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Keep Moving: Sustainability of an Early Mobility Protocol in an Academic Pediatric ICU

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ABSTRACT

Introduction: Mobilization protocols are safe and feasible for critically ill pediatric patients in the intensive care unit (ICU), but barriers exist to sustainability. This study described a focused early mobility protocol, sustained over 5 years, which is on time for therapy consults and patient mobilization at a single institution. **Methods:** A formal ICU mobility protocol was implemented as part of a unit-wide ICU liberation bundle. As part of the ongoing program assessment, over a specific 3-month timeframe annually from 2017 to 2023, the number of physical and occupational therapy (PT/OT) consults, mobilization rate, and time to PT/OT consult were analyzed. In addition, in 2023, we assessed specific barriers to early PT/OT consultation. **Results:** Annually, for each study timeframe, there was a sustained decrease in time to therapy consult from a mean of 3.8 days for PT and 7 days for OT in 2017 to 1.9 and 1.6 days, respectively, in 2023. Similarly, the mobilization rate increased from 20.3 sessions per 100 patient days in 2017 to 48.2 in 2023. There was a trend toward missed or delayed therapy consults at times of higher ICU census. No adverse events were associated with mobilization. **Conclusions:** An ICU early mobility protocol leads to a sustained decrease in the time to therapy consultation, an increase in the number of therapy consults, and an increase in the mobilization rate. Future interventions should focus on mitigating barriers to timely consultation, specifically at times of higher ICU census. *(Pediatr Qual Saf 2025;10:e783; doi: 10.1097/pq9.0000000000000783; Published online January 7, 2025.)*

INTRODUCTION

Many think that a patient's journey through critical illness ends when they leave the intensive care unit (ICU) or hospital. However, critical illness can have short- and long-term consequences on a patient's health, even after discharge home.[1,2] Pediatric patients are at the risk of not returning to baseline functioning months to years after discharge.[1,2] Early mobilization and the ICU liberation campaign from the Society of Critical Care Medicine have been developed to help mitigate some of these risks. The ICU Liberation Bundle includes 6 elements (ABCDEF) addressing pain assessment and control, sedation management, delirium assessment and management, spontaneous awakening and breathing trials, early mobility, and family engagement.[3] This campaign was originally focused on adults, but literature and guidance for the pediatric critical care practitioner soon followed. In 2022, as more pediatric literature became available, the pain, agitation, neuromuscular blockade, and delirium in critically ill pediatric patients with consideration of the ICU environment and early mobility guidelines were published to guide pain, sedation, and neuromuscular blockade management while keeping the ICU liberation bundle in mind.[4] Although these guidelines focused on the bundle's A, C, and D elements, there is evidence that implementation of the whole bundle may benefit critically ill children. Lin et al[5] conducted a multicenter study of 8 pediatric ICUs (PICUs) implementing the whole liberation bundle and found reduced mortality with increased bundle utilization.

Due to the emerging literature and focus on early mobility and ICU liberation, interested stakeholders at the Medical University of South Carolina's PICU convened a multidisciplinary committee to create the Sleep, Play, Heal (SPH) program, which aimed to implement best practices within the unit. The SPH program's ultimate goal is to

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Disclosure: The authors have no financial interest to declare in relation to the content of this article.

To cite: Domann JE, Davies LE, Zivick EE, Johnson L, Keller EP, Walz AA. Keep Moving: Sustainability of an Early Mobility Protocol in an Academic Pediatric ICU. Pediatr Qual Saf 2025;10:e783.

Received for publication March 5, 2024; Accepted November 16, 2024.

Published online January 7, 2025

DOI: 10.1097/pq9.0000000000000783

improve our patient population's functional status and build a culture that supports adherence to the ABCDEF bundle. Although the program involved all areas of the ICU liberation bundle, developing an early mobility protocol was a major focus. Implementing early mobility protocols in the PICU has been described in the literature as feasible with variable outcomes.[6–10] Wieczorek et al[6] described implementing a structured early mobility program in the PICU, showing increased consultations to therapeutic services and increased mobilizations per patient throughout 1 year. Betters et al[7] described an early mobility protocol for intubated pediatric patients, showing the feasibility and lack of serious adverse events in this patient population. Both studies by Gupta et al[9] and Ames et al[10] showed an increase in therapy consults with the development of an early mobility protocol but failed to reach mobilization goals despite this increase. A theme of much of this prior research included the discussion of barriers to early mobility observed with program implementation. These barriers included appropriate sedation and analgesia, physician or staff perceptions about the safety of early mobility, staff availability to facilitate protocols, and equipment availability.[6–10] The SPH program utilized this approach before research to develop and refine an early mobility protocol and propose focused strategies to address these barriers and sustain program adherence over time. This article describes our early mobility protocol development, implementation, and outcomes for 5 years.

METHODS

Context

The SPH program was created in early 2018 by a multidisciplinary champion team in the PICU at the Medical University of South Carolina. This team included pediatric intensivists, nurses, respiratory therapists, physical therapists, occupational therapists, speech-language pathologists, pharmacists, and child life specialists. In 2022, it expanded to include patient-family advocates, resident physicians, art and music therapists, and research associates. At the program's start, the PICU services included an 11-bed ICU and a 10-bed step-down unit serving patients from birth to 18 years of age old with critical illness. In 2020, following the construction of the free-standing Shawn Jenkins Children's Hospital, the unit was expanded to a 28-bed mixed acuity medical-surgical PICU. The PICU serves as a regional center for solid organ transplantation and extracorporeal life support, in addition to serving the state's only level 1 pediatric trauma center and pediatric burn referral center. The PICU admits approximately 1,200 patients per year.

Interventions

The development of the SPH program is divided into discrete phases (Fig. 1) during a 5-year timeline. Phase 1 focused on ICU liberation program development by creating a champion team, comprehensive multidisciplinary team education, and brainstorming strategies to implement

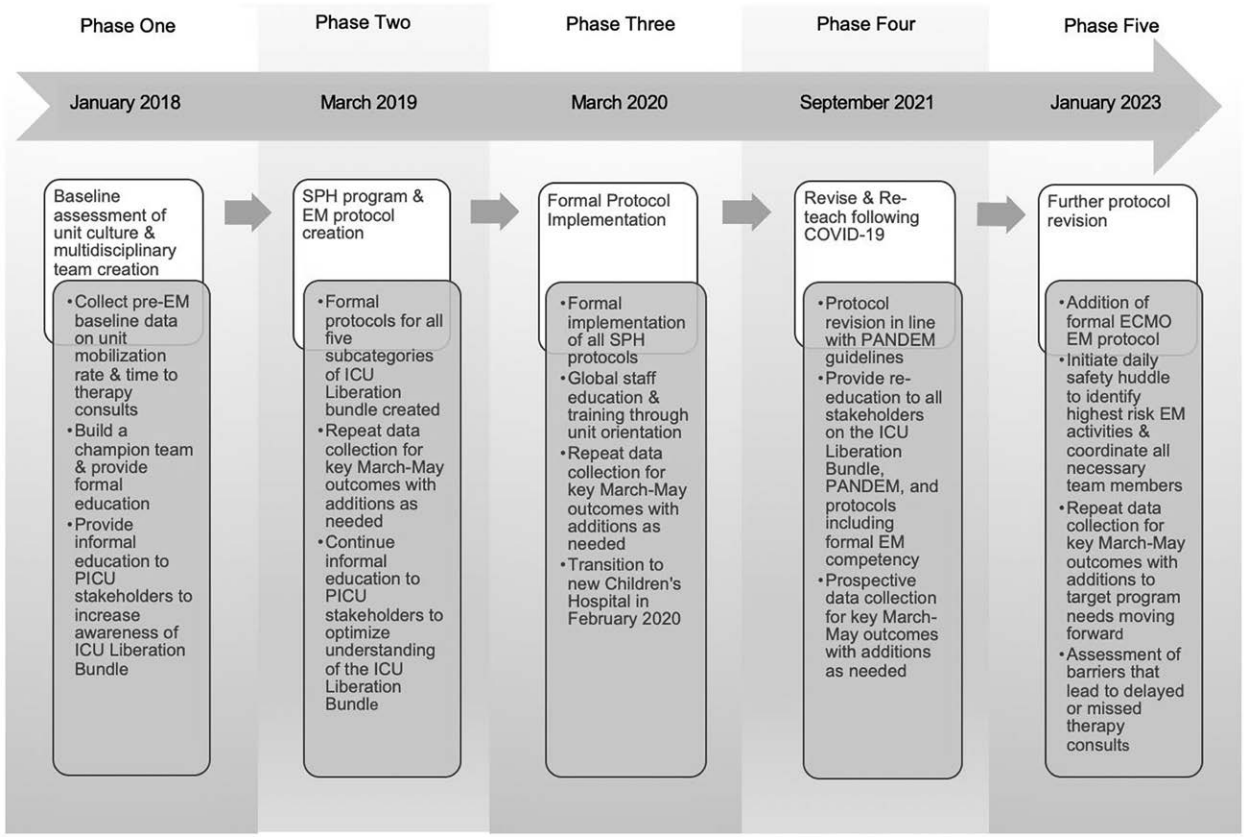

Fig. 1. Phases of program development.

ICU liberation bundle components. Phase 2 included the development of formal protocols for targeted sedation, spontaneous breathing trials, delirium screening, early mobility, and family engagement. These protocols were rolled out in phase 3. Phase 4 included re-education efforts following the publication of the pain, agitation, neuromuscular blockade, and delirium in critically ill pediatric patients with consideration of the ICU environment and early mobility guidelines[4] and the significant staff turnover in our unit following the COVID-19 pandemic. Phase 5 added early mobility protocol safety features specific to the mobilization of patients receiving extracorporeal membrane oxygenation therapy and the institution of a daily huddle discussion of the mobilization of high-risk PICU patients. All phases included comprehensive program development within the multidisciplinary team to support all ABCDEF bundle components.

The early mobility protocol was adapted from the previously published literature.[6–8] It included a tiered approach with levels of mobility stratified by severity of illness and associated mobility activities to perform at each level, which age groups further described. Safety monitoring and preventing adverse events during mobilization included a premobilization checklist and stoplight signs for vital signs changes. Early mobility protocol exclusion criteria included anticipated admission to PICU of fewer than 3 days unless therapy consults deemed necessary, terminal goals of care, unstable intracranial pressure, fractures that precluded mobilization, existing or rule-out pulmonary embolism or venous thromboembolism not yet medically optimized. A key component of the protocol was to consult physical and occupational therapy (PT/OT) for all patients expected to have a PICU length of stay >3 days, with consults placed by ICU day 3.

Measures and Analysis

Annual data collection for a specific 3-month period occurred to compare outcomes longitudinally. To account for seasonal trends, we chose March–May, as it is a timeframe outside of typical respiratory viral illness and trauma surges. For each period, data collection included the number of PT/OT consults for PICU patients, the time from ICU admission to PT/OT consult, the time from consult order placement to first PT/OT mobilization (defined as less than 1 calendar day or greater than 1 calendar day), and the mobilization rate calculated by the number of mobilizations per 100 PICU patient days. Baseline data were retrospectively collected from March to May 2017 as a historical control before any formal education or program implementation related to the ICU liberation bundle. We repeated data collection retrospectively from March to May 2019, with the addition of time from ICU admission to PT/OT consult. We implemented all SPH protocols in March 2020, aiming for all eligible patients to receive PT/OT consults <72 hours from PICU admission; however, data collection was paused for the COVID-19 pandemic. In 2022, we resumed prospective data collection for the March–May period, and in 2023, we additionally examined barriers to timely consultation and areas for improvement to inform future educational efforts. Collection of de-identified mobilization data occurred via medical records. Patient days, ventilator days, and unplanned extubation (UE) data collection occurred via the Children's Hospitals' Solutions for Patient Safety Reporting Tool. This project was awarded institutional review board exemption from our institution's institutional review board due to the quality improvement-focused nature of the work.

RESULTS

Participants

The study included all patients who received PT and OT consults and were admitted to the PICU from March to May during data collection for a total of 342 patients.

Primary Process Measure: Therapy Evaluation Consult

The number of therapy consults increased over each 3-month timeframe for each year of data collection. The baseline number of physical therapy consults was 47 in 2017, increasing to 79 in 2019, 117 in 2022 and 99 in 2023. The number of occupational therapy consults also increased for the study timeframe each year from a baseline of 27 in 2017, 50 in 2019, 79 in 2022, and 95 in 2023 (Fig. 2).

Primary Process Measure: Timeliness in Receiving Therapy Consult

The time from PICU admission to physical and occupational therapy consult was measured for each of the established 3-month study timeframes in 2017, 2019, 2022, and 2023 to receive the consult within 3 days of ICU admission. The median time to a physical therapy consult order placement at baseline was 2 days (overall mean 3.8 d; monthly mean 5.4, 3.3, and 2.7) in 2017 and decreased to 1 day (1.9, 2.7, 1.6, and 1.5) in 2019. The median remained 1 day (1.9, 2.2, 1.5, and 2.0) in 2022 and 2023 (2.4, 3.6, 1.5, and 2.2). For occupational therapy consults, the median time to consult at baseline in 2017 was 3 (6.9, 8, 9.5, and 3.3), which decreased to 2 (3.2, 3.4, 2.7, and 3.4) in 2019, remained at 2 in 2022 (2.6, 3.6, 1.4, and 2.8), and decreased to 1 (1.6, 1.8, 1.3, and 1.8) in 2023 (Fig. 3). In the 3-month study timeframes of 2019, 2022, and 2023, 81.3% of patients mobilized within 1 calendar day of the PT/OT consult order placement. For the patients who had a delay in their first mobilization greater than 1 calendar day after consult order placement, 38.9% of the delays were due to the patient undergoing surgical or bedside procedures; 21.1% were due to decline in medical status in the 24 hours following the consult order placement; 17.9% were due to the patient being busy with other staff members at the time of therapist evaluation attempt; 7.4% were

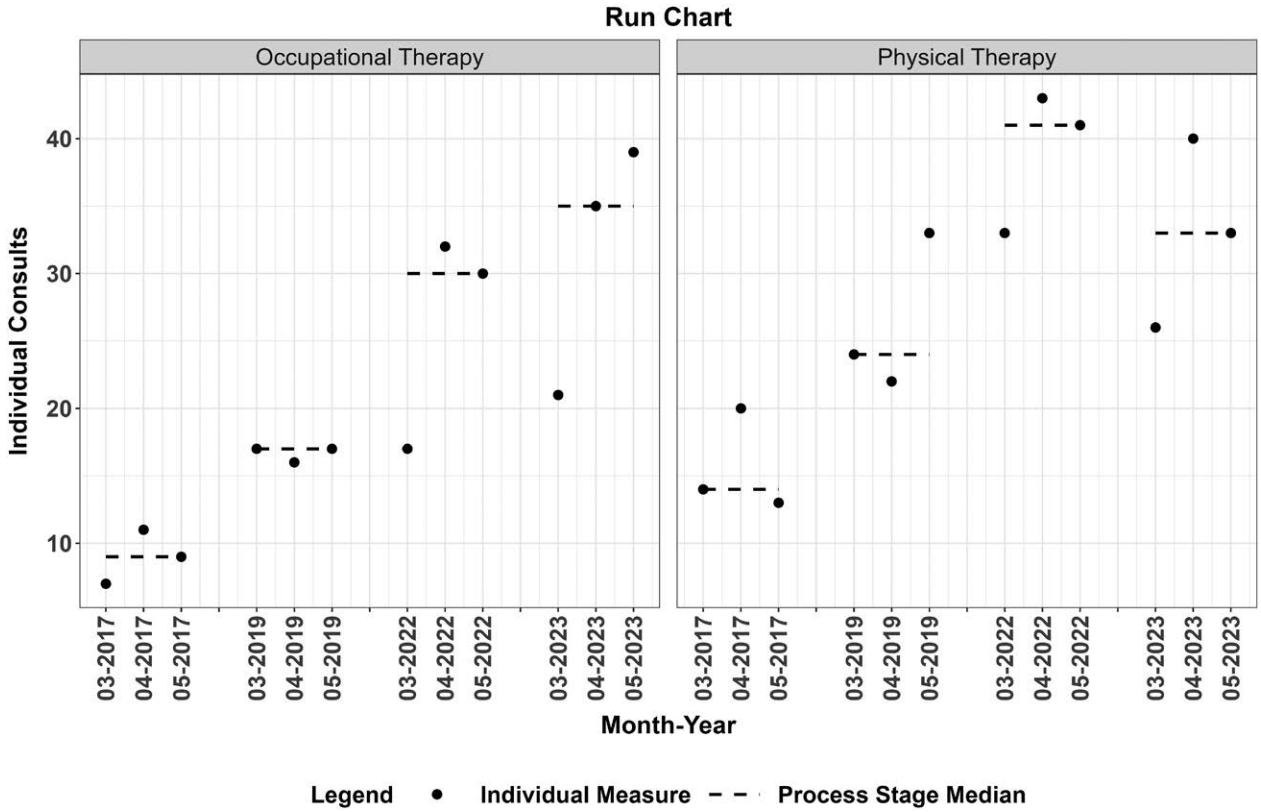

Fig. 2. Chart depicting the increase in several PT and OT consults during the 3-month study time frame for each year of data collection.

due to patient or parent refusal; and the remaining 14.7% were due to other reasons.

Primary Process Measure: Mobilization Rate

As the dataset did not include the total number of unique patients admitted to the PICU, we calculated a mobilization rate to compare the number of PT and OT consults with the total number of patient days in our PICU annually during the discrete 3-month timeframes. Our unit transitioned from a 21-bed unit to a 28-bed unit in 2020; however, there was not a significant difference in the number of patient days compared with our earlier data. In 2017, before the introduction of the SPH program, there were 20.3 mobilizations (14.6, 36.9, and 9.4) per 100 patient days; in 2019, this increased to 36.7 (47.1, 34.4, and 28.6), with a further increase to 46.4 (46.1, 47.8, and 45.4) in 2022 and 48.2 (47.3, 50.7, and 46.6) in 2023 (Fig. 4), which corresponded to a 138% increase in mobilization rate for 5 years.

Secondary Outcome Measure: Delayed or Missed Consults/Program Progression

To further assess program progress, data collection in 2023 also focused on the identification of discrete or modifiable barriers that led to delayed or missed consults, defined as a therapy consult occurring >3 days after PICU admission or no therapy consult for a patient who otherwise met study inclusion criteria, respectively. Based on our inclusion criteria, in March–May 2023, there were 12 missed PT and OT consults, 7 delayed PT and OT consults, and 5 delayed PT consults that did not receive OT consults. There was no trend or impact on missed or delayed consults when analyzing resident turnover, specific attending, the day of the week of patient admission, or the admitting diagnosis. Two potential factors identified for missed or delayed consults include the average PICU census on the day of admission and if the attending physician changed within 24 hours of PICU admission. The average census for the total period studied was 20.5 patients. The average census on days in which patients were admitted who eventually had delayed or missed consults was 22.75 patients; additionally, of the patients with missed or delayed therapy consults, 17 (70.8%) of 24 had a change of attending physician within 24 hours of admission to the PICU.

Safety/Balancing Measure

In 2017, the baseline UE rate from March to May was 0.85 per 100 nontracheostomy ventilator days. During the 3-month study timeframe in 2019, it was 0.86 per 100 nontracheostomy ventilator days, decreasing to 0.75 in 2022 and 0.4 in 2023. There were no adverse safety events associated with mobilization during our study period.

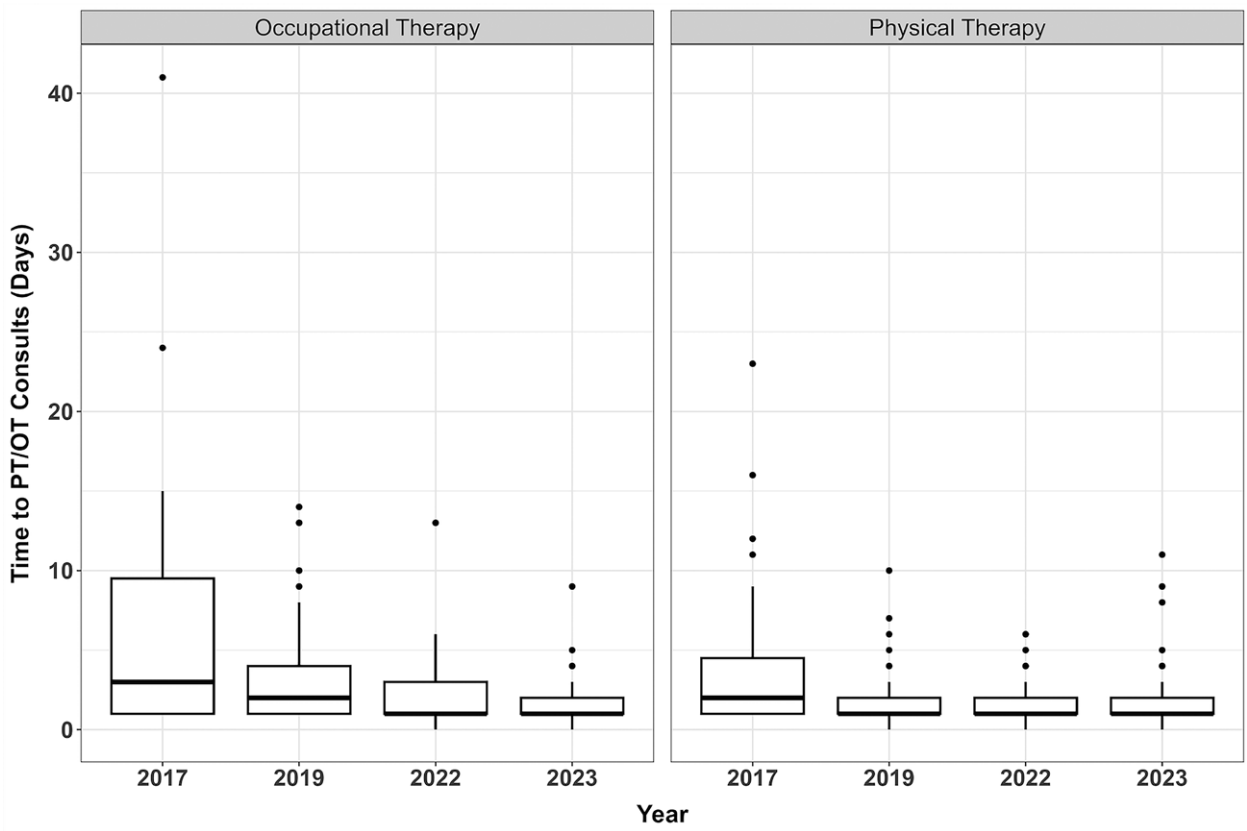

Fig. 3. Chart depicting the median number of days from PICU admission to physical and occupational therapy order placement during each established 3-month study time frame.

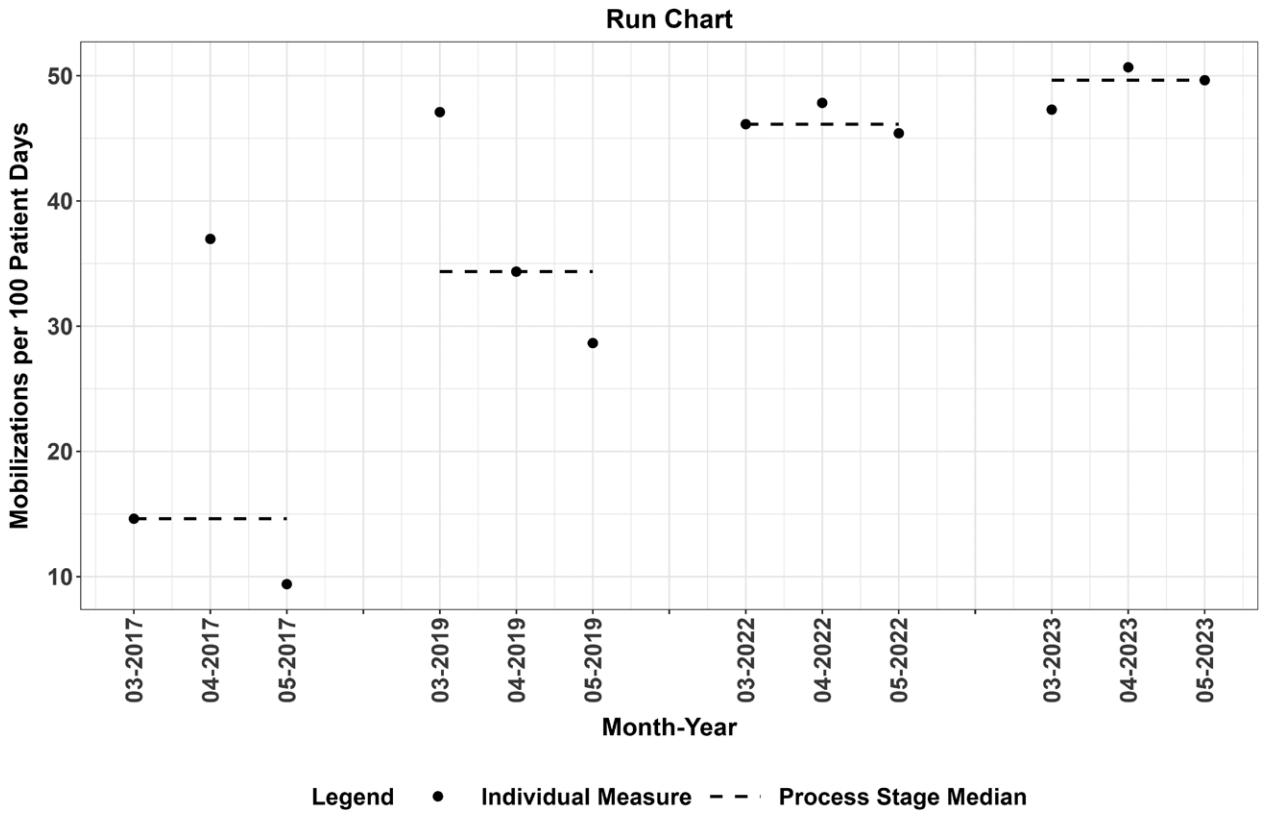

Fig. 4. Mobilization rate for each collection period.

DISCUSSION

Our program demonstrated a sustained improvement in the number of early PT and OT consults and patient mobilization rate. As our data for the 2017 and 2019 three-month timeframes were retrospectively collected, information to describe unique patient encounters was unavailable. Thus, our study used a mobilization rate based on patient days as a primary outcome marker. In the first 5 years of the SPH program, there was a sustained improvement in time to PT and OT consultation with PICU patients on average receiving PT and OT consults by ICU day 1.8 and 1.6, respectively, by 2023.

Our study has several important findings. Prior literature has focused on the safety and feasibility of early mobilization programs for critically ill pediatric patients.[6–10] This study contributes to this growing body of evidence that early mobilization is safe and feasible by demonstrating a decrease in our unit's UE rate, a key safety measure for mobilizing critically ill patients and recording no serious safety events related to patient mobilization. By examining multiyear program data, our study adds depth to the literature by demonstrating the sustainability of an early mobility protocol. Prior studies have yet to thoroughly explore factors contributing to delayed or missed PT and OT consults for critically ill children. Our study examined multiple individual and team factors to determine the potential effects of individual attending practice, day of the week of PICU admission, admitting patient diagnosis, PICU census on the day of admission, and the impact of both attending and pediatric resident switch day schedules, to develop focused processes to improve capture of patients that would benefit from early therapy involvement. There was a trend of missed or delayed therapy consults in times of higher PICU census. During our study period, the average PICU patient census was 20.5 patients. On the days that patients were admitted who would go on to have missed or delayed therapy consults, the PICU census was higher, with a census average of 22.75 patients, which could suggest that when the PICU is busier, the physician team is less likely to focus on placement of therapy orders, or perhaps, the therapy team is less likely to seek out additional consults when the workload is higher. A high proportion of patients in our study who had delayed or missed therapy consults (70.8%) had a change in attending physician of record within 24 hours of their PICU admission. This observation could suggest that standardized physician handoff should include therapy consultation status for critically ill patients.

Guided by our study, we developed several interventions to improve the capture of all patients eligible for early therapy consults. Our therapy teams are now included in a daily multidisciplinary PICU huddle as an opportunity to discuss mobilization plans for high-risk patients and have a direct team discussion about the need for PT and OT consults for any new patient admissions. Additionally, we have enacted a "just in time" rolling education campaign for our bedside nursing, physician, and respiratory therapy staff to encourage organic uptake of the early mobilization protocol. Future directions include adding a smart phrase for the PT and OT consultation date in the physician's daily progress note as a visual reminder to place consults for eligible patients and building an automated PT and OT consult order in the electronic health record on PICU day 3.

Limitations

There are several limitations to our study. Although our initiative showed a sustained increase in therapy consults and mobilization rate, with a decrease in time for PT and OT consults, we could not capture patient-level data related to specific mobilization activities or assess the frequency of mobilization when our PT and OT teams were not present. Specific, patient-level data will be prioritized in future studies. Comparing data for only a defined 3-month timeframe per year may limit the generalizability of our outcomes. Additionally, as our PICU experienced significant staff turnover during the study period, particularly around the COVID-19 pandemic, this may have inhibited the organic uptake of our early mobilization efforts. Finally, our early mobility protocol was not implemented in isolation but is part of our PICU's larger SPH quality improvement program to implement the ICU liberation bundle. Other elements of the bundle, enacted in parallel, positively influenced our outcomes.

CONCLUSIONS

Implementing an early mobility protocol showed a sustained improvement in early PT and OT evaluation and mobilization rate for critically ill patients in our tertiary PICU, accompanied by a continued decrease in time to therapy consult. The next steps will include exploring patient-level factors associated with the early mobility protocol, including the specific level of therapy activities and the impact of mobilization on patient morbidity.

ACKNOWLEDGMENT

The authors are grateful to Kaitlyn Schultz, OTS, for her contribution to data collection in 2023 as part of her occupational therapy doctorate capstone project.

Presented at Combined Sections Meeting, American Physical Therapy Association, San Diego, CA, February 2023; and at the Congress, Society of Critical Care Medicine, San Francisco, California, January 2023.

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