Guiding Protocolized Patient Care through Branching Logic

By Cindy Sparkman, BS, RRT-NPS and Mickey Roach, BS, RRT
FY2012 – Hospitals and Clinics; 4 Hospitals 10 Community Clinics
Total employees – 8657
Total Respiratory Therapists - 108
Inpatient Admissions – just over 30,000
Licensed Beds – 728
Physicians – 1,200 physicians
Attendees:

1. Will understand the value of electronic protocols in respiratory care
2. Will understand how to program branching logic codes for MediLinks protocols
3. Will understand how electronic protocols can improve patient care outcomes
• MD writes Respiratory Therapy Order
• Respiratory Therapist performs task

• Every order flagged at 48 hours
• DC’d at 72 hours
AARC defines that the purposes of the TDP are:

• Deliver individualized diagnostic and therapeutic respiratory care to patients
• Assist the physician with evaluating patients’ respiratory care needs and to optimize the allocation of respiratory care services
• Determine the indications for respiratory therapy and the appropriate modalities for providing high-quality, cost-effective care that improves patient outcomes and decreases length of stay
• Empower respiratory care practitioners to allocate care using signs-and symptom-based algorithms for respiratory treatment
25% of care misallocated, The Cleveland Clinic 1987

24.8% of therapy over ordered, 11.8% of therapy under ordered, Shelledy DC, LeGrand TS, Peters JI, 2004

38% Oxygen therapy over ordered, Brougher et al, 1986
Misallocation

- Therapy not needed
- Patient needs therapy, but not receiving
- Another therapy more effective
- Wrong frequency
Consequences of Misallocation

- Prolonged duration of mechanical ventilation
- Prolonged ICU LOS
- Prolonged hospital LOS
- Increased cost
Assemble a team
Review existing data on therapist driven protocols and RT procedures
Design **therapist driven protocols**

- Integrate branching logic software and incorporate into the existing work flow
- Forcing Function
- Protocol drives the therapy

**Training, Implementation, and Roll out**
Goals

1. To reduce misallocation of care and cost of care via *therapist driven protocols*
2. Improve The Exceptional Patient Care Experience
3. Monitor: Ventilator Days, ICU LOS, Hospital LOS, Number of therapies, Cost of care
TEAM

- Boaz Markewitz, MD, Medical Director
- Earl Fulcher, Respiratory Therapy Manager
- Cindy Sparkman, Respiratory Care Adult Care Coordinator
- Mickey Roach, Respiratory Care Computer System Administrator
- Jim Behnke, Ancillary Services Director
- Bob Goodsell, Respiratory Therapist
- Paul Kappelman, Respiratory Supervisor
- Steve Lafortune, Respiratory Therapist
- Linda Egbert, Quality & Patient Safety Specialist
- Jace Manning, Quality & Patient Safety Project Manager / Facilitator
University of Utah Protocols

• Developed a series of unique protocols for the University of Utah Hospital

➢ Lung Volume Expansion (LVE)
➢ Airway Clearance (AWC)
➢ Neuromuscular
➢ Bronchodilator
➢ Oxygen
Designing Protocols

• Patient population

• Evidence Based Medicine

• Strong Direction from Medical Director

• Robust electronic Programming - Medilinks
Designing Protocols

- Least Cost/ least invasive
- Moderate Cost/ moderately invasive
- Most Cost/ Most invasive
New Procedures

• Ventilator/CPAP/Manual Hyperinflation
• Vest therapy for Non-CF Patients
• Cough Assist
• Intrapulmonary percussive ventilation
• The ability to choose between Therapep and EzPAP
• MD writes Respiratory Therapy Order
• Respiratory Therapist performs task
• Every order flagged at 48 hours
• DC’d at 72 hours
• MD writes order-Perform Care for 24 hours
  Enroll patient into Resp. Care Protocols
• Physician orders- RT To Assess and Treat, Preferred method
• Immediately Assess and Enroll into Respiratory Care Protocols
• Every patient/Every unit with two exceptions
  CF and Pediatric
Protocol Workflow Tools in MediLinks

Current Respiratory Therapy Automated Electronic Protocol Work Flow

(A) From host system – TREATMENT ORDER or RESPIRATORY TO ASSESS & TREAT ORDER Interfaces to MEDILINKS

(B) Therapy Order

(C) Assess & Treat Order

(D) Auto-generated 24/48 hour assessment orders/tasks auto-populate to RT treatment assignment screen for new shift with new workflow

A “Patients Protocol Orders by Room” report is available showing all scheduled assessments.

Assessment/Re-assessment performed Charting will automatically generate:

1) Triage score
2) Care Plan and treatment frequency
3) Initial 24 hour assessment or 24/48 hour re-assessment order/task with future date/time
4) Discontinue previous assessment order/task

Assessment Order(s) will be automatically discontinued

NO

YES

Indication(s) for Continuing Therapy per Protocol Assessment?
This report typically lists 25-40 scheduled re-assessments orders
Into Airway Clearance

Diamond AC Is this a Neurology or Neurosurgical patient?

Artificial Airway Present ?

Perform Therapep Frequency and re-assessment interval determined by triage score

Which tx is pt able to perform effectively? Therapep? EzPAP? Neither?

Does patient have a productive cough?
How charting a therapy will generate the initial assessment order.
PRE TREATMENT ASSESSMENT:
HP 74 bpm
AT 15 bpm
Sniff

BREATH SOUNDS:
Pre-treatment breath sounds: rales in bases bilaterally.

PATIENT EDUCATION
Medication or therapy received previously along with pertinent educational information.

THERAPY:

POST TREATMENT ASSESSMENT:

BREATH SOUNDS:

ADVERSE REACTIONS

COUGH:

OXYGEN THERAPY
PRE TREATMENT ASSESSMENT:

- HP: 74 bpm
- RR: 15 bpm
- Soft

BREATH SOUNDS:
Pre-treatment breath sounds: clear in bases bilaterally.

PATIENT EDUCATION
Medication or therapy was received previously along with pertinent educational information.

THERAPY:
Finish.

POST TREATMENT ASSESSMENT:
Finish.

BREATH SOUNDS:
Finish.

ADVERSE REACTIONS
Finish.

COUGH:
Finish.

OXYGEN THERAPY
Finish.
A 24 hour assessment order code is embedded as a charge code on the branch code associated with this prompt.
Template branches are completed as normal

Assessors find the PIP (Patient Information Panel) very helpful.
In the sign/finish screen the INITIAL 24 HR assessment order is generated and will automatically post to the patient’s orders upon signing.
The order entry window opens automatically allowing user to modify the start date/time. Typically this will be 24 hours out for the initial assessment.
Example of how the INITIAL Assessment order automatically posts to the assessor RT who is assigned to the patient when the worklist is built for the following days.
RESPIRATORY THERAPY PROTOCOL

Patient's identity (Name and Medical Record Number) verified via wristband.

INITIAL RESPIRATORY ASSESSMENT

PATIENT ASSESSMENT

Respirations: Increased RR 21-25
Level of Consciousness: Alert, oriented, cooperative
Breath Sounds: Decreased bilaterally
Cough: Strong, non-productive
Level of Activity: Ambulatory (walks in hall) with assistance
Oxygen Required for SPO2 >90%: 1-3 lpm or FIO2 < 40% or chronic cpap/bipap at home settings

CHART ASSESSMENT

Pulmonary Status: Current smoker > 1 Pk/Day
Surgical Status: Lower abdominal surgery
Chest X-Ray: Clear

TRIAGE SCORE: 9

Patient complains of pain with deep breathing and coughing

Lung Volume Expansion Indications:
Upper abdominal surgery

LUNG VOLUME EXPANSION PROTOCOL
Patient has atelectasis by X-ray Patient does not have an artificial airway

Patient is able to perform effective EzPAP therapy.

CARE PLAN:

Perform EzPAP
Recommended frequency: TID, re-assess in 24 hours.

The assessment template will generate:

- The assessment results
- Triage Score
- Care Plan
- Recommended Tx Frequency (based on triage score)
- Reassessment interval (based on triage score)
- To automatically DC last assessment order
The initial 24 hr assessment order is automatically DC’d.

The NEXT assessment order generated from the INITIAL ASSESSMENT charting displays here in the Sign & Finish screen.
The new order entry window again opens automatically allowing user to put in the new date/time as needed.
The new 2ND Assessment order posts to the assessor RT who is assigned to the patient when the next day’s worklist is built.

In the treatment screen, the initial 24 hr assessment order is automatically DC’s.
CODING:
In the branch code containing the care plan, selection of the calculated Triage Score will determine the next re-assessment interval + it will DC the last assessment order automatically 😊

A – Embed Assessment order as a CHARGE CODE in Code Definition Tab

Freq. statements

<table>
<thead>
<tr>
<th>List Choice</th>
<th>Branch Code</th>
<th>Value</th>
<th>Goal</th>
<th>Observation</th>
<th>Charge Code</th>
<th>Charge Qty</th>
<th>Inserted Text</th>
<th>DC Order</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triage score (20+)</td>
<td>PSTDXX1</td>
<td>0</td>
<td>0</td>
<td>CARE PLAN - LVE - EoPAP</td>
<td>0_48 HR RE-ASSES</td>
<td>1</td>
<td>Q4, re-assess in 48 hours.</td>
<td></td>
</tr>
<tr>
<td>Triage score (14-19)</td>
<td>PSTDXX1</td>
<td>0</td>
<td>0</td>
<td>CARE PLAN - LVE - EoPAP</td>
<td>0_24 HR RE-ASSES</td>
<td>1</td>
<td>QID &amp; PRN, re-assess in 24 hours.</td>
<td>2</td>
</tr>
<tr>
<td>Triage score (9-13)</td>
<td>PSTDXX1</td>
<td>0</td>
<td>0</td>
<td>CARE PLAN - LVE - EoPAP</td>
<td>0_24 HR RE-ASSES</td>
<td>1</td>
<td>TID, re-assess in 24 hours.</td>
<td>3</td>
</tr>
<tr>
<td>Triage score (0-8)</td>
<td>PSTDXX1</td>
<td>0</td>
<td>0</td>
<td>CARE PLAN - LVE - EoPAP</td>
<td>0_48 HR RE-ASSES</td>
<td>1</td>
<td>BID, re-assess in 48 hours.</td>
<td>4</td>
</tr>
</tbody>
</table>
B – Embed Assessment orders to be DC’D in the Charges/Observations/DC Order tab (DC Order column)
RESPIRATORY THERAPY PROTOCOL

Patient's identity (Name and Medical Record Number) verified via wristband.

PATIENT ASSESSMENT

Respirations: Increased RR 21-25
Level of Consciousness: Lethargic, follows commands
Breath Sounds: Decreased unilaterally
Cough: Strong, productive
Level of Activity: Ambulatory (walks in hall) with assistance
Oxygen Required for SPO2 >90%: 1-3 lpm or FIO2 < 40% or chronic cpap/bipap at home settings

CHART ASSESSMENT

Pulmonary Status: New diagnosis of pulmonary disease
Surgical Status: No Surgery
Chest X-Ray: Any abnormality i.e.: opacity, effusion, or atelectasis of one lobe

TRIAGE SCORE: 11
Patient complains of some intermittent shortness of breath

Airway Clearance Indications:
Excessive secretions

Chest X-Ray findings:
Atelectasis

AIRWAY CLEARANCE PROTOCOL

Patient does not have an artificial airway
Patient has a productive cough
Patient is able to perform effective TheraPEP Therapy.

CARE PLAN:

Perform TheraPEP Therapy
Recommended Frequency: TID, reassess in 24 hours
Example of Assessment Protocol Data Entry PROMPT

Assessor selects from the list of pre-defined descriptors for the one that best matches the physical assessment of the patient for each assessment element.
EXAMPLE OF BRANCH CODING FOR ASSESSMENT OF RESPIRATIONS

Assign a value to each assessment element in List Choice.
### Select description of Level of Consciousness

- Alert, oriented, cooperative
- Lethargic but answerable & follows commands
- Confused & doesn’t follow commands
- Comatose but withdraws to pain
- Comatose & unresponsive

### PATIENT ASSESSMENT

- Respirations: Increased
- BP: 21-25
- Level of Consciousness: Lethargic, follows commands

Score: 2
EXAMPLE OF BRANCH CODING FOR ASSESSMENT OF LEVEL OF CONSCIOUSNESS

Each assessment category is coded similarly

<table>
<thead>
<tr>
<th>List Choice</th>
<th>Branch Code</th>
<th>Value</th>
<th>Goal</th>
<th>Observation</th>
<th>Charge Code</th>
<th>Charge Qty</th>
<th>Inverted Text</th>
<th>Display Order</th>
<th>DC Order</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alert, oriented, cooperative</td>
<td>AB50011</td>
<td>0</td>
<td></td>
<td>Level of Consciousness - Alert, oriented, cooperative (0)</td>
<td>0</td>
<td></td>
<td>Alert, oriented, cooperative</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Lethargic but arousable &amp; follows commands</td>
<td>AB50011</td>
<td>1</td>
<td></td>
<td>Level of Consciousness - Lethargic but arousable &amp; follows commands (1)</td>
<td>0</td>
<td></td>
<td>Lethargic, follows commands</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Confused &amp; doesn't follow commands</td>
<td>AB50011</td>
<td>2</td>
<td></td>
<td>Level of Consciousness - Confused &amp; doesn't follow commands (2)</td>
<td>0</td>
<td></td>
<td>Confused &amp; doesn't follow commands</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Oblivious but withdraws to pain</td>
<td>AB50011</td>
<td>3</td>
<td></td>
<td>Level of Consciousness - Oblivious but withdraws to pain (3)</td>
<td>0</td>
<td></td>
<td>Oblivious &amp; withdraws to pain</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Comatose &amp; unresponsive</td>
<td>AB50011</td>
<td>4</td>
<td></td>
<td>Level of Consciousness - Comatose &amp; unresponsive (4)</td>
<td>0</td>
<td></td>
<td>Comatose &amp; unresponsive</td>
<td>5</td>
<td>1</td>
</tr>
</tbody>
</table>
Select description of Breath Sounds:
- Clear
- Decreased unilaterally
- Decreased bilaterally
- Basilar crackles or Bronchial
- Wheezing
- Rhonchi
- Diffuse crackles

PATIENT ASSESSMENT
Respirations: Increased RR 21-25
Level of Consciousness: Lethargic, follows commands
Breath Sounds: Decreased unilaterally

Score: 3
"FOR THE PAST 24 HOURS", Select the most appropriate description of cough:

- Strong non-productive
- Strong productive
- Weak non-productive
- Congested non-productive cough
- Weak productive with or without expectoration
- No spontaneous cough or requires suction

PATIENT ASSESSMENT

- Respirations: Increased RR 21-25
- Level of Consciousness: Lethargic, follows commands
- Breath Sounds: Decreased unilaterally
- Cough: Strong, productive

Score: 4
PATIENT ASSESSMENT

Respirations: Increased RR 21-25
Level of Consciousness: Lethargic, follows commands
Breath Sounds: Decreased unilaterally
Cough: Strong, productive
Level of Activity: Ambulatory (walks in hall) with assistance

Score: 5
Select O2 required for SpO2 > 90%

Not on supplemental O2
1-3 lpm or FIO2 < 40% or chronic cpap/bipap at home settings
4-6 lpm or FIO2 40% - 49%
USE OF AN ARTIFICIAL AIRWAY (FIO2 21% - 49%)
FIO2 50% - 80% or Positive Pressure Ventilation
FIO2 >80% with or without Positive Pressure Ventilation

PATIENT ASSESSMENT

Respirations: Increased RR 21-25
Level of Consciousness: Lethargic, follows commands
Breath Sounds: Decreased unilaterally
Cough: Strong, productive
Level of Activity: Ambulatory (walks in hall) with assistance
Oxygen Required for SpO2 >90%: 1-3 lpm or FIO2 < 40% or chronic cpap/bipap at home settings

Score: 6
Select Appropriate Description of Pulmonary Status

- Current Admission to ICU
- Acute exacerbation of chronic pulmonary disease
- Pre-existing documented pulmonary disease
- New diagnosis of pulmonary disease
- Current smoker (> or = to 1 Pk/Day)
- Current smoker (< 1 Pk/Day) or *Former smoker with > 10 Pk/Years
- No Pulmonary Hx Never smoked or * Former smoker with < 10 Pk/Years

PATIENT ASSESSMENT

- Respirations: Increased RR 21-25
- Level of Consciousness: Lethargic, follows commands
- Breath Sounds: Decreased unilaterally
- Cough: Strong, productive
- Level of Activity: Ambulatory (walks in hall) with assistance
- Oxygen Required for SPO2 > 90%: 1-3 lpm or FIO2 < 40% or chronic cpap/bipap at home settings

CHART ASSESSMENT

- Pulmonary Status: New diagnosis of pulmonary disease

Score: 9
PATIENT ASSESSMENT

Respirations: Increased RR 21-25
Level of Consciousness: Lethargic, follows commands
Breath Sounds: Decreased unilaterally
Cough: Strong, productive
Level of Activity: Ambulatory (walks in hall) with assistance
Oxygen Required for SPO2 > 90%, 1-3 lpm or FIO2 < 40% or chronic cpap/bipap at home settings

CHART ASSESSMENT

Pulmonary Status: New diagnosis of pulmonary disease
Surgical Status: No Surgery

Score: 9
PATIENT ASSESSMENT

Respirations: Increased RR 21-25
Level of Consciousness: Lethargic, follows commands
Breath Sounds: Decreased unilaterally
Cough: Strong, productive
Level of Activity: Ambulatory (walks in hall) with assistance
Oxygen Required for SP02 > 90%; 1-3 lpm or FIO2 < 40% or chronic cpap/bipap at home settings

CHART ASSESSMENT

Pulmonary Status: New diagnosis of pulmonary disease
Surgical Status: No Surgery
Chest X-Ray: Any abnormality ie: opacity, effusion, or atelectasis of one lobe

Score: 11
PATIENT ASSESSMENT
Respirations: Increased RR 21-25
Level of Consciousness: Lethargic, follows commands
Breath Sounds: Decreased unilaterally
Cough: Strong, productive
Level of Activity: Ambulatory (walks in hall) with assistance
Oxygen Required for SPO2 >90%, 1-3 lpm or FIO2 < 40% or chronic cpap/bipap at home settings

CHART ASSESSMENT
Pulmonary Status: New diagnosis of pulmonary disease
Surgical Status: No Surgery
Chest X-Ray: Any abnormality ie: opacity, effusion, or atelectasis of one lobe

TRIAGE SCORE:
Score: 11
How to Code the Protocol Algorithm
Which of the following abnormalities are found on the patient’s most recent chest x-ray:

END SELECTION
Consolidation
Opacities
Infiltrates
Atelectasis
Low Lung Volumes
X-Ray > 48 Hrs with any OF THE ABOVE (pick at least one)
Clear X-Ray or No X-Ray available
MediLinks - Data Entry

Does pt have a PRODUCTIVE cough?

Na
Yes

MediLinks - Coded Charting Text

Branch Code: PAW2005
Abbreviated Text: NCPAWC - PRODUCTIVE COUGH?
Response Type: Selection List
Prompt: Does pt have a PRODUCTIVE cough?
Response Required: No
Active: Yes

Text

Value Goal

List Responses Text Responses Multi-List Responses

Add Modify Delete Clear Fields

Selection List Item

If No is selected insert this text: Patient does not have a productive cough

Branch Code: PAW2006 Value: 0

Observation: Productive Cough? - No

Quantity: Clear

List Choice Branch Code Value Goal Observation

No PAW2006 0 Productive Cough? - No
Yes PAW2020 0 Productive Cough? - Yes
MediLinks - Data Entry

Which therapy is patient able to perform effectively?

- TheraPEP
- ExPAP
- Neither

MediLinks - Coded Charting Text

Code Definition | Charges/Observations/DC Order
--- | ---
Branch Code | Abbreviated Text
PAW2020 | NCPAP/VC: Which TX is Ptl able to perform effectively

Prompt
Which therapy is patient able to perform effectively?

Text
Value | Goal
--- | ---

List Responses | Text Responses | Multi-List Responses
--- | --- | ---
Add | Modify | Delete

Selection List Item
If TheraPEP is selected insert this text

Inserted Text

<table>
<thead>
<tr>
<th>Observation</th>
<th>Quantity</th>
<th>Disp.Order</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient able to perform effective PEP? - Yes ()</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Patient able to perform effective EZPAP? - Yes ()</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

List Choice | Branch Code | Value | Observation | Charge Code | Charge Q
--- |--- |--- |--- |--- |---
TheraPEP | PAW2025 | 0 |Patient able to perform effective PEP? - Yes () |
ExPAP | PAW2004 | 0 |Patient able to perform effective EZPAP? - Yes () |
Neither | PAW2007 | 0 |Patient able to perform effective PEP or EZPAP? - Neither () |

Score: 0
Perform TheraPEP Therapy. Select the # that matches the triage score:

- Triage score (20+)
- Triage score (14-19)
- Triage score (9-13)
- Triage score (0-8)

Prompt:
Perform TheraPEP Therapy. Select the # that matches the triage score: [Response Required] [Active]

Text:
Patient is able to perform effective TheraPEP Therapy.

CARE PLAN:

Airway Clearance Indications:
- Excessive secretions

Chest X-Ray findings:
- Nodules

AIRWAY CLEARANCE PROTOCOL

- Patient does not have an artificial airway
- Patient has a productive cough
- Patient is able to perform effective TheraPEP Therapy.

CARE PLAN:

Score: 0

List Choice | Branch Code | Value | Goal | Observation | Charge Code | Charge | Inserted Text
---|---|---|---|---|---|---|---
Triage score (20+) | PST00X1 | 0 | CARE PLAN - AWC - PEP | 0_48 HR RE-ASSESS | 1 | Q4, re-assess in 48 hours
Triage score (14-19) | PST00X1 | 0 | CARE PLAN - AWC - PEP | 0_24 HR RE-ASSESS | 1 | Q4 & PRN, reassess in 24 hours
Triage score (9-13) | PST00X1 | 0 | CARE PLAN - AWC - PEP | 0_24 HR RE-ASSESS | 1 | TID, reassess in 24 hours
Triage score (0-8) | PST00X1 | 0 | CARE PLAN - AWC - PEP | 0_48 HR RE-ASSESS | 1 | BID, reassess in 48 hours
Airway Clearance Indications:
Excessive secretions

Chest X-ray findings:
Atelectasis

AIRWAY CLEARANCE PROTOCOL
Patient does not have an artificial airway
Patient has a productive cough
Patient is able to perform effective TheraPEP Therapy

CARE PLAN:
Perform TheraPEP Therapy
Recommended Frequency: TID, reassess in 24 hours

Score: 0
Once again the re-assessment order associated with the care plan is generated back into the work flow.
RESPIRATORY THERAPY PROTOCOL

Patient's identity (Name and Medical Record Number) verified via wristband.

PATIENT ASSESSMENT

Respirations: Increased RR 21-25
Level of Consciousness: Lethargic, follows commands
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Airway Clearance Indications:
Excessive secretions

Chest X-Ray findings:
Atelectasis

AIRWAY CLEARANCE PROTOCOL

Patient does not have an artificial airway
Patient has a productive cough

Patient is able to perform effective TheraPEP Therapy.

CARE PLAN:

Perform TheraPEP Therapy
Recommended Frequency: TID, reassess in 24 hours
1. To reduce misallocation of care and cost of care via therapist driven protocols
2. Improve The Exceptional Patient Care Experience
3. Monitor: Ventilator Days, ICU LOS, Hospital LOS, Number of therapies, Cost of care
OUTCOMES

The bar chart shows the outcomes of Length of Stay, ICU Length of Stay, and Ventilator Days before and after protocol implementation.

- **Pre-Protocol (Retrospective)**
- **Post-Protocol Implementation**

- **Length of Stay**
  - Pre-Protocol: 20 days
  - Post-Protocol: 10 days

- **ICU Length of Stay**
  - Pre-Protocol: 15 days
  - Post-Protocol: 10 days

- **Ventilator Days**
  - Pre-Protocol: 5 days
  - Post-Protocol: 10 days
### RESULTS

<table>
<thead>
<tr>
<th></th>
<th>Pre-Protocol (Retrospective) n=1051</th>
<th>Post-Protocol Implementation n=3452</th>
<th>p-Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of Stay</td>
<td>21.3 +/-20.4</td>
<td>16.4 +/-16.2</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>ICU- Length of Stay</td>
<td>12.4 +/-15.5</td>
<td>9.4 +/-12.8</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>Ventilator Days</td>
<td>10.1 +/-11.0</td>
<td>8.3 +/-10.3</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>Treatments/patient for AWC/LVE</td>
<td>24.2 +/-26.3</td>
<td>24.6 +/-31.5</td>
<td>0.74</td>
</tr>
<tr>
<td>Treatments/patient for Bronchodilator</td>
<td>37.4 +/-49.5</td>
<td>37.6 +/-56.0</td>
<td>0.92</td>
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</tbody>
</table>
## Measured Outcomes

### ICU Length of Stay

<table>
<thead>
<tr>
<th></th>
<th>All Pts</th>
<th>Vent Pts</th>
<th>Non-Vent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre protocol</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>12.929</td>
<td>16.319</td>
<td>4.799</td>
</tr>
<tr>
<td>n</td>
<td>812</td>
<td>573</td>
<td>239</td>
</tr>
<tr>
<td>Post Protocol</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>9.154</td>
<td>12.907</td>
<td>3.425</td>
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<tr>
<td>n</td>
<td>1991</td>
<td>1203</td>
<td>788</td>
</tr>
<tr>
<td>p(statistically significant)</td>
<td>&lt;0.0001</td>
<td>&lt;0.0001</td>
<td>0.0021</td>
</tr>
</tbody>
</table>

### Length Of Stay

<table>
<thead>
<tr>
<th></th>
<th>Vent</th>
<th>Non-Vent</th>
<th>All Pt</th>
</tr>
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<tbody>
<tr>
<td>Pre protocol</td>
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</tr>
<tr>
<td>Mean</td>
<td>25.511</td>
<td>12.456</td>
<td>21.67</td>
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<tr>
<td>n</td>
<td>573</td>
<td>239</td>
<td>812</td>
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<tr>
<td>Post Protocol</td>
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<tr>
<td>Mean</td>
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<td>9.284</td>
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</tr>
<tr>
<td>p(statistically significant)</td>
<td>&lt;0.0001</td>
<td>&lt;0.0001</td>
<td>&lt;0.0001</td>
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### Vent Days

<table>
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<tr>
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<tbody>
<tr>
<td>Pre protocol</td>
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</tr>
<tr>
<td>Mean</td>
<td>10.867</td>
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<tr>
<td>n</td>
<td>573</td>
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<tr>
<td>Post Protocol</td>
<td></td>
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<tr>
<td>Mean</td>
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</tr>
<tr>
<td>n</td>
<td>1203</td>
</tr>
<tr>
<td>p(statistically significant)</td>
<td>&lt;0.0001</td>
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## Measured Outcomes

### Airway Clearance/Lung Volume Expansion

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<th>Length Of Stay</th>
<th>Vent Days</th>
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<tbody>
<tr>
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<td>All Pts</td>
<td>Vent Pts</td>
<td>Non-Vent</td>
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<tr>
<td>Pre protocol</td>
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<tr>
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<tr>
<td>Mean</td>
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<td>13.6</td>
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<tr>
<td>n</td>
<td>2255</td>
<td>1406</td>
<td>850</td>
</tr>
</tbody>
</table>

\[ p(\text{statistically significant}) \]

- ICU Length of Stay: 0.0003, 0.0598, 0.0295
- Length Of Stay: 0.0004, 0.0013, <0.0001
- Vent Days: 0.018
Measured Outcomes

X-Bar Chart of ICU Days

ALOS - Critical Care Units

Length of Stay
• Protocols programmed into Mediserve’s MediLinks reduces variability and improves patient outcomes.
• The ability to automate features allows therapists to focus their time and energy on patients, instead of order reconciliation.
• Data captured can be utilized to monitor outcomes more effectively.
Questions
Want More Information?

Contact Your MediServe ASM!

Email: michelle.caldwell@mediware.com

Today’s presentation will be available on the Client Portal later this week!