Improving Resident Handoffs for Children Transitioning From the Intensive Care Unit

**AUTHORS**
Denise Warrick, MD, Javier Gonzalez-del-Rey, MD, MEd, Dawn Hall, RN, MHA, Angela Statile, MD, MEd, Christine White, MD, MAT, Jeffrey Simmons, MD, MSc, Sue Poynter Wong, MD, MEd
Cincinnati Children's Hospital Medical Center, Cincinnati, Ohio

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resident, patient handoff, PICU, hospital medicine, transfers, patient safety

**ABBREVIATIONS**
EMR: electronic medical record
HM: hospital medicine
HUC: hospital unit coordinator
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Dr Warrick conceptualized and designed the study, completed the data collection and analysis, and drafted the initial manuscript; Dr Gonzalez-del-Rey, Ms Hall, Dr Statile, Dr White, Dr Simmons, and Dr Poynter Wong helped with initial conception and design of project, served as advisors throughout the project, and reviewed and revised the manuscript; and all authors approved the final manuscript as submitted.

Address correspondence to Denise Warrick, MD, 3333 Burnet Ave, MLC 2011, Cincinnati, OH 45229. E-mail: denise.warrick@cchmc.org

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The Institute of Medicine report in 2000 concluded that at least 44,000 people die each year from preventable medical errors.1 Therefore, the institute challenged health care leaders to implement systems to ensure safe patient care delivery practices.2 The transmission of information that occurs during the transition of patient care from one group of physicians to another (ie, patient handoffs) may result in a delay in care or adverse safety outcomes if patient information is inaccurate or omitted. The changes made by the Accreditation Council for Graduate Medical Education (ACGME) in 2011 have restricted duty hours for residents, creating the need for more frequent patient handoffs.3 Given the steady increase in overall patient complexity and the multifaceted delivery of pediatric inpatient care in recent years,4,5 timely and accurate patient handoffs are important to help ensure patient safety during care transitions in the hospital.

**abstract**

**BACKGROUND AND OBJECTIVE:** Handoffs ensure patient safety during patient care transitions in the hospital setting. At our institution, verbal handoffs communicated by resident physicians are suggested practice for patients transferring from the PICU to the hospital medicine (HM) service. Despite their importance, these verbal handoffs occurred only 76% of the time before patient arrival on HM units. Our goal was to increase the completion rate of verbal handoffs to 100% within 5 months.

**METHODS:** Baseline data were collected in a daily survey of HM residents. Interventions were developed and tested on small, incremental change cycles. Key interventions included education about the importance of handoffs, standardization of the handoff process, standardization of handoff documentation, and identification and mitigation of handoff documentation failures. We tracked handoff completion rates by using statistical control charts. After success with improving the completion rate of patient handoffs to the HM service, we applied our process to handoffs from the PICU to all inpatient services.

**RESULTS:** Median completion of verbal patient handoff increased from 76% to 100% within 6 weeks, with improvement sustained for 15 months. Physician compliance with electronic medical record documentation increased from 58% to 94% within 8 months. After spreading to all patients transferring out of the PICU, documentation of patient handoffs increased from 76% to 94% in 5 months.

**CONCLUSIONS:** A system using improvement science methods was successful in increasing the reliability of resident verbal patient handoffs. Consistent documentation and internal redundancy with checklists were associated with sustained improvement.
Patient handoffs are particularly important in academic institutions, where care is often driven by resident physicians, but there are few studies evaluating handoff reliability and effectiveness. One study evaluating patient handoffs between internal medicine residents at a large academic program found multiple inaccuracies, including 69% with medication omissions, 22% with omissions from the patient problem list, 5.7% with code status errors, and 2.8% with medication allergy errors. Similarly, a recent study of a pediatric residency program suggested that a majority of residents feel uncertain about patient care plans due to incomplete verbal handoffs. Although many initiatives have attempted to standardize the process of resident handoffs between members of an inpatient care team, less is known about the reliability of resident handoff occurrence between members of different care teams during transitions of care (eg, from the ICU to the acute care floor).

At our pediatric academic institution, resident physicians, nurses, and clerical staff are all accustomed to the frequent introduction and trialing of quality improvement initiatives. Recent improvement projects have targeted efficiency of patient flow from the PICU to the inpatient ward, allowing us to prioritize transfer to facilitate bed availability for other patients needing PICU care. The expectation for the residents was that verbal handoff should occur before patients are transferred to the receiving service. However, before the implementation of our study, PICU nurses and hospital unit coordinators (HUCs) often did not know when resident physicians completed their verbal handoff. This lack of communication occasionally allowed a patient to transfer out of the PICU before physician handoff completion. Thus, we suspected that verbal resident handoffs were not occurring on a reliable basis before patients left the PICU. We sought to determine whether it was possible to increase the reliability of verbal resident handoffs for patients transferring to the inpatient HM service from the PICU by using quality improvement methods and reliability science and to generalize this model for all transfers from the PICU if it proved successful.

Our SMART (specific, measurable, actionable, relevant, and time bound) aim was to increase the median completion rate of a successful handoff between resident physicians before the transfer of a patient from the PICU to the HM service from 76% to 100% within 5 months.

**METHODS**

**Setting**

Cincinnati Children’s Hospital Medical Center is a 587-bed, freestanding academic children’s hospital providing both general pediatric and quaternary care. In fiscal year 2012, there were >30000 admissions, including 2400 admissions to our 35-bed PICU. In the PICU, patient care is provided by 2 multidisciplinary teams, each consisting of 1 advanced practice registered nurse, 4 to 5 resident physicians, 2 fellows, and 1 attending physician. Each of our 5 HM teams consists of 3 to 4 medical students, 5 to 6 resident physicians, and 1 attending physician.

**Human Subject Protection**

This study was reviewed by our institutional review board and deemed exempt as system improvement research.

**Planning the Intervention**

The improvement team consisted of a chief resident (leader of quality improvement team), 2 residency program directors, 2 resident physicians, 2 PICU attending physicians, 3 HM attending physicians, 2 patient flow nursing coordinators, 1 PICU nurse manager, and a quality improvement consultant. The group performed a failure mode effects analysis and examined key drivers for this process to design our interventions. Key drivers included standardization of the handoff timing, staff engagement in the handoff process, availability of PICU residents to perform handoff, availability of HM residents to perform handoff, and standardized documentation for patient handoff. Drivers were prioritized and interventions implemented over an 8-month period (Fig 1).

At our institution, all resident physicians are trained to perform verbal handoffs using the I-PASS mnemonic. I-PASS is a standardized communication model that includes illness severity (I), patient summary (P), action list (A), situation awareness and contingency planning (S), and synthesis by the receiving provider (S). Resident verbal handoffs are expected to be completed before PICU patients are transferred to the receiving service. Once a transfer order has been placed, the PICU nurse communicates nursing handoff to the accepting bedside nurse on the acute care floor, checks with the HUC to ensure a bed is available, and then physically transfers the patient out of the PICU.

Operational definitions were created for both verbal handoff and successful handoff. A verbal handoff was defined as a phone conversation between a PICU resident and a HM resident, using the I-PASS mnemonic and conveying pertinent information necessary for
patient care. A successful handoff was defined as completion of a verbal handoff before the patient transferred out of the PICU for optimal patient safety. Consistent with the Model for Improvement, interventions were developed and tested in small, incremental change cycles.

**Interventions**

**Standardization of Processes (Key Driver: Standardized Handoff Timing, Standardized Documentation for Patient Handoff)**

To ensure a successful patient handoff before the patient left the PICU, the PICU residents were instructed to call the HM resident when the decision to transfer was made. This initiative was supported by PICU leadership, including permission to leave family-centered rounds if necessary, to facilitate a timely handoff. After the call was completed, the PICU resident was expected to document in the electronic medical record (EMR) that the handoff occurred.

**Education (Key Driver: Staff Engagement in Handoff Process, Availability of PICU Residents for Patient Handoff, Availability of HM Residents for Patient Handoff)**

Education about the importance of successful patient handoffs was emphasized through e-mails to the PICU and HM attending physicians, residents, nurses, and HUCs each month. Communication via e-mail was deemed optimal to inform the large group of participants. E-mails included step-by-step instructions on how to complete the documentation, including screen shots of the EMR documentation process. A chief resident also met with each group of HM and PICU residents at team meetings before the start of each rotation to explain the process and answer questions.

**Standardization of Documentation (Key Driver: Standardization of Documentation for Patient Handoff)**

The occurrence of the successful patient handoff was documented in the
EMR. PICU residents who completed the successful handoff were instructed to document the call as a progress note in the EMR using a handoff template created by the improvement team. Simultaneously, we also implemented a paper checklist used by the PICU residents to document physician handoff for all PICU patients before transfer to the floor.

Identification and Mitigation (Key Driver: Staff Engagement in Handoff Process)

To ensure that resident physician handoff was complete, the HUCs were instructed to monitor and collect the paper checklists. If the patient was ready for physical transfer and the handoff was not documented on the checklist, the HUCs were instructed to check with the resident physician to ensure handoff was completed and documented before transfer. The HUCs were instructed not to allow a patient to physically leave the PICU without the resident completing the checklist, because it served as the PICU record of the successful handoff.

Individual handoff completion and handoff documentation failures were identified, and weekly feedback was provided directly to the PICU and HM residents by the team leader via e-mail. Overall performance by the HM and PICU teams was displayed on time series run charts and e-mailed weekly to the respective resident team members, PICU nurses, and HUC staff.

Data Collection

Data collection began in September 2012. On the day after a transfer, the leader of the quality improvement team received a list of transferred PICU patients, which included timing of the transfer and accepting team. Using this list, the team leader determined which patients transferred to the HM teams the previous day and surveyed the HM residents to confirm whether a successful handoff occurred. After 1 month, documentation of the patient handoff in the EMR by the PICU resident, using a progress note template, was implemented. Data collected via weekly EMR chart review then replaced surveying residents directly. Once the EMR transfer tab dedicated to handoff documentation was built, an electronic report was generated that pulled weekly handoff documentation compliance directly from the EMR.

Analysis

Statistical run charts and control charts were created to examine resident compliance with the patient handoff process. Our outcome measure was the percentage of all PICU to HM patient handoffs that were successfully completed before the patient left the PICU. Our process measure was the percentage of all PICU to HM patient handoffs that were successfully documented in the EMR. Once the handoff process was implemented by all other hospital services receiving PICU patient transfers, documentation of the completion of successful handoffs for all PICU patients was tracked. Our process and outcome measures were initially tracked weekly and then transitioned to biweekly starting in October 2013. Established rules for identifying special cause variation were used to interpret the control charts.

RESULTS

Analysis of the verbal handoffs between the PICU and the HM service in September 2012 demonstrated that verbal resident handoffs were occurring only 76% of the time before the patient’s arrival on the HM units. After our series of interventions documenting that resident handoff occurred was implemented, the mean completion rate for successful patient handoffs by resident physicians for PICU to HM transfers increased from 76% to 100% within 6 weeks and has been sustained for 15 months (Fig 2).

Unexpectedly, the initial increase in completion of HM patient handoff preceded an improvement in our process measure of handoff documentation in the EMR. Early in the project, handoff documentation via progress note in the EMR by PICU residents was not reliable because residents had to remember to document handoff only for HM patients. Despite the transition of responsibility for recording the patient handoff in the EMR to the HM resident and simultaneous trialing of the paper checklist by the PICU residents, there was still no observable change in the reliability of the handoff occurrence.

It was not until we created a specific transfer tab for handoff documentation in the EMR, transitioned the responsibility of documentation back to the PICU resident to reduce duplication of work, and included documentation of handoffs for all PICU patients that we were successful in increasing the reliability of our documentation from 58% to 94% (Fig 3).

After the documentation intervention was extended to all patients transferring from the PICU, the residents no longer had to remember which patients needed handoff documentation. In addition, once the handoff documentation was built into the EMR, the HUCs were also able to easily see the date and time the handoff was
documented. This information enabled them to confirm handoff completion before transfer out of the PICU. As a result, within 5 months after we extended the process to include all patients (including HM patients) transferring out of the PICU, the mean compliance of documentation of successful patient handoff increased from 76% to 94% (Fig 4).

**DISCUSSION**

With the use of improvement science\(^1\) and reliability methods, we were successful in increasing the reliability of successful patient handoff occurrence. Key interventions included education about the importance of handoffs, standardization of the handoff process, standardization of handoff documentation, and identification and mitigation of the handoff documentation failures.

The rapid initial increase in our outcome measure of completion of successful physician handoffs was probably the result of education and increased awareness of the importance of patient handoffs by the PICU physicians, nurses, and staff. Education via e-mail and at monthly team meetings was essential because the residents on the PICU and HM teams rotate each month. The monthly reeducation was labor intensive for the study team, but it improved awareness and solidified resident participation in the project. The monthly change in physician personnel was anticipated to result in intermittent lapses in handoff documentation, but it did not affect our outcome measure. This finding was probably an indication of the culture change that occurred in the PICU regarding the importance and awareness of handoff occurrence.

Because education and increased awareness are low-reliability interventions,\(^2\) we sought to ensure sustainability by instituting more reliable interventions, such as standardizing essential tasks and identifying failures in real time. We did so by creating the PICU paper checklist and having the HUCs monitor compliance. The role of the HUC was to serve as a safety checkpoint to ensure that a patient did not transfer out of the PICU until the successful handoff was completed.

In addition, weekly feedback to frontline staff and data transparency helped ensure sustainability. E-mail messages displaying performance data and highlighting specific instances of failures were sent to motivate staff. They also enabled front-line staff to
provide additional suggestions for process improvement.

Our initial data were limited by both low sample size and possible recall bias, because the study involved direct questioning of residents to determine whether verbal patient handoff had occurred before the patient arriving on the floor. To minimize this concern, individuals were surveyed within 24 hours of the handoff occurrence.

Initial data collection was also labor intensive, because it involved locating the specific residents who were involved in the patient handoff. There may also have been a Hawthorne effect, because the data were collected by a pediatric chief resident and the residents knew they were being observed. This effect could have led to rapid improvement in the completion rate of physician patient handoffs. However, we did not perform direct observations to ensure that this tool was actually used with each PICU handoff during this study.

We are also not able to objectively show that increased reliability of successful patient handoff occurrence has contributed to overall patient safety. Our hospital-wide serious safety events, including medical response team and code rates, were very low at baseline, and we were unable to find an association between ensuring safe patient handoff and decreasing serious safety events. We suspect that some near miss or precursor events may have been prevented by increasing the reliability of our handoffs, but we were unable to objectively evaluate these events. Some of these precursor events might include medication errors, allergy errors, code status errors, omissions from the problem list, or rapid transfer back to the PICU.

With the success of this project, we have extended the interventions to other care providers, including nurses and respiratory therapists, to improve reliability of their successful handoffs for patients transferred out of the PICU. Incorporation of nursing and respiratory therapist handoff documentation into the EMR is under way. This additional documentation will allow HUCs to see that physician, nursing, and respiratory therapist documentation of handoffs is complete before patient transfer.

We are investigating a patient-related outcome measure to link to our improvement in successful handoff reliability. In addition, we plan to standardize the content of PICU handoffs. Standardization will probably include making direct resident observations to assess compliance with the I-PASS mnemonic and studying errors and omissions in patient handoffs.

CONCLUSIONS

A system using improvement science methods increased the reliability of successful physician handoff occurrence. Consistent documentation in the EMR and internal redundancy with checklists were associated with a sustained improvement in completion of successful patient handoffs. Direct resident feedback about individual performance and targeted education about the importance of patient handoffs were effective reinforcement strategies.

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REFERENCES


