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Research Article

Implementation of a Standardized Pediatric Emergency Medicine Transfer of Care Sign-out Guide: A Feasibility Study

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Abstract

This is a feasibility study to determine if a standardized transfer of care (TOC) sign-out guide for Pediatric Emergency Department (PED) patients improves resident satisfaction. Residents from various training programs (Emergency Medicine, Pediatrics, and Family Medicine) voluntarily reported their TOC sign-out satisfaction [100mm Visual Analog Scale (VAS)] and duration (minutes) pre- and post-implementation of a sign-out guide. Pre-intervention data collection occurred from September 2011 to January 2012, and post-intervention data collection occurred from February to May 2012. The guide included the following prompts: chief complaint, past medical history, history of present illness, admission reason, triage and final vital signs, pertinent positive and negative exam findings, and if applicable, medications, fluids, radiographic studies, consultant

recommendations, and noted improvements (or lack of). A final section of the guide prompted the PED resident to ask if the receiving team had any questions. Resident satisfaction and TOC sign-out duration pre-and post-implementation of the sign-out guide were analyzed (n=292, 167 pre- and 125 post-implementation). Use of the sign-out guide improved resident satisfaction [Satisfaction (100mm VAS): Pre-implementation – 80 (95% Confidence Interval (CI) 70 – 83); Post-implementation – 95 (95% CI 87 – 99, *p*-value 0.02] without a statistically significant difference in sign-out duration [Duration: Pre-implementation – 5 minutes (95% CI 4.2 – 6.8); Post implementation – 5 minutes (95% CI 4.7– 5.8), *p*-value 0.3]. A standardized sign-out guide successfully allowed residents to convey important patient care information regarding TOC and improved resident satisfaction.

Keywords: Transfer of care (TOC), sign-out, resident satisfaction, Pediatric Emergency Department (PED).

Introduction

Communication failures are well known reasons for adverse events within hospital settings as shown by Horwitz et al (2006 and 2009), Arora et al (2005 and 2007), and Sulcliffe et al (2004). The transition from the Emergency Department (ED) to an inpatient unit and the hand-off communication or transfer of care (TOC) between residents (ED and inpatient team) remains an important and sometimes error prone step in patient care.

Currently, there is no formal curriculum to train competence and proficiency in patient TOC among medical students, interns and residents. Interns verbally learn from their senior residents the skill of communicating TOC sign-outs as they rotate through the ED. There is also the added potential for error-prone communication seen among rotating residents with varying skills

and expertise as they attempt to effectively and clearly participate in patient TOC.

The Joint Commission National Patient Safety Goals require accredited hospitals to implement standardized patient hand-off tools to improve communication according to the acronym SHARE: standardize critical content, hardwire within your system, allow opportunity to ask questions, reinforce quality, educate and coach (Joint Commission Center for Transforming Healthcare 2013).

Sign-out systems have shown improvement following targeted interventions as shown by Wheat et al (2012). In their quasi-experimental project, they demonstrated improved resident satisfaction in internal medicine (i.e. inpatient) sign-outs following their intervention. Improvements in hand-off accuracy

and completeness have been shown in the surgical setting when simple, standardized systems were used as exemplified by Wayne et al (2008) and Nakayama et al (2012). These communication systems, however, are different than transitions that occur from the ED.

Ineffective hand-off communication has been identified as a key cause of ED medical errors by the Institute of Medicine. To date, past studies as exemplified by Beach et al (2003), Singer et al (2006), and Alvarado et al (2006) have focused on how inter-shift (change of shift) sign-outs among ED physicians affect patient safety. However, the role of TOC sign-outs from the ED to the inpatient team remains underexplored. As a first step to having systemic standardization of ED TOC sign-outs, we undertook a feasibility study to determine the impact of

standardization on resident satisfaction and TOC sign-out duration.

Residents in our Pediatric Emergency Department (PED) rated their TOC sign-out experience and reported the duration of time taken to complete the sign-out prior to and after implementation of a standardized sign-out guide utilizing the Joint Commission's principles. The study was performed from September 2011 to May 2012 in order to capture our PED's seasonal variation and variable ED length of stay (LOS). We hypothesized that use of a standardized guide would improve resident satisfaction without a statistically significant increase in sign-out duration.

Materials and Methods

Study Design and Setting

Following study approval from our hospital's institutional review board, we collected anonymous and voluntary resident surveys (convenience sample) completed immediately after a patient sign-out (for TOC) from our tertiary care PED from September 2011 to May 2012. These study months were chosen to allow equal distribution of winter volume (based on previous year patterns) pre- and post-implementation of the TOC sign-out guide. Our ED has an annual volume of 65,000 patient visits and approximately 7500 admissions to the hospital. Patients admitted to the pediatric team (~40-60% of daily admissions) require a verbal sign-out via telephone just prior to physical transfer to the inpatient unit. Any resident, responsible for most

of the ED care, performing a TOC sign-out was encouraged (via email and conference announcements) to submit a data form to rate their satisfaction on a 100mm Visual Analog Scale (VAS). The scale was anchored as “not at all satisfied” on the left and “completely satisfied” on the right. They also provided information regarding their training program, year of training, sign-out duration (minutes) and patient’s LOS (hours) within the ED at the time of sign-out (preceding TOC to the inpatient team). Residents always perform their TOC sign-outs in front of a computer, where the times at both the start and completion of the sign-out are readily available. Admissions to the pediatric intensive care unit were excluded since they do not undergo the same telephone TOC.

From September 2011 to January 2012, residents completed the data form (appendix A) following the usual (non-standardized)

method they were taught to sign-out which typically included either learning from other residents, being guided by the inpatient team, or based on previous experience. Appendix A was designed to obtain baseline resident satisfaction and TOC sign-out duration. From February 2012 to May 2012, the data form completed during their TOC sign-out was modified (appendix B) and included the following prompts as a TOC sign-out guide: chief complaint, past medical history, history of present illness, reason for admission, triage and final vital signs, pertinent positive and negative exam findings, and if applicable, medications, fluids, radiographic studies, consultant recommendations, and improvements (or lack of) noted in the ED course. A final section on the data collection form prompted the PED resident to ask for and determine if the receiving team had any questions. Examples of consultant recommendations included the following: Otolaryngology recommendations for a patient with cervical

lymphadenitis / abscess, Oncology recommendations for a leukemic patient being admitted with febrile neutropenia, or Endocrinology recommendations for a patient being admitted with diabetic ketoacidosis. Residents did not receive any formal training on how to perform the TOC sign-out, though all physicians were aware of the study as it is our policy to routinely announce all studies being performed in the ED to the pediatric residency program and to all rotating residents. Both resident and attending physicians (from the inpatient team) could have received TOC sign-outs. All attending physicians who received a TOC sign-out were subsequently contacted (1-3 days post ED admission by the primary author) to determine how often a complete TOC sign-out was given by the ED resident. A complete TOC sign-out implied that all aspects in appendix B were reported without prompts by the attending physician. Though our design is a feasibility study and not a safety study, we do

report the number of Rapid Response Team (RRT) activations (total number during study) that lead to transfer to the intensive care unit that occurred within 12 hours of ED admission during the study months as a proxy for medical errors. Our average number of RRT activations leading to transfer to the intensive care unit range from 1-6/month.

Primary Data Analysis

Data analysis was performed by the corresponding author using IBM Statistical Package for the Social Sciences (SPSS) for Windows (Version 19, IBM Corp., Armonk, NY, 2010). An α -level of 0.05 (two-tailed) was used for all tests of statistical significance. Data are presented as raw numbers (% total) or as the median value with 95% Confidence Intervals (CI). Fisher's exact test was used to analyze binary categorical variables (all

expected cell counts > 5). Non-parametric statistical analysis, Mann-Whitney U, was employed for ED LOS, resident satisfaction and TOC sign-out duration pre- and post-implementation of the standardized sign-out guide. Subgroup analysis was performed to compare interns and senior residents, rotating and in-house residents, and Emergency Medicine (EM) and non-EM residents. Outliers [i.e. extended interruptions to TOC sign-outs (lasting > 15 minutes) for issues such as requiring repeated calls to the inpatient team or requiring escalation to the attending on service due to lack of response from the resident team] were excluded from the analysis.

Results

A total of 292 (response rate 18%, outliers excluded 5) sign-out forms were analyzed. Table 1 provides a breakdown of all TOC sign-outs and the residents who completed them.

Table 1: Illustration of TOC Sign-Outs (Raw Number, % Total) Based on Program Type and Post-Graduate Year (PGY) of Training

TOC sign-outs (292)	Pre-guide (167, 57%)	Post-guide (125, 43%)
Pediatrics	110 (66%)	78 (62%)
Emergency Medicine	52 (31%)	39 (23%)
Family Practice	5 (3%)	8 (6%)
PGY-1	27(16%)	22(18%)
PGY-2	69(41%)	46 (37%)
PGY-3	71 (43%)	57(46%)

A detailed list of all TOC sign-outs and the residents performing them are illustrated in figures 1 (pre-implementation) and 2 (post-implementation).

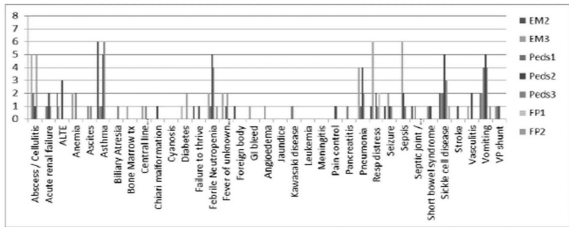


Figure 1: TOC Sign-out Diagnosis and Resident (Including Training Year) Illustration Pre-Guide Implementation. Emergency Medicine – EM, Pediatrics – Peds, Family Practice – FP.

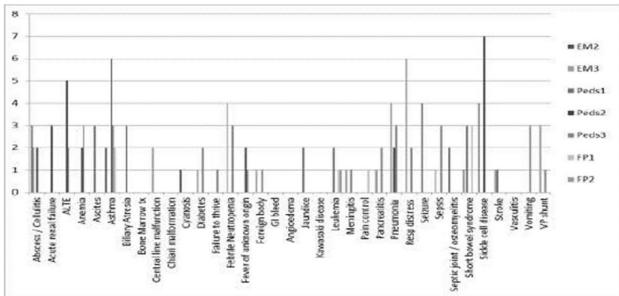


Figure 2: TOC Sign-out Diagnosis and Resident (Including Training Year) Illustration Post-Guide Implementation. Emergency Medicine – EM, Pediatrics – Peds, Family Practice – FP.

ED LOS was statistically longer following the intervention [Pre-implementation ED LOS 5.7 hours (95% CI 5.1-6.2); Post-implementation ED LOS 7.5 hours (95% CI 6.6-8.2), *p*-value 0.01]. The total number of RRT activations leading to transfer to the intensive care unit during the study was 17 [Pre-implementation 9, Post-implementation 8]. Table 2 shows the total number of TOC sign-outs received by inpatient attendings.

Table 2: Illustration of TOC Sign-outs (Raw Number, % Total) Received by Inpatient Attendings Based on Program Type and Post-Graduate Year (PGY) of Training

TOC sign-outs (71)	Pre-guide (38, 54%)	Post-guide (33, 46%)
Pediatrics	23 (60%)	20 (61%)
Emergency Medicine	14 (37%)	11 (33%)
Family Practice	1 (3%)	2 (6%)
PGY-1	5 (14%)	5 (15%)
PGY-2	16 (42%)	12 (35%)
PGY-3	17 (44%)	16 (48%)

Table 3 displays the percentage of time inpatient attendings reported receiving a complete TOC sign-out. The number of complete sign-outs improved from 37% to 61%, but this was not statistically significant (Fisher's exact test: $p=0.06$, effect size $\Phi=0.24$).

Table 3: Illustration of Complete TOC Sign-outs (Raw Number, %Total) Received by Inpatient Attendings

TOC sign-outs (71)	Pre-guide (38, 54%)	Post-guide (33, 46%)
Complete TOC sign-out	14 (37%)	20 (61%)

Resident Satisfaction and Sign-Out Duration

Implementation of the standardized sign-out guide improved resident satisfaction [Pre-implementation VAS 80 (95% CI 70-86); Post-implementation VAS 95 (95% CI 87-99), p -value 0.01]. Sign-out duration did not show any statistically significant difference following the intervention [Pre-implementation 5 minutes (95% CI 4.2-6.8); Post-implementation 5 minutes (95% CI 4.7-5.8), p -value 0.3].

Interns and Senior Resident Comparison

Resident satisfaction and sign-out duration were compared among interns and senior residents separately. Interns (PGY 1) showed no difference in resident satisfaction [Pre-implementation VAS 76 (95% CI: 62-79); Post-implementation VAS 80 (95% CI: 74-87) p -value 0.2], while senior resident (PGY 2 and 3) satisfaction improved [Pre-implementation VAS 80 (95% CI 74-86); Post-implementation 97 (95% CI 87-99) p -value 0.02]. Sign-out duration showed no statistically significant difference in interns [Pre-implementation 6 minutes (95% CI 5-7.5); Post-implementation 6 minutes (95% CI 6.2-7.4, p -value 0.37] and senior residents [Pre-implementation 5 minutes (95% CI 3.8-6.1); Post-implementation 4 minutes (95% CI 3.7-4.9), p -value 0.21] pre-and post-implementation of the sign-out guide.

In-House and Rotating Resident Comparison

Resident satisfaction and sign-out duration were analyzed among in-house and rotating residents separately. In-house resident satisfaction improved [Pre-implementation VAS 80(95% CI: 76-87); Post-implementation 96 (95% CI: 89-99) *p*-value 0.03]. Rotating resident satisfaction showed improvement [Pre-implementation VAS 74(95% CI 44-84); Post-implementation 90(95% CI 75-99) *p*-value 0.04], but with overlapping confidence intervals. Sign-out duration showed no difference for in-house [Pre-implementation 5 minutes (95% CI 4-6.4); Post-implementation 4 minutes (95% CI 3.8-5), *p*-value 0.8] and rotating residents [Pre-implementation 5 minutes (95% CI 5-10); Post-implementation 7 minutes (95% CI 3.9-7.5), *p*-value 0.08] pre-and post-implementation of the sign-out guide.

Emergency Medicine (EM) and Non-EM Resident Comparison

EM and Non-EM resident satisfaction and sign-out duration were compared. EM resident satisfaction improved [Pre-implementation VAS 80 (95% CI: 77-86); Post-implementation VAS 98(95% CI: 88-100) p -value 0.02]. Non-EM resident satisfaction also improved [Pre-implementation VAS 80 (95% CI 70-84); Post-implementation VAS 90 (95% CI 85-99) p -value 0.01]. Sign-out duration showed no statistically significant difference in EM [Pre-implementation 4 minutes (95% CI 3-5); Post-implementation 4 minutes (95% CI 3-4.6.2), p -value 0.8] and Non-EM residents [Pre-implementation 5 minutes (95% CI 4-7); Post-implementation 5 minutes (95% CI 4.7-6), p -value 0.7] pre-and post-implementation of the sign-out guide.

Discussion

Effective communication is critical with any transition of care. A TOC sign-out is the exchange of patient information and the TOC between health professionals (in our study, ED to inpatient pediatric team). In a large, tertiary care PED, residents from different programs with varying levels of experience and expertise are performing sign-outs while managing acutely ill patients in an often crowded and chaotic setting. Furthermore, they are performing this task without any prior formal training specifically in ED TOC.

We implemented a standardized PEM sign-out guide as a first step to developing a high fidelity process, and have demonstrated overall improved resident satisfaction without a statistically significant difference in duration. Our data demonstrated an

improvement in the number of complete TOC sign-outs received by inpatient attending, although this improvement was not statistically significant. The low n for TOC sign-outs received by inpatient attendings likely accounted for the lack of statistical significance. There was also no change in the number of RRT activations leading to intensive care unit transfer following ED admission. Our study was designed as a feasibility study. A safety study would require a significantly greater n to have sufficient power to determine if an intervention would decrease RRT activations leading to intensive care unit transfer soon after ED admission.

To our knowledge, our study is the first to systematically implement and assess the completeness of a TOC sign-out and to determine the amount of time it takes residents to perform them pre-and post-implementation of a standardized guide. Horwitz et

al did record the time in their study evaluating asynchronous voicemail sign-outs from ED physicians. However, they did not account for the relevant active dialogue in sign-outs, an evaluation performed in our study. An extension of this research would be to quantitatively assess active physician dialogue by comparing telephone and bedside TOC sign-outs.

The greatest improvement in resident satisfaction occurred in senior and EM residents. The least statistically significant improvement occurred in non-EM residents. Finally, overlapping confidence intervals suggest no improvement occurred in rotating residents. This varying improvement in resident satisfaction might be expected in that non-EM and rotating residents are the most unfamiliar with our complex ED setting. This highlights the need for improved teaching of residents earlier in their training, especially if they train at multiple sites in

different hospitals where no one standardized sign-out procedure for TOC exists. A more actively taught approach rather than the mere presence of a form may be needed.

This sign-out process may need to be taught to interns with less experience with regard to medical communication in general. In our study, interns demonstrated no difference in satisfaction, and seemed to have longer sign-out durations (though not statistically significant). One possibility is that they needed time to acquaint themselves with yet another task during internship. It is also plausible that prior to the implementation of a standardized communication format, they were not discussing all the aspects included in the sign-out guide, as reflected by the lower percentage of complete TOC sign-outs. This is consistent with the findings of Chang et al, where interns overestimated the effectiveness of their hand-off communication. In our study, the

added time may be appropriate since that may represent the time needed to communicate relevant patient information.

Limitations

The response rate was 18%, which may not be a true reflection of the total number of TOC sign-outs completed during the study months. A highly motivated group of residents are more likely to respond and report increased satisfaction. Resident scheduling in our institution is sporadic and several months may pass from one ED rotation to another for an individual resident. As such, there were different residents pre- and post-implementation of the TOC sign-out guide during our study months, leading to potential confounding variables present pre- and post-intervention. In the subset where an attending physician received a TOC sign-out from an ED resident, it is possible that some training / teaching

may have been given by the attending. This study was not designed to study this aspect of the TOC or control for its possible influence. The improvement noted by the attending physicians may have been due to resident growth as they get further in their residency training and not necessarily due to the intervention. Furthermore, attending physicians were not contacted immediately after the TOC sign-out potentially creating recall bias.

Even though we attempted to have even distribution across the winter season, the greater ED LOS following the intervention argues that the distribution was not ideal. The ED LOS pre- and post-intervention, though long, was within the range for our institution. The greater ED LOS may lead to more patient interventions, thus increasing the number of items needed to communicate during the TOC sign-out and increasing sign-out

duration. However, sign-out duration did not increase. VAS has not been specifically validated for a physician rating their satisfaction with their own performance. Since satisfaction exists on a continuum, we chose to quantify this using VAS rather than merely using categorical values. Intern satisfaction showed no improvement. Fewer forms were submitted by interns than by senior residents potentially contributing to this result. Finally, our study was not designed to assess if implementation of the sign-out guide leads to fewer errors in patient care. Such a study may be needed to assess if additional teaching improves satisfaction while at the same time assessing for errors in patient care.

Conclusion

The current study demonstrated improved resident satisfaction following implementation of a standardized TOC sign-out guide which follows currently published best practice recommendations as reported by Beach et al (2012). Our evidence suggests that a TOC sign-out system may be implemented in a large, tertiary care children's hospital with improved resident satisfaction. In addition, a specific need was identified in residency education related to ED specific TOC sign-outs.

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Appendix A

Date_____ Time_____ Weight (kg)_____

Allergies_____

ED resident: Training program_____	
Year of training _____	
Duration of sign out (minutes)	
Time (hours) in ED at time of sign out	

ED Resident satisfaction (Visual analog scale)

Not at all

Completely satisfied

0[_____] 100 Satisfied

Appendix B

Please See Appendix B in Full PDF Version