



# Barriers to Adherence of Early Mobilization Protocols in the Pediatric Intensive Care Units

Katherine M. Rodriguez<sup>1,2</sup> Taemyn Hollis<sup>1</sup> Valerie Kalinowski<sup>1</sup> Marylouise Wilkerson<sup>1</sup>

<sup>1</sup> Department of Pediatrics, Rush University Medical Center Children's Hospital, Chicago, Illinois, United States

<sup>2</sup> Department of Pediatrics, University of California San Diego, San Diego, California, United States

**Address for correspondence** Marylouise Wilkerson, MD, Department of Pediatrics, 1620 W. Harrison St., 462 Pavilion, Chicago, IL 60612, United States (e-mail: marylouise\_k\_wilkerson@rush.edu).

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## Abstract

Children who survive critical illness suffer many sequelae of prolonged hospitalization. National guidelines recommend pediatric intensive care units (PICUs) employ ICU care bundles to combat acquired delirium, pain, and weakness. While the use of early mobility (EM) protocols has increased in PICUs, there remain challenges with adherence. The aim of this study is to better understand perceived barriers to EM in the PICU before and after introducing an EM protocol. We hypothesized that providers would be most concerned about the safety of EM. This pre–post-survey study was conducted at a single-center tertiary PICU. A total of 94 PICU providers were included in this study, including nurses, physicians, and therapists. Responses were collected anonymously. Survey respondents consented to participation. The initial survey was conducted prior to enacting an EM protocol to gauge knowledge and opinions surrounding EM. Based on the results, education regarding EM was performed by a multidisciplinary team. An EM protocol “Move Jr.” was initiated. Four months postinitiation, a follow-up survey was sent to the same cohort of providers to determine knowledge of the protocol, changes in opinions, as well as barriers to the implementation of EM. While providers believed that EM was beneficial for patients and were interested in implementing an EM protocol, the initial top three perceived barriers to EM were risk of inadvertent extubation, risk of inadvertent loss of central lines, and time constraints. Four months after the initiation of the EM protocol, a follow-up survey revealed that the top three perceived barriers of EM had changed to time constraints, increased workload, and level of sedation. After 4 months, the change in perceived barriers suggests greater acceptance of the safety of EM but challenges in application. Survey responses describe a desire to perform EM exercises but difficulty finding time. Understanding of the protocol also differed among providers. Greater collaboration among providers could lead to more cohesive therapy plans. There was a clear benefit in educating providers to consider EM as a priority in patient care.

## Keywords

- PICU
- critical care
- early mobility
- ICU care

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## Introduction

Patients who survive critical illness have been shown to suffer long-term sequela of prolonged hospitalization in the intensive care unit (ICU).<sup>1,2</sup> These sequela often involve significant functional impairment that may persist for years after discharge in both pediatric and adult populations. These sequelae are summarized with the term postintensive care syndrome (PICS). PICS includes ICU-acquired weakness (ICU-AW), neurocognitive morbidities, mental health sequelae, and decreased overall quality of life.<sup>3,4</sup>

It is well established in the adult ICU literature that early mobilization (EM) and rehabilitation with physical therapy (PT) and occupational therapy (OT) have many benefits in helping to combat PICS and reduce hospital costs.<sup>5</sup> Recently, the need to establish EM protocols has become widely accepted in pediatric intensive care unit (PICUs).<sup>6–16</sup> The 2022 SCCM PANDEM Guidelines suggests “performing EM to minimize the effects of immobility in critically ill pediatric patients”.<sup>17</sup> Evidence shows that effective EM can reduce delirium and mitigate ICU-AW.<sup>17</sup> This is best achieved by enacting an EM protocol.<sup>18,19</sup> However, reports show that only 26 to 39% of PICUs have an EM protocol in place.<sup>17</sup> Those units that do have a protocol continue to struggle with implementation. A recent study evaluating EM implementation at another center reports that lack of resources, such as staff and equipment, and difficulty coordinating EM sessions are some of the main barriers.<sup>16</sup> Here, we describe the results of a pre-post-survey study conducted at a single-center tertiary PICU that examines what barriers exist to implementation and adherence to EM protocols.

## Materials and Methods

### Setting

This study was conducted at Rush University Medical Center (RUMC), a tertiary care children’s hospital in Chicago, Illinois. Rush University Children’s Hospital is a 98-bed children’s hospital within a larger academic center, with an 18-bed combined medical-surgical PICU. The PICU is a closed unit with the ICU team functioning as the primary service. The study took place from September 2019 to February 2020. At the time of this study, the hospital employed three full-time pediatric-trained OTs. The OTs were available Monday through Friday for 7.5 hours per day. Therapists spend 45 to 60 minutes per patient session. The children’s hospital also employed one full-time and two part-time pediatric-trained PTs. The PTs worked Monday through Friday for 8.5 hours per day, with special availability on the weekends. They spent 30 to 60 minutes per patient session. The PTs and OTs were consulted throughout the children’s hospital and managed patients on the general pediatric floor, PICU, and neonatal ICU. No additional equipment or personnel was obtained prior to the initiation of this study.

### Early Mobilization Protocol

Prior to the initiation of this study, there was no EM protocol in place indicating when PICU patients should have PT or OT

ordered. Practices involving intubated patients posed challenges to enacting active therapy secondary to deep sedation, use of neuromuscular blockade, and a perceived lack of acceptance among PICU staff. Working together in a multidisciplinary work group including nursing, therapists, critical care attendings, and pediatric resident representatives, an EM program was developed.

The EM protocol called “Move Jr.” was introduced in the PICU in October 2019. This protocol was based on the established protocol PICU Up! developed at Johns Hopkins.<sup>18,20,21</sup> The goal of the “Move Jr.” protocol is for all patients in the PICU to be mobilized at least twice daily and within 48 hours of admission. Patients were categorized into one of four mobility levels based on acuity of illness (**►Fig. 1**, **►Table 1**, **►Supplementary Material III**, available in the online version). Mobility levels were decided, and pertinent orders were placed on daily rounds. Colored door signs were displayed outside of each patient room to reflect which mobility level they were assigned. All admitted patients were eligible for the EM protocol. As part of the protocol, recommendations are included on when to consult rehabilitation therapists such as PT and/or OT (**►Table 1**). If level 1 patients are at their baseline mobility level no consultation is needed; however, if rehabilitating, PT/OT consultation should be made. Level 2 patients should have PT/OT consultation. Depending on ability to follow commands level 3 patients should have PT and/or OT consultation. Level 4 patients do not require PT consultation, but OT may be consulted for orthotics.

### Survey Development

With permission, a survey adapted from Joyce et al was distributed to PICU staff members including attending critical care physicians, senior pediatric residents, nurses, physical therapists, and occupational therapists to better understand provider attitudes and beliefs regarding EM (**►Supplementary Material I**). We identified PICU providers using email distribution lists. Survey participation was voluntary, and no incentive was offered. Free and informed consent was obtained. Responses were collected anonymously via Survey Monkey. This survey was developed following review of adult EM literature and questions were based on published data regarding provider concerns and barriers to EM implementation in adults.<sup>22</sup> Questions were specifically tailored to pediatric patients through the inclusion of age ranges.<sup>22</sup> The survey was distributed 1 month prior to initiation of an EM protocol and used to determine the level of EM acceptance among PICU staff. Additionally, the survey assessed future challenges for EM implementation. Subsequently, an interdisciplinary EM work group collaborated to enact an EM protocol, “Move Jr.” Specific education and re-education efforts were made for nursing staff and residents working in the PICU in the months after initiation including presentations at weekly meetings and distribution of handouts. A follow-up survey was sent 4 months after protocol implementation to providers to evaluate changes in beliefs and to assess knowledge of the protocol (**►Supplementary Material II**, available in the

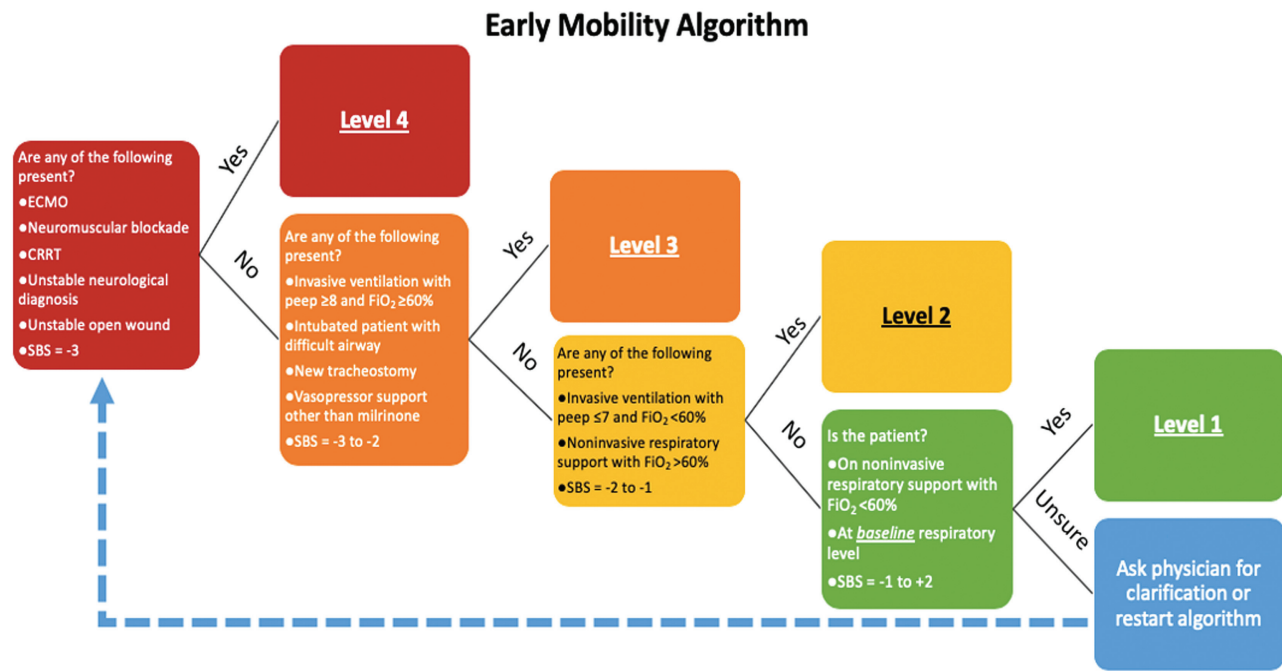


Fig. 1 "Move Jr." protocol

Table 1 "Move Jr." protocol

Level	Description	Activity	Consultation
Level 4	Highest acuity—ECMO, CRRT, neuromuscular blockade, etc.	Passive range of motion twice daily, repositioning every 2 h	PT/OT consultation not necessary
Level 3	Higher acuity—intubated with high settings, new tracheostomy, on vasopressors	Active range of motion twice daily. Head of bed $> 30$ degrees	$\pm$ PT/OT consultation if able to follow directions
Level 2	Moderate acuity—intubated with low settings or noninvasive support with $FiO_2 > 60\%$	Mobilize twice daily—sit up, dangle legs. In chair or ambulating if possible	PT and OT consultation
Level 1	Lowest acuity—noninvasive respiratory support with $FiO_2 < 60\%$	Mobilize twice daily—out of bed, ambulation	$\pm$ PT/OT consultation if rehabilitating

Abbreviations: ECMO, extracorporeal membrane oxygenation; CRRT, continuous renal replacement therapy; PT/OT, physical therapy/occupational therapy.

online version). This project was approved by the RUMC institutional review board, ORA#:19080506-IRB01.

## Results

### Participant Characteristics

Participation was similar from the presurvey (46%; 43 of 94 respondents) to the postsurvey participation (49%; 46 of 94 respondents; **Table 2**). Most respondents were registered nurses, 57% in the presurvey and 59% in the postsurvey. In the presurvey, percent participation by discipline was highest among rehabilitation therapists (100%). In the postsurvey, participation by discipline was highest among resident physicians (67%). The portion of providers that spent  $> 50\%$  of their clinical time in the PICU was similar from the presurvey (63%) to the postsurvey (67%).

### Confidence in Mobilization

All participants in the preintervention survey believed EM is beneficial for pediatric patients, with 90% expressing interest in the implementation of EM. After a 4-month period with an EM protocol in place, clinician comfort with EM remained largely unchanged. Comfort initiating EM and mobilizing out of bed continued to be greatest in older children and those requiring noninvasive ventilation compared to younger children and those requiring invasive ventilation (**Table 3**). Although fewer providers believed that mechanically ventilated patients could be safely mobilized out of bed to chair (76% post vs. 81% pre) or be ambulated (44% post vs. 67% pre). These results were analyzed by chi-squared test and were not found to be statistically significant when using a  $p$ -value  $< 0.05$  (**Supplementary Material IV**, available in the online version).

**Table 2** Participant demographics

Survey respondents	Preintervention survey, n (%)	Postintervention survey, n (%)
Attending MD	3 (7%)	4 (9%)
Resident MD	9 (21%)	12 (26%)
RN	25 (57%)	27 (59%)
Rehab Therapists	6 (14%)	3 (6%)
Percentage of time spent in PICU		
<25%	12 (28%)	11 (24%)
25–50%	4 (9%)	49 (9%)
50–75%	0 (0%)	0 (0%)
75–99%	1 (2%)	6 (13%)
100%	26 (61%)	25 (54%)

Abbreviation: PICU, pediatric intensive care units.

### Perceived Benefits of Early Mobilization

Most clinicians (54%) believed that a decreased length of ICU stay was the biggest benefit of EM. Decreased length of mechanical ventilation and reduced use of sedation were ranked second and third (►Table 4). The ranking of perceived benefits of EM did not significantly change after implementing “Move Jr.” (►Table 4).

### Perceived Barriers to Early Mobilization

Initially, safety risks, such as inadvertent extubation or loss of central lines, were the barriers clinicians were most concerned about. After EM protocol implementation, clinicians ranked time constraints and increased workload as the strongest barriers to EM (►Table 5).

### Change in Practice

Prior to initiation of the EM protocol, 76% of providers thought that the frequency of therapy services PICU patients received were inadequate. Since the initiation of “Move Jr.” In total, 46% of clinicians believed that patients were now receiving more mobility therapy, while 52% of clinicians maintained that there was no change in the amount of mobility therapy patients received. Free response comments described a consensus that providers were more aware of the importance of EM and working to incorporate it into their care more often. Some providers reported a desire to perform ROM exercises for patients regularly, although they endorsed that it was challenging to fit in to the day.

### Protocol Knowledge

Regarding the newly implemented EM protocol, 87% of respondents were aware of “Move Jr.” However, only 57% of respondents were able to accurately describe where to find related data such as range of motion (ROM) and mobility

**Table 3** Clinician comfort with EM by age

Age group	Mobilization can be initiated, n (%)		Safe to mobilize out of bed on NIPPV, n (%)		Safe to mobilize out of bed while intubated, n (%)	
	Pre	Post	Pre	Post	Pre	Post
0–9 mo	31 (72%)	39 (85%)	21 (49%)	25 (54%)	15 (35%)	16 (35%)
9 mo–2 y	33 (77%)	39 (85%)	23 (54%)	23 (50%)	14 (33%)	10 (22%)
2–5 y	33 (77%)	41 (89%)	26 (61%)	30 (65%)	17 (40%)	12 (26%)
5–8 y	34 (79%)	41 (89%)	38 (88%)	37 (80%)	20 (47%)	21 (46%)
>8 y	37 (86%)	41 (89%)	39 (91%)	40 (87%)	31 (72%)	37 (80%)

Abbreviation: NIPPV, non-invasive positive pressure ventilation.

**Table 4** Ranked clinician consensus of perceived EM benefits

Preimplementation		Postimplementation	
Benefits of EM	All clinicians, n (%)	Benefits of EM	All clinicians, n (%)
1. Decreased ICU length of stay	23 (54%)	1. Decreased ICU length of stay	19 (43%)
2. Decreased length of mechanical ventilation	18 (42%)	2. Decreased length of mechanical ventilation	16 (36%)
3. Reduced use of sedation	12 (28%)	3. Reduced use of sedation	11 (25%)
4. Reduced incidence of delirium	17 (40%)	4. Reduced incidence of delirium	12 (27%)
5. Improved sleep	18 (42%)	5. Improved sleep	14 (32%)
6. Improved family satisfaction	18 (42%)	6. Improved family satisfaction	15 (34%)
7. Staff satisfaction	17 (40%)	7. Possible cost saving	11 (25%)
8. Possible cost saving	17 (40%)	8. Staff satisfaction	22 (50%)

Abbreviations: EM, early mobility; ICU, intensive care unit.

**Table 5** Ranked clinician consensus of perceived EM barriers

Preimplementation		Postimplementation	
Barriers to EM Implementation	All clinicians, n (%)	Barriers to EM implementation	All clinicians, n (%)
1. Safety: Risk of inadvertent extubation	14 (33%)	1. Time constraints	17 (39%)
2. Safety: Risk of inadvertent loss of central lines	14 (33%)	2. Increased workload	15 (34%)
3. Time constraints	9 (21%)	3. Level of sedation	12 (27%)
4. Increased workload	7 (17%)	4. Safety: Risk of inadvertent loss of central lines	10 (23%)
5. Level of sedation	11 (26%)	5. Resources (lack of equipment)	10 (23%)
6. Resources (lack of equipment)	10 (24%)	6. Safety: Risk of inadvertent extubation	8 (18%)
7. Cultural change	6 (14%)	7. Culture change	8 (18%)
8. Risk of fall	17 (40%)	8. Risk of fall	20 (47%)

Abbreviation: EM, early mobility.

exercises in the EHR. By discipline, registered nurses had the highest number of correct responses (81%), while resident physicians had the lowest (8%).

## Discussion

Despite several studies demonstrating the safety and efficacy of EM and national guidelines, there remain barriers to adherence and a lack of standardization that impairs universal EM usage.<sup>7,17,19</sup> Some of the challenges affecting the implementation of pediatric EM include the heterogeneous nature of patients' development and size, increased levels of sedation, and lack of acceptance of the safety and necessity of EM. What remains unanswered in the SCCM PANDEM guidelines is, "what factors promote success of EM?" and "what are the best practices for a successful EM program in the PICU?"

The change in perceived barriers among our cohort suggests that providers were receptive to the education around EM and were then able to observe the safety of mobilizing patients who were intubated or with central lines. However, once tasked with regularly completing EM exercises, bedside providers described difficulty managing the increased workload. Most respondents were RN's who were newly responsible for completing and documenting ROM exercises as part of the protocol.

A key aspect of the EM protocol is performing ROM exercises in the high acuity (level 3 or 4) patients. This is typically performed by the bedside nurse or family, as passive ROM does not require the specialized training of a physical or occupational therapist. Therefore, while there may have been an increase in mobility practices administered at the bedside, this would not translate to an increase in PT/OT utilization and most likely was not documented in the medical record. Another challenge is that PT/OT consultation require a physician order. Having a rounding checklist built into the EHR can prevent this from being forgotten on morning rounds. While most respondents in the postimplementation survey were aware of the EM protocol, results of

the survey suggested lack of awareness regarding location of EM documentation in the EHR. Documentation is a critical form of communication for the care team. In our institution, therapists document in notes, while nursing staff typically documents in flowsheets. The different modes of documentation can cause confusion when reviewing what mobility practices a patient has performed and make multidisciplinary collaboration among team members more difficult.

While the initiation of "Move Jr." appears to have been beneficial in educating and engaging many of the providers to consider EM as a priority in patient care, there is still significant work to be done. Staff reeducation of the protocol is important to improve adherence and facilitate knowledge of documentation requirements. Many physician providers were unable to identify where these activities were documented and therefore had difficulty confirming which mobility recommendations had been completed. Many nurses cited limited time and increased workload as barriers to EM. This suggests that a more family centered, multidisciplinary approach should be taken to complete PT/OT and mobility tasks for the day. For example, child life, family members, and patient care technicians could be given mobility goals for the day with nursing staff completing documentation and focusing on the high risk, high acuity patients. This could augment and drive goals of care set by dedicated pediatric rehabilitation therapists two to three times per week. The frequency and quality of therapy would improve if patients received this intervention from dedicated pediatric rehabilitation therapists. This would require our institution to increase the number and availability of pediatric rehabilitation therapists and needed equipment.

Some of the limitations of this study include that it was a single-center study and responses may be biased by institutional resources. Participant responses were not paired to assess individual changes in perception. There was no distinction between participants who primarily work day shift or night shift, which would have inherent differences in EM participation. Due to the anonymous nature of the survey



rate of attrition was not known. Additionally, participants in the postsurvey that had been recently hired were unable to comment on changes in the unit.

## Conclusions

EM has been shown to be beneficial to patients in the pediatric ICU. Our data suggest that safety concerns are no longer a barrier to EM practices. A primary driver of decreased protocol adherence is a lack of dedicated therapists and support staff to assist with and perform mobility exercises. This may be augmented by engaging family members and bedside staff in assisting in mobility exercises. Increased availability of specialized equipment for a variety of patient sizes can make mobilizing patients a more efficient and approachable task for bedside staff. Additionally, streamlining documentation may increase collaboration and communication among team members of different disciplines. Additional research is needed to determine the impact of EM on clinical outcomes such as length of stay, duration of mechanical ventilation, and sedation exposure. With added education and resource implementation, we hope to continue to promote a culture of mobility.

## Abbreviations

EHR:	Electronic Health Record
EM:	Early Mobilization
ICU:	Intensive Care Unit
ICU-AW:	ICU-acquired weakness
OT:	Occupational Therapy
OTs:	Occupational Therapists
PCT:	Patient Care Technician
PICS:	Postintensive Care Syndrome
PICU:	Pediatric Intensive Care Unit
PT:	Physical Therapy
PTs:	Physical Therapists
PANDEM:	Pain, Agitation, Neuromuscular Blockade, and Delirium in critically ill pediatric patients with consideration of the PICU Environment and Early Mobility
ROM:	range of motion
SCCM:	Society of Critical Care Medicine

## Conflict of Interest

None declared.

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