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Parent and Provider Experience and Shared Understanding after a Family-Centered Nighttime Communication Intervention

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Abstract

Objective—To assess parent and provider experience and shared understanding after a family-centered, multidisciplinary nighttime communication intervention (nurse-physician brief, family huddle, family update sheet).

Methods—Prospective intervention study at a children's hospital from 5/2013-10/2013 (pre-intervention) and 5/2014-10/2014 (post-intervention). Participants included 464 parents, 176 nurses, and 52 resident-physicians of 582 hospitalized 0-17-year-old patients. Pre- vs. post-intervention, we compared (1) parent/provider top-box scores (e.g., “excellent”) for experience with communication across several domains; (2) level of agreement (shared understanding) between parent, nurse, and resident reports of patients' reason for admission, overnight medical plan, and overall medical plan, as rated independently by blinded clinician reviewers (agreement=74.7%, kappa=.60).

Results—Top-box parent experience improved for 1 of 4 domains: Experience and Communication with Nighttime Doctors (23.6% to 31.5%). Top-box provider experience improved for all 3 domains, including Communication and Shared Understanding with Families (resident-rated: [16.5% to 35.1%]; nurse-rated: [32.2% to 37.9%]) and Experience, Communication, and Shared Understanding with Other Providers (resident-rated: [20.3% to 35.0%]; nurse-rated: [14.7% to 21.5%]). Independently-rated shared understanding remained unchanged for most domains, but improved for: parent-nurse composite shared understanding (summed agreement for reason for admission, overall plan, and overnight plan; 36.2% to 48.2%), and nurse-resident shared understanding regarding reason for admission (67.1% to 71.2%) and regarding overall medical plan (45.0% to 58.6%). All $p < .05$.

Conclusions—A family-centered, multidisciplinary nighttime communication intervention was associated with improvements in some, but not all, domains of parent/provider experience and shared understanding, particularly provider experience and nurse-family shared understanding. The intervention was promising but requires further refinement.

Keywords

family-centered care; hospital experience; communication; shared understanding

Introduction

Communication breakdowns are a leading cause of hospital medical errors, contributing to >60% of sentinel events,¹ the most serious adverse events. Efforts to improve hospital communication have focused on standardizing intra-disciplinary communication among providers.²⁻⁴ Interventions to improve communication among providers and parents and among inter-disciplinary teams of providers^{5,6} are understudied, particularly at night.

Nighttime care represents over half of care provided in hospitals and presents unique communication challenges and opportunities for family and nurse engagement. Nighttime care is particularly error-prone,^{7,8} and may be particularly susceptible to communication lapses⁹⁻¹¹ due to inadequate care transitions,¹² decreased staffing,¹³ increased workload, lack of formal bedside rounds, and provider/parent fatigue and sleep deprivation.

Improved communication may enhance patient safety by ensuring shared understanding between team members (Figure 1). Shared understanding is necessary to achieve a shared mental model, an organized understanding of relevant information shared by team members.⁴ Shared understanding ensures situational awareness—the understanding, perception, and ability to project future events in a dynamic environment¹⁴—and helps promote patient safety.

Adequate nighttime communication is also essential to ensure optimal patient experience,¹⁵ an increasingly important quality metric for patient outcomes,¹⁶ reimbursements,¹⁷ and hospital performance.¹⁸ By improving communication at night, it may be possible to improve patient safety and experience at a critical but overlooked time. However, standardized nighttime communication practices do not currently exist in most hospitals.

Therefore, given the lack of standard nighttime communication practices and the risks associated with nighttime care, we developed a nighttime communication bundle intended to improve safety and quality of nighttime care. We hypothesized that its implementation would be associated with improved parent and provider top-box experience and shared understanding.

Methods

Data, Setting, Study Population

We conducted a prospective intervention study of parents and nighttime providers (nurses and senior-residents) of 0-17-year-old patients on two pediatric inpatient units at a tertiary care children's hospital between 5/1/2013-10/31/2013 (pre-intervention) and 5/1/2014-10/31/2014 (post-intervention). Each unit included non-surgical general pediatric, short-stay, and subspecialty patients.

Each unit was staffed by night-shift bedside nurses (nurse-patient ratio 1:4-5) supervised by a charge nurse and an intern supervised by a senior-resident. Resident and nurse handoffs from day teams occurred at ~5:30 and ~7:00 pm, respectively. We collected data on weeknights the primary resident night team was on service (Monday-Thursday). Providers

provided written informed consent and parents provided verbal consent. The hospital's IRB approved the study.

Inclusion/Exclusion Criteria

Given lower staffing and higher workload at night (night senior-intern pairs covered up to ~30 patients while simultaneously receiving 7-15 mostly early evening admissions), we realized that any nighttime intervention should target patients most in need of additional communication. Therefore, our study sample and intervention included only these most “active” patients. We defined active patients as those with rapidly evolving clinical statuses, high acuity, puzzling diagnoses, or who were newly admitted by the day team. Participating senior-residents identified the two most active patients on their unit each evening, and we approached only these patients' parents for the study.

Given limited nighttime interpreter resources, we excluded non-English-speaking parents. We also excluded parents of patients: admitted by the night team (because they had not undergone a day-to-night-team transition in care), boarding in the unit awaiting psychiatric placement, and in state custody.

Standard Practices

Prior to our intervention, our institution practiced daytime family-centered rounds (FCRs) in most cases, though variability by provider existed. No standardized practices for nighttime verbal or written family communication existed. Residents and nurses routinely conducted “midnight rounds,” ~10-minute joint resident-nurse briefs every evening to review patient concerns. However, briefs typically occurred in a conference room, not at the bedside, well past midnight, after families were asleep. Residents and nurses used I-PASS (Illness Severity-Patient Summary-Action Items-Situation Awareness and Contingency Planning-Synthesis by Receiver),² for intra-professional handoffs. However, I-PASS was not used for inter-professional (nurse-physician) communication, FCRs, or written/verbal family communication.

Intervention

We developed our intervention iteratively, with input from parents, nurses, physicians, and the hospital's Family Advisory Council, residency program, and nursing leadership. Before intervention development, we conducted a needs assessment. This involved ~45-minute semi-structured, in-person and telephone interviews of 15 parents, nurses, and residents about their experiences with nighttime communication, including challenges, needs, and suggestions.

Residents reported receiving frequent pages and cited workload as a barrier to communication. Nurses reported lacking answers to parent questions and “batching pages” to avoid disturbing residents. Parents reported frequently being unable to come to the hospital until after work. Additionally, parents noted that when they were able to be present during the day, they were often not seen or updated by a physician. One parent partner (BA) emphasized that communication from providers at night would be particularly comforting

and orienting, suggesting that a nightly written update of the day's events would improve family communication.

Based on parent and other key stakeholder feedback, evidence for I-PASS,² and principles of family-centered care, including information sharing and partnership and collaboration in discussion and decision-making,¹⁹ we formulated a targeted early evening intervention aimed at improving communication and shared understanding between residents, nurses, and families. We piloted and refined our intervention using Plan-Do-Study-Act cycles in the study units (e.g., adjusting huddle timing and participants).

Our intervention involved three components: (1) ~5-minute in-person or telephone nurse-resident unit-wide early evening briefs after change of shift to discuss active patients, questions, and parent concerns (~7:30 pm); (2) for each unit's 2 most active patients, ~7-minute evening bedside family-centered huddles in I-PASS format led by senior-residents, with nurses or parents providing synthesis of plan (~8-9pm); and (3) for each unit's 2 most active patients, written family update sheets (Figure 2) completed by daytime senior-residents in the early afternoon (taking ~2 minutes) and distributed to families by night teams during family huddles.

Residents were briefed about the intervention before their two-week night rotation with an informational email and an in-person ~10-minute training on applying I-PASS principles to family huddles. We also held an hour-long didactic session with interactive discussion at resident noon conference. Charge nurses were briefed in-person with 5-minute trainings before their first shift. There was a 6-month wash-in period following intervention rollout before post-intervention data collection, thereby ensuring pre- and post-intervention data collection occurred at the same time of year.

Survey Instrument

With survey methodologist and parent partner assistance, we developed a paper-based survey assessing experience and shared understanding. We cognitively tested the instrument with parents, nurses, and residents and refined it accordingly prior to study start.

Each evening (between ~8-10 pm), research assistants solicited written surveys from parents and providers of the 2 most active patients on each ward. Parents typically completed surveys once during hospitalization.

To assess experience, parents rated the following *a priori* constructs: (1) Understanding of Overnight Plan (6 questions); (2) Experience and Communication with Nighttime Doctors (5 questions); (3) Experience and Communication with Nighttime Nurses (5 questions); (4) Shared Understanding with and between Nighttime Doctors and Nurses (3 questions). Items used 5-point Likert scales for agreement ("strongly disagree" to "strongly agree," 12 questions), extent ("not at all" to "completely," 1 question), and quality ("poor" to "excellent," 4 questions). The parent survey had a Flesch-Kincaid²⁰ reading grade level of 7.5.

Providers rated the following *a priori* constructs: (1) Family Understanding of Overnight Plan (3 questions); (2) Communication and Shared Understanding with Families (2

questions); (3) Communication, Experience, and Shared Understanding with Other Providers (3 questions). Items used 5-point Likert scales for agreement (6 questions), extent (1 question), and quality (1 question). Residents and nurses completed identical surveys. Construct reliability for both parent and provider surveys was good (Cronbach's $\alpha > 0.78$ for all constructs).

In the post-intervention period, parents and providers also reported on 4-point Likert scales (“definitely no” to “definitely yes”) whether family huddles and written update sheets improved communication.

To assess shared understanding, parents and providers described patients': (1) reason for admission, (2) overall plan for hospitalization, and (3) detailed overnight (next 12 hour) plan. Questions 1 and 2 were open-ended while question 3 was closed-ended, with select-all-that-apply categories (e.g., imaging) and optional free-text “other” and “miscellaneous” responses.

Other Data

We also collected early-evening electronic patient sign-out data from the medical record. Sign-outs, updated by outgoing day residents and provided to night residents at handoff, served as a proxy for the day team's understanding of the medical plan. We obtained parent and provider self-reported demographic data and patient hospital administrative record-based clinical and demographic data.

Reviewer-Rated Shared Understanding

To assess shared understanding, we analyzed agreement between resident-parent, resident-nurse, and nurse-parent dyads, as well as between respondents and the sign-out.

Physician and nurse reviewers compared parent and provider responses to one another and to the sign-out for each of 3 categories: (1) reason for admission, (2) overall plan for hospitalization, and (3) detailed overnight plan. We developed a rating rubric to standardize reviews. For each dyad, reviewers rated agreement for each question on a 3-point scale (1= “not at all/a little,” 2= “somewhat,” 3= “mostly/completely”). Ratings were subsequently dichotomized (1 vs. 2/3) at the question-level for purposes of analysis. Average agreement between reviewers across categories was 74.7% ($\kappa=0.60$).

Reviewers also provided summary 3-point case complexity ratings (1=simple, 2=intermediate, 3=complex) based on whether patients had acute clinical concerns, multiple body-system involvement, unknown diagnoses, 1 subspecialty consults, high levels of bedside care, complex past medical histories, multiple comorbidities, or complex social situations.

Outcomes

We compared top-box parent and provider experience pre- vs. post-intervention. “Top-box” refers to the most positive response on a scale (e.g., “excellent”). Responses were subsequently coded onto a 5-point scale for analysis (e.g., “excellent”=5) and considered to

have “top-box” overall experience for a particular construct if they scored 5 out of 5 for all items in the construct.

We secondarily compared proportion of shared understanding pre- vs. post-intervention among provider, parent, resident, and sign-out dyads about the reason for hospitalization and the overall and overnight plan for hospitalization. We also examined composite ratings of shared understanding, derived by summing the three individual questions (reason for hospitalization, overall plan, and overnight plan). Dyads with composite rating scores ≥ 6 out of 9 (e.g., agreement scores ≥ 2 for each of the 3 questions) were considered to have shared understanding.

Statistical Analyses

We used descriptive statistics to compare pre- vs. post-intervention subject characteristics. These included parent, provider, and patient age, sex, and race/ethnicity; parent household income, education, and primary language; and patient length of stay, insurance, complex chronic condition (CCC) count (an ICD-9-CM-based marker of medical complexity determined from hospital discharge administrative data),²¹ and 3-point case complexity ratings (as assessed by reviewers). Age and length of stay remained continuous; other variables were categorized as presented in Table 1.

For experience, we compared mean Likert scores and top-box percentages by item in the pre- and post-intervention cohorts using Wilcoxon's rank sum test, Fisher's test, or repeated measures regression. We then analyzed experience scores by construct, comparing top-box percentages in the pre- and post-intervention cohorts (based on the above tests). We used repeated measures regression to account for cases where providers provided responses for multiple patients. We used multivariable linear, logistic, or repeated measures regression modeling to test whether observed differences in outcomes between pre- and post-intervention cohorts persisted after adjusting for patient, parent, or provider characteristics that, on bivariate analyses, differed between pre- and post-intervention cohorts (at a threshold of $p \leq .1$).

For shared understanding, we used Fisher's exact tests or repeated measures regression to compare subjects' shared understanding scores in pre-intervention and post-intervention cohorts. As with experience, we used multivariable logistic or repeated measures modeling to control for patient, provider, and patient characteristics that differed between pre- and post-intervention cohorts on bivariate analyses at a threshold of $p \leq .1$. We used repeated measures regression to account for cases where providers provided responses for multiple patients.

We also performed similar experience and shared understanding analyses for the subset of post-intervention cases that received all three components of the intervention. A p -value $< .05$ was considered statistically significant for all analyses. We used REDCap²² for data capture and SAS 9.4 (SAS Institute) for all analyses.

Results

Sample Characteristics

Pre- and post-intervention, respectively, 89% and 84% of parents, 97% and 95% of senior-residents, and 95% and 100% of nurses consented for the study. Our sample included 464 parents, 52 senior-residents (including 3 who participated in both pre- and post-intervention arms), and 176 nurses (including 53 who participated in both arms) who completed reports for 594 total patient admissions (326 pre-intervention, 268 post-intervention) representing 582 unique patients. Residents and nurses filled out multiple report forms each. Pre- and post-intervention response rates were 86.5% and 71.8% (parent), 91.2% and 80.1% (resident), and 88.5% and 89.0% (nurse).

Parents and providers had similar characteristics in pre- and post-intervention groups (Table 1), as did patients, except for mean length of stay and case complexity, which both increased post-intervention (and for which all analyses subsequently adjusted).

Parent-Rated Communication and Experience

Post-intervention, parent unadjusted mean [SD] Likert (pre-intervention, post-intervention) scores improved for 2 of 8 items (Table 2): chance to ask nighttime doctors questions (4.16 [0.96] to 4.39 [0.86], $p=.01$) and quality of communication with nighttime doctors (4.07 [1.06] to 4.30 [0.98], $p=.02$).

Adjusted percent top-box construct scores improved for Experience and Communication with Nighttime Doctors (23.6% [n=65] to 31.5% [n=56], $p=.03$, Table 3).

Resident-Rated Communication and Experience

Resident unadjusted mean Likert scores significantly improved for 6 of 8 items (Table 2). Individual items showing greatest improvement included resident perceptions that family was told (3.96 [0.65] to 4.29 [0.72], $p=.002$), understood (3.88 [0.68] to 4.28 [0.69], $p<.001$), and agreed with plan (4.27 [0.72] to 4.58 [0.65], $p=.003$).

Adjusted resident top-box scores increased for 3 of 3 constructs (Table 3): Family Understanding of Overnight Plan (14.4% [n=42] to 37.1% [n=78], $p=.004$); Communication and Shared Understanding with Families (16.5% [n=48] to 35.1% [n=73], $p=.01$); and Experience, Communication, and Shared Understanding with Other Providers (20.3% [n=61] to 35.0% [n=75], $p=.02$).

Nurse-Rated Communication and Experience

Post-intervention, nurse unadjusted mean Likert scores significantly improved for 2 of 8 items (Table 2). Individual items showing greatest improvement by nurses included whether the family was told (4.01 [0.91] to 4.26 [0.78], $p=.003$) and understood the plan (3.98 [0.92] to 4.21 [0.80], $p=.006$).

Adjusted nurse top-box scores increased for 3 of 3 constructs (Table 3): Family Understanding of the Overnight Plan (18.9% [n=55] to 33.5% [n=78], $p<.001$); Communication and Shared Understanding with Families (32.2% [n=94] to 37.9% [n=88],

$p=.02$); and Experience, Communication, and Shared Understanding with Other Providers (14.7% [$n=43$] to 21.5% [$n=51$], $p=.02$).

Independently Assessed Shared Understanding

Post-intervention, nurse-parent dyads demonstrated an increase in adjusted composite shared understanding (36.2% pre-intervention to 48.2% post-intervention, $p=.002$, Table 4). Frequency of shared understanding about the overall medical plan increased between nurse-resident dyads (45.0% to 58.6%, $p<.001$) and between nurses and the sign-out (61.8% to 71.3%, $p=.007$). Frequency of shared understanding about the overnight medical plan also increased between residents and the sign-out (93.1% to 98.9%, $p=.004$). See Table 5 for examples of dyads with and without shared understanding.

Intervention Uptake

Among 268 post-intervention patients with completed surveys, 105 (39.2%) received all 3 intervention components. Nurse-resident unit briefs occurred most frequently (75.4%), followed by family huddles (73.7%). Written family update sheets occurred least frequently (44.4%).

Overall, 96.0% of parents, 98.8% of nurses, and 73.5% of residents rated the huddle as probably or definitely improving communication; 94.8% of parents, 93.1% of nurses, and 55.3% of residents rated the family update sheets as probably or definitely improving communication.

Our subset analysis of post-intervention cases receiving the full intervention found further improvements in experience and shared understanding (Figure 3).

Discussion

We found that certain domains of parent and provider experience and shared understanding improved significantly following implementation of a family-centered, multidisciplinary nighttime communication intervention. Resident and nurse top-box experience scores improved for all 3 constructs (perceived family understanding of overnight plan, communication with families, and communication with other providers), with absolute improvements between 6% and 23%. Parent experience scores showed improvements in fewer areas, improving by 8% in 1 of 4 constructs (experience and communication with nighttime doctors). Improvements were generally greater among the subset of cases that successfully received all 3 intervention components.

Improvements in top-box experience and perceptions of communication were accompanied by improvements in certain elements of independently assessed shared understanding. Although shared understanding did not significantly improve in all areas, parent-nurse composite shared understanding demonstrated a 12% absolute improvement and nurse-resident shared understanding regarding the overall medical plan demonstrated a 14% absolute improvement post-intervention.

Parent experience during hospitalization is an important quality metric,²³ with implications for hospital reimbursements¹⁷ and patient safety.²⁴ Strategies to improve parent experience have had limited success²⁵ and typically have not focused on nighttime care or interprofessional communication. We previously found that parent perception of communication with and among nighttime providers was associated with parent overall experience of care.¹⁵ We also found that parents seemed to report lower experience scores for their nighttime physicians. Therefore, by potentially improving parent perceptions of parent-physician nighttime communication, our intervention may address a critical area affecting overall parent experience. In an environment where experience scores are tied to reimbursements and pay-for-performance, even small increases in experience scores can have substantial impacts on rankings, and therefore on penalties and incentives.

Nighttime presents a distinct opportunity to engage families and nurses in care delivery and communication, which affect safety. However, the family's role in contributing to nighttime patient safety and quality of care is understudied.^{15,26,27} Families often remain at their hospitalized children's bedside, and may be particularly important at night, when staffing may be lower and physicians may be otherwise occupied. Nurses similarly play a particularly active role at night by communicating and providing care to families^{15,28,29} at a time when physicians may have less opportunity for face-to-face communication. Improved nurse-physician communication may also indirectly contribute to improved family shared understanding and therefore safety promotion. For instance, our observed improvements in shared understanding between parents and nurses may partly result from improvements in shared understanding between nurses and residents. For families and nurses to serve as partners in safety, however, they must be actively engaged in care of and communication about patients. Interventions like ours have the potential to support such engagement.

Our intervention was built on evidence-based approaches for standardized communication and inter-professional collaboration. Multimodal communication techniques such as checklists and multidisciplinary briefs⁶ have been associated with improved processes of care,⁵ staff experience,^{30,31} and safety outcomes.³² Structured communication programs such as I-PASS³³ have been associated with reductions in errors and adverse events.² While I-PASS has been shown to improve safety, prior to our study, I-PASS had been primarily applied to handoffs between providers within the same discipline, not to inter-professional communication, FCRs, or family communication. By applying I-PASS principles of structured and bidirectional communication to inter-professional and family-centered written and verbal communication, our intervention sought, in a novel manner, to engage families as members of the care team, an increasingly valued principle.^{34–36}

Our study had several limitations. As with all observational studies, this pre-post intervention study is limited to showing association, not causation. We conducted our study at a tertiary care children's hospital with predominantly English-speaking, White, college-educated, higher income parents, excluding parents of patients in state custody and awaiting psychiatric placement. This limits generalizability, as applying our intervention in other settings with more varied patients and parents from different socioeconomic and cultural backgrounds may require additional considerations. Additionally, though we intentionally targeted our intervention and study on the resident-defined most “active” patients on a unit,

this definition was subject to interpretation and may have varied between residents and nurses. Furthermore, the types of patients who are “active” at our institution may be different than those in smaller, non-tertiary care settings.

Provider ratings of family communication and shared understanding may have been biased by knowledge of whether providers themselves participated in the intervention, leading to respondent bias. However, we supplemented provider-reported data with parent-reported data and independently-assessed shared understanding, which suggested that some objective improvements occurred, particularly in experience. That said, although provider ratings of family understanding of the overnight plan improved post-intervention, neither parent self-reported understanding of the overnight plan nor objectively-assessed parent-nurse or parent-resident shared understanding of the overnight plan improved. This suggests that providers may overestimate family understanding of the overnight plan, when in fact there is room for improvement.

Intervention uptake was also limited. However, although less than half of eligible patients actually received the complete intervention bundle, all patients may have benefitted from certain components of the intervention, such as the generally well-implemented unit-wide nurse-resident briefs. Though we implemented the intervention at night by design, this likely resulted in variable uptake of the intervention given limited nighttime staffing and increased workload. This may have limited uptake of more time-, labor-, and personnel-intensive portions of the intervention (e.g., the family-nurse-resident huddles and family update sheets).

Although top-box scores for nighttime communication significantly improved in several domains, they remained fairly low post-intervention. This may reflect, in part, the intentionally high bar we set for top-box scores (scores of 5 out of 5 for all items comprising a construct), or the difficulties with improving nighttime communication in general given competing priorities and challenges at night. Regardless, there is room for continued improvement.

Our intervention might have been easier to implement during the day, when staff resources are greater and sleep is not a competing demand. Improving afternoon and late day communication, both among providers themselves and between families and providers, may be needed before nighttime communication itself can be fully improved. It is possible that improving communication and safety in the afternoon, when many communication breakdowns begin, could have downstream implications for nighttime providers and families without placing onus on already busy night teams.

Finally, our intervention targeted residents primarily, and nurses secondarily. This may explain why improvements in resident experience appeared greater than improvements in nurse and parent experience. Increased engagement of parents and nurses in communication initiatives throughout the 24-hour cycle of hospitalization may lead to greater improvements in parent experience and objectively rated parent-resident shared understanding. Additionally, elements not included in our intervention, such as health literacy training (e.g.,

including plain language,³⁷ read-back, chunk-and-check³⁸), eliciting family concerns first, and training and empowering families to speak up, may enhance future interventions.^{39,40}

We are currently exploring these possibilities in the ongoing multicenter Patient and Family Centered I-PASS Study, which builds upon the successes and limitations of the present study. In Patient and Family Centered I-PASS, we seek to refine our intervention elements to better integrate with existing daytime and afternoon workflow processes, better engage and train families and nurses, include non-English speakers, and highlight health literacy principles.

Conclusions

Elements of provider and parent experience and shared understanding improved following implementation of a family-centered, multidisciplinary nighttime communication intervention, although uptake varied and continued intervention refinements are needed. Improved family and inter-professional communication has the potential to improve patient and family experience, shared understanding, and ultimately patient safety.

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Abbreviations

CCC	Complex Chronic Conditions
ICD-9-CM	International Classification of Diseases, Ninth Revision, Clinical Modification

What's New

Interventions targeting family-centered and inter-professional communication are understudied, particularly at night. A family-centered, multidisciplinary nighttime communication intervention (nurse-physician brief, family huddle, family update sheet) was associated with some improvements in parent/provider experience and shared understanding, though intervention refinement remains necessary.

Figure 1. Associations between Communication, Experience, Shared Understanding, and Safety
 A conceptual model illustrating the relationships between communication and experience as well as between communication, team shared understanding, situational awareness, and safety.

NIGHTLY FAMILY UPDATE SHEET (EXAMPLE)	
Dear Parent/Guardian: This is an information sheet about your child from your child's doctors. The purpose of this sheet is to help keep you updated about your child's care. Please note that the plan may change.	
Child's Name: Mary Jones	
Reason your child was admitted to the hospital: osteomyelitis (bone infection)	
Date:	6/19/14
Today's updates:	-antibiotic (vancomycin) dose increased -infectious disease doctors consulted -today's blood cultures still negative (not growing bacteria) -no fevers since yesterday morning
Care plan for the next 12 hours:	-draw antibiotic level from blood tonight -draw blood culture if has fever tonight -nothing to eat or drink after midnight tonight -MRI in the morning -wait for infectious disease recommendations (in the morning)
Things to look out for:	-fevers -worse pain or swelling -low blood pressures -positive blood culture

Figure 2. Written Family Update Sheet

Part of the nighttime communication intervention bundle, the nightly family update sheet was a handwritten or written tool completed by daytime senior-residents at the end of their shifts and distributed to families by the night resident during the evening family huddles.

Figure 3. Provider and Parent Improvements in Top-Box Experience Construct Scores and Shared Understanding Following Implementation of a Nighttime Communication Bundle (Pre-Intervention, Post-Intervention, and Complete Intervention Subset^a)

^aSubset of post-intervention cases receiving all 3 intervention components (nurse-resident brief, family-centered huddle, written family update sheet); Based on adjusted repeated measures analysis for senior and nurse data and adjusted logistic regression for parent data; Adjusted p-values: * $<.05$, ** $<.01$, *** $.001$ (vs. pre-intervention)

Table 1
Parent, Patient, and Provider Characteristics

Characteristics, n (%)	Pre-Intervention n (%)	Post-Intervention n (%)	p-value
Parent	n=281	n=183	
Age, y, mean (SD) range	37 (8.8) 18-64	37 (9.1) 19-71	.92
Missing	13	9	
Relationship			
Parent	265 (96)	176 (98.3)	
Other ^a	11 (4)	3 (1.7)	.25
Missing	5	4	
Sex			
Female	217 (78.6)	143 (80.3)	
Male	59 (21.4)	35 (19.7)	.72
Missing	5	5	
Race/Ethnicity			
Hispanic or Latino	34 (12.4)	31 (17.4)	
Asian, non-Hispanic	16 (5.8)	11 (6.2)	
Black, non-Hispanic	38 (13.8)	16 (9.0)	.38
White, non-Hispanic	167 (60.7)	109 (61.2)	
Other Race, non-Hispanic	20 (7.3)	11 (6.2)	
Missing	6	5	
Education			
Less than high school degree	9 (3.3)	6 (3.4)	
High school degree or GED	48 (17.5)	25 (14.4)	
Some college to 4-year degree	135 (49.3)	89 (51.1)	.85
More than 4-year college degree	82 (29.9)	54 (31.0)	
Missing	7	9	
Income			
<\$29,999	63 (26.4)	40 (25.8)	
\$30,000-\$49,999	23 (9.6)	22 (14.2)	
\$50,000-\$74,999	20 (8.4)	19 (12.3)	.16
\$75,000-\$99,999	18 (7.5)	18 (11.6)	
\$100,000-\$ 149,999	46 (19.2)	22 (14.2)	
>\$150,000	69 (28.9)	34 (21.9)	
Missing	42	28	
Patient	n=326	n=268	
Age, y, mean (SD) range [†]	6.7 (5.8) .01-17.8	6.3 (5.8) .01-17.97	.31
Sex			
Female	161 (49.4)	114 (42.5)	.10

Characteristics, n (%)	Pre-Intervention n (%)	Post-Intervention n (%)	p-value
Male	165 (50.6)	155 (57.5)	
Race/Ethnicity			
Hispanic or Latino	29 (9.6)	29 (11.8)	
Asian, Non-Hispanic	15 (5)	10 (4.1)	
Black, Non-Hispanic	43 (14.2)	38 (15.4)	.63
White, Non-Hispanic	178 (58.8)	131 (53.3)	
Other Race, Non-Hispanic	38 (12.5)	38 (15.4)	
Missing	23	22	
Insurance			
Public	133 (42.2)	114 (42.9)	
Private	182 (57.8)	152 (57.1)	.93
Missing	11	2	
CCC Count			
0	244 (74.8)	207 (77.2)	
1	70 (21.5)	49 (18.3)	.53
2	9 (2.8)	11 (4.1)	
3	3 (0.9)	1 (0.4)	
CCC Type			
Neuromuscular	7 (2.2)	6 (2.2)	1.0
Cardiovascular	15 (4.6)	16 (6)	.47
Respiratory	9 (2.8)	2 (0.8)	.12
Renal	10 (3.1)	7 (2.6)	.81
Gastrointestinal	11 (3.4)	3 (1.1)	.10
Hematologic/Immunologic	25 (7.7)	16 (6)	.52
Metabolic	6 (1.8)	14 (5.2)	.04*
Malignancy	4 (1.2)	5 (1.9)	.74
Other	12 (3.7)	5 (1.9)	.22
Case complexity ^{†,b}			
Simple	133 (42)	77 (30.6)	
Intermediate	124 (39.1)	97 (38.5)	.001**
Complex	60 (18.9)	78 (31)	
Length of stay, d, mean (SD) [†]	4.3 (5.5)	6.2 (9.6)	<.001***
Nurse[‡]	n=106	n=123	
Age, y, mean (SD) range [‡]	32.7 (6.7) 24-56	32.2 (7.1) 22-53	.31
Missing	3	3	
Sex [‡]			
Female	101 (97.1)	118 (98.3)	.41
Male	3 (2.9)	2 (1.7)	

Characteristics, n (%)	Pre-Intervention n (%)	Post-Intervention n (%)	p-value
Missing	2	3	
Race/Ethnicity [‡]			
Hispanic or Latino	4 (3.9)	6 (5)	.39
Asian, Non-Hispanic	0 (0)	0 (0)	
Black, Non-Hispanic	0 (0)	0 (0)	
White, Non-Hispanic	90 (86.5)	105 (87.5)	
Other Race, Non-Hispanic	10 (9.6)	9 (7.5)	
Missing	2	3	
Staff Level [‡]			
Staff Nurse 1	73 (70.2)	90 (76.9)	.14
Staff Nurse 2	30 (28.8)	25 (21.4)	
Staff Nurse 3	1 (1.0)	2 (1.7)	
Missing	2	6	
Resident[‡]	n=29 residents	n= 26 residents	
Age, y, mean (SD) range [‡]	29.9 (1.8) 28-33	29.9 (2.0) 26-34	.90
Sex [‡]			
Female	19 (65.5)	18 (69.2)	.76
Male	10 (34.5)	8 (30.8)	
Race/Ethnicity [‡]			
Hispanic or Latino	1 (3.5)	1 (3.85)	.71
Asian, Non-Hispanic	5 (17.2)	1 (3.85)	
Black, Non-Hispanic	0 (0)	1 (3.85)	
White, Non-Hispanic	22 (75.9)	23 (88.45)	
Other Race, Non-Hispanic	1 (3.5)	0 (0)	
Residency Training Level [‡]			
2 nd year	3 (10.3)	5 (19.2)	.07
3 rd year	24 (82.8)	14 (53.9)	
4 th year	2 (6.9)	7 (26.9)	

Based on Fisher's test,

[‡] Wilcoxon rank sum test, or

[‡] bivariate repeated measures analysis; p-values:

* <.05;

** <.01;

*** <.001 (compared to pre-intervention)

^a Other relations include grandparents (n=8), guardians (n=4), other (n=2)

^b Raters reviewed each patient's status and medical plan and provided a summary case complexity rating on a 3-point scale (1=simple, 2=intermediate, 3=complex)

Table 2
Unadjusted Mean Parent and Provider Experience Scores, by Item

Item #	Item	Pre-Intervention Mean (SD)	Post-Intervention Mean (SD)	p-value
Parent-Reported		n=281	n=183	
4	I was updated enough about what happened with my child today.	4.32 (0.95)	4.34 (0.89)	.78
5	I was told enough about the overnight medical plan for my child.	4.30 (0.88)	4.33 (0.90)	.72
6	I completely understand the overnight medical plan for my child.	4.34 (0.89)	4.33 (0.94)	.89
7 ^b	I agree with the overnight medical plan for my child.	4.63 (0.68)	4.58 (0.79)	.52
8	I was updated enough about what symptoms the medical staff will be looking out for with my child overnight.	4.32 (0.88)	4.36 (0.87)	.58
9	I was updated enough about what symptoms I should look out for with my child overnight.	3.92 (1.12)	4.09 (1.05)	.13
10	I had enough of a chance to ask my child's nighttime doctors questions about my child.	4.16 (0.96)	4.39 (0.86)	.01 *
11	My child's nighttime doctors and I have the same understanding about my child's medical plan for the night.	4.29 (0.83)	4.34 (0.85)	.53
12 ^c	How would you rate the quality of communication you had with your nighttime doctors?	4.07 (1.06)	4.30 (0.98)	.02 *
13 ^c	How well did you child's daytime and nighttime doctors coordinate with each other?	4.18 (0.91)	4.17 (0.90)	.99
14	My child's nighttime doctors think of me as an important part of the healthcare team caring for my child.	4.25 (0.83)	4.31 (0.76)	.38
15	I had enough of a chance to ask my child's nighttime nurses questions about my child.	4.51 (0.71)	4.56 (0.66)	.45
16	My child's nighttime nurses and I have the same understanding about my child's medical plan for the night.	4.49 (0.72)	4.48 (0.67)	.95
17 ^c	How would you rate the quality of communication you had with your nighttime nurses?	4.41 (0.83)	4.46 (0.78)	.48
18 ^c	How well did your child's daytime and nighttime nurses coordinate with each other?	4.26 (0.87)	4.31 (0.84)	.51
19	My child's nighttime nurses think of me as an important part of the healthcare team caring for my child.	4.41 (0.75)	4.48 (0.63)	.27
20	My child's nighttime doctors and nurses have the same understanding as one another about my child's medical plan for the night.	4.34 (0.67)	4.44 (0.65)	.13
Resident-Reported		n=301	n=218	
4	The family was told enough about the overnight medical plan for this patient.	3.96 (0.65)	4.29 (0.72)	.002 **
5	The family completely understood the overnight medical plan for this patient.	3.88 (0.68)	4.28 (0.69)	<.001 ***
6 ^b	The family agreed with the overnight medical plan for this patient.	4.27 (0.72)	4.58 (0.65)	.003 **
7	The family and I have the same understanding of the overnight medical plan for this patient.	3.93 (0.67)	4.32 (0.64)	<.001 ***

Item #	Item	Pre-Intervention Mean (SD)	Post-Intervention Mean (SD)	p-value
8	The patient's family had enough of a chance to ask me questions about their child.	3.72 (0.99)	4.28 (0.80)	<.001 ***
9	Other nighttime providers and I have the same understanding of the overnight medical plan for this patient.	4.28 (0.62)	4.44 (0.57)	.11
10 ^c	How well did this patient's day and night teams of care providers coordinate with each other?	4.18 (0.71)	4.29 (0.66)	.30
11	I feel like I am valued as an important part of the healthcare team caring for this child.	4.17 (0.56)	4.37 (0.59)	.046 *
Nurse-Reported		n=292	n=242	
4	The family was told enough about the overnight medical plan for this patient.	4.01 (0.91)	4.26 (0.78)	.003 **
5	The family completely understood the overnight medical plan for this patient.	3.98 (0.92)	4.21 (0.80)	.006 **
6 ^b	The family agreed with the overnight medical plan for this patient.	4.55 (0.66)	4.64 (0.61)	.19
7	The family and I have the same understanding of the overnight medical plan for this patient.	4.31 (0.59)	4.40 (0.59)	.09
8	The patient's family had enough of a chance to ask me questions about their child.	4.39 (0.56)	4.47 (0.61)	.20
9	Other nighttime providers and I have the same understanding of the overnight medical plan for this patient.	4.20 (0.61)	4.31 (0.61)	.05
10 ^c	How well did this patient's day and night teams of care providers coordinate with each other?	3.86 (0.78)	3.90 (0.83)	.48
11	I feel like I am valued as an important part of the healthcare team caring for this child.	4.18 (0.54)	4.24 (0.60)	.30

Based on t-tests for parents and bivariate repeated measures regression for residents and nurses

p-values:

*
<.05;

**
<.01;

<.001 (compared to pre-intervention)

Items rated on 5-point Likert scales for agreement ("strongly disagree" to "strongly agree"),

^b extent ("not at all" to "completely"), or

^c quality ("poor" to "excellent")

Table 3
Top-Box^a Parent and Provider Experience Scores by Construct

		Pre-Intervention n (%)	Post-Intervention n (%)	Unadjusted p-value	Adjusted ^b p-value
Parent-Reported					
Understanding of the Overnight Medical Plan (Q4-9)	n=460	65 (23.3)	43 (23.8)	.91	.48
Experience and Communication with Nighttime Doctors (Q10, 12-14)	n=449	65 (23.6)	56 (31.5)	.07	.03 *
Experience and Communication with Nighttime Nurses (Q15, 17-19)	n=456	103 (37.3)	66 (36.7)	.89	.38
Shared Understanding with and between Providers (Q11, 16, 20)	n=456	92 (33.4)	69 (38.1)	.31	.19
Resident-Reported					
Family Understanding of the Overnight Medical Plan (Q4-6)	n=501	42 (14.4)	78 (37.1)	.007 **	.004 **
Communication and Shared Understanding with Families (Q7-8)	n=498	48 (16.5)	73 (35.1)	.02 *	.01 *
Experience, Communication, and Shared Understanding with other Providers (Q9-11)	n=515	61 (20.3)	75 (35.0)	.08	.02 *
Nurse-Reported					
Family Understanding of the Overnight Medical Plan (Q4-6)	n=524	55 (18.9)	78 (33.5)	<.001 ***	<.001 ***
Communication and Shared Understanding with Families (Q7-8)	n=523	94 (32.2)	88 (37.9)	.28	.02 *
Experience, Communication, and Shared Understanding with other Providers (Q9-11)	n=529	43 (14.7)	51 (21.5)	.03 *	.02 *

Based on linear regression for parents and repeated measures regression for nurses and residents, p-values:

* <.05;

** <.01;

*** <.001 (compared to pre-intervention)

^aTop-box responses refer to the most positive responses on a Likert scale (e.g., “excellent”). Responses were coded onto a 5-point scale for analysis (e.g., “excellent”=score of 5). Participants were considered to have “top-box” overall experience for a particular construct only if they scored 5 out of 5 for all items in the construct. Questions (from Table 2) comprising individual constructs are denoted parenthetically; Cronbach’s α > .78 for all constructs.

^bAdjusted for patient age, patient gender, patient length of stay, case complexity, nurse staff level, physician residency training level (characteristics varying between pre- and post-intervention cohorts with a threshold of p .1 in bivariate analysis, see Table 1).

Table 4
Shared Understanding, Pre-Intervention vs. Post-Intervention

	Pre-Intervention n (%)	Post-Intervention n (%)	Unadjusted p-value	Adjusted ^a p-value
Parent-Resident				
Reason for admission	178 (66.9)	106 (70.7)	.47	.09
Overall medical plan	112 (42.1)	62 (41.3)	.97	.63
Overnight medical plan	204 (76.7)	117 (78.0)	.71	.53
Composite shared understanding (n=416)	125 (47.0)	71 (47.3)	.82	.53
Nurse-Resident				
Reason for admission	188 (67.1)	136 (71.2)	.28	.02 *
Overall medical plan	126 (45.0)	112 (58.6)	.004 **	<.001 **
Overnight medical plan	247 (88.2)	165 (86.4)	.60	.84
Composite shared understanding (n=471)	137 (48.9)	105 (55.0)	.17	.08
Parent-Nurse				
Reason for admission	160 (61.5)	111 (66.9)	.24	.16
Overall medical plan	95 (36.5)	66 (39.8)	.52	.62
Overnight medical plan	206 (79.2)	127 (76.5)	.52	.93
Composite shared understanding (n=426)	94 (36.2)	80 (48.2)	.01 *	.002 **
Resident Sign-out				
Reason for admission	215 (92.7)	166 (89.2)	.29	.52
Overall medical plan	166 (71.6)	131 (70.4)	.92	.87
Overnight medical plan	216 (93.1)	184 (98.9)	.008 **	.004 **
Composite shared understanding (n=418)	197 (84.9)	147 (79.0)	.14	.07
Nurse Sign-out				
Reason for admission	187 (83.1)	175 (83.7)	.81	.14
Overall medical plan	139 (61.8)	149 (71.3)	.04 *	.007 **
Overnight medical plan	209 (92.9)	199 (95.2)	.34	.24
Composite shared understanding (n=434)	162 (72.0)	159 (76.1)	.31	.08
Parent Sign-out				
Reason for admission	166 (79.8)	138 (84.1)	.28	.06
Overall medical plan	101 (48.6)	82 (50.0)	.78	.44
Overnight medical plan	175 (84.1)	143 (87.2)	.41	.34
Composite shared understanding (n=372)	128 (61.5)	104 (63.4)	.71	.22

Percent of cases with shared understanding pre- vs. post-intervention. Cases were considered to have shared understanding if they had an agreement score 2 (“somewhat” or “mostly/completely”) out of 3. Shared understanding scores are included for individual domains ([a] reason for admission, [b] overall medical plan, [c] overnight medical plan). Composite shared understanding (sum of scores for domains [a], [b], and [c], with scores 6 out of 9 considered as having shared understanding) is also represented.

p-value:

*
<.05;

**
<.01;

<.001 (compared to pre-intervention); Analysis completed using Fisher's exact test or logistic regression for parent sign-out and repeated measures regression for all other pairings listed above.

^a Adjusted for patient age, patient gender, patient LOS, nurse staff level, physician residency training level, case complexity (characteristics varying between pre- and post-intervention cohorts with a threshold of p .1 in bivariate analysis, see Table 1).

Table 5
Examples of Cases Rated as (A) Exhibiting and (B) Lacking Shared Understanding

Subject Responses			
	Resident	Nurse	Parent
(A) Shared Understanding			
Reason for admission	Cellulitis	Cellulitis	Cellulitis infection
Overall medical plan	Treatment of cellulitis - antibiotics	IV antibiotics until cellulitis improves	Give IV antibiotics to treat infection, awaiting results of blood stream
Overnight medical plan	Antibiotics	Antibiotics Pain meds Monitor for allergic reaction	Antibiotics Pain meds Z-pack and home meds Monitor for allergic reactions to IV antibiotics Awaiting blood cultures
(B) Lack of Shared Understanding			
Reason for admission	Evaluation of fever, chest infiltrate	IV fluids IV antibiotics	Has a pulmonary problem – was not feeling good, took blood, chest x-ray, and didn't look good so they admitted her
Overall medical plan	IV antibiotics Lab monitoring	Treat possible PNA Reinforce compliance	To make her cold go away and try different medications
Overnight medical plan	Antibiotics Steroids Send blood to lab Place an IV Monitor for respiratory distress	Antibiotics IV fluids Place an IV	Pain meds Steroids IV fluids Place an IV