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Working Off the Record: Physicians' and Nurses' Transformations of Electronic Patient Record-Based Patient Information

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Abstract

Background

Electronic patient records (EPRs) are increasingly being used in health care, but little is known about how EPR-based patient information is used in daily care activities, nor about its potential influence on novice training.

Method

Seventy-two physicians and nurses participated in an eight-month study on a single pediatric ward. Eighty hours of nonparticipant observations and 20 interviews were conducted. Data were

analyzed using constructivist grounded theory and visual rhetoric.

Results

Three main features of participant interactions with EPR-based information were identified: (1) EPR-based information was routinely transformed into paper documents; (2) these transformations were organized by profession-specific guiding principles; and (3) transformation strategies were learned through an informal curriculum.

Conclusions

This study describes how and why health care professionals work around EPR-based patient information, and suggests that an EPR's visual organization may be incompatible with professional activities. The study addresses the socializing implications of these activities, and highlights their educational potential.

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Electronic patient records (EPRs) are increasingly being used in medical centers to replace paper-based patient records—and for good reasons. EPRs are acclaimed for providing decision support,¹ reducing medication errors,² improving adherence to clinical practice guidelines,³ and improving the delivery of preventative health services.⁴ To the extent that they fulfill these functions, EPRs can potentially alter and improve patient care. This potential, of course, is related to health care professionals' ability to use EPRs effectively. Although research has investigated the impact of EPRs on medical record-keeping practices⁵⁻⁷ and office work flows,⁸ we know little about how health care professionals use EPR-based information in daily care activities. How does the EPR structure clinical work? How does it interact with other forms of communication, such as oral and paper-based discourse? And how, in a training setting, does it shape novice learning and professional identity formation?

Our study explored how health care team members, both novice and expert, interact with and employ information from an EPR system. In particular, we sought to describe how EPR discourse shapes clinical work.

Method

This study is part of a larger investigation into the relationship between EPRs and the communicative and professional work done by health care practitioners in a multimodal health care setting. Although the original study investigated the work of several health care professionals (including physicians, nurses, social workers, dieticians, and physiotherapists), this paper reports exclusively on physicians and nurses. The study received Research Ethics Approval.

Setting

The study occurred over an eight-month period at a Canadian, urban, pediatric teaching hospital, on a single inpatient ward. This ward, like the hospital generally, carried out its communications via various media including paper-based documents, oral communications, and an EPR. However, most daily activities,

such as patient data retrieval and pharmaceutical order entry, could only be completed through the EPR.

Participants

All 14 physicians on the ward consented to participate. Due to ward rotation scheduling during the study period, 9 physicians actively participated. Sixty-two nurses consented and participated to varying degrees. Only 3 of the nurses working on the ward declined participation. Participants represented a range of professional experience, from residents on their first rotation and novice nurses working their first hospital shift, to senior staff physicians and nurse ward leaders. A breadth of computer expertise was represented ranging from novice to expert, evaluated by self-report and observer assessment.

Data collection

Two data sources were collected: field observations and interviews.

Field observations. Eighty hours of nonparticipant observations were conducted, resulting in 191 pages of field notes recording the content and context of conversations, the participants'

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interactions with various forms of communication, and the intended audience for relevant comments. A theoretical sampling⁹ method was used, whereby analysis was conducted during data collection, emerging theoretical categories were identified, and then recursive delimited observations were conducted to identify theoretical boundaries and the fit and relevance of these categories. This method was used until theme saturation¹⁰ was achieved, in which all new data were fitting into the categories already created. Observer effect was minimized by the observer's routine presence for long periods of time in the research setting¹¹ and by her efforts (through similar dress, age and compartment) to blend into the participant group.¹² Field notes were rendered anonymous.

Interviews. Semistructured interviews were conducted with each of the 9 physician participants and with 11 nurses, purposefully sampled¹³ to include a breadth of professional nursing experience (novice to expert), until theme saturation¹⁰ occurred. Interviews were conducted based on participant availability resulting in a convenience ordering. Interviews began in the third month of the study and were distributed throughout the remainder of the study. The interviews ranged between 45–90 minutes in length, and resulted in 202 pages of anonymized transcription. The interview script was developed during observational data collection and analysis in order to explore emergent trends. Open-ended questions probed users' understandings of their use of electronic and paper records and, more broadly, their perceptions of the impact of record use on their work practices.

Data analysis

Using a constructivist grounded theory approach,¹⁴ one researcher read all observation and interview transcripts recursively. Preliminary data analysis occurred in conjunction with data collection in an iterative and constant comparative process.⁹ As the researcher identified emergent themes, exemplary portions of the data set were discussed with three additional researchers, to refine, challenge, and elaborate the developing thematic structure.¹⁰ Confirmability¹⁵ was ensured by maintaining an audit trail of all analytical memos, minutes of the meetings, and

revisions to the coding structure. One coder applied the final coding structure to the complete data set, using qualitative data analysis software (NUD*IST – N6) in order to facilitate cross-referencing.¹⁶

Results

Analysis revealed three main features of participants' interactions with the EPR-based patient information. First, participants persistently transformed EPR information into paper-based notes. For both the physician and nursing participants, these transformations took two forms: complete overhauls or marginalia additions. Second, these changes were organized by two guiding principles: what the health care provider needed "to know" and what s/he needed "to do." These principles were applied differently in medicine and nursing transformations. Third, the knowledge of what, when, and how to transform patient data was part of the informal curriculum for physicians and nurses, an expertise that novices acquired through modeling and mimicry.

Observations established that study participants, both physicians and nurses, routinely transformed EPR-based information into paper-based texts for use in daily work. For the physicians, this process occurred at the outset of their shift when they used the EPR to access summary information for each patient under their care. This summary, called a Medical Summary (MS), visually presented patient data in separate categories, organized in a predetermined sequential ordering (e.g., Patient History, Nutrition Orders, Fluids, IVs). While each physician started with the EPR-based MS, they immediately printed out paper copies of each patient's MS. These paper-based MSs were exact versions of the EPR-documents, with the same predetermined categories, displayed in sequential order. With the MS print-out in hand, the physician began manually rewriting the patient information, transforming it into a different visual organization. It was these reorganized, hand-written documents that the physicians used throughout their daily care activities.

Similarly, all nurses transformed EPR-based information into paper-based documents at the beginning of every shift. Each observed nurse started their

workday by accessing an EPR-based patient summary, called a Patient Care Summary (PCS), for the patients under their care during that shift. The PCS, like the physicians' MS, visually presented data in a predetermined, sequential ordering of categories of patient information (e.g., Allergies, Alerts, Pre-Existing Conditions). The nurses started their day by collecting printed versions of patient PCSs, which were exact reproductions of the EPR-based PCS and followed the same visual structure and information ordering. From these paper-based PCSs, the nurses began rewriting the patient data, arranging them into other visual designs. Each nurse thus transformed the paper-based PCSs, creating hand-written documents for use throughout their shift.

These handmade transformations appeared in two formats: complete overhauls or marginalia additions. Complete overhauls were single-page transformations of summary data that participants created on separate pieces of paper. Participants read the MS or PCS and rewrote pertinent information into this new document. Marginalia additions were transformations of patient summary data that were rewritten in the margins of the MS or PCS itself. While reading the printed MS or PCS, participants would manually transfer patient data items from within the printout into its margins. Physicians consistently restricted these marginalia additions to the first page of the MS, as did most nurses. These transformations, both overhauls and marginalia, became the visually concise documents that participants relied on throughout their work day. For instance, nurses consistently referred to and updated their transformed documents as they moved through their tasks. The critical reliance on these documents was particularly evident if they were misplaced. For instance, when a senior physician momentarily misplaced his complete overhaul, this was cause for alarm:

- Staff A: "Oh great! I lost my sheet!!"
- Staff begins patting down his pant pockets. There is a sense of urgency in his action. He checks both his front pant pockets, then his back pocket. There are a number of small notes in each of these and he is anxiously looking through those notes.

- Resident C begins searching through the papers on the counter where they are standing.
- Staff, pats the front breast pocket of his shirt and finds his complete overhaul: (sighs) “Oh, good!” (Observation #0517)

In each profession, guiding principles shaped these transformations. For physicians, these principles were: (1) to become acquainted with key pieces of patient data (collecting “to know” information) and (2) to structure tasks (creating “to do” notes). Physician transformations were overviews of key patient information items placed visually along side, but differentiated from, medical action items. For nurses, the guiding principles were: (1) to become acquainted with a patient’s care requirements for that day (creating “to do” notes) and (2) to structure their activities (organizing timing of each “to do”). Nurse transformations consisted of hourly schedules of tasks for each of their patients.

During interviews, participants reflected on how they had learned these transformation strategies. Respondents from both professions reported that they had learned this set of practices informally. Novice physicians regularly indicated that they had noticed senior staff physicians making transformations and had begun mimicking that process without having explicit instruction. More senior staff physicians reported creating transformations early in their training, but they did not recall having received direct instruction. Instead, they described the process of learning to make transformations as an evolution of their personal practice. As one physician explained, his transformations had undergone several “evolutions” to arrive at his current use of a small ringed booklet containing complete overhauls: “I am just more comfortable with that” (Staff E). Only one staff physician articulated intentionally passing on transformation strategies to students, explaining that transformations enabled better contextualization of patient data: “almost every day [I] print out the medical summary . . . and I try to train people in this way, [to] always look at your blood results in the context of medications” (Staff C).

Nurses also reported that learning to make transformations was part of an informal curriculum. Novice nurses repeatedly recounted learning this practice on the ward from a preceptor or mentor. They reported receiving explicit instruction regarding transformation practices during informal discussions with preceptors. Senior nurses confirmed this mentorship instruction, but also commented that transformation practices evolved into systems that individual nurses tailored to meet their needs. As one nurse indicated, her preceptor had suggested making transformations as a means of balancing case loads. As she gained experience, her practices evolved: “I revamped it every once and a while. It has become my thing that I do” (Nurse K). The senior nurse leader confirmed the intentional transferring of transformation skills, explaining that every new nurse on the ward is taught to create these documents: “we are really just initiating them into that, as soon as they come on the floor” (Nurse R). And yet, she also emphasized both the individual nature of this mentoring (“you are assigned a mentor and you are following that person”) and the flexibility allowed for individual organizational design choices (“however they want to arrange it”) (Nurse R).

Discussion

Our findings illustrate that physicians and nurses persistently transformed EPR-based patient information in ways that structured their daily work. Each profession used its own guiding principles to organize their transformations, with emphasis on what each worker needed to know and needed to do with the patient information. Novices learned what, when and how to transform EPR-based information within an informal curriculum heavily reliant on mentoring and modeling.

Given the high expectation in the literature for EPRs to improve care delivery,²⁻⁴ we were fascinated to see physicians and nurses working off the record – that is, not only interacting with patient data on paper print-outs rather than in a virtual environment, but also reengineering the information on these print-outs to reflect their own working preferences and practices. What motivates this common practice? And, given its impact on clinical work, what

are the educational implications of novices acquiring such expertise in an informal manner?

When we asked participants to articulate their reasons for transforming MS and PCS print-outs, a recurring explanatory theme was the problematic visual organization of the EPR-generated summaries. The preset sequential listing of categories of patient information was reported to be troublesome for both physicians and nurses since it failed to display patient data in a visual design that supported their professional work activities. For instance, nurses preferred a visual design organized around timing of “to do” tasks given their work situation of caring for multiple care-intensive patients. As one nurse explained: “I make my cheat sheet [complete overhaul] so I can visually see what my day is going to entail” (Nurse E). Participants generally agreed that the sequential organization of the EPR-generated summaries was “cumbersome” (Staff A). As one physician explained: “There are so many pieces of information that I need and they’re all here [MS]. Somewhere. I have to make sense of all of this” (Staff D).

A consideration of the EPR’s function provides insight into this disjoint between EPR-based summaries and professional transformations. Mann and Williams state that a medical record, including an EPR, serves two functions: primarily, it supports direct patient care and, secondarily, it acts as a medico-legal record.¹⁷ As Sarangi and Roberts suggest, an information system like an EPR needs to support institutional functions but also needs to be used by individuals to support professional functions.¹⁸ A rhetorical analysis¹⁹ of the visual layout of this study’s EPR shows that it is visually oriented to prioritize the social actions of the institution. The EPR-generated summaries presented patient data in a sequential ordering of specific categories of information. Through this visual organization, these summaries visually signify the comprehensive collection of patient information, and act as the eternal memory of patient data collected within the hospital. This visual design facilitates the record’s institutional role as a medico-legal document by sorting evidence for use in clinical audit and research, resource allocation, epidemiology, service planning and/or performance monitoring.⁵ However, this

same visual organization does not facilitate professional work activities. For instance, within each category, entries are listed in chronological order from the earliest to the most recent activities. Providers must sift through screens of old data that are often irrelevant to today's care delivery. Further, the logic of sequencing in this EPR does not reflect the logic of clinical practice. As one physician complained: "I can't look at meds properly. They're in alphabetical order which makes no sense" (Staff D). Consequently, the EPR was consistently rejected by both physicians and nurses and they visually worked around its logic. Staff created new priorities and logics of order in their transformed patient information sheets, imposing the space (the ward) and time (the shift) of daily work onto information that the EPR had organized to reflect the space (hospital) and time (total patient admission experience) of institutional oversight.

Although this disjoint between the institutional purpose and the clinical purpose seems dysfunctional and in need of a "fix" to save professionals time, the transformational activity may have some functionality. As they create complete overhauls of and marginalia additions to their patient summaries, participants acquaint themselves with the particularities of each case, and, based on those details, they organize their care activities for the day. This process may serve the important cognitive function of enabling health care providers to assimilate large quantities of patient information. However, while the act of transformation required extensive examination of patient data, this cognitive reviewing function was not explicitly acknowledged by most participants. While one senior staff and the ward's nurse leader did highlight the meaningfulness of the reviewing activity behind transformations, the other participants did not reflect on the cognitive benefit of this process. Rather, their rationales for the transformation process focused only on the cumbersome visual design and the need to renovate the data presentation in order to complete their daily work.

We propose that transformations are likely motivated both by a need to revisualize patient information, and to review those same data. Therefore, while improved visual designs in the EPR could

decrease the work entailed in creating transformations (for instance, by limiting the quantity of data listed in summaries instead of including all entries from the patient's admission date), the process of creating these documents is important to patient care and should not be circumvented. Creating a more work-oriented visual design for EPR-based summaries may have the paradoxical effect of making physicians and nurses less acquainted with their patients (a proposition consistent with the literature on fluency being mistaken for understanding²⁰) because they would not have to review patient data as extensively as they did in this study. Since this study involved only one EPR visual design, further investigation is needed to understand how other designs are used by professionals and how they might influence learning.

Our finding of persistent transformations by two groups of professionals suggests that the visual organization of EPR-based information may be incompatible with professional work. Further, the pervasiveness of this activity—conducted by all observed physicians and nurses at the beginning of every observed shift—suggests that transformations could be a critical bridge between the patient data an EPR generates and the use of those data in the work of care delivery. However, from an educational perspective, the lack of explicit curriculum around such a fundamental discursive activity in the clinical setting is problematic. These transformation moments harbor critical lessons for novices regarding how to value some kinds of patient information over others, how to prioritize actions, how to organize clinical work, and how to negotiate collaborative practices. Other research has suggested that when novices learn discursive strategies implicitly, they may misunderstand the professional values inherent in those strategies.^{21–24} Because these transformations are regularly dubbed "cheat sheets" by their users, we might speculate that the implicit education regarding their use may be grounded in the perception that working off the record is not legitimized by the institution or by professional governing bodies. Thus, explicitly acknowledging the process could be important for legitimizing the educational value of such transformations and thereby legitimizing explicit training regarding the

professional goals of creating these documents. Certainly this study suggests that there is a function in transformation "dysfunction" that should not be ignored and that might be productively cultivated for novice learning.

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