Changes in Provider Perceptions Regarding Early Mobility in the PICU*

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Objectives: Early mobility in the PICU is safe and feasible. However, PICUs continue to meet barriers to implementing early mobility. PICU providers were surveyed before and after initiating an early mobility protocol to determine perceived barriers and continued challenges in performing early mobility.

Design: This single-center prospective study surveyed PICU providers regarding 26 potential barriers to early mobility using a five-point Likert scale. A survey was distributed 1 month prior to and 6 months after beginning an early mobility protocol.

Setting: Free-standing academic tertiary care children's hospital.

Subjects: PICU providers of various professions.

Interventions: Implementation of PICU-wide early mobility protocol.

Measurements and Main Results: Paired pre- and post-early mobility protocol implementation surveys from 97 providers were compared. System-based barriers decreased after implementation of the early mobility protocol, such as lack of guidelines (75–20%; $p < 0.01$), inadequate training (74–33%; $p < 0.01$), lack of early mobility orders (72–30%; $p < 0.01$), and delayed recognition of early mobility candidates (68–35%; $p < 0.01$). Difficulty coordinating early mobility sessions, although significantly decreased, still remained a concern for 66% of providers in the postsurvey. Lack of resources, specifically staff (85–82%; $p = 0.68$) and equipment (67–60%; $p = 0.36$), also remained significant barriers. Presence of an endotracheal tube was a barrier for only 29% of providers' post-early mobility protocol, compared with 69% prior ($p < 0.01$). Clinical instability remained a top concern (82–79%; $p = 0.63$) as well as agitation (74–67%; $p = 0.23$). Day shift providers, with more early mobility exposure, perceived fewer barriers compared with night shift providers. Ninety percentage of post-early mobility survey participants felt that early mobility positively impacted their patients.

Conclusions: Implementation of an early mobility protocol significantly changed provider perceptions regarding barriers to early mobility. Certain factors, such as staff availability, coordination difficulty, equipment shortage, and patient clinical factors, continue to be significant challenges to early mobility in the PICU population. (*Pediatr Crit Care Med* 2020; 21:e30–e38)

Key Words: barriers; critical care; early mobilization; pediatrics; quality improvement; rehabilitation

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PICU mortality has decreased by nearly 50% within the last decade (1). Improved survival has allowed for a shift in focus from preventing mortality to long-term outcomes and functionality (2, 3). With decreased mortality, a greater proportion of children are discharged with substantial disability now than in the prior 3 decades (4, 5). Motor dysfunction is a leading morbidity observed in post-PICU patients (6, 7). A multicenter study determined that approximately 80% of pediatric patients experience functional deterioration while in the ICU, and 24% do not regain baseline functional mobility 6 months postdischarge (7).

Immobilization in the ICU contributes to muscle wasting, functional deterioration, and organ dysfunction in critically ill adults and children as early as the first days of hospitalization (8–12). In children, ICU-acquired weakness is associated with worsening clinical outcomes (13, 14). Early mobility (EM),

defined as the delivery of physical therapy early on in critical illness (15), is used to ameliorate ICU-acquired weakness (16). EM in adults has demonstrated improvement in functional outcomes as well as decreased length of stay and lower delirium rates (17, 18). Additionally, critically ill adults receiving EM had more ventilator-free days and increased physical independence at discharge compared with controls (19). Because of its efficacy, EM has been implemented to minimize postintensive care syndrome (20) and incorporated into the ICU Liberation bundle to mitigate ICU complications (21–23).

EM in the PICU setting has been proven to be safe and feasible (24–28). However, less than half of patients receive any type of mobilization according to a 2014 multicenter study of Canadian PICUs (29). Continued barriers prevent EM implementation in the PICU. Provider attitudes regarding patient safety, especially unplanned extubations, and intervention efficacy are among top concerns (30). These concerns impact providers' willingness to commit to EM (24). Other reported barriers include patient's clinical status, level of sedation, analgesia, and delirium (24, 31). Staff limitations and demands combined with difficulty of coordination between teams have also been noted barriers (24, 26). Lack of equipment availability was a main barrier after mobility implementation in a single-center study (26). Barriers to EM have existed in the adult population and have been addressed to allow for successful protocol implementation (32–34). In an effort to facilitate incorporation of EM into PICU culture, we surveyed PICU providers to determine challenges in administering EM in an academic children's hospital. Six months after initiating an EM protocol, we analyzed shifts in provider perceptions to ascertain changes in PICU culture and identify remaining barriers.

MATERIALS AND METHODS

Setting

This single-center survey study was conducted from April 2018 to December 2018 at Monroe Carrell Jr. Children's Hospital at Vanderbilt, a 271-bed free-standing tertiary care academic children's hospital. The EM protocol was implemented in both of the hospital's PICUs, a 24-bed medical-surgical ICU, and 18-bed cardiac ICU. Both ICUs are closed units, with the ICU team functioning as the primary service on all admitted patients. The study was approved by the Vanderbilt University Institutional Review Board. Survey participants consented to participation.

Survey Development

A survey was created in the Research Electronic Data Capture (REDCap) electronic database (www.project-redcap.org) based on previously reported barriers to EM in both adult and pediatric literature (9, 20, 24, 30, 31, 33–36). The survey consisted of a five-point Likert scale questionnaire on 26 potential barriers to EM (**Appendix I**, Supplemental Digital Content 1, http://links.lww.com/PCC/B116). The variables can broadly be categorized into systems-based barriers, provider concerns, and patient factors. Participants were queried on their discipline, years of ICU experience, and any previous adult ICU experience. The postsurvey included a question regarding timing of shift work, due to the possibility that nightshift providers have less exposure to the EM protocol. Prior to study start, the survey was evaluated and tested in a focus group setting utilizing our research-focused community advisory board. The board was asked to provide feedback related to readability, understanding of questions, type of questions asked, and outcomes of interest.

Participants and Survey Distribution

We identified PICU providers using email distribution lists for faculty and fellow physicians, nurse practitioners (NPs), physician assistants, registered nurses (RNs), physical therapists (PTs), occupational therapists (OTs), respiratory therapists (RTs), speech language pathologists (SLPs), and extracorporeal membrane oxygenation (ECMO) team members. The electronic survey was distributed via email to all medical-surgical PICU and cardiac PICU providers 1 month prior, in April 2018, and 6 months after implementation of an EM protocol in both units, in November 2018. Automated reminders were disseminated weekly to providers that did not yet respond for up to a month. Residents and students were excluded due to their lack of continuity in the PICU and minimal exposure to the EM protocol. Pre- and post-EM protocol email lists differed slightly due to provider turnover and new hires. Participants were given an option to participate in a gift card raffle.

EM Protocol

In September 2017, a multidisciplinary committee comprised of PTs, OTs, SLPs, RTs, RNs, NPs, child-life specialists, and physicians was formed to create, review, and implement an EM protocol. Each discipline approved the final protocol, as well as all admitting subspecialists and surgical teams. An EM dashboard and order panel were created in the electronic medical record (EMR) to improve recognition of EM candidates. Ordering providers could load the dashboard to display as part of their daily rounding list. Once a patient has reached 72 hours consecutive length of stay in the ICU, the dashboard flags the patient as needing EM orders. The provider can then place EM orders using the order panel to clear the patient flag. Although the standard time frame for order placement is 72 hours ICU length of stay, certain high-risk patients may have EM orders placed sooner. Exclusion criteria from the EM protocol are hemodynamic instability, active hemorrhage, unstable intracranial pressure, full spinal precautions, and an open chest less than 24 hours. Otherwise all admitted patients are included in the EM protocol.

In an effort to facilitate scheduling and communication, a daily morning call tree algorithm was created, as well as EM door signs to write planned session times. The full EM protocol can be found in **Appendix II** (Supplemental Digital Content 2, http://links.lww.com/PCC/B117). Education on the EM protocol was provided to all PICU provider groups by EM Committee champions after completion of the initial survey and at the beginning of protocol implementation. The EM protocol was implemented on May 1, 2018, in both the medical-surgical ICU and the cardiac ICU.

Statistical Analysis

Analysis was performed using R software (version 3.5.2; R Foundation for Statistical Computing, Vienna, Austria). Pre- and postsurveys were paired through participants' email addresses by a single researcher who subsequently deidentified the data set. Paired and unpaired statistical analysis were conducted. Scoring range was 1–5 with a higher score corresponding to a higher level of agreement that the factor was a barrier (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree). For each variable, the number of participants responding "strongly agree" and "agree" were combined as an agree frequency. Those responding "strongly disagree," "disagree," and "neutral" were combined as nonagree frequency. Pre- and postsurvey values of these two frequencies were compared using McNemar test for paired and Pearson chi-square test for unpaired data. The Likert mean scale scores were analyzed using Wilcoxon signed rank test for paired analysis and Wilcoxon rank sum test for unpaired analysis.

Subgroup analyses were performed to determine differences among participant characteristics. Pearson chi-square test was used to analyze effects of adult ICU experience on pre-EM protocol responses and shift time effects on post-EM protocol responses. The effects of years of ICU experience on agree probability in the pre-EM survey were analyzed using logistic regression. For logistic regression, the 26 factors were grouped into six categories based on clinical knowledge and supported by confirmatory factor analysis with a Tucker-Lewis Index of 0.95 and root mean square error of approximation of 0.05 (90% CI, 0.04–0.07).

RESULTS

Participant Characteristics

The pre-EM protocol survey was emailed to 331 providers, with a 57% response rate (188 respondents). One hundred forty-eight of 338 (44%) responded to the post-EM survey. Thirty-three of these survey responses were partial responses (20 in the initial survey, 13 in the second survey). **Table 1** depicts characteristics of respondents. Ninety-seven participants completed both pre- and postsurveys. Paired and unpaired data analyses yielded similar results, and paired responses were used for primary analyses. Unpaired data analyses can be found in **Appendix III** (Supplemental Digital Content 1, http://links.lww.com/PCC/B118).

Barrier Analyses

Table 2 displays the number of survey participants who agreed or strongly agreed that a factor was a barrier to EM in both the pre- and post-EM protocol surveys. Among all systems-based factors, the highest reported barrier was lack of staff (85% of presurvey respondents and 82% of postsurvey respondents; $p = 0.68$). Lack of equipment was also a top concern in both surveys (67–60%; $p = 0.38$). Reported barriers in the provider concerns category all significantly decreased after implementation of the EM protocol (Table 2).

Regarding patient factors (Table 2), the majority of providers before the EM protocol had concerns regarding dislodgment of patient devices/catheters (88%), which significantly decreased postmobilization by 27% ($p < 0.01$). Patient clinical instability remained a top concern (82–79%; $p = 0.63$); however, concerns about EM in patients that were overly sedated or delirious both significantly decreased in the post-EM protocol survey (63–43%, $p < 0.01$, and 63–44%, $p < 0.01$ respectively).

Table 3 illustrates the pre and postsurvey responses analyzed using mean Likert scale scores with similar results as the percent agree/strongly agree analysis.

Provider Differences

The majority of factors reported as barriers post-EM protocol did not differ between respondents who worked night shift versus day shift. The few differences were noted in the following

TABLE 1. Characteristics of Survey Participants

Characteristic	Pre-EM Protocol (*n* = 168)	Post-EM Protocol (*n* = 135)	*p*
Profession, *n* (%)			0.77[a]
Registered nurses	88 (52)	73 (54)	
Respiratory therapists	33 (20)	18 (13)	
Physicians	19 (11)	19 (14)	
Physical therapy/occupational therapy/speech language pathologist	12 (7)	12 (9)	
Nurse practitioner/physician assistant	9 (5)	7 (5)	
Extracorporeal membrane oxygenation team	7 (4)	6 (4)	
Years of ICU experience, median (25th, 75th)	4.0 (2.0, 10.0)	4.0 (2.0, 9.0)	0.55[b]
Adult ICU experience (yes), *n* (%)	47 (28)	31 (23)	0.32[a]

EM = early mobility.
[a]Pearson χ^2 test.
[b]Wilcoxon rank sum test.
All data presented as n (%) unless noted otherwise.

TABLE 2. Percent of Providers Reporting Factor as a Barrier to Early Mobility (Paired Responses)

Factor	Pre-EM Protocol,[a] *n* (%)	Post-EM Protocol,[a] *n* (%)	Delta,[b] %	*p*[c]
Systems-based barriers				
Protocol/training				
No guidelines/protocol ($n = 94$)	70 (75)	19 (20)	55	< 0.01
Inadequate EM training ($n = 96$)	71 (74)	32 (33)	41	< 0.01
No EM orders ($n = 95$)	68 (72)	28 (30)	42	< 0.01
Delayed recognition of EM candidates ($n = 95$)	65 (68)	33 (35)	33	< 0.01
Routine bed rest orders ($n = 94$)	49 (52)	30 (32)	20	0.01
Communication/coordination				
Difficulty coordinating ($n = 95$)	75 (79)	63 (66)	13	0.04
Lack of communication ($n = 95$)	54 (57)	46 (48)	9	0.24
Resource limitations				
Not enough staff ($n = 94$)	80 (85)	77 (82)	3	0.68
Not enough equipment ($n = 90$)	60 (67)	54 (60)	7	0.36
Provider concerns				
Safety concerns about EM ($n = 96$)	85 (89)	62 (65)	24	< 0.01
No champion/advocate ($n = 96$)	68 (71)	24 (25)	46	< 0.01
EM not priority ($n = 94$)	63 (67)	45 (48)	19	< 0.01
Lack of support culture ($n = 95$)	63 (66)	30 (32)	34	< 0.01
No administrative support ($n = 93$)	31 (33)	11 (12)	21	< 0.01
Patient factors				
Clinical status				
Too clinically unstable ($n = 93$)	76 (82)	73 (79)	3	0.63
Too agitated ($n = 93$)	69 (74)	62 (67)	7	0.23
Over sedated ($n = 93$)	59 (63)	40 (43)	20	< 0.01
Delirious ($n = 92$)	58 (63)	40 (44)	19	< 0.01
Head injury/traumatic brain injury ($n = 91$)	51 (56)	40 (44)	12	0.09
Inadequate pain control ($n = 93$)	48 (52)	38 (41)	11	0.12
Organ support				
Devices/catheters ($n = 93$)	82 (88)	57 (61)	27	< 0.01
Extracorporeal membrane oxygenation ($n = 92$)	66 (72)	50 (54)	18	< 0.01
Endotracheal tube ($n = 93$)	64 (69)	27 (29)	40	< 0.01
Continuous renal replacement therapy ($n = 90$)	56 (62)	36 (40)	22	< 0.01
Other				
Difficulty communicating with patient ($n = 92$)	47 (51)	35 (38)	13	0.07
Parental concerns ($n = 92$)	34 (37)	16 (17)	20	< 0.01

EM = early mobility.

[a]Participants responding "agree" or "strongly agree," data presented as *n* (%).

[b]Delta calculated as pre-EM protocol percent – post-EM protocol percent.

[c]McNemar test.

TABLE 3. Provider-Reported Barriers Represented as Median Likert Scale Score[a] (Paired Responses)

Factor	Pre-EM Protocol Median[b]	Post-EM Protocol Median[b]	*p*[c]
Systems-based barriers			
Protocol/training			
Inadequate EM training ($n = 96$)	4 (3, 5)	3 (2, 4)	< 0.001
No guidelines/protocol ($n = 94$)	4 (3.25, 4)	2 (2, 3)	< 0.001
No EM orders ($n = 95$)	4 (3, 4)	2 (2, 4)	< 0.001
Delayed recognition of EM candidates ($n = 95$)	4 (3, 4)	3 (2, 4)	< 0.001
Routine bedrest orders ($n = 94$)	4 (3, 4)	3 (2, 4)	< 0.001
Communication/coordination			
Difficulty coordinating ($n = 95$)	4 (4, 4.5)	4 (3, 4)	0.02
Lack of communication ($n = 95$)	4 (3, 4)	3 (2, 4)	0.011
Resource limitations			
Not enough staff ($n = 94$)	4 (4, 5)	4 (4, 5)	0.37
Not enough equipment ($n = 90$)	4 (3, 4)	4 (3, 4)	0.24
Provider concerns			
Safety concerns about EM ($n = 96$)	4 (4, 5)	4 (3, 4)	< 0.001
No champion/advocate ($n = 96$)	4 (3, 5)	2 (2, 3.25)	< 0.001
Lack of support culture ($n = 95$)	4 (3, 5)	3 (2, 4)	< 0.001
EM not priority ($n = 94$)	4 (3, 4)	3 (2, 4)	< 0.001
No administrative support ($n = 93$)	3 (3, 4)	2 (2, 3)	< 0.001
Patient factors			
Clinical status			
Too clinically unstable ($n = 93$)	4 (4, 5)	4 (4, 5)	0.09
Too agitated ($n = 93$)	4 (3, 4)	4 (3, 4)	0.07
Delirious ($n = 92$)	4 (3, 4)	3 (2, 4)	< 0.001
Over sedated ($n = 93$)	4 (3, 4)	3 (2, 4)	< 0.001
Head injury/traumatic brain injury ($n = 89$)	4 (3, 4)	3 (2, 4)	0.005
Inadequate pain control ($n = 93$)	4 (3, 4)	3 (2, 4)	0.09
Organ support			
Devices/catheters ($n = 93$)	4 (4, 5)	4 (2, 4)	< 0.001
Endotracheal tube ($n = 93$)	4 (3, 5)	3 (2, 4)	< 0.001
Extracorporeal membrane oxygenation ($n = 92$)	4 (3, 5)	4 (2, 4)	< 0.001
Continuous renal replacement therapy ($n = 90$)	4 (3, 4)	3 (2, 4)	< 0.001
Other			
Difficulty communicating with patient ($n = 92$)	4 (3, 4)	3 (2, 4)	0.03
Parental concerns ($n = 92$)	3 (2, 4)	2.5 (2, 3)	< 0.001

[a]Likert scale scores as follows: 1 = strongly disagree, 2 = agree, 3 = neutral, 4 = agree, and 5 = strongly agree.
[b]Data presented as median (25th, 75th quartiles).
[c]Wilcoxon signed rank test.

factors: lack of staff (61% of nightshift respondents compared with 84% of dayshift; $p = 0.03$), difficulty coordinating (61% of nightshift vs 81% dayshift; $p < 0.001$), and presence of endotracheal tube (68% nightshift vs 33% of dayshift; $p = 0.004$).

Pre-EM protocol, providers with adult ICU experience were less likely to report the following as barriers: devices/catheters (78% of those with adult ICU experience vs 91% of those without adult ICU experience; $p = 0.03$), endotracheal tubes (57% vs 83%; $p = 0.001$), ECMO (59% vs 81%; $p = 0.004$), and CRRT (49% vs 71%; $p = 0.009$). Providers with more years of ICU experience were less likely to report patient clinical status factors (i.e., clinical instability, agitation, sedation, delirium, head injury, and inadequate pain control) as barriers (odds ratio, 0.92 [CI, 0.85–0.99]; $p = 0.03$). Responses to other factors did not change according to adult ICU experience or years of ICU experience.

Analysis of top concerns per profession is provided in **Table 4**. Before EM protocol implementation, the top factors in which all participants, regardless of profession, agreed or strongly agreed to be barriers were risk of dislodging devices or catheters (87%), safety concerns about mobilizing patients (86%), and patient being too clinically unstable (85%). Six months after EM implementation, the top concern remained patient being too clinically unstable (83%), followed by not enough staff (77%), and difficulty coordinating (70%).

Reported Equipment Limitations

When asked about equipment limitations preventing EM, pre-EM protocol survey participants reported need for neurologic chair (45%, $n = 75$), tilt table (42%, $n = 71$), Tumble Form chair (40%, $n = 67$), feeder chair (38%, $n = 64$), walker/stander ($n = 5$), patient lift/hoyer ($n = 5$), portable ventilator ($n = 3$), and bed bike ($n = 2$). Wheel chair, slide sheet, and stand table were also of need (each $n = 1$). In the post-EM protocol survey, participants continued to report need of Tumble Form chair (47%, $n = 64$), neurologic chair (37%, $n = 50$), feeder chair (23%, $n = 31$), and tilt table (23%, $n = 31$). Participants also noted the need for Tumble Form straps ($n = 3$), portable ventilators ($n = 3$), and walkers/standers ($n = 2$).

Perceived Impact and Commentary

Among post-EM protocol survey participants, 90% ($n = 119$) agreed or strongly agreed to the statement "Overall, I found that mobilization positively impacted my patients." Only 4% of participants ($n = 5$) disagreed or strongly disagreed.

Initial survey participants left a total of 25 comments regarding EM. The majority of comments emphasized concerns regarding resource limitations (59%), risk of dislodgment of devices or catheters (14%), and inadequate training (14%). In the post-EM protocol survey, participants made a total of 33 comments. Forty-five percentage ($n = 15$) of comments expressed enthusiasm about progress and/or impact of EM. Fifty-five percent ($n = 18$) of comments emphasized concerns, 56% of which were regarding resource limitations. Other comments regarded difficulty with communication, coordination, and lack of support culture.

DISCUSSION

Although studies have assessed barriers to EM, our study is the first to determine shifts in barriers to EM in the PICU setting

TABLE 4. Top Factors of Concern Per Profession

Profession	Pre-EM Protocol	Post-EM Protocol
All providers	Devices/catheters (87%)	Clinically unstable (82%)
	Safety concerns (87%)	Not enough staff (77%)
	Clinically unstable (85%)	Difficulty coordinating (69%)
Registered nurses	Devices/catheters (96%)	Too clinically unstable (92%)
	Too clinically unstable (90%)	Safety concerns (85%)
	Safety concerns (88%)	Too agitated (83%)
Physicians	Not enough staff (95%)	Clinically unstable (79%)
	Safety concerns (90%)	Not enough staff (68%)
	Too sedated (90%)	Too sedated (63%)
Respiratory therapists	Difficulty coordinating (91%)	Difficulty coordinating (83%)
	Not enough staff (88%)	Not enough staff (83%)
	Devices/catheters (87%)	Clinically unstable (63%)
Physical therapy/occupational therapy/ speech language pathologist	Safety concerns (100%)	Difficulty coordinating (100%)
	Delayed recognition (92%)	Not enough staff (100%)
	Lack of communication (92%)	Not enough equipment (92%)

EM = early mobility.

after implementation of an EM protocol. Prior to our EM protocol, surveyed providers conveyed similar concerns as in previous studies (24, 26, 30, 31). Although there was a substantial decrease in reported barriers only 6 months post-EM protocol implementation, some factors remained significant barriers. Addressing these barriers will help sustain EM in the PICU.

Distribution of respondents' professions closely mirrored PICU workforce ratios. More than half of survey participants were bedside nurses. Other top responders were RTs and physicians. Our response rates of about 50% are high compared with ICU provider response rates in prior survey studies (30, 37, 38). Staff turnover over the 6-month period contributed to a lower proportion of paired responses. Pairing pre- and postresponses of 97 participants controlled for confounders and outliers, although our unpaired responses yielded similar results (**Appendix III**, Supplemental Digital Content 3, http://links.lww.com/PCC/B118).

Providers had the greatest change in perception regarding systems-based barriers. Specifically, guidelines, training, and EM electronic orders were each of concern to greater than 70% of providers prior to the EM protocol. As expected, these concerns each significantly decreased in the post-EM protocol survey. These findings support the utility of an EM protocol and EM education for providers. The importance of an education plan to foster a culture of EM has been highlighted in prior studies as well (26, 32). Creating an EM dashboard (**Fig. 1**) and order panel in the EMR allowed for timely identification of EM candidates, and thus fewer providers perceived a delay in recognition of EM candidates' post-EM protocol.

Despite adequate training, difficulty coordinating EM between teams was still a reported barrier in the post-EM protocol survey, as was lack of communication. Free text comments noted the difficulty of synching schedules of bedside team members with the EM team's rounds. To facilitate scheduling and communication, a daily morning call tree algorithm and EM door signs to write session times were created for each patient. Despite these efforts, providers still reported difficulty coordinating and communication as a significant barrier in the postsurvey. Given the acute nature of PICU patients, and often unplanned procedures and clinical changes, it continues to be a challenge to preschedule a coordinated EM time daily.

Another major concern that persisted after the EM protocol was resource limitations, predominantly lack of staff. Comments highlighted that providers had other work demands limiting their ability to mobilize patients. A recent study in the PICU regarding EM also supports this finding (30). Our EM protocol was implemented without increased staff, and as such finding time for EM sessions during busy days continues to be a challenge, especially in the winter months when our second survey was completed and seasonal unit volume and acuity are higher. In general, unit staffing during these busy winter months tends to be a constant challenge, regardless of EM. In addition to lack of staff, survey respondents noted lack of equipment as a persistent barrier in both surveys. At the start of the EM protocol, the EM Committee obtained a grant to purchase PICU-specific Tumble Form chairs and in-bed cyclers. Despite these efforts, lack of equipment continued to be a significant barrier in the postsurvey. Comments also suggested portable ventilators and walkers/standers to allow for greater degrees of mobility. Using the results of our survey, the EM Committee is working with administration to budget for more equipment. A larger outcomes study is underway at our institution, with hopes that improved patient outcomes could justify increased staffing and equipment to facilitate EM.

Although certain patient factors remained top barriers to EM in both the pre- and postsurveys, such as patient agitation and clinical instability, providers' concern about the safety of EM and risk of dislodgment of devices, catheters, and organ support decreased significantly. A well-established concern in previous pediatric and adult studies (30, 34, 39), endotracheal tube dislodgement was of significant concern prior to EM protocol implementation. However, this factor had the greatest decrease within the patient factors category and was among the lowest reported barriers in the postsurvey. We attribute this large decrease to our protocol, as well as increased provider experience. When establishing our EM protocol, we mandated RT presence during mobilization of intubated patients. Although this increased RT workload significantly and contributes to scheduling difficulties, there have been zero unplanned extubations during EM sessions since protocol institution. Similar decreases, although not to as large of an extent, were noted in reporting of ECMO and CRRT as barriers to EM. Our hope is with more EM experience, providers will continue to perceive fewer patient factors as barriers to EM.

We found notable variation between providers with different experiences. Postsurvey differences between nightshift and dayshift responses can be explained by extent of exposure to EM, given EM sessions usually occur during dayshift.

Room/Bed	Patient Name/Age/Sex	DOB	MRN	Early Mobility Status	Primary Team	PT/OT Sticky Note	Bed Request Status
Patient location	Patient demographics	Patient date of birth	Medical record number	Red "X" if patient has been admitted to ICU for > 72 hours and early mobility order set has not been ordered, Green "√" if orders are placed, blank circle if patient has not reached 72 hour length of stay (ICU length of stay and ICU admission date listed underneath)	Primary medical care team assigned to patient	Assigned PT/OT for day	Denotes if a patient has transfer orders placed to leave ICU

Figure 1. Depiction early mobility electronic medical record dashboard. DOB = date of birth, MRN = medical record number, OT = occupational therapy, PT = physical therapy.

Nightshift providers more often perceived presence of endotracheal tube as a barrier, likely due to less experience mobilizing intubated patients. Fewer nightshift providers perceived staff limitations and difficulty coordinating as barriers likely due to less exposure to EM and therefore less coordination for EM sessions. We found that providers with adult ICU experience were less likely to perceive organ support and devices/catheters as barriers to EM, which may be explained by previous exposure to EM in the adult population. The more years of ICU experience providers had the more likely they perceived protocol barriers. More experienced providers may have more familiarity with protocol-driven practice, therefore, perceive lack of protocol as a barrier.

Despite concerns and barriers, the overwhelming majority of providers perceived a positive impact of EM on their patients. Our future efforts will surround collecting patient outcome data to quantitate this perceived positive impact. Adult EM programs have seen substantial cost savings with improved patient outcomes (40). Similar findings in pediatrics would help advocate for increased EM resources in the PICU population. In addition, a parent/caregiver survey of EM perceptions is underway at our institution to further improve EM team communication and engagement with families.

Important limitations of this study should be highlighted. Because this is a single-center study, provider-reported barriers may be biased based on institutional factors and resources. Because participation in the study was voluntary, a self-selection bias is possible as providers who felt strongly about EM, whether favorably or unfavorably, may have been more motivated to complete the survey compared with neutral providers. The purpose of the study was not blinded to either participants or researchers. Participants' responses may have been influenced by knowledge of our study aims, otherwise known as a "Hawthorne effect." Despite this, participants seemed forthcoming about concerns in the written feedback. Changes in concerns correlated with changes in external factors, such as protocol and training. We must note that this study measures perceptions, which may differ from true limitations to EM. However, perceptions can be a guide in identifying limitations as in the case of persistent concern regarding resource shortages.

CONCLUSIONS

Implementation of a PICU EM protocol significantly changed provider perceived barriers over a 6-month period. After initiation of an EM protocol, reported barriers regarding system issues and safety of EM in patients with catheters and devices decreased significantly. Barriers such as resource limitations and patient clinical instability persisted after EM protocol implementation, highlighting future areas for improvement to sustain EM in the PICU culture.

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