

# BEFORE I FORGET: HOW CLINICIANS COPE WITH UNCERTAINTY THROUGH ICU SIGN-OUTS

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Transitions between shifts in the intensive care unit (ICU) create potential gaps in the continuity of care, and practitioners necessarily rely on distributed cognition to prevent the formation of gaps during work-cycle shift changes. The complexity and uncertainty of each ICU patient's condition require efficient communication between practitioners during transfers between departments or when cycling work through shifts. This study observed twelve unit-level exchanges among six clinicians handing off a 33-bed PICU and step-down unit, then examined them using conversation analysis.

Our research shows that pediatric ICU fellow sign-outs demonstrate high context sensitivity, compact reference, gestures, and stylized expressions. We find that sign outs account for both what is known and what is not known about a patient's condition, and to assess expectations for the oncoming shift. Uncertainty about patient condition influences handoff content and form. Clinicians change the amount time that they allocate to handoffs based on other aspects of work load, such as rounds or procedures. Clinicians apportion time to discuss individual patients according to the perceived severity and stability of each patient's condition.

Expertise in hand-off communications depends on the ability to prioritize relevant information and to transfer insights effectively. Relevant, efficient hand-offs significantly affect the ability of clinicians to provide care at the unit level, within and between departments, and across specialties such as intensivists, nurse anesthetists, and anesthesia technicians. Even though they affect patient care quality and continuity, sign outs are not taught but are instead learned on the job. Formal study of, and training in, the conduct of sign outs may benefit both care providers and patients alike.

## INTRODUCTION

The coordination of acute care clinical work, authority, and responsibility are critical to patient care, particularly in the intensive care unit (ICU). Transitions between shifts in the ICU, which typically occur twice a day, create potential gaps in the continuity of care (Cook, Render, Woods, 2000). Practitioners necessarily rely on between shift patient sign-outs to distribute cognition (Hutchins, 1995) in order to prevent the formation of gaps during transfers between departments or during work-cycle shift changes. The complexity of medical interventions as well as the complexity, uncertainty and rapid changes in patient condition make effective sign outs both essential and difficult.

Our ongoing research into the coordination of clinical work across shift boundaries examines the nature of scheduled exchanges of authority and responsibility (Woods, 1993) in order to improve clinician ability to

perform sign outs and to improve the continuity of patient care. The research we report in this paper shows that clinicians manage transitions between shifts using verbal hand-offs, or "sign outs," to coordinate clinical work, authority, and responsibility.

## BACKGROUND

U.S. hospitals reduced resident work hours to a maximum of 80 per week (ACGME, 2002) in response to patient safety recommendations in the 1999 Institute of Medicine report (IOM, 2000). While the intention was to reduce fatigue among resident physicians, one of the mandate's effects was to increase the need for residents from other units to replace, or "cross cover," residents who had reached their hourly maximum. The increased frequency of patient care turnovers that resulted made effective sign outs more crucial to patient care in teaching hospitals.

## METHODS

ICUs are hospital units that are equipped and staffed to provide specialized care for the most critically ill patients. Pediatric intensive care treats children, although patient ages in the unit can range from newborn to early twenties. Typical conditions requiring treatment in the PICU include congenital abnormalities, traumatic injuries, and illnesses such as asthma and epilepsy. Patients' conditions are fragile, unstable, and can deteriorate rapidly. It is common for these patients to need intravenous (IV) medications or ventilator-assisted breathing to support life. The severity of patients' conditions in ICUs requires a practitioner to be present in the unit at all times. Hand-offs are necessary in an ICU because the length of a patient's stay often exceeds the amount of time one individual can offer. Each hand-off conveys complex information about extremely ill patients and that information may be misrepresented, forgotten, misunderstood, or misreported. The complex nature of interventions and the possibility of rapid deterioration in patient conditions make communication between caregivers essential in order to ensure continuous, efficient, and effective patient care.

The nature of what occurs during sign-out conversations can be understood through the work of H.P. Grice (1913-1988). Grice's writings on the philosophy of language in the 1970's and 80's changed the debate over the nature of meaning from linguistic representation to mental representation. His "Cooperative Principle" (Grice, 1975:45-46) describes general features of conversation that participants are expected to observe: "Make your conversational contribution such as is required, at the stage at which it occurs, by the accepted purpose or direction of the talk exchange in which you are engaged." Those who engage in conversation and who follow four categories, or maxims, would produce results that reflect the Cooperative Principle.

*Quantity:* Make your contribution as informative as is required (for the current purposes of the exchange). Do not make your contribution more informative than is required.

*Quality:* Do not say what you believe to be false. Do not say that for which you lack evidence

*Relation:* Be relevant

*Manner:* Avoid obscurity of expression. Avoid ambiguity. Be brief (avoid unnecessary prolixity). Be orderly.

We sought to determine whether sign-out conversations reflect Grice's maxims, and to accurately describe sign-out content and form.

The project employed three methods to conduct research: direct observation, cognitive analysis, and conversation analysis. (Nemeth, 2004)

### Direct Observation

Our research analyzed between-shift hand-offs that were conducted among five intensivists fellows over six weeks in the PICU of a major urban teaching hospital. Fellows are medical doctors who have completed residency and are performing further training in a specialty such as pediatric intensive care.

After obtaining informed consent according to institutional review board requirements, we observed twelve unit-level exchanges as the fellows handed off the 13-bed PICU and nearby 20-bed Step-Down Unit (SDU). Exchanges were conducted between an off-going and on-coming fellow during the morning (7:30AM) or afternoon (4:30 PM) shift change. One of the authors (MB) participated in the exchanges as part of the routine clinical rotation and made audio recordings of each discussion which were then transcribed.

We used two methods to analyze the hand-off data: cognitive analysis through process tracing (Woods, 1993) and conversation analysis (Drew and Heritage, 1992).

### Cognitive Analysis

Two of the authors (MB and CN) reviewed audio recordings of each exchange while seated at a workstation that was equipped with an audio cassette player, microphones, and a video camera pointed down at the desk surface. They played the recording of each hand-off, discussed what occurred during the exchange, and moved a token across a floor plan diagram of the PICU to indicate where the fellows were located in the unit. The sessions traced the process of unit-level review between the off-going and on-coming fellow. The process enabled MB to provide context, and describe physical position and gestures that were made during the sign-outs. This enabled CN to pose naïve questions that elicited further reflection. Videotapes of the analyses captured the original sign-off audio, the commentary about the exchange, and the image of the floor plan with token.

### Conversation Analysis

The hand-off audio recordings were digitized by connecting the field cassette recorder to a Dell personal computer and using the Sound Recorder utility program to convert analog recordings to digital files. Initial review of transcripts accounted for the content, speaker, and length of each exchange. Another team

member (JK) used Computerized Language Analysis (CLAN) software to analyze the digital recordings. CLAN's voiceprint display made it possible to specify the timing of conversational elements during each exchange to the level of fractions of a second, revealing utterance duration, overlaps, and pauses. Results of the analysis could then be represented in the form of annotated transcripts and diagrams such as timelines.

We also figured correlations (Pearson  $r$ ) between the length of time spent discussing each patient and the patient's degree of acuity (the amount of care required based on whether a patient had a cardiac condition, was on a ventilator, and how many infusion devices were in use).

## RESULTS

Work-cycle characteristics place a high premium on efficient communications between practitioners, and we found that clinicians do meet this need through communications with characteristics that reflect Grice's maxims. The following examples demonstrate how they make this happen.

### Quantity

The fellows used compact reference to manage quantity. One sign-out devoted the majority of time to discuss the condition and prognosis for one very sick patient. The off-going fellow quickly referred to the remaining patients and summarized the condition of each as:

"Fine... fine.... fine...."

This is evidence that a sign-out is not merely a summary of vital signs that are fixed in content and duration, but rather a conversation where length and density depend on population size and acuity, and varies from extended monologue summaries to casual interchanges.

### Relation

Fellows used verbal and, at times, physical gestures to convey information efficiently. For example, references were made to patients elsewhere on the unit, on other units, and who were no longer on the unit but typified the condition or circumstance that was being discussed.

R: before I forget, this kid needs an echo, this kid needs an echo [pointing to kid across the room], when J. asks. Vital signs are stable, everything is ok, I did an EKG

### Manner

Fellows employed highly encoded language, cues, and terms that facilitated their interchanges by using stylized expressions (*e.g.*, "crump") and protocols rather than

plain language.

M: Yeah, something like that. Doing ok, uhmm, really no significant problems. Lactate had been rising a little bit to like 2.7 but stabilizing there. The only thing was that uhmm platelets uhmm they are accepting lower platelet counts of 50,000 but we've had to transfuse a couple times for platelets like 11 or 14,000

### Quality

Clinicians protected truth through high sensitivity to the patient context. In this example, an RN interrupts a sign-out when she overhears information that is not accurate.

H: What

N: You know what that neurology resident's name is

R: [D3]

H: [D3] [the fellow?]

?: [( ?? )]

H: Yeah

N: Oh she's a fellow

H: Yeah

N: Already good I'll have this (for you [tomorrow])

H: [He thinks ] you stole the grey chart

: (0.7)

?: She stole the gray chart

M: ((Laugh))

H: That's not okay (1.2) D3

?: She won't be on [yet]

M: [No] she might be (0.6) in the yellow page book

R: Yellow, yellow book

M: Which I have on me

: (2.9)

H: So since he got back from the second procedure which was like one thirty in the morning...

Each instance shows that sign-outs are as diverse, complex and variable as the work environment that they seek to manage.

## DISCUSSION

We expected that the greatest amount of attention (expressed in the length of time that care providers spent discussing an individual's condition) would be paid to patients who required the greatest amount of care. If this was true, patients who were ventilator-dependent, required cardiac care, or required multiple intravenous medications would receive the greatest amount of attention. However, correlations between discussion time and care demand were not significant. Further analysis of the transcripts revealed that it is uncertainty about patient condition that influences handoff content and form.

Sign outs are primarily used to account for what is known and not known about a patient's condition, and how both are likely to play out through the oncoming

shift. Analysis of the hand-offs also showed that clinicians vary the content, form, and structure (strategy) of their hand-offs as a way to cope with the demands of their uncertain, complex work setting.

Hand-offs are not reports, but are instead conversations. Expertise in hand-off communications depends on the ability to prioritize relevant information and transfer insights effectively. Clinicians use variations of monologue and dialogue to transfer information at a high level. Both forms demonstrate the same variable, emotion-laden, dynamic, and complex traits as the work domain that they are used to manage. (Conant and Ashby, 1970) We find that sign-outs account for both what is known and what is not known about a patient's condition, and to assess expectations for the oncoming shift. The fresh perspective of the oncoming individual can increase the likelihood that misperceptions due to fixation bias will be detected. (Patterson, *et. al.*, 2004) Uncertainty about patient condition influences handoff content and form. Clinicians change the amount time that they allocate to handoffs based on other aspects of work load, such as rounds or procedures. Clinicians apportion time to discuss individual patients according to the perceived severity and stability of each patient's condition.

Even though they affect patient care quality and continuity, sign-outs are not taught but are instead learned on the job. Formulaic "canned" approaches to handling sign-outs are a poor match to deal with the uncertainty and complexity of the critical care environment. Clinicians create hand-offs that are unique in content and form in order to manage PICU circumstances. Findings from this study and further analyses can be used to develop training in hand-offs for junior clinicians such as nurses and residents so that they can become more proficient, sooner.

## CONCLUSION

Our research has shown that pediatric ICU fellow handoff content varies but exchanges conform to Grice's maxims by demonstrating high context sensitivity, compact reference, gestures, and stylized expressions. The conventional view considers hand-offs to be data-focused, simply structured, uniform in content, and singular in form. By contrast, our data show that hand-offs focus on what is uncertain, are complex and flexible in their structure, necessarily variable in their content, and take multiple forms. This is because patient progress is complex, unpredictable, and does not follow a direct course of improvement. Relevant, efficient hand-offs significantly affect the ability of clinicians to provide care at the unit level, within and

between departments, and across specialties. Improvement their ability to perform this vital task through training promises to benefit both care providers and patients alike.

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