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ORIGINAL RESEARCH

## Using I-PASS to Improve Multidisciplinary Handoffs in a Large, Level IV Neonatal Intensive Care Unit

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### Introduction

Patient handoffs may result in communication failures and adverse hospital events.<sup>1,2</sup> The Accreditation Council for Graduate Medical Education (ACGME) has revised its Common Program Requirements to include provisions to require training in transitions of care and to ensure residents and fellows are competent in transitions of patient care.<sup>3</sup> I-PASS, a structured handoff process, was developed to address this requirement for pediatric residents in an inpatient non-ICU setting. I-PASS implementation has been shown to improve communication rates and reduce medical errors.<sup>4</sup> I-PASS is a mnemonic that stands for illness severity (I), patient summary (P), action list (A), situation awareness (S), and synthesis by receiver (S).<sup>5</sup> In short, “illness severity” describes the patient’s clinical status (stable, watcher, or unstable), and “patient summary” describes age, diagnosis, and pertinent medical management. The receiver will get an “action list” of things to do for each patient with contingency plans, giving the receiver a “situation awareness” for potential unanticipated events related to the patient’s condition. The receiver “synthesizes” this information by repeating and questioning important points.

In our Level IV, 118 patient bed NICU, handoff styles differed between the fellows, who were trained in an organized handoff style during residency, and Neonatal Nurse Practitioners (NNPs), who trained with nursing-style handoffs. A study by Brown et al. suggests that nursing staff perceive handoffs to be time consuming with irrelevant information given.<sup>6</sup> Additionally, one subject observed that the nurse was interrupted most of the time.<sup>6</sup> This may explain the observed tendency for our NNPs to remedy these problems with more abrupt handoffs with higher tolerance of interruptions and background noise compared to our fellows.

To date, the effect of a structured handoff process in a large, multidisciplinary, level IV NICU has not been reported.<sup>7</sup> While I-PASS implementation in our NICU was designed to improve local handoff, it is also one of the first examples of handoff evaluation amongst both trainees and NNPs. The main aim of

this project is to improve handoff content, both verbal and written, by 50% as measured by inclusion of each I-PASS component within 8 months. Secondary aims include improving handoffs by decreasing background distraction and frequency of interruptions by 75% within 8 months. An additional outcome is improvement of staff satisfaction with the quality of handoff process by 75% within 8 months.

### Materials and Methods

#### Pre-implementation of I-PASS

Prior to implementation, the QI project was presented to all key stakeholders, which included neonatology faculty, fellows, NNPs, and nurses, at the NICU Quality and Safety Council. The QI project was exempt from formal IRB approval according to our institutional guidelines and discussions with the committee for protection and human services at McGovern Medical School.<sup>8</sup> A 4-point Likert scale survey was conducted amongst the participants to determine baseline attitudes toward handoffs. The survey queried staff on their satisfaction with handoffs, whether they felt the environment was conducive to handoffs, what they thought impeded the environment from being conducive and how they would alter handoffs. Didactic and simulation training was then provided to all fellows and NNPs. The survey was given to 13 NNPs who work day shifts (Day Team), 4 NNPs who work night shifts (Night Team), and 5 fellows. Handoffs were observed to measure baseline duration of background noise, frequency of interruptions, and incorporation of the I-PASS components.

#### I-PASS Handoff Process

The I-PASS handoff was originally designed for pediatric residency training programs.<sup>2</sup> Because inpatient non-ICU pediatric services differ vastly from a large, level IV NICU in terms of acuity and quantity of patients, the I-PASS handoff process was modified to address these differences while

maintaining efficiency and improving handoff content. The fellows and NNPs cover a service of 60-70 patients per day, which are generally transitioned between care teams twice daily. I-PASS was modified to emphasize those infants who were considered “unstable” or “watcher” by illness severity. For these patients, all I-PASS components were required in verbal handoffs with an additional expectation that documentation of “situation awareness” component would be written in our NICU handoff document. For those infants labeled “stable,” the minimum required components evaluated during handoffs included the verbal statement of illness severity, patient summary, and action list. There was no formal evaluation of the written documentation of these infants.

### *Implementation of I-PASS Handoff Process*

An iterative QI process was implemented incorporating cumulative steps of change. Each I-PASS component was implemented sequentially over an 8-month period from August 2015 to March 2016. Prior to implementation, handoffs occurred in a common room in which multiple handoffs occurred simultaneously. During the intervention, each handoff was assigned to a separate room. A standardized process was instituted in which the “on call” phone was rotated between fellows and NNPs during the designated handoff time in order to minimize interruptions for those involved in handoffs. An average of 177 discrete patient handoffs was observed by two people each month. The observers also recorded the number of interruptions and background noise during handoffs. Monthly meetings were conducted to introduce the new I-PASS component. At the end of the intervention period, a post-survey, similar to the pre-survey in content, was given to participants to determine their satisfaction with handoffs using I-PASS.

### *Statistical Analysis*

We observed and measured the inclusion of each I-PASS component from the time the intervention was implemented to its conclusion. We measured the total number of patients per handoff and recorded the frequency of verbalized illness severity, patient summary, and action list components per handoff. As a proportion, the frequency of each component was calculated over the total number of patients per handoff. Once a patient was reported as “watcher” or “unstable,” then the observer would record and calculate the proportion of how many instances the reporter verbalized and documented the “situation awareness” component and the receiver’s “synthesis” of the information for those patients.

Since I-PASS implementation dates varied for each component, results are reported in months and compared to pre-implementation assessments. Proportions reviewed were tested between implementation periods by generalized linear model (GLM) with logit function and binomial family that allows for dependent outcomes ranging from 0 to 1. Robust standard errors were used in the model and adjusted for clustering within the three different handoff teams observed throughout the study. Predicted probabilities (95% confidence intervals) from the GLM were used to summarize monthly proportions and

intervention periods. Multivariate GLM included pre- and post-intervention months as well as minutes spent during handoffs per patient, proportion of watcher/unstable infants, and an interaction term of minutes per patient with proportion watcher/unstable infants. Univariate comparisons on minutes spent during handoffs and proportion of watcher/unstable infants pre- versus post-implementation were reported as means (min-max) and tested by rank sum test. A two-sided p-value < 0.05 indicated statistical significance.

### **Results**

Seven of 13 Day Team NNPs completed the pre-survey. Of those who responded, 14% and 86% thought the environment was never or sometimes conducive for handoffs, respectively. The Day Team cited background noise, competing conversations, and telephone calls as reasons for distractions during handoffs. Nine of 13 Day Team NNPs responded to the post-survey. Eleven percent and 78% thought the environment was always or usually conducive for handoffs, respectively.

Three of 4 Night Team NNPs and 3 of 5 fellows responded to the pre-survey. Sixty-seven percent of Night Team NNPs and 100% of fellows thought the environment was sometimes conducive for handoffs (data not shown). They cited background noise, competing conversations, and telephone calls as reasons for distractions during handoffs. Three fellows and 4 Night Team NNPs responded to the post-survey. All of the Night Team NNPs responded that the environment was usually conducive, and 67% of fellows thought that it was always conducive.

Pre-intervention, only 43% of the Day Team was satisfied with the quality of the existing handoff process. This increased to a satisfaction of 67% post-intervention. The satisfaction with the handoff process amongst the Night Team and fellows increased from 67% and 33%, respectively, pre-intervention to 100% post-intervention. Post-intervention, 100% of the Day Team and 33% of fellow respondents stated that handoffs took a longer time with I-PASS implementation. None of the Night Team felt that handoffs took a longer time. In actuality, handoff duration increased significantly ( $p = 0.0491$ ) from 0.8 minute/patient prior to I-PASS implementation to an average of 1.2 minute/patient.

Interruptions decreased from pre-intervention results (16) to a range of 1 to 4 interruptions in post-intervention months. Prior to intervention, the range of percentage duration of background noise during handoffs was 37-94%. After sequestering handoffs in separate rooms, all background noise was eradicated since there were no external conversations other than the handoffs.

A total of 1451 patient handoffs (39 observation days) have been observed. Of these, 201 handoffs (4 observation days) were monitored prior to intervention, and 1250 handoffs (35 observation days) were monitored post-intervention. Illness severity was mentioned more frequently for all post-intervention months compared to pre-intervention results (all p-values for post-intervention months < 0.001; Figure 1). Action

list was mentioned more frequently for all post-intervention months versus pre-intervention results (all p-values for post-intervention months < 0.001; Figure 1). There was a decrease in verbalization of patient summary from 91% (pre-intervention) to 87% in January 2016 (p = 0.324) and 76% in both February and March 2016 (both p ≤ 0.002, Figure 1). Situation awareness was verbalized and documented more frequently for all post-intervention months versus pre-intervention results (all p-values ≤ 0.001; Figure 2). Synthesis by receiver demonstrated significant improvement from pre-intervention results (44%) in the first month (February 2016) after intervention (62%, p = 0.28), but it was not maintained in March 2016 (38%, p = 0.827, Figure 2).

### ***Limitations***

Our project must be considered in light of certain limitations. Data collection was done through direct observations. Thus, there could be the possibility of a Hawthorne effect. Observers were physically present outside the room during handoffs with team members' awareness that they were being observed and evaluated. Further, there is risk of observer bias since the individuals who collected the monthly data were also the ones who conducted the didactic, simulation, and monthly presentations. There was also a less than ideal response rate to both the pre- and post-surveys, which could have skewed the results.

### ***Discussion***

Our study showed that I-PASS significantly improved verbal and written handoffs in terms of illness severity, action list, and situation awareness. However, patient summary and synthesis by receiver were included least frequently in handoffs compared to other components. Given that there were a slightly higher proportion of watcher/unstable infants in the pre-intervention group, this finding may be affected by a significantly higher probability of patient summaries being verbalized when handoffs included more watcher/unstable infants (p < 0.001) in multivariate analysis. Further, handoff receivers asked questions for clarification but did not always repeat the information back to the handoff giver. Nevertheless, the results suggest that I-PASS can be adapted to a large level IV NICU, encompassing a wide spectrum of patient acuity, amongst both fellows and NNPs, while also improving satisfaction.

When creating the I-PASS handoff process for our NICU, we initially considered fellows and NNPs to be equivalent in their handoff needs. Yet during the I-PASS implementation, we discovered that despite having more exposure to structured handoffs in residency, fellows whose service months were more sporadic had more trouble remembering to use the I-PASS components, while NNPs who had consistent service months continued to improve with steady practice. Also, fellows did not always attend the monthly meetings. Monthly meetings played an integral role in striving to maintain the sustainability of the I-PASS process as it provided consistent feedback to fellows and NNPs and transparency of data that were presented during those meetings.

Our patient outcomes were not evaluated, so we cannot quantify cost avoidance. However, \$17 to \$29 billion are estimated national costs for preventable adverse events.<sup>9</sup> I-PASS has been proven to reduce medical errors and preventable adverse events.<sup>4</sup> Thus, the implementation of this cost effective tool to reduce adverse events could potentially reduce the costs of hospital stay.

To date, there have been few studies to evaluate a handoff process in a multidisciplinary ICU setting. Solan et al<sup>7</sup> examined similar objectives amongst residents and nurses but in a pediatric inpatient setting. Further, a study reported that complications often result from team miscommunication rather than individual failures.<sup>10</sup> This QI project improves team communication and demonstrates significantly improved satisfaction with a standardized handoff process amongst neonatal-perinatal fellows and NNPs in an ICU setting.

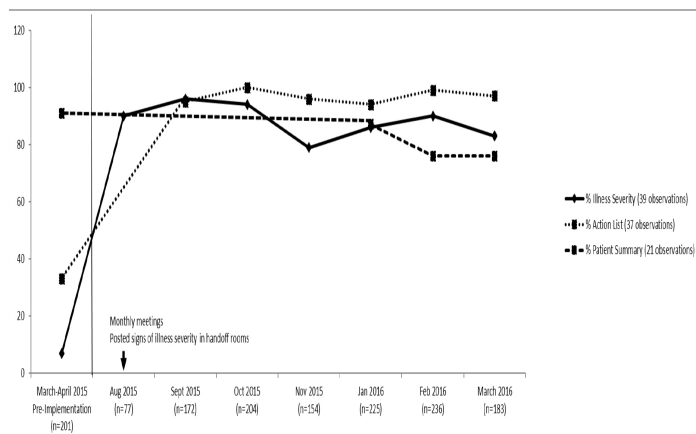
A uniqueness that lends to the success of I-PASS implementation in our NICU but may limit its generalizability, is the close, working relationship between the fellows and NNPs. There is also a long history of active involvement of NNPs and fellows in QI projects, which contributes to a strong, local culture of patient safety. In order to ensure continuation of I-PASS in our NICU, participation in I-PASS will be formally evaluated by the fellowship program director and the NNP manager. Additionally, neonatal faculty has been tasked with ensuring that handoffs continue in the quiet, separate rooms. New fellows and NNPs will receive didactic and simulation training on the I-PASS process.

### ***Conclusion***

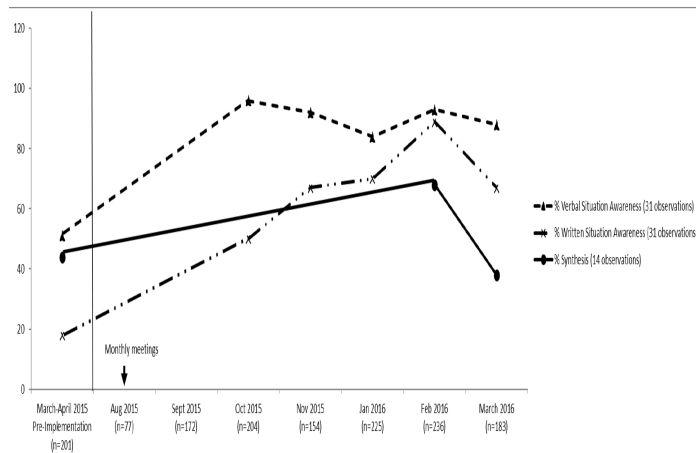
Our project demonstrated the feasibility of I-PASS implementation in a multidisciplinary NICU setting. The results add to the knowledge of implementing a formal handoff process in a large, level IV NICU. Further observations are needed, however, to evaluate the prospective evolution of handoff duration and to demonstrate the sustainability of the standardized handoff process.

## Figures

**Figure 1.** Inclusion of Illness Severity, Action List, and Patient Summary in Handoffs.



**Figure 2.** Inclusion of Synthesis by Receiver and Situation Awareness in Verbal and Written Handoffs



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