<table>
<thead>
<tr>
<th>Time</th>
<th>Presentation Order</th>
<th>Presenter</th>
<th>Title</th>
<th>Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Andrea Rapolothy-Beck</td>
<td>Andrea Rapolothy-Beck, M.Sc, Jennifer Fleming, PhD; Merrill Turpin, PhD.</td>
<td>The effectiveness of early occupation-based therapy in an intensive care unit: a single-site randomized controlled feasibility trial (EFFORT-ICU)</td>
<td>Surgical Treatment and Rehabilitation Service</td>
</tr>
<tr>
<td>2</td>
<td>SooHyun Wi</td>
<td>SooHyun Wi, PT, Ph.D, Hyung Ik Shin, MD, Ph.D, Sung Eun Hyun, MD, Hyun Jei, MD, Jiwan Kim, PT, PhD, Woo Hyung Lee, MD, Ph.D</td>
<td>Protocol for a single-blinded randomized controlled clinical trial to investigate the effect of in-bed cycling/stepping on functional mobility in critically ill patients</td>
<td>Seoul National University Hospital</td>
</tr>
<tr>
<td>3</td>
<td>Vimal Palanichamy</td>
<td>Fazila Binte Abu Bakar Askewi, Irene Too Ai Ling, O.H. Kueyen, Vimal Palanichamy</td>
<td>Compact ICU Trolley for Efficient and Safe Mobilisation of Critically Ill Patients</td>
<td>Singapore General Hospital</td>
</tr>
<tr>
<td>4</td>
<td>Abhinandan Chittal</td>
<td>Abhinandan Chittal, MBBS; Isabel Trejo-Zambrano, MD; Israa Hassan, MBBS; Muna Abbas, MBBS; Earl Manthely, BA; Vasudha Maddukuri, MBBS; Constant Oliver Kemi Pondy; Stephanie Hsu, PT, DPT</td>
<td>Physical Therapy Dose Among Mechanically Ventilated Patients in the Medical ICU at Johns Hopkins Hospital</td>
<td>MedStar Health Internal Medicine Residency Program</td>
</tr>
<tr>
<td>5</td>
<td>Shirah Moses</td>
<td>Madeline Arena, PT, DPT; Shirah Moses, OTR/L</td>
<td>Non-Pharmacological Delirium Management in the Medical ICU</td>
<td>New York Presbyterian Hospital Columbia Irving Medical Center</td>
</tr>
<tr>
<td>6</td>
<td>Lydia Sura</td>
<td>Lydia Sura MOT, OTR/L, Jenna Hightower PT, DPT, CCS, Jennifer Bisat, OT, Olivia Davis, MOT, OTD, OTR/L, Pablo Moreno Franco, MD, Pranod Gunu, MBBS, MD, Gregory Worswicz, MD, Nikiki Matos, APRN, DNP, Devang Sanghavi, MD</td>
<td>The Role of Occupational Therapy in Patients Requiring Extracorporeal Membrane Oxygenation with Coronavirus Disease: A Pilot Case Series</td>
<td>Mayo Clinic</td>
</tr>
<tr>
<td>7</td>
<td>James Stout</td>
<td>Elizabeth Turnipseed, MD, Phillip R. Morris, RN, BSN, Jimmy Stout, RN, MBA, Sam Himah</td>
<td>A Dynamic Interdisciplinary Approach to Weaning the Complex Ventilator Patient in the Acute Inpatient Setting</td>
<td>Special Care Providers/UAB Hospital</td>
</tr>
</tbody>
</table>
The effectiveness of early occupation-based therapy in an intensive care unit: a single-site randomized controlled feasibility trial (EFFORT-ICU)

Andrea Rapolothy-Beck1, 2, 3, Jennifer Fleming1, Merrill Turpin1, Kellie Sosnowski2, Simone Dullaway3 and Hayden White3
1 Surgical Treatment and Rehabilitation Service 2 Logan Hospital 3 School of Health and Rehabilitation Sciences, The University of Queensland

Multidisciplinary Rehabilitation: Why OT?

Early multidisciplinary rehabilitation within ICUs has become an established validated practice to improve functional outcomes with associated financial savings. Occupational therapists have been recognised as key team members of the multidisciplinary team providing therapeutic input into other acute care services and contributing to cost savings. Yet there is limited evidence regarding the effect of occupational therapy within the intensive care setting on long term functional gains and the symptoms of PCS, further influencing occupational therapy staffing, service provision and scope of practice.

This feasibility trial explored the safety and efficacy of delivering occupational therapy to mechanically ventilated patients in a medical surgical ICU.

Methods

Design: randomised controlled assessor-blind feasibility trial comparing enhanced early occupation-based therapy (intervention) to standard care (control) with outcomes measures at ICU discharge, hospital discharge and 90 days post randomisation.

Setting: level 5, 6 normal medical/surgical ICU at Logan Hospital, Brisbane
Participants: Participants were consecutive admissions to the unit between August 2018 and October 2019 (n=30)
Inclusion criteria were a) aged 18 and over, b) requiring mechanical ventilation for greater than 48 hours.

Outcome Measures and Intervention

Primary Outcome measure: The Functional Independence MeasureTM (FIM) Secondary Measures: The Modified Barthel Index (MBI), The Montreal Cognitive Assessment (MoCA), Grip strength was measured using a dynamometer (Jamar), The Hospital Anxiety and Depression Scale (HADS), The Short-Form (36) Health Survey (SF-36v2™)

Intervention: Control Group: usual occupational therapy including splinting, positioning, pressure care management.
Intervention Group: Up to 60 mins daily of individualised occupation-based therapy which covered a range of activities which were individualised based on the pre-intervention measures and included grooming, leisure tasks, cognitive stimulation and upper limb function in function.

Results

Data Analysis: SPSS version 28.0 was used. Data were analysed via per protocol and intention to treat analysis. Continuous variables were compared between the groups at each follow-up using independent groups t-tests with adjustment if indicated by Levene’s test for equal variance. Effect sizes were calculated using Cohen’s d and interpreted as a small (d=0.2), medium (d=0.5) and large (d=0.8) effect (45). A p value of 0.05 (one-sided) was considered significant.

Results Summary:

Sample characteristics for the groups suggested they were similar. All outcome measures could be administered at the 3 timepoints. The difference between groups approached significance at 90 days post randomisation in the FIM Motor and MBI (p=0.05) with both variables having large effect sizes (d=0.76, d=0.75) in favour of the intervention group. Further moderate to large effect sizes were obtained in favour of the intervention group for cognitive status, functional ability and quality of life. Not statistically significant results were obtained.

Conclusion:

The feasibility trial supports progressing to a full-scale RCT of occupation-based therapy in ICU.

References:


Clinical Implications

Occupational therapy into ICU is safe and feasible

Daily cognitive stimulation can contribute to better outcomes

Participation in individualised occupation-based therapy may enhance recovery

The feasibility trial supports progressing to a full-scale RCT of occupation-based therapy in ICU.

Protocol for a single-blinded randomized-controlled clinical trial to investigate the effect of in-bed cycling/stepping on functional mobility in critically ill patients

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1Department of Rehabilitation Medicine, Seoul National University Hospital, Seoul National University College of Medicine, Korea
2Biomedical Research Institute, Seoul National University Hospital, Seoul, South Korea

Introduction

- ICU-acquired weakness: prolonged immobility in the ICU can trigger neuromuscular weakness due to disuse atrophy, decrease in strength, and functional deterioration.
- Early rehabilitation of critically ill patients can reduce the incidence and severity of ICU-acquired weakness.

Objective

- To compare effects of conventional rehabilitation plus graded multimodal exercises with cycling/stepper compared to conventional rehabilitation on functional mobility in critically ill patients.

Methods

- Design: Prospective, pragmatic, open-label, add-on, assessor-blinded RCT
- This study protocol is a randomized control trial with an intervention time from ICU admission to ICU discharge.
- After screening, the participants are randomly assigned to the intervention group or the control group with stratification of age, sex, and status of mechanical ventilation.
- The intervention consists of graded multimodal exercises according to the condition of consciousness, and motor power of patients and provides passive, active-assisted, active, and resistance exercises using in-bed cycling/stepper daily in addition to conventional rehabilitation.
- The control group will receive only conventional rehabilitation.

Table 1. Modified ICU Rainbow Mobilization Scale- Graded multimodal exercise intervention

Results

- Primary outcome: functional mobility of de Morton Mobility Index at ICU discharge.
- Secondary outcomes: level of consciousness, mobility assessment, muscle strength, and quality of life.
- Outcome measurements will be taken by blinded assessors.
- Adverse event data will also be gathered from the beginning of each intervention session.

Table 2. Outcome measurements

Conclusion

This study is a clinical trial to estimate the effect of multimodal exercise intervention using in-bed cycling/stepper on functional mobility in critically ill patients. If expected results are achieved in this study, methods of ICU rehabilitation will be enriched.

Acknowledgement

This work was supported by the Korea Medical Devices Development Fund grant funded by the Korea government (the Ministry of Science and ICT, the Ministry of Trade, Industry and Energy, the Ministry of health & Welfare, the Ministry of Food and Drug Safety) (KMDF-In0, NTIS 2020-1318).
Compact trolley for efficient and safe mobilization of critically ill patients
Mr Vimal Palanchamy¹, Dr Sewa Duu Wen², Ms Olikh Harminder Singh³, Ms d/o Thirusalven Deborah Heymamarini Deborah², Dr Too Al Ling Irene³, Ms Binte Sunari Raden Nurheryany³, Mr Oh Xueyan⁴
Ms Fazila Aloweni¹, 1. Physiotherapy, 2. Department of Respiratory and Critical Care Medicine, 3. Nursing, 4. Engineering

Background of the problem
Early mobilisation is vital in ensuring good clinical outcomes for patients in intensive care unit. However, mobilising acute ill patients is labour intensive and require significant coordination and resources. Current mobilisation process needs to be simplified.

Aims
To develop a trolley prototype that can hold all the equipment needed and can be used as a mobility aid to ambulate ICU patients.
To be attached to a wheelchair for safe and efficient mobilisation out of ICU (ambulation and sunshine therapy).

Method:
Phase 1:
Adopting a design thinking methodology, we designed a compact trolley prototype that can be attached to an existing wheelchair and has compartments that can safely hold all equipment such as monitoring devices, portable suction pump, infusion pumps and drainage bottles. Technical inputs from biomedical engineers, physiotherapists and nurses were thoroughly considered during designing the prototype. The completed prototype was evaluated on healthy volunteers, and feedback was used to inform the design of the final prototype.

Phase 2:
Final prototype was approved by the hospital infection control personnel, patient safety advocate and environmental services. It was used on patients for sunshine therapy and ambulation. Feedback was collected from health care workers and patients.

Results:
Twenty-five participants (1 doctor, 3 physiotherapists and 21 nurses) evaluated the ICU trolley prototype. No one had opted for strongly disagree in the survey. All factors were rated above 70% (range 72% to 96%) except for two factors: easy to store (68%) and easy to hook (68%). The highest rated factors were that the evaluators agreed that the trolley will be safe for patient use (96%) and it is easy to push on its own (92%).

Features
- 65 cm by 65 cm base
- 4 wheels with brakes
- Provision to latch on to high recline wheelchair
- No sharp edges
- Easy to clean
- Easy to store

Picture 1: Simulated items on trolley and its location

<table>
<thead>
<tr>
<th>No</th>
<th>Description</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Drip pole</td>
<td>Top</td>
</tr>
<tr>
<td>2</td>
<td>Cardiac monitor</td>
<td>Compartment</td>
</tr>
<tr>
<td>3</td>
<td>Portable ventilator</td>
<td>Compartment</td>
</tr>
<tr>
<td>4</td>
<td>Oxygen tank</td>
<td>Compartment</td>
</tr>
<tr>
<td>5</td>
<td>Portable suction pump</td>
<td>Compartment</td>
</tr>
<tr>
<td>6</td>
<td>Infusion/ syringe pump</td>
<td>IV pole</td>
</tr>
<tr>
<td>7</td>
<td>Emergency medical kit</td>
<td>Basket</td>
</tr>
<tr>
<td>8</td>
<td>Resuscitation bag</td>
<td>Basket</td>
</tr>
<tr>
<td>9</td>
<td>Trachy dilator</td>
<td>Hook on</td>
</tr>
<tr>
<td>10</td>
<td>Urine bag</td>
<td>Hook on</td>
</tr>
<tr>
<td>11</td>
<td>Chest drainage bottle</td>
<td>Hook on</td>
</tr>
</tbody>
</table>

Picture 2: Final product

Picture 3: Sunshine therapy with volunteer

Conclusion:
Patients, patient’s family and health care providers found the trolley safe, easy to use, clean and store. It could be used for ambulation of ICU patients and for sunshine therapy.
Objective
To describe the dose of physical therapy among mechanically ventilated patients:
- Timing of initiation
- Frequency
- Intensity
- Duration
- Types of interventions.

Methods
- **Design:** Cross sectional study
- **Inclusion criteria:** admitted to the medical ICU at Johns Hopkins Hospital between June 1, 2021 and January 31, 2022; admitted > 24 hours; mechanically ventilated; receiving physical therapy services
- **Exclusion criteria:** prone position; receiving paralytics; COVID-positive; presence of temporary/permanent pacemakers
- **Data extracted:** Demographics, PT data, physiological data
- **Analyses:** Data was summarized via descriptive statistics; intensity was defined as % of heart rate reserve

### Table 1. Characteristics of Critically Ill Patients (n=96)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, y</td>
<td>50 (47-68)</td>
</tr>
<tr>
<td>APACHE II Score</td>
<td>26 (20-33)</td>
</tr>
<tr>
<td>Male sex</td>
<td>55 (52)</td>
</tr>
<tr>
<td>FiO₂, %</td>
<td>40 (30-40)</td>
</tr>
<tr>
<td>Race</td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>55 (52)</td>
</tr>
<tr>
<td>White</td>
<td>41 (38)</td>
</tr>
<tr>
<td>Asian</td>
<td>5 (5)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>2 (2)</td>
</tr>
<tr>
<td>Other</td>
<td>3 (3)</td>
</tr>
<tr>
<td>ICU admission diagnosis category</td>
<td></td>
</tr>
<tr>
<td>Respiratory failure</td>
<td>41 (39)</td>
</tr>
<tr>
<td>Sepsis</td>
<td>18 (17)</td>
</tr>
<tr>
<td>Gastrointestinal</td>
<td>11 (10)</td>
</tr>
<tr>
<td>Cardiovascular</td>
<td>10 (9)</td>
</tr>
<tr>
<td>Cardiopulmonary arrest</td>
<td>7 (7)</td>
</tr>
<tr>
<td>Central Nervous System</td>
<td>4 (4)</td>
</tr>
<tr>
<td>Nephrology</td>
<td>3 (3)</td>
</tr>
<tr>
<td>Other</td>
<td>12 (11)</td>
</tr>
<tr>
<td>Location Prior to Hospital</td>
<td></td>
</tr>
<tr>
<td>Home/Apartment (independent)</td>
<td>91 (85)</td>
</tr>
<tr>
<td>Home/Apt/Retirement facility (assistance)</td>
<td>6 (6)</td>
</tr>
<tr>
<td>Nursing home/sub-acute rehab</td>
<td>4 (4)</td>
</tr>
<tr>
<td>Homeless</td>
<td>4 (4)</td>
</tr>
<tr>
<td>Unknown</td>
<td>1 (1)</td>
</tr>
<tr>
<td>Highest Level of Activity prior to hospital</td>
<td></td>
</tr>
<tr>
<td>Walking</td>
<td>94 (88)</td>
</tr>
<tr>
<td>Unknown</td>
<td>8 (8)</td>
</tr>
<tr>
<td>Bedbound</td>
<td>3 (3)</td>
</tr>
<tr>
<td>Transfer from bed/chair</td>
<td>1 (1)</td>
</tr>
</tbody>
</table>

### Table 2. Physical Therapy in the ICU (n=765)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Median (IQR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time from ICU admission to first session</td>
<td>2 (1-5)</td>
</tr>
<tr>
<td>Session duration, min</td>
<td>38 (25-40)</td>
</tr>
<tr>
<td>Frequency, % of ICU days</td>
<td>77 (63-85)</td>
</tr>
<tr>
<td>Percentage of HRR</td>
<td>5 (0-13)</td>
</tr>
<tr>
<td>FSS-ICU Score</td>
<td>10 (4-16)</td>
</tr>
</tbody>
</table>

Results

- Only 122 (16%) PT sessions achieved >20% of heart rate reserve (%HRR)
- With every 1-minute increase in duration or 1 unit increase in JH-HLM the odds of achieving >20% HRR increase by a factor of 1.0 or 1.2, respectively.

Conclusion

- Among patients admitted to the ICU, physical therapy typically begins within the first 48 hours of admission and is provided at least five days per week.
- Most of the physical therapy sessions were classified as very light intensity (<20%) based on the %HRR that patients achieved during the sessions.
Non-Pharmacological Delirium Management in the Medical ICU

Madeline Arena, PT, DPT; Shirah Moses, OTR/L

Objectives
Recent research supports use of multiple non-pharmacological interventions for delirium management. Nurses play an important role in managing delirium. An interdisciplinary team in the medical ICU developed an evidence-based delirium education intervention and the Communication & Cognition Cart (CCC) to address nursing communication and engagement with patients with delirium. The objective of this study was to evaluate nurses’ perceptions about their management and communication with patients with delirium pre- and post-delirium intervention.

Methods
A quasi-experimental (pre-test/post-test) design was used in this study. All nursing staff in the medical ICU were recruited. Participants anonymously completed a six-item survey pre and post intervention. The delirium intervention occurred over one month. Post surveys were administered six weeks after the intervention.

Results
Improvements were seen in nurses’ perceived level of knowledge and resources needed to communicate effectively with patients with delirium. There was a significant increase in the perception of having the tools to communicate effectively (p = 0.017). There was a significant decrease in the perception of being able to communicate effectively in the patient’s primary language (p = 0.047).

Conclusions
Post intervention, nurses expressed an improvement in perceived knowledge and in having the tools to communicate effectively with patients with delirium. However, decreases in areas of perceived capability show that continued education is needed. This data can be used to improve future delirium education in the medical ICU.

References
[Provide a list of references]

Delirium Survey

<table>
<thead>
<tr>
<th>I have sufficient knowledge of the approaches/tools to effectively communicate with my patients with delirium</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I know about the non-pharmacologic interventions that I can use to manage delirium</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have the tools I need to communicate effectively with my patients with delirium</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have the resources I need to implement non-pharmacologic interventions for delirium</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I communicate effectively (in the language I speak) with patients with delirium (i.e., minimize distractions, attempt to maintain attention, eye contact, repeat/review)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Communication & Cognition Cart

[Include images or descriptions of the Communication & Cognition Cart]
The Role of Occupational Therapy in Patients Requiring Extracorporeal Membrane Oxygenation with Coronavirus Disease: A Pilot Case Series

Lydia Sura MD, OTRL1, Jenna Hightower PT, DPT, CCS2, Jennifer Biet OT, Olivia Davis MD, MOT, OTD, OTRL1, Pramod Guru MBBS, MD2, Gregory Wonsiewicz MD1, Nikki Matey APPN, DNP1, Devang Sanghavi MD1

Department of Physical Medicine & Rehabilitation1 and Critical Care Medicine2
Mayo Clinic, Jacksonville, FL, United States

ABSTRACT

BACKGROUND

The purpose of this study is to describe the occupational therapy (OT) course and functional outcomes in critically ill patients requiring mechanical ventilation (MV) and extracorporeal membrane oxygenation (ECMO) with coronavirus (COVID-19).

OBJECTIVE

This is a retrospective case series from a quaternary care hospital for patients with confirmed COVID-19 from April 2020 to July 2021.

METHODS

Patients were included in the study if they were admitted to the intensive care unit (ICU) on MV, on ECMO, and had OT during their hospitalization. The Activity Measure for Post-Acute Care (AM-PAC) “6-Clicks” was utilized to track each patient’s functional progress throughout the hospitalization. A total of 11 (n = 11) patients that met study criteria were included in the series. A total of 5 (n = 5, 45%) patients were evaluated and treated while on ECMO, whereas the remainder (n = 6, 54%) were treated post-ECMO decannulation.

RESULTS

The ECMO group had OT initiated earlier in the hospitalization than the post-ECMO group at 13.2 days versus 23.1 days, respectively. AM-PAC scores improved in the ECMO group by 40.41% and post-ECMO group by 23.75%.

CONCLUSIONS

Patients who received OT for COVID-19 while on ECMO made substantial gains in their functional status by discharge compared to those who received OT only after ECMO decannulation.

INTRODUCTION

Phyical rehabilitation for patients with ARDS requiring ECMO is safe, with a multidisciplinary team using procedural considerations, mobility safety checklists, and treatment guidelines. Despite these advances, the role of OTs in the ICU is not currently well established in literature, while current interventions are focused on physical rehabilitation with a growing need for delirium prevention and functional-ADL intervention.

The purpose of this study is to describe the role and importance of early OT intervention for patients requiring ECMO with COVID-19 through improvement of functional outcomes using The Activity Measure for Post-Acute Care (AM-PAC™) “6-Clicks” daily activity assessment.

RESULTS

Occupational therapy evaluation was initiated on median hospital day 13.3 for ECMO group and hospital day 23.2 for post-ECMO group. The ECMO group had more occupational therapy sessions on average: 13.2 sessions per hospitalization versus 10.5 sessions for the post-ECMO group (Figure 2).

ECMO group performed their first sit-to-stand on median hospital day 24.8, which was almost a week earlier than the post-ECMO group on hospital day 31.8 (Figure 2). ECMO group stood sooner in their therapy sessions (on session three versus session five for the post-ECMO group) to prepare for further occupational performance and ADL participation through functional mobility.

AM-PAC scores improved in the ECMO group by 40.41% and post-ECMO group by 23.75%, demonstrating a 16.66% increase with early occupational therapy intervention.

Length of stay for patients in both the ECMO and post-ECMO group ranged from 13 days to 111 days. The median length of stay for the ECMO group was 55.0 days while the post-ECMO group was 43.6 days (Figure 2). The COVID-19 ECMO group was culminated longer at 27.0 median days (52% of hospital days) compared to post-ECMO group at 18.3 (41% of hospital days).

Average Charlson Comorbidity Index at admission for ECMO group was 1.6 and post-ECMO group 0.5. SOFA score of ECMO group at culmination was 8.4 and post-ECMO group 10.8.

FIGURE 1: COMPARISON OF AM-PAC

METHODS

Inclusion criteria includes referral to OT from ICU team and ECMO cannulation due to COVID-19 diagnosis from April to July 2021, for adults. Patients were retroactively included in the study once these five inclusion criteria were met. Thirteen patients met the initial inclusion criteria, however, two expired during hospitalization and were excluded. Comparative analysis were performed between ECMO and post-ECMO groups.

REFERENCES

• Early functional OT intervention improves AM-PAC “6-Clicks” daily activity score, decreases levels of care required for post-acute care discharge destinations, and improves functional mobility

• The role of OT in the ICU with mechanical circulatory support is important, leading to greater functional outcomes and decreasing the required level of care upon discharge

• The role of OT should focus on ADL integration, delirium prevention, functional mobility, and activity tolerance to promote occupational performance. OT departments may benefit from establishing safety protocols, mobility checklists, and standardized outcomes related to self-care performance and cognition for this patient population with collaboration of their intensive care interdisciplinary team.

DISCUSSION

The role of early intervention OT in the ICU with mechanical circulatory support is important leading to greater functional outcomes and decreasing the required level of care upon discharge. The role of OT should focus on ADL integration, delirium prevention, functional mobility, and activity tolerance to promote occupational performance. OT departments may benefit from establishing safety protocols, mobility checklists, and standardized outcomes related to self-care performance and cognition for this patient population with collaboration of their intensive care interdisciplinary team.

FIGURE 1: AVERAGES DURING HOSPITALIZATION

CONCLUSIONS
Free At Last: A Dynamic Interdisciplinary Approach to Address Prolonged Mechanical Ventilation.

Elizabeth Turnipseed, MD; Jimmy Stout RN, BSN, MBA; Phillip Morris RN, BSN; Sam Nimah, MBA

Special Care Providers/University of Alabama at Birmingham

Introduction
In October 2016, UAB Hospital partnered with Special Care Providers to open the Special Care Unit (SCU) designed to improve care for patients who experience Prolonged Mechanical Ventilation (> 21 days) with a goal of reducing ventilator days, improving quality, and reducing overall length of stay.

Setting:
Patients are cohort within an Intermediate Care Respiratory Wearing Unit with dedicated multi-disciplinary staffing in an 110 bed Academic Medical Center.

Methods
Participants:
Prolonged Mechanical Ventilation (PMV) is defined as requiring at least 6 hours daily of ventilator support for at least 21 days. Ventilated patients admitted are evaluated based on a referral process with our Intensive Care Units and are eligible for admission to the unit based on the following criteria:
A) Hemodynamic stability defined as not requiring continuous vasoactive infusions to maintain normotensive pressures
B) FiO2 of <= 60% and PEEP <= 10 while maintaining an oxygen saturation >= 90%
C) No continuous infusion of a sedating or pain relieving medication
D) No critical or acute renal failure resulting in the need for continuous dialysis
E) No acute or critical renal failure
F) No uncontrolled severe infectious processes
G) No pending Surgical Interventions
H) No severe life threatening arrhythmia.

Results
All participants were cohort on a ventilator weaning unit and received individualized daily multidisciplinary care (this team includes medical, Nursing, IT, PCT, and SLP) with a low Patient to Therapist Ratio (Therapy is defined as the following roles: RT, PT, OT, SLT) until it was determined ready for discharge.

A retrospective analysis of non-patient specific outcomes data from October 2016 to July 2022 on subjects N=658 discharged from the Special Care Unit of University of Alabama-Birmingham Hospital.

We recorded the following observations for discharged patients:

- Ventilator Wean Rate = 85.4%
- Length of stay on unit = 23.8 days

Conclusions
Our work in this area suggests there is a strong association between successful weaning in the PMV population and the following interventions: referral to specialized respiratory weaning unit, dedicated multi-disciplinary staff, and low therapist-to-patient ratios.

References
1. Data used in this presentation is on request.

Acknowledgements
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