Changes in Efficiency and Safety Culture After Integration of an I-PASS–Supported Handoff Process

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Dr Sheth conceptualized and designed the study, interpreted the data, and drafted the initial manuscript; Drs Shin and Sharek designed the study, carried out the initial analysis and interpreted the data, and critically revised the manuscript for important intellectual content; Ms McCarthy and Drs Kipps, Wood, and Roth acquired and analyzed the data and critically revised the manuscript for important intellectual content; and all authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

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BACKGROUND AND OBJECTIVES: Recent publications have shown improved outcomes associated with resident-to-resident handoff processes. However, the implementation of similar handoff processes for patients moving between units and teams with expansive responsibilities presents unique challenges. We sought to determine the impact of a multidisciplinary standardized handoff process on efficiency, safety culture, and satisfaction.

METHODS: A prospective improvement initiative to standardize handoffs during patient transitions from the cardiovascular ICU to the acute care unit was implemented in a university-affiliated children’s hospital.

RESULTS: Time between verbal handoff and patient transfer decreased from baseline (397 ± 167 minutes) to the postintervention period (24 ± 21 minutes) (P < .01). Percentage positive scores for the handoff/transitions domain of a national culture of safety survey improved (39.8% vs 15.2% and 38.8% vs 19.6%; P = .005 and 0.03, respectively). Provider satisfaction improved related to the information conveyed (34% to 41%; P = .03), time to transfer (5% to 34%; P < .01), and overall experience (3% to 24%; P < .01). Family satisfaction improved for several scores, including: “satisfaction with the information conveyed” (42% to 70%; P = .02), “opportunities to ask questions” (46% to 74%; P < .01), and “Acute Care team’s knowledge about my child’s issues” (50% to 73%; P = .04). No differences in rates of readmission, rapid response team calls, or mortality were observed.

CONCLUSIONS: Implementation of a multidisciplinary I-PASS–supported handoff process for patients transferring from the cardiovascular ICU to the acute care unit resulted in improved transfer efficiency, safety culture scores, and satisfaction of providers and families.

Ineffective handoff communication is a recognized patient safety risk in health care. In response, quality improvement experts have developed methods for structuring and standardizing transfer processes and handoff communication. These have included mnemonics for use during handovers, scripts or worksheets for the standardization of information conveyed, and the minimization of interruptions and distractions during verbal handovers.1–4 Recent studies have also reported successfully leveraging multidisciplinary team strategies and workflow adjustments, such as reducing nighttime transfers from the ICU.5 Most notably, the implementation of the I-PASS (illness severity, patient summary, action list, situation awareness and contingency plans, and synthesis by receiver)—supported handoff bundle studied with resident-to-resident handoffs has...
shown reductions in medical errors and preventable adverse events.\textsuperscript{1,6–8}

Although previous reports have shown important benefits in standardizing handoffs, there is little information available reflecting the association of standardized handoff process with efficiency and culture of safety. One recent report found that a standardized communication process was not associated with an increase in time for handoff between the operating room and the recovery room.\textsuperscript{9} In such cases in which patients are transferred from 1 unit to another, efficient handoffs between sending and receiving unit teams are challenged by disparate clinical agendas, contributing to delays in the transfer process.\textsuperscript{10} The impacts on efficiency and safety culture from standardized handoff processes are outcome measures of interest to investigators and clinicians alike to explore the value and reliability of timely but safe care.

The goals of our quality improvement efforts were as follows: (1) to redesign the process for patient transfer between the cardiovascular ICU (CVICU) to the acute care unit (ACU), including an integration of the previously successful I-PASS\textsuperscript{1} tool; (2) to reduce delays in patient transfer; (3) to improve the culture of safety surrounding handoffs and transitions in these 2 units; and (4) to maintain patient/family and care provider satisfaction surrounding the transfer process.

### METHODS

**Setting**

We conducted a prospective cohort study using data from July 2012 to January 2013 to assess the impact of an I-PASS–supported handoff process for patients transferring from the CVICU to the ACU. The quality improvement initiative was conducted at the Children’s Heart Center at Lucile Packard Children’s Hospital, a nonprofit, freestanding academic children’s hospital at Stanford University. The center has \textasciitilde 800 admissions per year and provides all of the hospital services for cardiology and cardiovascular surgery, treating both children and adults with congenital heart disease and children with acquired heart disease. Patients admitted to the CVICU commonly transition their care to the ACU before being discharged from the hospital. Cardiac care is provided by teams of medical students, residents, cardiology and critical care fellows, hospitalists and advanced practice providers and is supervised by attending physicians. The Institutional Review Board at Stanford University Medical Center approved the study and certified that it met the criteria for a waiver of informed consent. This article was prepared in accordance with the SQUIRE (Standards for Quality Improvement Reporting Excellence) guidelines.\textsuperscript{11}

**Planning the Quality Improvement Intervention**

The Heart Center Handoff Taskforce was formed in July 2011 in response to a trending gap between our institution’s performance and that of other pediatric institutions with handoff/transitions survey results from the Agency for Healthcare Research and Quality’s Hospital Survey on Patient Safety Culture.\textsuperscript{12} The taskforce primarily consisted of a cardiology-trained quality improvement fellow working with CVICU- and ACU-based local improvement teams (Table 1). The local improvement teams at Lucile Packard Children’s Hospital are modeled after the Dartmouth and Institute for Healthcare Improvement’s clinical microsystems.\textsuperscript{13} The teams’ responsibilities included participation in all aspects of development and implementation of the intervention and subsequent auditing and iterative improvement. The Handoff Taskforce was formed during a hospitalwide effort to standardize communication to a “one message, one time” handoff process, where all teams involved in a patient care transition were brought together for a single face-to-face communication supported by information prepopulated in the electronic medical record in an I-PASS format, conscious minimization of distractions, a formal time for questions to be asked, and a formal spoken acknowledgment of acceptance of accountability for the patient from the receiving team.\textsuperscript{9} The Handoff Taskforce reported to an institutional handoff oversight committee but had the ultimate responsibility of tailoring the transfer process to the CVICU and ACU workflows.

In an effort to effect rapid process improvement, the team met weekly, set goals, developed and implemented an education plan and process flow map (Fig 1), and used the Institute for Healthcare Improvement’s Guide to Practice Change to develop and implement a new handoff process.

### RESULTS

#### Impact of the Intervention

The team implemented improvements by focusing on handoffs at the bedside and identifying the critical steps in the transfer process. All interventions were informed by the core team’s process map (Fig 1). The team trained on face-to-face communication supported by the I-PASS tool and incorporated changes to improve patient safety and decrease handoff process delays. The local improvement teams were formed to act as a link between the core team and the bedside teams. The process of creating the local improvement teams is described in the Table 1. The local improvement teams are modeled after the local improvement teams at Stanford University Hospital.

### DISCUSSION

This study demonstrated that a hospitalwide quality improvement initiative was successful in improving handoff processes. The findings support the use of a standardized handoff process to improve patient safety and decrease handoff delays. The study also highlights the importance of involving bedside teams in the quality improvement process to ensure the success of the interventions.

### TABLE 1 Heart Center Handoff Taskforce

<table>
<thead>
<tr>
<th>Team Role</th>
<th>Role Within the Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Executive sponsors</td>
<td>Chief Patient Safety Officer</td>
</tr>
<tr>
<td>Team leader</td>
<td>Heart Center Quality Improvement fellow</td>
</tr>
<tr>
<td>Core team</td>
<td>Cardiology administrative support</td>
</tr>
<tr>
<td>Ad hoc members</td>
<td>Representative, transfer center</td>
</tr>
</tbody>
</table>

Charge nurse
Intervention

The handoff bundle consisted of 4 major elements. First, the taskforce defined the handoff intent to ensure that a common understanding of the patient is achieved. The common understanding was confirmed by the receiving team’s use of a “read-back” technique. Second, the taskforce standardized the handoff content, aided by a standard template using the I-PASS structure with prepopulated patient-specific information pulled from the electronic medical record. Third, the handoff process was standardized to require sending and receiving team disciplines to participate in face-to-face communication in a “one-message, one-time” format with time allocated for receiver synthesis of information and questions. Fourth, the handoff concluded with a formal acknowledgment of responsibility and accountability to ensure clear transition of care.

Patient Population

Demographic features (age, gender) and surgical complexity (as defined by the Risk Adjusted Congenital Heart Surgery Score [RACHS-1]16) were collected. Case-mix index, based on the US Centers for Medicare and Medicaid Services cost weights, was assessed for each patient who spent at least 1 day in the CVICU and transferred to the ACU during the baseline or postintervention time frame. Patients in the baseline and postintervention periods were compared to determine if significant differences in demographic characteristics or severity of illness existed.17
Compliance was defined as using a convenience sampling process was measured by auditors. The compliance to the handoff process (postintervention) occurred in the exchange of information to another” and “problems often ‘fall between the cracks’ when transferring patients from one unit to another” and “problems often occur in the exchange of information across hospital units” were evaluated for the CVICU and the ACU from the hospitalwide survey completed in 2012 (preintervention) and 2014 (postintervention).

Transfer latency was determined to be the most important outcome metric in this initiative because the period of time between the verbal handoff and the patient’s transfer at our institution was a period of risk associated with confusion in provider accountability and/or decreased clinical monitoring and/or decreased clinical monitoring.

Full compliance to the elements of the handoff bundle occurred for 114 (93.4%) of these 122 audited transfers. Characteristics of inpatients included during the study protocol are displayed in Table 2.

RESULTS

Transfer Latency

A total of 278 patient transfers from the CVICU to the ACU occurred during the study period. A total of 122 (47%) transfers were audited for bundle compliance by convenience sampling and included for analyses. Full compliance to the elements of the handoff bundle occurred for 114 (93.4%) of these 122 audited transfers. Characteristics of inpatients included during the study protocol are displayed in Table 2.

Provider Satisfaction

We evaluated the impact of provider satisfaction using a 12-question survey tool for the providers involved in patients transferred in the postintervention period. Preintervention provider satisfaction was determined by surveying providers for a 2-month period before the intervention. Postintervention provider satisfaction was determined by surveying providers ~6 months after completion of the postintervention period. Each of the 12 questions had the following 5 answer options: (1) strongly agree, (2) agree, (3) neutral, (4) disagree, and (5) strongly disagree. A positive response was considered as answers of either “strongly agree” and “agree,” and the percentage of positive responses was defined as the total number of positive responses over the total number of responses.

Family Satisfaction

We evaluated the impact of patient satisfaction using a 12-question survey tool for families present at the time of transfer for all patients transferred during the baseline and postintervention periods. Patients and families were surveyed with a face-to-face structured interview ~30 to 60 minutes after handoff by using a convenience sampling approach. Each question had the following 5 options for answering: (1) strongly agree, (2) agree, (3) neutral, (4) disagree, and (5) strongly disagree. A positive response was considered as answers of either “strongly agree” and “agree,” and the percentage of positive responses was defined as the total number of positive responses over the total number of responses.

Data Analysis

Descriptive statistics were used to compare patient characteristics in the time periods before and after the intervention with variables expressed as means with SDs or medians with interquartile ranges according to their parametric distribution. A process control chart was used to follow transfer latency time over the study period. Unless otherwise specified, χ² analysis, Fisher’s exact test, rank-sum test, and Mann-Whitney U test were used to compare the transfer latency periods, patient characteristics, and survey response before and after the intervention. Statistical analyses were performed with the use of PRISM, version 5.0a (2007).
respondents in 2014. During that time period, there was an increase in the mean percentage of respondents who gave a positive response to the 2 questions in the handoffs and transitions domain of the survey relevant to the between-unit handoff process (Table 3).

Balancing Metrics

Patient and family satisfaction in their CVICU-to-ACU transition increased in the postintervention period. Families reported strong satisfaction with the information conveyed (from 41% to 70%; \( P = .02 \)), opportunity to ask questions (from 46% to 74%; \( P < .01 \)), and satisfaction regarding the receiving team's knowledge with the medical issues (from 50% to 73%; \( P = .04 \)) after handover (Fig 4). Providers also reported strong satisfaction in the amount of information conveyed (from 34% to 41%; \( P = .03 \)), transfer time after handoff (from 5% to 34%; \( P < .01 \)), and overall transfer process (from 3% to 24%; \( P < .01 \)) (Fig 5). There were no differences in CVICU 24-hour readmission rates, in-hospital mortality, and rapid-response team calls between the baseline and postintervention periods.

DISCUSSION

We report improvements in transfer efficiency and handoff safety culture after the implementation of a standardized I-PASS–supported handoff process for patients transferring from the CVICU to the ACU. Although previous studies using the I-PASS tool for between-shifts handoffs between residents have been associated with improved patient safety outcomes, this is the first report that we are aware of that demonstrates an I-PASS–supported handoff process associated with improved transfer efficiency and handoff safety culture. The intervention, despite the inherent challenges associated with the coordination from both sending and receiving teams, was not associated with decreased satisfaction related to the handoff process. In fact, the new process was associated with improved satisfaction with the transfer experience among families and providers involved in the patient care transition.

Our findings are aligned with previous studies that have shown improvements in provider satisfaction, handoff-related care failures, and clinical outcome with standardization of handoff processes. However, these studies did not specifically measure the potential benefit on the efficiency of care delivery often associated with standardization in high-reliability systems. A small number of studies have measured handover time as a balancing metric; these
showed handover protocols to be noninferior.9,18,21

The coordination of unit teams with varying patient care agendas around a patient transfer from the CVICU to ACU introduces unique challenges in productivity and efficiency. Improved efficiency adds a new dimension to the value of standardized handover protocols, which have already been linked to better patient outcomes and provider satisfaction. To our knowledge, this is the first report showing improved efficiency in patient care with the use of an I-PASS–supported handoff bundle applied to unit-to-unit transfers between teams.

One notable finding was the significant baseline variation and delay between the time of verbal handover of patient information and the time of patient transfer from the CVICU to the ACU. Before the intervention, the handoff of information commonly occurred far ahead of actual patient transfer. In addition, attending, fellow, and nursing handover of information occurred independently from each other and often excluded the patient and family. This latent period between the verbal handoff of information and patient transfer is a particularly vulnerable time in patient care.22 We found that the I-PASS–supported handoff process eliminated important redundancy and delay in patient care transitions and synchronized communication into a singular, cross-discipline handoff at the moment of patient transfer. This finding is consistent with production strategies such as Just In Time,23,24 which deploys the “right resources (personnel), at the right place, at the right time” to improve efficiency. Our finding is also consistent with high-reliability organization theory, which suggests that cross-training, standardization, and shared situational awareness lead to decreased variability and improved efficiency, thereby promoting safety in complex environments.20,25

After implementation of the redesigned handoff process, we found significant improvements in CVICU and ACU patient safety culture survey scores in the “handoff and transitions” domain. There is ample evidence that links culture of safety to reductions in preventable harm and mortality.26–28 Improvements in safety culture have also been associated with reductions in adverse events within hospitals.26 Yet, only a few reports have described quality improvement initiatives associated with shifts in safety culture over time. We found that multidisciplinary participation in a standardized handoff process was associated with significant improvements in handoff-related safety culture scores for the 2 questions relevant to between-unit handoffs over a 3-year span.

We found that the inclusion of families was associated with improved satisfaction with several components of the transition. As previous studies have shown, transfer from the ICU can be a source of significant anxiety for a patient and his/her family.30,31 Families are increasingly being recognized as an essential part of the care team, and

FIGURE 3
Statistical process control chart showing latency time over time during the study period. The intervention was implemented on July 5, 2012. Upper and lower confidence limits denote 3 SDs. LCL, lower confidence limit; UCL, upper confidence limit.

| TABLE 3 | Culture of Safety Survey Results for CVICU and ACU |
| Survey Question |  |  |  |
| Things “fall between the cracks” when transferring patients from 1 unit to another | 2012 | 2014 | P value |
| Positive, % | 15.20 | 46 | 39.80 | 83 | .005 |
| Problems often occur in the exchange of information across hospital units | 19.60 | 46 | 38.80 | 85 | .031 |

The percentage positive responses are based on those who responded “Strongly disagree” or “Disagree,” or “Never” or “Rarely” (depending on the response category).

a Fisher’s exact test.
many children's hospitals are moving to more family-centered rounding processes. Integrating families into the handoff process offers several advantages that are consistent with the theories behind family-centered care. We observed a high baseline level of family satisfaction with handoffs. We surmise that this high baseline satisfaction level resulted from our institution's previous adoption and robust integration of family-centered care before and during the study period. Still, family and patient satisfaction significantly increased during the implementation period, suggesting that their formal inclusion in a standardized process is associated with enhanced satisfaction adjunctive to a culture of family centeredness. Similar to previous single-site studies, we also found that provider satisfaction was not compromised after the implementation of a standard handoff process.

There are several limitations to our study that deserve discussion. First, because this is an experience from a single institution, some of the success in improving efficiency and culture observed may be attributed to unique institutional features. However, previous studies have highlighted important patient risk during transitions in care, so it is likely that other institutions may benefit from similar approaches. Second, because this was a pre-post study, concurrent improvement initiatives, the Hawthorne effect, or unrecognized secular trends may be important biases that could have influenced our observations. For example, we did observe small differences in CVICU and ACU censuses between the baseline and postintervention periods. Although statistically significant, we do not think these differences are clinically significant or likely to bias our outcome measures. In fact, the postintervention period showed higher census activity than the baseline, suggesting that transfer efficiency improved despite increased unit-level activity. In addition, bias resulting from concurrent improvement initiatives is unlikely given the significant and sustained centerline shift witnessed in the statistical control chart at the exact time of the intervention (Fig 3). Third, data regarding satisfaction were obtained by interview. The nature of asking the same questions to the same providers throughout the implementation period subjects the process to confirmation bias or anchoring. Fourth, although we were able to demonstrate improvements in transfer efficiency and culture, we did not evaluate the impact of this process on clinical harm. Although the findings of this study include key measures of the Institute of Medicine's 6 specific domains of quality care (specifically efficient, timely, and patient-centered care), future investigations should focus on the clinical impact of this
I-PASS–supported handoff process when analyzing unit-to-unit transfers to better understand the impact on clinical harms.

CONCLUSIONS

We found improvements in transfer efficiency and handoff-related patient safety culture during patient care transitions after the implementation of an I-PASS–supported handoff process. The handoff process was not associated with decreased provider satisfaction and was, in fact, associated with improved satisfaction among patients, families, and providers. Future studies of this handoff process should evaluate the impact on clinical harms, operational productivity, and cost-effectiveness.

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REFERENCES


ABBREVIATIONS

ACU: acute care unit
CVICU: cardiovascular ICU
I-PASS: illness severity, patient summary, action list, situation awareness and contingency plans, and synthesis by receiver

POTENTIAL CONFLICT OF INTEREST: The authors have indicated they have no potential conflicts of interest to disclose.


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