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Quality Improvement Initiative Increasing Early Discharges From an Acute Care Cardiology Unit for Cardiac Surgery and Cardiology Patients–Associated With Reduced Hospital Length of Stay

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Introduction: Discharging patients from the acute care setting is complex and requires orchestration of many clinical and technical processes. Focusing on timely discharges improves throughput by off-loading ICUs and coordinating safe outpatient transitions. Our data review demonstrated most discharges occurred later in the day. We sought to improve our discharge times for cardiology and cardiovascular surgery (CVS) patients in our 26-bed inpatient acute care cardiology unit (ACCU). We aimed to increase the number of discharges between 6 AM and 12 PM for cardiology and CVS patients on ACCU from 5 to 10 patients per month over 6 months and sustain. **Methods:** We performed a simplified Failure Mode Effect Analysis on the discharge process and identified improvement opportunities. Our key drivers centered around education, documentation, and planning. Our interventions included: staff education, communication of discharge expectations, daily quality board rounds, hospital-wide collaboration emphasizing conditional discharges, and hospital information technology (IT) improvements. We utilized statistical process control charts to analyze the data. **Results:** Discharges between 6 AM, and 12 PM increased from a baseline of 5 (8%) to 12 (18%) patients per month with a centerline shift. Our process measures demonstrated appropriate conditional discharge usage linked to earlier discharges. Upgrades to our EMR, documentation further increased our timely discharges. Our efforts resulted in a 22% reduction in hospital length of stay from 11.2 to 8.7 days without increased readmission rates suggesting that improved efficiency did not impact care quality. **Conclusion:** We successfully show how multidisciplinary collaboration and systems-based improvement can increase the number of safe, early discharges. *(Pediatr Qual Saf 2022;7:e587; doi: 10.1097/pq9.0000000000000587; Published online August 1, 2022.)*

INTRODUCTION

Discharging patients in the acute care pediatric setting is complex and can be inefficient due to the interdepence of many factors. The Centers for Medicare & Medicaid Services (CMS) created a set of rules focusing on safe and timely discharges, which emphasizes the importance of early planning.[1] Discharge inefficiency leads to increased lengths of stay (LOS) and higher costs.[1] In times of high census, delayed discharges have downstream impacts on admissions and surgical scheduling. Efforts to increase early discharges can improve throughput from higher acuity settings such as operating rooms, intensive care units (ICUs), and the emergency department.[2] Improvement in

discharge times and processes can positively impact hospital finances, safety, and patient experience.

Our review of discharge data highlighted that patients leave the hospital late in the day, with the most leaving in the 3 PM hour. This shifts timing of bed availability for transfers and admissions to later times. Vulnerability exists in healthcare settings during handoff times such as nursing shift change and at night with minimal staffing. Having new patients transfer at these times is suboptimal for a seamless transition.[3]

Our quality improvement (QI) project took a deep dive into the discharge process in our single, mixed, acute care pediatric cardiology unit (ACCU). We mapped out the discharge process. We took a multidisciplinary approach to understand discharge complexity and create sustainable improvements. Our primary aim was to increase the number of discharges between 6 AM and 12 PM for cardiology and cardiovascular surgery (CVS) patients on the ACCU from 5 to 10 patients per month over 36 months and sustain. The purpose of this paper was to describe the QI efforts and outcomes.

METHODS

This was a healthcare quality improvement project, which spanned 3 years: January 2017 to December 2019. The improvement team included a medical ACCU director, quality improvement coach, data coordinators, nursing, case management, social workers, and advanced practice providers (APPs). We started by mapping the discharge process and understanding the challenges along the way. We asked all members to walk through their roles in supporting discharge. We spoke to key players individually, requested email responses, and asked staff to leave sticky notes on a whiteboard. From the input, we held a multidisciplinary meeting to create a simplified Failure Mode Effect Analysis (sFMEA) (see Supplemental Digital

Content 1, http://links.lww.com/PQ9/A396). We utilized this tool to ensure we understood the finite details needed for a patient to leave safely. We shared the process on a whiteboard in the nursing team center, distributed it to stakeholders via email, and invited comments and insights on challenges and opportunities in the process. This guided the development of our Key Driver Diagram (Fig. 1).

Setting

The ACCU consists of 26 private and shared beds located within a free-standing quaternary Children's Hospital in Washington, DC.[4,5] The ACCU is not a closed cardiac unit, though cardiology patients and cardiac surgery patients are solely admitted to the unit. Nephrology patients are preferentially admitted to the ACCU, and other services could be admitted during high census times when their traditional units are full. In 2016, the ACCU had 1,383 discharges—40% from cardiology, 19% from CVS, and 23% from nephrology. The remainder were from other hospital services. First-line providers are second-year pediatric residents on their cardiology rotation for cardiology patients and 5 advanced practice providers (APPs) for CVS patients. The cardiology residents are supervised by the cardiology fellow and attending whereas the CVS APP reports to the pediatric CV surgeon. The CVS APPs meet with the surgeons daily in the morning to review patients. Decisions about discharge suitability often occur at this time. The APPs then see the patients with the bedside nurse to implement plans and determine discharge readiness. Twelve cardiologists participated in the weekly rotation, providing inpatient cardiology coverage and performing daily rounds with the residents and multidisciplinary team.

Study Population

All CVS and cardiology patients discharged from the ACCU were included. Any patient admitted to the ACCU but not under cardiology or CVS service was excluded.
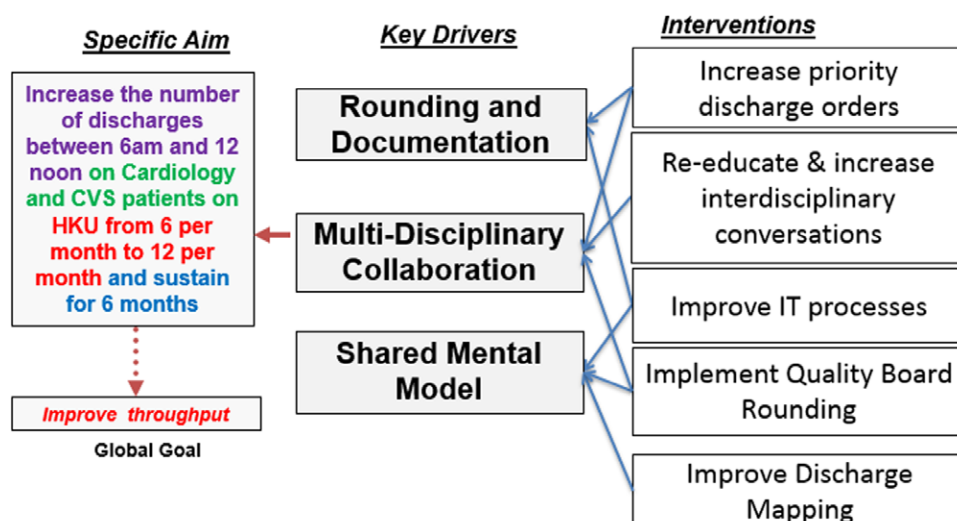

Fig. 1. Key driver diagram.

Interventions

We implemented the following interventions: (1) education and increased situational awareness of frontline staff and communication of discharge expectations to staff and families (March–June 2017); (2) daily quality board rounds to establish situational awareness for throughput and census issues rounding time (April–June 2018); (3) hospital-wide collaboration emphasizing conditional discharges (January 2019); and (4) hospital information technology (IT) improvements including "BearBoost" computer upgrades that improved efficiency in discharge documentation (September 2019).

Education and Situational Awareness for Frontline Staff

The first step was increasing awareness of our work. We did this through email and presentations at department meetings for CVS and cardiology and our nonprovider staff, including nurses and patient care assistants on the ACCU. This enabled us to receive feedback and generate buy-in for our work.

We implemented several interventions to increase discharge conversations and create a shared mental model. A whiteboard in each patient's bed space includes patient information and a spot for discharge goals. We instructed the nurses and attendings on service to fill out the discharge criteria on the whiteboard. This forced clearer communication about discharge needs and created a shared understanding of items that needed completion. We also created a road map for discharge, "Bear Steps to Home" to display for our patients and families (Fig. 2). The intent was to create a visual descriptor of common steps toward discharge, which would be checked off as complete. Charge nurses tracked and documented the results of random audits for compliance.

Daily Quality Board Rounds

In conjunction with our IT leadership, we created a digital Quality Board (see Supplemental Digital Content 2, http://links.lww.com/PQ9/A396). This Board is displayed at the front of the ACCU in a HIPAA-compliant way. It routinely updates the customized unit data and lists high acuity patients. Quality Board rounding was implemented in October 2018. The nursing team recites a script about the patient census, safety issues, and knowledge of transfers, admits, and potential discharges. It concludes with each team sharing safety concerns for patients on the floor.

Hospital-wide Collaboration Emphasizing Conditional Discharges

Hospital leadership created a throughput committee. We partnered with them to improve the use of an order called "conditional discharge." A conditional discharge order is placed in the EMR and describes medical criteria needed for discharge, such as weaning off oxygen or meeting weight goals and whether a discharge exam is required. Patients could then be discharged once the criteria were met. We set the expectation that the conditional discharge order would be used ahead of the patient's medical readiness so that discharge could be anticipated. We decided that an order written more than 6 hours ahead of the anticipated discharge time qualified as appropriate use of the tool. The time of 6 hours enabled sufficient time to prepare for discharge yet was not close enough
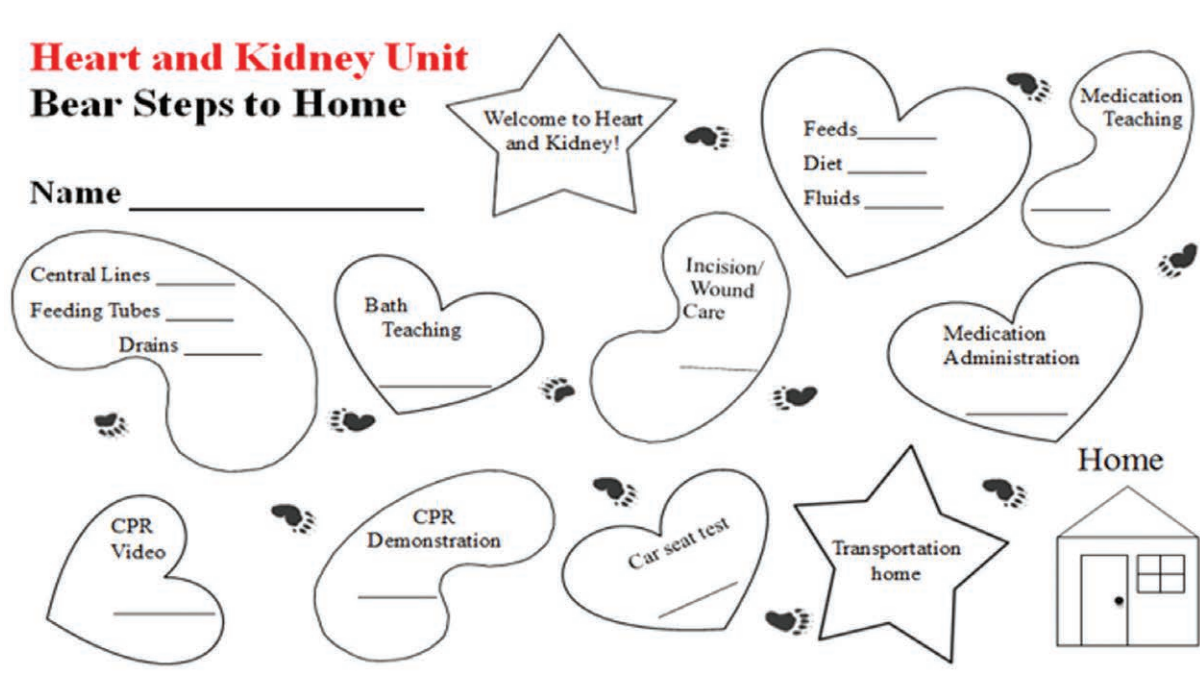

Fig. 2. Graphic illustration of bear steps to home.

to the discharge time that a typical discharge order could be written. If the patient did not meet the criteria, orders were canceled or updated to reflect new criteria. Canceled conditional discharges were not counted. We joined the conditional discharge committee in January 2019.

Hospital IT Improvements

Upgrades to the medical record coincided with our discharge efforts. BearBoost, an institutional improvement, changed note formatting and processes for discharge, making hospital summaries solely electronic. Before BearBoost, families received a hard copy of the discharge summary. BearBoost changed the workflow so that discharge summaries were electronically sent to the pediatrician and families upon signature by the attending. Bear Boost went live in October 2019.

Metrics and Goals

Outcome Measure

Our primary aim was to double the number of cardiology, and CVS patients discharged between 6 AM and 12 noon. We chose absolute numbers rather than percentages because we believed improvements in individual numbers would better reflect our change processes rather than be diluted or elevated due to differences in discharge numbers by month and season. We chose the times of 6 AM to 12 PM as our sweet spot for early discharge. Since residents often leave for conference or afternoon responsibilities around noon, we believed that discharges before noon would best reflect successful process improvement implementation. Times earlier than 6 AM would not accurately reflect improved processes but potential failures from the day before and could falsely improve our analysis. The process measure was increasing first-line providers' utilization of the conditional discharges. The balancing measure was the rate of hospital 7-day-readmissions.

Our global aim was to decrease length of stay. We hoped that by focusing on discharge practices, we would optimize early discharges and become more efficient at discharging overall.

Data Collection

We collected data by querying databases for all discharges from our ACCU. We sorted by service at discharge to include only CVS and cardiology patients. We know that we included all cardiology and CVS patients because we do not admit patients to other units. When a patient discharges, the time is documented on their paperwork and entered in the system by our unit clerk. We have confidence that the time of discharge is accurate. We reported discharge time data monthly.

The throughput committee tracked the conditional discharge data and readmission rates. They queried the database and medical record for the date and time of the conditional discharge order. We used hospital collected data on readmission rates.

Analysis

We performed our analysis using QI Macros (2019, Denver, CO) and Microsoft Excel (365, Redmond, WA). We created run charts for our process measures. For LOS and early discharges, we created statistical process control charts and defined our baseline as 6 months before our start in January 2017. A centerline shift was determined based on 8 or more datapoints above or below the centerline.[4,5]

Study of the Interventions

We audited completion rates for the use of the whiteboard tool and "Bear Steps to Home." Charge nurses performed random check-ins after rounds to evaluate the data on the whiteboard and Bear Steps to Home and documented it on a spreadsheet. Quality Board rounds were led by the charge nurse team, who had excellent buy-in. They tracked compliance with attendance and reported back to the QI team as part of the process measure.

We tracked conditional discharge order use weekly and shared it with appropriate teams. We discussed opportunities for increasing improvement and understanding barriers to implementation. Bear Boost was a hospital-wide IT initiative that went live coincidentally during our project and was noted in our dataset.

This project was approved by our Institutional Review Board as a QI project with exemption.

RESULTS

There were 2167 discharges from our ACCU that met inclusion criteria from January 1, 2017, to December 31, 2019; 36% of discharges were for CVS patients and 64% for cardiac patients.

Outcome Measure

Across 36 months, the number of discharges between 6 AM, and 12 PM more than doubled from a baseline of 5.7 patients to 14.9 patients per month with a centerline shift (Fig. 3). Although we combined the services for our data, evaluation of the separate services also showed increased discharges by month. We did not notice seasonal differences in the number of early discharges, and the average number of discharges per month was 62.7, with a SD of ±9.6. The most significant impact appeared with our efforts using conditional discharges and the technological processes surrounding discharge documentation in the electronic medical record. Overall discharge times did not change significantly until changes in the EMR showed a trend toward earlier discharge times (Fig. 4). Our efforts resulted in a reduction in hospital length of stay (LOS) from a baseline of 11.2 days to 8.7 days. The X bar chart for LOS demonstratesthis centerline shift (Fig. 5). The S chart for LOS shows special cause with higher LOS than expected in individual months. Each of these months had 1 patient with a LOS greater than 150 days, and May 2018 had 2 patients with LOS greater than 150 days.
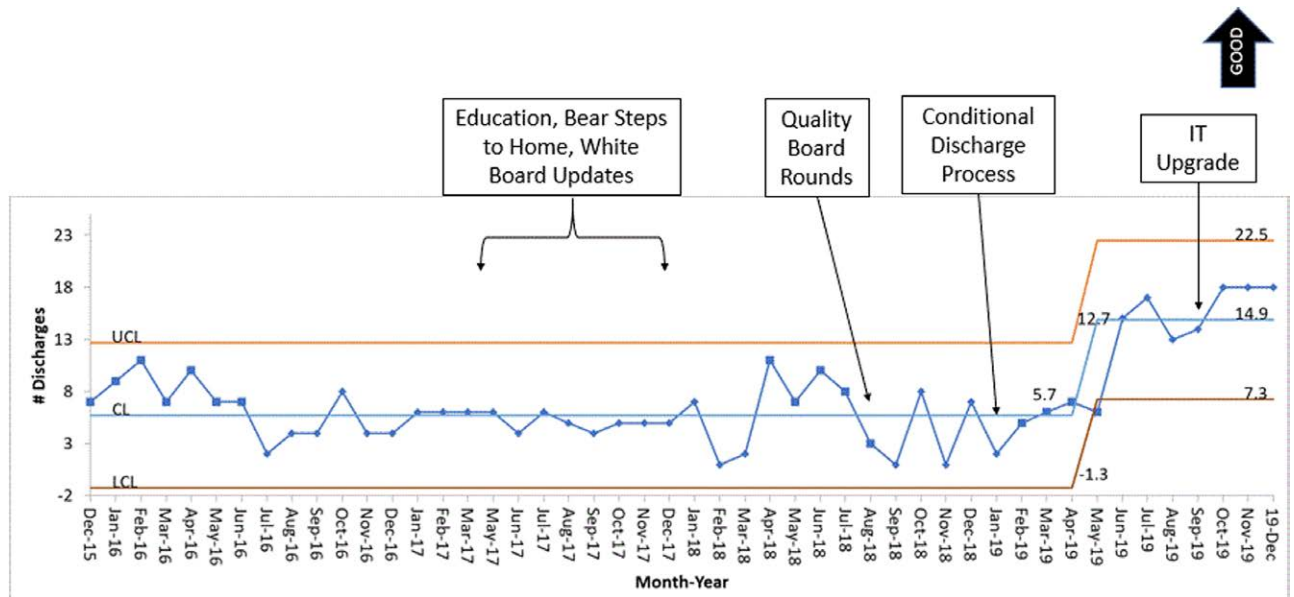
Fig. 3. Discharges between 6 AM and noon by month (December 15–19)—I Chart.
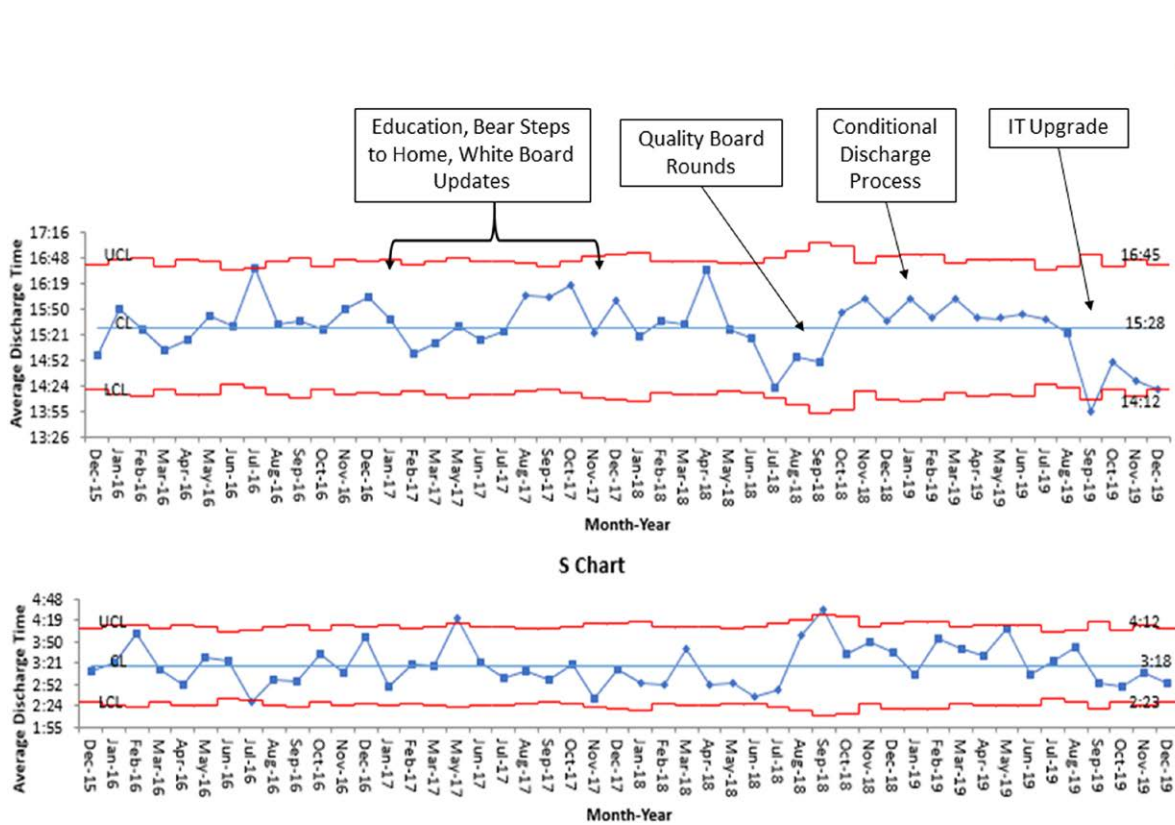
Fig. 4. Average discharge time by month (December 15–19)—XbarS Chart.

Process Measures

Collaboration with the conditional discharge committee resulted in increased numbers of appropriate conditional discharge orders (Fig. 6). We saw sustained improvements in the use of conditional discharges in the CVS patients.

Our cardiology team had mixed success with the usage of the conditional discharge order.

Our bedside team responded well to the goals of improving our discharge times and creating a more efficient process. However, our efforts to streamline discharge
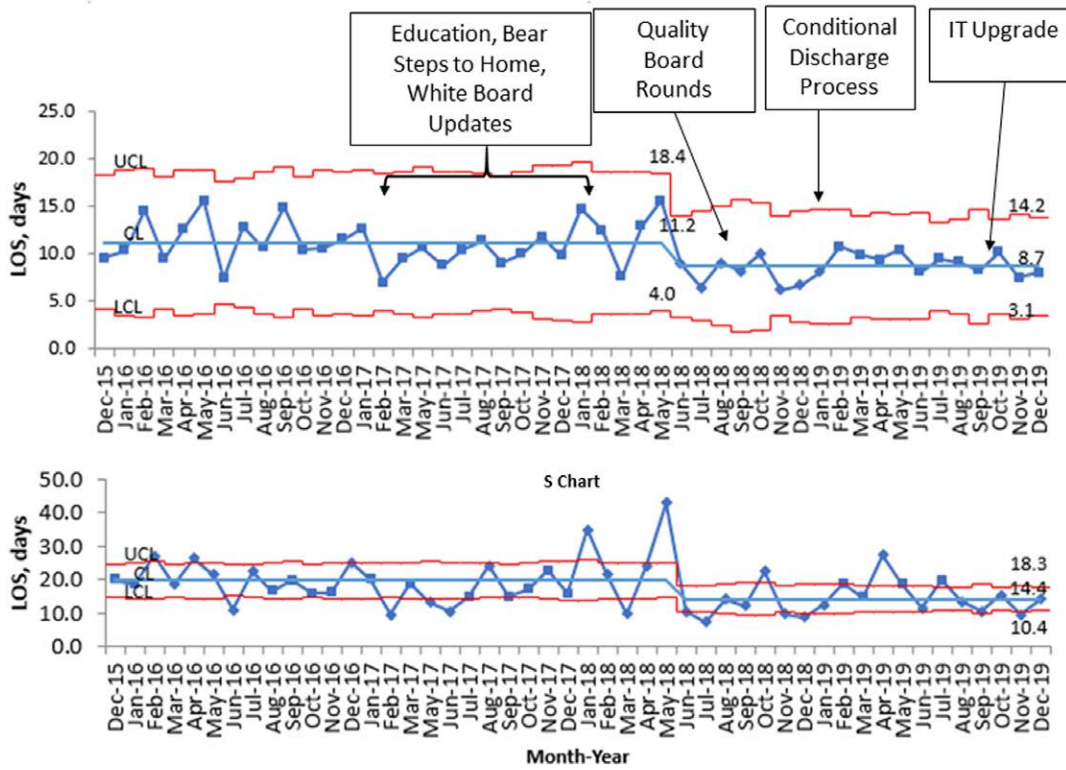
Fig. 5. LOS by month (December 15–19)—XbarS Chart. LOS, length of stay.
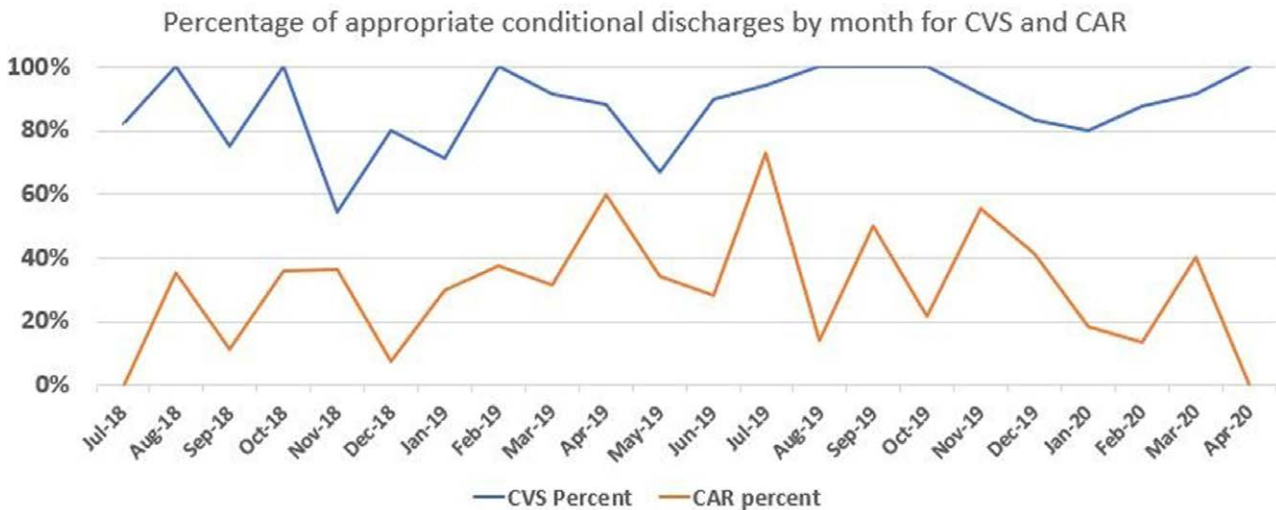
Fig. 6. Run chart of percentage of appropriate conditional discharge orders for CVS and cardiology. CVS, cardiovascular surgery.

communication through the use of the whiteboard tool and "Bear Steps to Home" proved challenging. There was poor adoption of these processes with 66% usages rates.

Balancing Measure

There was no significant change or increase in the 7-day readmission rate to the hospital during our study period with rates per discharge of 5% before and 8% after, which is not statistically significant (T-test *P* value = 0.15). We reviewed our CICU LOS and STAT categories before and after our project started to ensure that the effects seen do not reflect less complex patients or changes in the CICU LOS (see Supplemental Digital Content 3, http://links. lww.com/PQ9/A396).

DISCUSSION

This study highlights the complexity of patient discharges. Over 3 years, we focused on process improvements in multiple aspects of discharge readiness. We successfully increased the number of early discharges on our ACCU. Drivers of success included standardized care teams such as our APP led CVS team and systematic changes in the EMR. Our efforts resulted in a reduction in hospital LOS with no significant increase in the 7-day readmission rate to the hospital. Multicenter quality improvement collaboratives have endorsed the value of a multidisciplinary team approach to quality and value of care.[6–8]

Harnessing IT tools can improve care coordination and communication, which helps staff prioritize tasks and improves family awareness and inclusion. The fast-paced environment of hospitals contributes to communication failures among healthcare providers while impacting patient care and patient flow. An effective mechanism for sharing patients' discharge information with healthcare team members is required to improve patient throughput. The communication of a patient's discharge plan was identified as crucial in alleviating patient flow delays at our tertiary care, academic medical center. By identifying the patients who were expected to be discharged the following day, the healthcare team could initiate discharge preparations in advance to improve patient care and patient flow. The patients' electronic medical record served to convey dynamic information regarding the patients' discharge status to the healthcare team via conditional discharge orders. Use of a conditional discharge order has been demonstrated to improve discharge efficiency.[9] Two neurosciences units piloted a conditional discharge order initiative. Conditional discharge orders were designed in the electronic medical record so that the conditions for discharge were listed in a dropdown menu. The healthcare team was trained on the conditional discharge order protocol, including when to write them, how to find them in the patients' electronic medical record, and what actions should be prompted by these orders. On average, 24% of the patients discharged had conditional discharge orders written the day before discharge. The average discharge time for patients with conditional discharge orders decreased by 83 minutes (0.06 day) from baseline. Qualitatively, the healthcare team reported improved workflows with conditional orders. The conditional discharge orders allowed physicians to communicate pending discharges electronically to the multidisciplinary team. The initiative positively impacted patient discharge times and workflows. We observed the success of the conditional discharge order on other units and felt incorporation of this process could significantly improve our discharge times. The early adoption of the tool by CVS compared to the Cardiology team demonstrated the importance of team composition and the benefits of continuity in QI efforts. CVS APPs in ACCU provide continuity unparalleled by the cardiology medical team. Having a smaller, consistent group of first-line providers made it easier for change implementation.

Sustained improvements with trainees related to discharge efficiency is challenging.[10] We found this to be the case with our residents. Individual interviews with residents who chose not to use the conditional discharge order revealed a general knowledge gap in physiology related to medical ready criteria and desire for formal rounds and attending input to discharge a patient. We saw a decrease in appropriate conditional discharge use for the cardiology team, yet the CVS team continued with exceptional performance. This difference reflects the acquired comfort with the process by an exerpeienced and consistent team compared to requiring frequent reminders and education needed for a changing resident team. APP involvement in the ACCU has also been shown to have a shorter-than-expected postoperative LOS supporting creating systems around consistency.[11] The success seen within the CVS patients encourages efforts to standardize inpatient medical cardiology coverage. "Development of a subspecialized group of cardiologists within a larger group reduces practice variation" and improves adoption of new QI, which will improve care and may be the key to combat resident variability and hesitation.[12]

As the reimbursement model is different between surgical CVS and medical cardiology patients, using conditional discharges may differentially impact reimbursements. The conditional discharge order allows for patient discharge before rounds, yet attendings are still encouraged to examine the patient though not required. Surgical CVS patients are reimbursed as a bundle and are not influenced by the fee-for-service model. As the healthcare system continues to evolve into value-based care, one would expect more adoption of conditional discharges in the future.

Simple education was not enough to change processes, a well-known challenge in quality improvement. We successfully improved our communication through the daily rounding with our quality board. The direct correlation between this practice and discharges is hard to connect; however, we believe that improved multidisciplinary situational awareness fostered earlier discussion about disposition for all patients.

The IT upgrade unearthed an important limitation in early discharges: paperwork. Before our IT upgrade, discharge summaries needed to be completed, printed, and reviewed with families before discharge. Competing resident demands and computer and printer problems created barriers to the timely completion of paperwork. Nurses became aware earlier of discharge readiness and could prepare proactively. The electronic upgrade eliminated many steps in the process and positively impacted our early discharges.

Any discharge improvement effort must evaluate unanticipated consequences. We did not see any changes in our readmission rates overall or separated by service during our discharge efforts. Medication safety is another important consideration for expedited discharges, yet one that was hard to track and not highlighted here. There were no significant changes in the complexity of the patients or

in the CICU LOS, supporting that our improvements can be attributed to the ACCU.

Tracking time of day for discharge can arguably be less important than other measures of throughput and bed utilization. One could argue that decreasing the length of stay is a more important measure of the impact of our efforts than the actual time of discharge. For example, a discharge today at 7 PM is better than 1 tomorrow at 8 AM. We recognize that many factors impact timely discharges and LOS. We saw an important decrease in LOS, which correlates overall with multiple improvement efforts and an enhanced discharge focus rather than 1 specific intervention. We interpret our data with the realization that there will always be outliers in LOS preventing strict statistical control. Although not the project's focus, we demonstrated that attention to various discharge-related processes can decrease overall LOS.

Our center attempted to harness checklists and bedside tools. Although others have had success with paper documentation,[13] we demonstrated that paper checklists or whiteboard use are hard to sustain. Integration of those checklists in the EMR can improve discharge timing.[14] Having adequate resources and buy-in from all providers is key.[13,15]

Limitations

We did not examine the challenges of discharging medically ready patients due to social factors. This is a known limitation to discharges as patients wait for rides or the completion of extensive teaching needs. Future discharge work will consider this aspect of the discharge process.

CONCLUSIONS

Our multidisciplinary discharge project increased early discharges was associated with a decrease in LOS. Divers of success were the involvement of APPs and systematic changes with the EMR. We believe the ideal care model to positively impact discharges should include consistent team members and a well-integrated electronic system to create standard work and minimize inefficiency. Future work will involve tackling challenges related to parent and family factors arising between time achieving medical readiness and time of departure.

DISCLOSURE

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

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AUTHOR CONTRIBUTIONS

Dr Colyer contributed to design of the QI project, collecting data, interpreting results and drafting the article. Lisa Ring contributed to and revised the article. Sarah Gallagher contributed to and revised the article. Mary Mullenholz contributed to and revised the article. Jan Robison contributed to and revised the article. Kathleen Rigney-Radford contributed to and revised the article. Ashraf S. Harahsheh revised the article critically for important intellectual content. All authors approved the final article as submitted and agree to be accountable for all aspects of the work.

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