sitting, standing and walking sessions with patients on ventilators.
- Underwent daily sedation interruption followed by PT & OT daily until achieving physical function independence
  - Safety events occurred in 16% of all sessions
    - Loss of 1 arterial line, 1 nasogastric tube, 1 rectal tube
    - Therapy was stopped on 4% of all sessions for vent asynchrony, agitation, or both
    - Delirium present 53% of the time during therapy sessions


Feasibility of PT & OT at Beginning of Mechanical Ventilation

- 49 mechanically ventilated patients
- Underwent daily sedation interruption followed by PT & OT daily until achieving physical function independence
- Started with ROM, ADL’s, sitting, standing and walking as tolerated

Feasibility of PT & OT at Beginning of Mechanical Ventilation

- 55% of the 49 patients in the early PT OT group had acute lung injury (most with ARDS)
- 69% had steroids ever administered
- Patient had delirium on 53% of all therapy sessions
- 75% of therapy sessions, A central line was present. A dialysis catheter was present 18% of therapy sessions
- Safety events occurred in 16% of all sessions
  - Loss of 1 arterial line, 1 nasogastric tube, 1 rectal tube
- Therapy was stopped on 4% of all sessions for vent asynchrony, agitation, or both


Barriers to Mobilization

4 week prospective audit on 106 mixed med-surg patients comparing mobilized & non-mobilized patients

Hemodynamic Instability

???

Is it a Barrier to Positioning?

Hemodynamic Status

- No differences noted in hemodynamic variables between supine & positions
- Lateral turn results in a 3-9% decrease in SVO2 which takes 5-10 minutes to return to baseline
- Appears the act of turning has the greatest impact on any instability seen
- Minimize factors which contribute to imbalances in oxygen supply & demand

Patients at Risk for Intolerance to Positioning

- Elderly
- Diabetes with neuropathy
- Prolonged bedrest
- Low Hb and cardiovascular reserve
- Prolonged gravitational equilibrium

Vollman KM. Crit Care Nurs Q, Vol. 36, No. 1, pp. 17–27

Decision Making Tree for Patients Who Are Hemodynamically Unstable with Movement

Vollman KM. Crit Care Nurs Q. 2013 Jan;36(1):17-27
It Takes a Village

“Even if you are on the right track, you will get run over if you just sit there.”

Will Rogers
Changing Culture

Recognizing the Hard Work and Safety Issues

- Mobilizing critically ill patients is not without risk
  - Having an well-structured framework helps to reduce fear and improve safety...build the will
  - Having the knowledge that it is not as risky as first perceived
  - Acknowledgement that it can be time consuming/labor intensive
- Demands coordination of resources from multiple disciplines
- Ensure the right technology is available to facilitate the plan of care
- Displaying the Progressive Mobility Continuum at the bedside allowed for just-in-time coaching
- Developed formal exclusion criteria. If no exclusions then patient gets mobilized
- Create a reliable process for early mobility that includes measurement & feedback mechanisms

Ensuring Safety & Success

- Mobility readiness assessment
- Determining absolute contraindications for any mobility protocol
- Criteria for stopping a mobility session
- Changing the culture
- Sufficient resources and equipment to make it easy & safe to do
Pre & Post Measures

- **Process Measures**
  - Direct observation of q 2hr turning
  - Number of patients on the protocol, are they leveled and are the actions taking place
  - Achieving education on products & processes
  - Readmission to the ICU

- **Outcome Measures**
  - LOS (ICU & Hospital)-financials
  - VAE/HAP/Pressure ulcers
  - Discharge location
  - Readmission to the hospital < 30days
Be Courageous

We all are responsible for the safety of our patients and ourselves. Own the Issues

• “If not this, then what??”
• “If not now, then when?”
• “If not me, then who??”