Quality improvement and patient care checklists in intrahospital transfers involving pediatric surgery patients

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Abstract

Background: Intrahospital transfers are necessary but hazardous aspects of pediatric surgical care. Plan-Do-Study-Act processes identify risks during hospitalization and improve care systems and patient safety.

Methods: A multidisciplinary team developed a checklist that documented patient data and handoffs for all intrahospital transfers involving pediatric surgical inpatients. The checklist summarized major clinical events and provided concurrent summaries by 3-month quarters (Q) over 1 year.

Results: There were 903 intrahospital transfers involving 583 inpatients undergoing surgery. Total handoffs were documented in 436 (75% of 583), with greater than 1 handoff in 202 (46% of 436). Documented problems occurred in 31 transfers (3.4%), the most during Q1 (19/191; 9.9%). Incidence fell to 3.5% (9/260) in Q2, 0.4% (1/243) in Q3, and 1.0% (2/209) in Q4 (P < .001). Patient care issues (14/31; 45%) were most common, followed by documentation (10, 32%) and process problems (7, 23%). The quality improvement team was able to resolve patient instability during transport (5 in Q1, none in Q3, Q4) and poor pain control (3 in Q2, 1 in Q3, Q4). Of the patients, 3.2% had identified problems with patient care during intrahospital transfer.

Conclusions: Plan-Do-Study-Act review emphasizes ongoing process analysis by multidisciplinary teams. Checklists reinforce communication and provide feedback on whether system goals are being achieved.

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emphasize the need for protocols and proper monitoring equipment during transfer [3,4], but documented improvements in outcome are lacking.

The multiplicity of departments and complexity of the patient population demand a system-wide approach. In contrast to the traditional compartmentalized organization model of modern hospitals, a new concept of the critical care cascade has been proposed that encompasses a unified multidisciplinary and multispecialty team organized as a system of care that addresses a specific problem, such as trauma and stroke [5]. Central to the care cascade concept is communication among providers, smooth transfers of care, and quality assurance feedback loops that guide team performance using objective, quantifiable measures.

Since 2008, we have organized the pediatric surgery service at our hospital along these concepts [6]. The basic approach was the Plan-Do-Study-Act (PDSA) cycle as described by W. Edwards Deming [7] and described in a health care context by Berwick [8]. The Institute of Medicine and the Joint Commission advocate the use of PDSA as a basic tool to improve the quality of processes in health care [9,10]. In brief, a quality improvement (QI) team plans a project to improve patient care, the first “plan” step with measurable outcome goals. Implementation is the second “do” step, the performance metrics forming the basis of concurrent review as the third “study” step. The results then guide further “action,” the fourth step, either wider adoption of the project or its modification through another PDSA cycle.

A central feature of patient care is intrahospital transfers between various departments, involving a multiplicity of handoffs between nurses and providers. Recognizing the dangers and the communications problems inherent in the transfer process, we targeted transfers of care as an initial PDSA project. A check-off list was created as a communication tool and a data abstraction summary that both assisted in the transfer of patient information and allowed monitoring of desired outcome data.

1. Materials and methods

1.1. The pediatric QI team

In April 2008, a group met to organize a pediatric surgical program at the Medical Center of Central Georgia, a 518-bed tertiary referral community hospital in Macon, GA. A multidisciplinary QI team included (a) representatives from hospital administration to provide system leadership, (b) pediatric specialty surgeons and anesthesiologists to give clinical technical expertise, and (c) nurse leaders from the OR, PACU, anesthesia department, and inpatient and critical care areas to drive the project and oversee data collection. The team focused on inpatient OR services. Outpatient operations were excluded.

1.2. Goals and objectives

One goal addressed by the team was the safe and smooth intrahospital transfer of patients from patient care areas—the pediatric ward, newborn nursery, neonatal intensive care unit (NICU), PICU, and emergency department (ED)—to the OR and radiologic suites and back again. There were 3 areas addressed: (a) patient care issues, such as instability during transport, loss of airway, hypothermia, and medication errors; (b) documentation problems affecting smooth transitions of care, such as lacking history and physical examination (H & P) and necessary preoperative orders for antibiotics and blood products; and (c) process problems that reflected system inefficiencies, such as late arrival to the OR, and excessive wait times for critically ill patients.

1.3. Patient handoff checklist

The QI team developed a 1-page checklist that summarized patient data and documented face-to-face nurse-to-nurse handoffs for all intrahospital transfers involving patients on the pediatric surgery service (Table 1). Included were basic demographic data, including diagnosis and planned procedure and destination within the hospital. Another section documented overall patient status with vital signs, allergies, medications, nil per os (NPO) status, laboratory results, and radiologic reports. The checklist also verified the presence of required items for all OR procedures such as consents, site verification, H & P, preoperative antibiotics, and necessary blood products. The QI team wanted to be sure that parents were accounted for, so parent (or guardian) location was documented and their personal telephone numbers were recorded on the checklist.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Intrahospital patient checklist</th>
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<tbody>
<tr>
<td></td>
<td>Patient identifying data</td>
</tr>
<tr>
<td></td>
<td>Physician</td>
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<tr>
<td></td>
<td>Diagnosis</td>
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<tr>
<td></td>
<td>Procedure</td>
</tr>
<tr>
<td></td>
<td>Destination (OR, sedation, and radiology)</td>
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<tr>
<td></td>
<td>Isolation status (contact, airborne, MRSA, VRE, AFB, etc)</td>
</tr>
<tr>
<td></td>
<td>Medications (including preoperative antibiotics and pain medications)</td>
</tr>
<tr>
<td></td>
<td>Required documentation (history and physical, operative and anesthesia consent, code blue summary)</td>
</tr>
<tr>
<td></td>
<td>Laboratory and radiology reports</td>
</tr>
<tr>
<td></td>
<td>Blood bank</td>
</tr>
<tr>
<td></td>
<td>Family location (cell phone number, home telephone number)</td>
</tr>
<tr>
<td></td>
<td>Handoffs (reporting and receiving nurse, time, events, and results)</td>
</tr>
<tr>
<td></td>
<td>Problems encountered (patient care, documentation, and process)</td>
</tr>
<tr>
<td></td>
<td>NPO status (not NPO; time of last solids, last breast milk, and last clear liquids)</td>
</tr>
</tbody>
</table>

MRSA indicates methicillin-resistant *Staphylococcus aureus*; VRE, vancomycin-resistant *Enterococcus*; AFB, acid-fast bacillus.
The last section of the checklist confirmed face-to-face reporting by having the nurse reporting and nurse receiving the handoff sign the form.

Most of the checklist was process items such as consents and histories and physical examination documents, along with items required by the OR such as identification and allergy bands in place. Specific clinical items on the checklist were a vital signs section to assure overall clinical stability at transfer and medication lists, reminders that basic medications (such as pain meds and preoperative antibiotics) were ordered. The checklist was modified, as new problems emerged. The most recent iteration has blood gas data for intubated patients on the left side of the checklist was devoted to documenting whether a problem occurred. All checklists were collected, and data were summarized. Checklists were considered a QI tool and not part of the permanent patient record.

1.4. PDSA QI process

The QI team met each month to review problem cases and data summaries of the completed checklists. After discussion, the QI team either resolved the issue at hand or assigned responsibility for addressing problem areas among team members. The area of review thus included hospital functions and patient care areas that affected overall team performance. Month-to-month review of problems encountered and data summaries allowed determination whether interventions decided upon by the QI team were effective and whether other problems arose.

1.5. Adoption of the checklist

The QI team members developed the checklist after its first meeting in April 2008. It underwent several modifications to include items required by OR. After its introduction, several months were required for it to become routinely used and fully completed by nurses. Problems were identified during this initial period and were addressed by the QI team during this initial rollout period. We arbitrarily felt that adoption was sufficiently widespread when two thirds of the checklists had nurses’ signatures. This occurred December 2008, where we began a 12-month period of review ending November 2009. We aggregated results into 4 consecutive quarters of 3 months each (Q1, Q2, Q3, and Q4).

1.6. Data analysis

Accumulation of data for publication was approved by the Medical Center of Central Georgia Institutional Review Board. Outcome data were analyzed using $r \times c$ contingency table analyses and $\chi^2$; differences, considered significant at $P < .05$.

2. Results

There were 903 documented intrahospital transfers on the service, including those going to the OR (Table 2). The pediatric surgery service had 583 inpatients undergoing surgery during the period of review. We identified patient care areas at the time of surgery in 444 (76%, 444/583): from the NICU in 103 (23% of 444); PICU, 21 (5%); ED, 1 (1%); and the general pediatric ward, 318 (72%). We were able to document the numbers of handoffs of care with each intrahospital transfer in 436 episodes (75% of 583). One handoff was documented in 234 (54% of 436); 2, 143 (33%); 3, 49 (11%); and more than 4, 10 (2%).

Over the year, 31 transfers (3.4% of 903) had documented problems. The highest incidence occurred in Q1 (19/191; 9.9%), with the highest month being the first month of the quarter, December 2008 (6/36; 16.7%). The incidence of problems fell significantly over the year, with an intermediate level of 3.5% (9/260) in Q2 and reaching 0.4% (1/243) in Q3 and 1.0% (2/209) in Q4 ($P < .001$). We classified 14 of the 31 problem transfers as patient care issues (45.2%; Table 3), 3.2% (14/444) of patients with identified patient care areas: 2.9% (3/103) from the NICU, 9.5% (2/21) from the PICU, 0% (0/2) from the ED, and 2.8% (9/318) from the ward.

2.1. Unstable postsurgical patients

The most important Q1 patient care problem that we had to address was unstable patients after surgery (5/8; 63%), 2 coming from the NICU, 1 from the PICU, and 2 from the inpatient ward. One infant developed a critical airway obstruction after operation during transport that required an emergency tracheotomy upon his return to the NICU. Another infant was hypothermic after surgery who was hypothermic (core body temperature of 34.6°C) and required intubation shortly after arrival at the NICU. A PICU patient had low oxygen saturation (91%) upon arrival there and required fluid resuscitation to correct hypovolemia. One patient from the ward developed postoperative apnea on the

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Intrahospital transfers and numbers with documented problems by 3-month quarters (Q1, Q2, Q3, Q4), December 2008 to November 2009</th>
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<tbody>
<tr>
<td></td>
<td>Q1</td>
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<tr>
<td>Intra....</td>
<td></td>
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<tr>
<td>Hospital transfers</td>
<td>191</td>
</tr>
<tr>
<td>No. of problem transfers</td>
<td>19</td>
</tr>
<tr>
<td>(%)</td>
<td>(9.9)</td>
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</tbody>
</table>

$P < .001$ by $\chi^2$ for a $2 \times 4$ contingency table, $\chi^2 = 35$, $df = 3$. 
Another ward patient had hyperthermia after surgery (axillary temperature of 38.8°C) and tachycardia (heart rate of 250) that required sponge baths, acetaminophen, and hydration. These events led to several changes in postsurgical anesthesia care before transfer out of the operating room. Critically ill newborns already intubated before operation are routinely left intubated during transfer back to critical care areas, rather than attempting extubation in the OR before transfer. Infants receive more aggressive passive warming with forced air conductive devices during surgery (Bair Hugger; Arizant, Inc, Eden Prairie, MN) and warm blankets during transfer. Infants at risk for apnea are admitted to the pediatric intermediate care unit adjacent to the PICU after surgery. Quality improvement meetings during Q1 provided educational opportunities that emphasized patient care issues that, in turn, were brought to nurses, respiratory therapists, surgical residents, and anesthesia staff. These measures were adopted after review of aggregated checklist data and discussion at the monthly QI meetings. The incidence of unstable patients arriving from the OR to patient care areas decreased to 1 in Q2, a ward patient with oliguria requiring fluid resuscitation, and none in Q3 and Q4.

### 2.2. Postoperative pain control

Another patient care issue that emerged during Q2 was inadequate pain control that occurred in 3 ward patients (Table 2). Review among QI team members led to adoption of a standard order sheet for pain medication and mandatory consultation of the pediatric pain team for all postoperative pediatric surgical patients on the ward. There was only 1 ward patient with pain control issues during the remainder of the review period (Q4).

### 2.3. Documentation issues

The incidence of cases with documentation problems decreased over the year to 1 in Q4 from 6 in Q1 (Table 2). Four ward patients in Q1 lacked an H & P, a basic requirement for all OR patients that was resolved by reinforcing strict adherence to the checklist.

### 2.4. Process issues

Process problems similarly decreased over the year to 0 in Q4 from 5 in Q1 (Table 2). Of the 5, 2 patients had problems in the timing of patient transfer from critical care areas to the OR, 1 patient from the NICU waiting more than 1 hour, and another from the PICU with a delay of nearly 2 hours. The QI team identified communication as the core issue. The NICU and PICU needed more time to set up transport ventilators and isolettes and to prepare portable infusion pumps, tasks that patients from the ward and those admitted on the day of surgery do not require. A critical care nurse also has other patient assignments that must be covered during an intrahospital transfer, so a needlessly long wait creates a hardship to the home unit. The OR staff, not aware of these issues, worked with the NICU and PICU for a more appropriate time to call the patient to the OR. This resolved late arrivals to the OR from the NICU and PICU. Late arrivals continued from the ward, 1 in each of the Q2 and Q3 periods.

The other 2 of the 5 Q1 process issues involved breaks in communication protocols. In patient from the NICU there was no face-to-face handoff between the nurse from the critical care area and the receiving OR nurse. The second patient was a ward patient’s family wandering away from the designated waiting area without a telephone contact number recorded on the checklist.

### 3. Discussion

Our multidisciplinary pediatric surgery QI team used the PDSA process and the intrahospital checklist to identify and resolve major patient care and process of care issues within 20 months of its implementation (April 2008 to November 2009). Over a 12-month period of review (December 2008 to November 2009), the QI process documented significant improvements in issues such as transport of unstable patients, postoperative pain control, H & P and consents for operation, and timely transfer. Each has an important impact on overall quality of care.
Several patient care issues were the clinical anesthesia and surgical and critical care problems specific to the patient’s condition and treatment. Patient stability is a direct patient care issue and not attended to by a simple checklist. Such problems, however, may continue, worsen, or emerge during transport. Part of the PDSA project was to prevent transfer of unstable patients, so every effort was made to stabilize patients in the unit or OR before transfer. Patients were stabilized (such as maintaining an airway) or problems anticipated (warming blankets, administering pain medications, and double checking on pain medication orders) before transfer so that the patient remained safe during transport and arrived at the receiving unit in a stable condition.

We did not do the detailed analysis to see whether the same providers were involved in repeated problems, which, gratifyingly, were unusual in those involving direct patient care. However, systemic problems emerged that did repeat, including lack of pain medications, and process problems such as documentation. These were clearly oversights from not following routine and adherence to the checklist and were rectified during the PDSA process.

Our experience demonstrates the importance of bringing together the various nursing units and departments to resolve issues that impact on overall patient care. Meeting regularly, representatives are familiar with the issues involved and the problems that arise. They know from direct experience solutions that are likely to work and how to best implement them. Representatives from hospital administration emphasize the importance of the team’s work. They provide appropriate resources and suggestions, such as making available databases, information system support, and the assistance from other hospital departments.

The essential tool is the checklist that both reminds caregivers of essential process steps and documents progress toward desired objectives. Summary data from the checklist provided feedback to the QI team and demonstrated how its solutions were working. Importantly, the checklist showed that as 1 problem resolved (instability during transport, Q1), another emerged (postoperative pain control, Q2), a good illustration that the QI and PDSA processes are interdependent and ongoing.

Several studies confirm that intrahospital hospital transfers are dangerous. Complications occurred during transport in 5% to 6% of adult patients from critical care areas in both low- and high-risk groups, defined as the need for positive end-expiratory pressure of more than 5 cm H2O or infusions of dolbutamine or norepinephrine (1). Patients free from ventilatory support but still requiring oxygen had significant deterioration of PaO2 and oxygen saturations during transport [11]. Patients undergoing intrahospital transports are more severely ill by Mortality Probability Model II score, use of vasopressor agents, and mechanical ventilation compared with those who did not require them and of those who did, 45% required more than 2 transports during their stay [12].

The fewer studies in pediatric intrahospital transfers confirm the observations summarized above in adults. Seventy-seven percent of intrahospital transfers in critically ill PICU patients were associated with at least 1 adverse event [2]. The majority was clinically significant changes in vital signs or blood gas measurement, of which 18% required a major therapeutic intervention such as a fluid bolus, vasoactive drugs, changes in ventilator settings, and mannitol. In a separate editorial, the senior author emphasized careful attention to detail during transport, including transport ventilators, intravenous lines, and infusion pumps [3,4]. These precautions are important considerations in any intrahospital transfer and have been widely adopted as essential in the care of pediatric patients.

Errors occur when patients are handed off to new caretakers, either at a change in shift or when the patient is transferred to the radiology suite, the OR, or a new nursing unit. This has led to a concept of the critical care cascade where management depends on the working diagnosis and care provided by an interconnected multidisciplinary team [5]. The connection, thus, depends on communication among team members. The Joint Commission emphasizes standard forms of communication to improve clarity and reduce ambiguity, while making sure relevant aspects of the patient’s condition and plan of care are reviewed completely [13].

A checklist summarizes the necessary information that the recipient of the handoff needs to responsibly continue patient care [14]. Importantly, it also teaches others new to the process about expected information. The use of forms has been shown to improve participants’ perceptions the accuracy and completeness of handoffs among surgical residents [15]. An important international study conducted by the World Health Organization showed that the incidence of surgical deaths and complications significantly decrease when checklists are used that address major workflow milestones in perioperative care, such as preoperative antibiotic administration, correct site identification, and anesthetic delivery [16]. The importance for such handoffs among nurses has been emphasized as essential for patient safety in the OR [17].

Improvement in results seen in our study may be the result of “the Hawthorne effect,” where participants in a clinical study “appear to fare better than those in routine practice by virtue of their participation [18].” In terms of quality, a Hawthorne effect is beneficial in that study of a process tends to improve results in addition to identifying problems that need to be corrected.

The complexity of patient scheduling and the geographic separation of the ED, OR, radiology suites, intensive care units, and patient wards reinforce treatment “silos” that segregate areas of care and defy coordination. Authorities emphasize that solutions involve interdepartmental teamwork and communication [5]. Quality improvement based on a systems approach, such as the cascade of care concept, emphasizes teamwork that is exemplified by ongoing process analysis by multidisciplinary teams. Communication tools such as checklists reinforce communication and important points of care and provide important feedback on whether system goals are being achieved.
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References

Discussant: Kurt Heiss, MD, (Atlanta, GA): Dr Nakayama, you are the chief at a general hospital and so this involved all players. Did you find a proportion of transfers as being a problem more so or less so in the pediatric population in your hospital?

Response: Dr Nakayama: This came from problems that we had in pediatric surgery. If you are familiar with my background, it is general surgery and then when I went into the Medical Center of Central Georgia, we were confronted with people being afraid of taking care of kids and being very cautious and not looking critically at how they were doing. This improvement project actually came from pediatric surgery, and it became a model for other product lines, and although people were threatened to initiate it for other product lines, I think that it is a model and I think that we can use it as translatable to other service lines in the hospital.

Discussant: Brian Kenney, MD, (Columbus, OH): We also tried to do similar work and one of our problems has been trying to demonstrate improvement and how do we know this change has made a difference, as you pointed out.

I wanted to ask about your problems that you said decreased over time. Was this a list of problems that were predetermined that you then saw decreases in, or was this just problems that people would bring up at the end of a transfer and give you feedback about and the number of feedbacks you received decreased over time? I just wonder if it was specified or unspecified before the project began.

Response: Dr Nakayama: When we first met, we looked at specific problems and looked for process problems such as whether patients were coming in on time, whether the babies were stable or unstable, if there were interventions or problems during transfer, and we especially want to know how many of those transfers were uncomplicated, so we had a denominator. So, some of it was directed because we had a sense that there were problems of face-to-face transfers and not having documents and patients getting lost and patients arriving late, but as we began to meet other things occurred and these problems such as pain medications emerged later on but really there was also a problem of having inadequate pain medication. That is the advantage of having monthly meetings, and we have a sheaf of all these passport tools and we just go over it. If there is a problem, then people write on the margin, and that is how the QI team is alerted that there are problems. At the end of a period of time, then we take a look and actually see what we have as far in regard to identified problems that are being monitored and any new problems that we have to monitor. That is the essence of Plan-Do-Study-Act. You start with a plan. You actually do the study, and as problems resolve, you go on to the next problem.