The transition from hospital-to-home presents a safety risk to pediatric patients.\(^1\)\(^-\)\(^3\) Current practices do not ensure that caregiver home management skills are routinely taught before hospital discharge.\(^1\)\(^-\)\(^6\) Errors in medication use, failure to adhere to follow-up appointments stem from lapses in provider-to-caregiver handoffs before hospital discharge.\(^7\)\(^-\)\(^9\) Likewise, communication between inpatient and outpatient medical care providers is often delayed and contingency plans, and failure to 
lacks essential information, leading to confusion over ownership of pending results and delays in care. Ineffective hospital-to-home transitions may contribute to increased hospital reuse and overall health care costs.

Reducing reuse (readmission to the hospital and/or return to the emergency department) has become a target for improvement throughout the health care community. Decreasing unplanned reuse highlights each of the goals of the Institute for Healthcare Improvement’s Triple Aim framework by improving the patient experience of care, enhancing population health, and reducing per capita health care costs.

A review of literature showed that no single intervention was effective in reducing hospital reuse.

Several studies of geriatric patients, including 2 randomized controlled trials, suggest that care transition bundles can increase adherence to follow-up plans and reduce hospital reuse. Key components of these bundles include: use of a transitions coach, predischarge confirmation of patient/caregiver discharge readiness, caregiver education and understanding of essential components of the care plan, and a postdischarge phone call to review and clarify information.

There is limited pediatric literature to support the usefulness of individual interventions. Investigations of pediatric posthospital reutilization have suggested the importance of discharge education, access to discharge medications, a clear follow-up plan, and caregiver attitudes. Efforts to improve communication between pediatric hospital and outpatient providers have demonstrated improvement in the relay of concise, accurate, and timely information. The importance of a comprehensive approach to hospital-to-home transitions has been demonstrated in medically complex children. However, no universal pediatric hospital-to-home transition care bundle has been reported to date.

The first 2 phases of the American Academy of Pediatrics, Section on Hospital Medicine Transitions of Care Collaborative improved the timeliness and defined the essential content of pediatric hospitalist to primary care provider (PCP) communication during hospital-to-home care transitions. The current phase of this collaborative seeks to promote partnerships between parents/caregivers and medical teams via shared ownership of care transitions at hospital discharge. To that end, the Improving Pediatric Patient-Centered Care Transitions (IMPACT) project, a multicenter quality improvement research collaborative, developed a 4-element patient-centered pediatric care transitions (PACT) bundle based on review of existing literature. The objective of this pilot study is to demonstrate the feasibility of bundle implementation and to assess the early impact of the bundle on outcome measures, namely, caregiver’s home management skills (primary outcome) and reuse rates (secondary outcome). We hypothesize that reliable implementation of all 4 bundle elements will be associated with an improvement in both primary and secondary outcomes.

METHODS

Context

Four pilot sites (Table 1) instituted the PACT bundle. The bundle includes: a transition readiness checklist; predischarge caregiver teach-back of essential home management skills; timely and complete medical provider handoff; and a postdischarge phone call (Fig 1). Subjects were technology-supported and non–technology-supported patients, age 0 to 18 years who were discharged to home. Technology-supported patients were defined as patients with of the following: ventriculoperitoneal shunt, tracheostomy tube, surgically placed feeding tube, and/or indwelling central venous catheter. The non–technology-supported patients were infants, toddlers, asthma patients age 2 to 17 years old, or all patients admitted to a specific geographic area or unit. These subpopulations were determined based on evidence of increased reuse risk or availability of evidence suggesting that targeted predischarge interventions decreased transition risks.

We excluded patients with a primary oncologic diagnosis and those discharged from the newborn nursery or critical care units. We used a convenience sampling based on each pilot site’s patient annual volume, resource availability, and organizational priorities.

Interventions

A pediatric hospitalist from each site served as local improvement team leader. The composition of teams varied, but included patient/family representatives, pediatric hospitalists, subspecialists, resident physicians, PCPs, nurses, case managers, social workers, pharmacists, information technologists, and administrative staff. Monthly conference calls occurred between the 4 pilot sites to facilitate resource sharing and promote successful bundle implementation. The project was approved for American Board of Pediatrics Maintenance of Certification Part IV credit for eligible participants.

Each pilot site improvement team mapped local preintervention processes for medical provider handoff at discharge and parent/caregiver education and used multiple planned sequential interventions to implement the 4 bundle elements (Fig 2). The transition checklist (Supplemental Fig 1) documents logistical components of family and medical provider
handoffs including: parent/caregiver perceptions of discharge readiness, preferred language and arrangement for professional interpretation for teaching, and identification of transportation, financial, or social barriers to a safe transition. The checklist existed as a paper document or was integrated into the electronic health record (EHR).

Teach-back is an evidence-based, patient-centered, closed-loop communication tool to confirm understanding of information provided by asking patients and caregivers to explain in their own words what they need to know or do.24 A teach-back curriculum, which includes a “just-in-time” teach-back primer, and video were developed at 1 pilot site and shared across other sites (Supplemental Information). Nurse educators at each site trained staff nurses on teach-back techniques.

### Table 1: Institution of PACT Bundle

<table>
<thead>
<tr>
<th>Measure (and Type)</th>
<th>Description</th>
<th>Time-Bound Goal (Denominator for Rates Is Entire Enrolled Patient Population at Each Site)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Predischarge caregiver teach-back of home management skills (P)</td>
<td>Must document successful teach-back of all 4 components: medication use, follow-up appointments, contingency plan (when to call PCP or return to emergency department), equipment contact information (if applicable)</td>
<td>Improve documentation of successful caregiver explanation of all elements to 90% within 12 mo</td>
</tr>
<tr>
<td>Transition readiness checklist (P)</td>
<td>Checklist use in paper or electronic chart, Any use: at least 1 item documented, Complete: all items documented</td>
<td>Improve to 90% complete checklist use within 12 mo</td>
</tr>
<tr>
<td>Timely and complete handoff to the PCP (P)</td>
<td>Must include documentation of all 7 elements of essential discharge communication content bundle: (admission/discharge dates, discharge diagnosis, medications, follow-up, results pending, immunizations administered during hospitalization, brief description of hospital course) and be sent within one day of discharge</td>
<td>Improve rates of documented discharge summaries including all 7 elements sent within one day to 90% within 12 mo</td>
</tr>
<tr>
<td>Postdischarge phone call to caregiver within 3 d of discharge (P)</td>
<td>Transcript of call in medical record used to measure successful contact</td>
<td>Improve contact rate (from all enrolled patients) to 70% within 12 mo</td>
</tr>
<tr>
<td>Postdischarge caregiver teach-back of home management skills (O)</td>
<td>Caregiver demonstration of successful teach-back of all 4 components: medication use, follow-up appointments, contingency plan (when to call PCP or return to emergency department), equipment contact information (if applicable)</td>
<td>Improve documentation of successful caregiver explanation to 90% within 12 mo (denominator is all patients with successful phone contact)</td>
</tr>
<tr>
<td>Reuse (O)</td>
<td>Return to emergency department within 3 d or readmission within 30 d of index discharge date</td>
<td>Reduce by 10% from baseline within 24 mo</td>
</tr>
</tbody>
</table>

0, outcome; P, process.

![Diagram of Transition Checklist, Teach-Back, Postdischarge Phone Call, Timely and Complete Communication with PCP](image-url)

**FIGURE 1**

Patient-centered care transitions bundle elements.

Timely and complete communication with the PCP was defined as documentation of verbal or written communication to the PCP within 1 day of discharge that included 7 essential elements (Table 2).12 At each site, essential information elements were incorporated into EHR discharge summary templates (Supplemental Fig 12).

Staff nurses and/or care coordinators performed postdischarge phone calls within 3 days of discharge (Table 1). Phone call scripts were piloted, revised, and standardized across sites (Supplemental Information).
Specific aims of our initiative included increased caregiver understanding of home management skills and timely and complete communication between inpatient and outpatient providers (Table 2). Therefore, the rates of nursing predischarge teach-back documentation of essential home management skills (contingency plan, follow-up appointment, medication management, and medical equipment provider contact information, if applicable) and rates of timely transmission of a complete discharge document were used as process measures. Additional process measures included the following: postdischarge phone call attempt and connectivity rates, as well as the discharge (PACT) checklist completion rates.

Outcome measures assessed the effect of bundle implementation. We used rates of caregivers’ predischarge teach-back of the essential home management skills during a postdischarge phone call as the primary outcome measure. A 30-day reuse rate assessed our secondary outcome.

Chart review was performed for all included patient populations at each site, including audit of transitions checklist use, discharge education documentation, discharge summaries, transcripts from postdischarge phone calls, and reuse episodes within 30 days. The components of each of these bundle elements were assessed individually. Element implementation was considered complete if all components of the domain were documented in the EHR (Table 2). Additional information obtained in the chart reviews included patient age, gender, insurance type, and details of any reuse event.

With multiple study personnel from each site performing chart review and data entry, several safeguards were developed to ensure internal validity of data. Each pilot site reviewed charts for their identified study population and entered data into an online, password-protected, de-identified database (REDCap). This IMPACT data collection tool was drafted and revised based on investigator feedback from each site. At each pilot site, the initial chart review was performed by all study personnel on the same 10 charts and results were compared for consistency. Ambiguous choices for data entry were identified and recommendations for consistent interpretation were made to the national group. Once consensus was reached, a data collection manual and data entry webinar were developed, recorded, and shared.

**Analysis**

Statistical process control p-charts were used to plot and analyze data. The center line (CL) (mean) and upper and lower control limits were calculated using QI Charts (licensed by Richard Scoville, Scoville Associates, 2009). Established rules for detecting special cause were applied.

**Ethical Considerations**

Central institutional review board (IRB) approval was obtained from the primary investigator’s institution. At each pilot site, IRB approval or exemption was obtained according to local IRB policies. Consent for the study was waived at all sites, except at site B, which required verbal consent at initiation of the postdischarge phone call.

**RESULTS**

During the pilot study phase (January 2014–May 2015), 4 sites reviewed 2601 patient records (Table 1), 1394 of which had postdischarge telephone encounters. Supplemental Table 3 includes a detailed table of interventions for each bundle element at each site. The Supplemental Information includes collaborative and site-specific control charts for each process and outcome measure.

**Process Measures**

**Predischarge Teach-back**

Composite completion of predischarge teach-back improved
<table>
<thead>
<tr>
<th>Site</th>
<th>No. of Patients Enrolled in Pilot Phase</th>
<th>No. of Technology-Supported Patients Enrolled in Pilot Phase</th>
<th>Total No. Discharged Patients From Pediatric Hospitalist Service in 2014</th>
<th>Patient Type</th>
<th>Hospital Type</th>
<th>Pediatric Medical/Surgical Beds (Excluding Newborn and ICU)</th>
<th>EHR Type</th>
<th>Transmission of Discharge Summaries</th>
<th>Who Performs Postdischarge Phone Calls</th>
<th>Start Date for Bundle Implementation</th>
<th>PCP Survey Sent</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1264</td>
<td>154</td>
<td>971</td>
<td>All patients on pediatric hospitalist service including technology-supported</td>
<td>Children’s hospital within a larger hospital</td>
<td>39 Epic</td>
<td>On attending physician signature: Automatic route to Epic providers</td>
<td>95% patients called by 1 of 2 transition nurses Patients who receive primary care from hospital-based resident clinic (~5%) called by clinic nurse</td>
<td>January 2014</td>
<td>June 2015</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>433</td>
<td>0</td>
<td>2892</td>
<td>Age &lt;1 y, asthma Free-standing children’s hospital</td>
<td>180 Epic</td>
<td>On attending physician signature: Automatic route to Epic providers</td>
<td>Majority of patients called by 2 designated study nurses Rarely called by other study medical providers</td>
<td>January 2014</td>
<td>March 2015</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>615</td>
<td>44</td>
<td>1323</td>
<td>Technology-supported patients Asthma Age &lt;2 y</td>
<td>Children’s hospital within larger hospital</td>
<td>30 AllScripts</td>
<td>Calling PCP</td>
<td>Nurses are expected to call all discharges</td>
<td>April 2014</td>
<td>March 2015</td>
<td></td>
</tr>
</tbody>
</table>
Categories of interventions included: interprofessional engagement/education; EHR modifications; and family engagement (Supplemental Table 3). As new sites joined, decreased composite performance was noted (Fig 3). One site (site C) achieved the aim using interventions noted (Fig 4).

Timely and Complete Hospitalist-to-PCP Handoff at Hospital Discharge

Composite rates of timely and complete hospitalist-to-PCP handoff improved from 51.9% to 77.7% (Fig 5). Interventions included: interprofessional education/engagement and integrating essential handoff elements into EHR systems (Supplemental Table 3). Site A linked a percentage of physician compensation to quality metrics in timely and complete handoff performance. This contributed to a significant increase in performance from 74% to 87.6% (Fig 6).

Transition Checklist

For the discharge readiness checklist, both efforts to integrate a paper checklist into existing workflows and attempts to incorporate the checklist into the EHR resulted in multiple barriers to increase institutional support for EHR change and promote interprofessional buy-in (Supplemental Table 3). One site (site A) successfully integrated the checklist into the EHR in January 2014 (Fig 7).}

Postdischarge Phone Call Connection

Rates

Figure 8 depicts the composite phone call attempt and contact rates. Strategies to improve rates included ensuring documentation rates included ensuring the correct telephone number in the EHR, calling within 24 hours after discharge (site A), and partnership with outpatient providers (site D).
Outcome Measures

Caregiver Understanding of Essential Discharge Home Management Skills

Caregiver performance of teach-back of essential home management skills during a postdischarge phone call was a primary outcome measure and there was significant improvement from 17.7% to 81.8% as bundle implementation advanced. A decline in rates were noted with the late addition of site D (Fig 9).

Hospital Reuse

Decreasing hospital reuse rates was an additional outcome measure; however, to date, no improvement in this measure has been noted (Supplemental Information). Composite reuse rates increased with the addition of site D (November 2014). Stratification of reuse rates between technology-supported and non–technology-supported patients showed dramatically different reuse rates between the 2 populations (Fig 10) and explain the effect of the addition of site D (high proportion of technology-supported patients) on the composite chart (see control charts in the Supplemental Information). Reuse rates for non–technology-supported patients have remained unchanged (CL = 7.2%, Fig 10B), whereas reuse rates for technology-supported patients have shown more variability (CL = 27%, Fig 10A).

DISCUSSION

The main objective of this pilot quality improvement report was to demonstrate the feasibility of the implementation of the PACT bundle. The secondary objective was to demonstrate the early impact of the PACT bundle on outcome measures. With regards to the primary objective, the pilot sites have implemented the 4-element PACT bundle, showing an improvement in all process measures: teach-back, timely and complete handoff, follow-up phone call connectivity, and discharge checklist use. Individual pilot sites had different implementation rates for individual bundle elements, and no site implemented all bundle elements, which is consistent with the influence of local context. Bundle implementation was associated with a significant improvement in our main outcome, caregiver ability to teach-back essential home management skills. Although reuse rates were comparable to previously published rates, they remained unchanged during the pilot study. This is not surprising, because we did not reach reliable implementation of all bundle elements and the number of technology-supported patients enrolled was relatively small.

As previously reported, several large collaboratives (Solution for Patient Safety Network, Pedi-Boost, Children’s Hospital Association) have been working to improve care transitions and reduce readmissions. Although each collaborative is using a different set of tools, to date there are no...
published reports on pediatric bundle implementation. Similar to reported adult bundles, the PACT bundle consists of evidence-based and patient-centered tools.\textsuperscript{5,19,20}

Implementation of the teach-back communication tool varied between sites and was highly dependent on the degree of nursing buy-in and the availability of EHR teach-back documentation templates. High-impact interventions, such as EHR modification to capture teach-back documentation with interprofessional education, were the most useful in improving this metric. Teach-back, contingency planning, and follow-up telephone calls are useful bundle elements that address the recently described limited ability of caregivers to process information gathered during hospitalization (ie, the “in a fog” concept), the need for individually tailored “red flags” (what to watch for after hospitalization), and additional support after hospitalization.\textsuperscript{38,39}

For example, we employed follow-up telephone calls not only to ensure caregiver understanding of home management skills, but also as a safety tool to detect and correct misunderstandings. Once again, local context greatly influenced the post discharge telephone call. As a relatively “high-resource” bundle element, processes developed to accomplish post discharge phone calls differed across sites. Connectivity rates varied based on several key factors, including the availability of dedicated personnel, the population type enrolled, and whether a culture of making post discharge calls predated the initiation of the project. Although the composite phone call connection rate (68.8\%) was near the goal of 70\%, higher rates are needed to generalize bundle effects across patient populations.\textsuperscript{40}

Identifying the correct telephone number and calling within 24 hours after hospital discharge were among the interventions that helped improve the connectivity rates. At this point in time, the influences of the type of caller (inpatient versus outpatient provider, nurse versus physician) on the success of the caregiver’s teach-back of essential home management skills are unknown.

The transition checklist was the most challenging bundle element to implement, and ultimately to integrate, into the EHR. This EHR-integrated checklist is meant to provide a prominently visible multidisciplinary display of a patient’s progress toward identified discharge readiness elements. This requires EHR editing access of a single document by multiple interprofessional users. Current EHR products do not support this functionality.\textsuperscript{41,42} However, a recent report highlights new solutions and has served as a model to avoid redundant documentation.\textsuperscript{33}

With respect to hospitalist-to-PCP handoff at discharge, previously identified essential discharge content (7 elements) aligned well with the content of continuous care documentation as well as meaningful use requirements, a universal incentive for hospitals.\textsuperscript{43}
Therefore, modifications of the EHR to add missing elements to discharge summary templates (pending laboratories and immunizations received during hospitalizations) were expedited across sites, requiring only 1 to 2 Plan, Do, Study, Act cycles to complete. Educational interventions were focused on improving physicians’ (trainees and attending physicians) adherence to complete and timely delivery of discharge information to outpatient providers.

With bundle implementation, we observed a significant improvement in the main outcome, caregiver teach-back of home management skills during follow-up telephone calls across all sites. As stated above, during the pilot study, we were not able to demonstrate the impact of the PACT bundle on reuse. Larger sample size and reliable implementation of all bundle elements is needed to demonstrate change.31,37

This is an observational study and causation cannot be inferred. Feasibility and local context precluded randomization of sites. Similarly, with the exception of reuse data, it was not feasible to collect baseline data because bundle elements were newly introduced at most sites.

In cases where randomization is not practical or not feasible as in the pilot study, other strategies can be used to overcome this limitation. The use of center points at the beginning, middle, and end of the study as controls has been suggested. This replication can be used to check for special cause variation that may have occurred during the study.44 In addition, data collected during the early months of the pilot phase can help to define the baseline.

Preliminary power calculations suggested that a larger number of participants are needed to demonstrate 20% change in reuse rates; 10,000 for a baseline rate of 2.5% and 650 for 24%. The spread phase with additional sites will likely realize this goal. Additional limitations include the lack of direct observation of in-person and telephone teach-back and therefore the quality of “yes” checked for both metrics.

Furthermore, our ability to generalize the success of caregiver’s self-management skills during follow-up telephone calls is limited by relatively low connectivity rates. Additional analyses are needed to prospectively identify risk factors associated with decreased access to follow-up care (including visits and phone calls) and the impact this may have on adequate home management and hospital reuse.
FIGURE 9
Composite postdischarge teach-back rates (n = 1,394 phone contacts). Composite control p-chart of postdischarge phone call teach-back rates. The addition of site D coincided with a decline in rates. High census affected rates negatively. LCL, lower control limit; UCL, upper control limit.

FIGURE 10
Reuse rates (technology supported versus not). Composite control p-charts showing reuse rates by month per study population for (A) technology-supported versus (B) non–technology-supported patients. Note mild rises on both charts during high-census periods (March 2014 and 2015). Cumulative rates remain unchanged for both populations when evaluated separately. LCL, lower control limit; UCL, upper control limit.

CONCLUSIONS
Project IMPACT’s 17-month pilot phase demonstrates that our bundle is feasible to implement and measure across 4 different sites. This “grass roots” quality improvement research collaborative capitalized on the lessons learned at individual sites, including optimization of EHR functionality and the effect of the local contextual factors on the project’s success.

Through shared learning, our pilot team identified which aims were achievable, how to practically access identified measures in the EHR and how to differentiate general issues versus those embedded in local context. These early insights are critical in guiding the spread phase to other sites and can be applied to improvement efforts in a variety of other health care settings.

The next steps will include enhancing internal validity (use the American Academy of Pediatrics Section on Hospital Medicine–sponsored data entry webinar for all participating sites, adopt identified EHR-specific solutions, standardize the role of callers across sites), and external validity (increasing enrollment for all subject populations, particularly technology-supported patients). In addition, the spread phase will allow us to evaluate the impact of bundle adherence on reuse and study other transition metrics, including composite metrics and providers’ and patients’ satisfaction.

ACKNOWLEDGMENTS
We acknowledge Niccole Alexander and the American Academy of Pediatrics Section on Hospital Medicine for supporting collaborative meetings, both telephonic and at annual meetings. We also acknowledge the following individuals: David Caplan, Deana Guerrero, Joel McMullin, and Wendy Craig for analytic support and family-centered care representatives, Sharon Cray, Amy Whifen, and Brandy Robertson.

ABBREVIATIONS
CL: center line
EHR: electronic health record
IMPACT: Improving Pediatric Patient-Centered Care Transitions
IRB: institutional review board
PACT: patient-centered pediatric care transition
PCP: primary care physician
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## Project IMPACT Pilot Report: Feasibility of Implementing a Hospital-to-Home Transition Bundle

Leah A. Mallory, Snezana Nena Osorio, B. Stephen Prato, Jennifer DiPace, Lisa Schmutter, Paula Soung, Amanda Rogers, William J. Woodall, Kayla Burley, Sandra Gage, David Cooperberg and IMPACT Pilot Study Group

*Pediatrics* originally published online February 15, 2017;

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