“We Are Not Entirely Replacing Paper”: Understanding Paper Persistence in Emergency Medical Settings

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Abstract

The introduction of an electronic flowsheet for documenting resuscitations at an urban, pediatric teaching hospital provided a unique opportunity to study the transition from paper to electronic documentation. We examine the persistent use of paper as a workaround by nurse documenters during the adoption of new technology and how these workarounds become routinized in their work practices. We discuss the effects of paper persistence on aspects of documentation and nurses' workload.

Author Keywords

Electronic health records; nursing documentation; paper persistence; emergency medicine; workarounds.

ACM Classification Keywords

• Human-centered computing~Field studies • Human-centered computing~Empirical studies in HCI

Introduction

As the healthcare domain moves towards digitization of work, information systems like Electronic Health Records (EHRs) are becoming increasingly ubiquitous. Some emergency medical settings like trauma and medical resuscitations, however, have not completely

Figure 1: Nurse documenters use a paper towel (top) and scrap paper (bottom) to write during resuscitation events.

adopted electronic flowsheets due to their fast-paced and high-stress nature. Flowsheets provide a comprehensive narrative of events during resuscitations and contribute to continuity of patient care. Prior research has shown that only a few emergency departments (EDs) use electronic flowsheets for documenting resuscitations [2,5,7,1]. These studies have focused on documentation completion, design process, and efficiencies gained after the electronic flowsheet has been implemented. However, the effects of electronic flowsheet implementation on clinicians' work practices in high-risk, time-critical settings are less understood. The introduction of an electronic flowsheet for resuscitations at our research site in May 2017 provided a unique opportunity to study the transition process from paper to electronic flowsheets.

In this poster, we describe the workarounds used by nurse documenters as they adapt to the new technology in resuscitation settings. We examine factors contributing to paper persistence and discuss its effects on nursing documentation practices and workloads. Studies of workarounds and technology adoption in medical settings have found that paper artifacts still persist and have not been completely replaced by information systems [3,8,4]. The use of paper artifacts remains persistent due to the many physical and cognitive affordances that paper provides [6]. Saleem et al. [4] identified several categories of paper-based workarounds used by clinicians, including using paper as a cognitive and awareness aid. Sellen and Harper [6] suggested that introducing a new technology does not completely displace paper, but alters the ways in which paper is used. Understanding these shifts in paper use provides insights about work processes in collaborative medical settings. These

insights can in turn help us guide the design of tools and technologies to support these processes.

Methods

We have been conducting a field study in a level-1 trauma center at a U.S. pediatric teaching hospital since April 2017. Until February 2018, we spent 616 hours at the site, shadowing and interviewing nurse documenters and observing their work practices in the resuscitation bay, a designated room in the ED for treating severely injured and acutely ill patients. We used video review to observe resuscitations that occurred outside of researcher work shifts. We report the results from 14 in-situ observations, 30 video reviews, and 24 semi-structured interviews. Field notes and video review notes were transferred to an observation log. Interviews were audio recorded and transcribed. We used thematic analysis to identify themes and relationships from the log and transcripts. On average, nurses had four years of experience in the ED. All interviewed nurses were trained on the new electronic flowsheet before it was introduced.

Findings

Our findings show that paper-based workarounds play two key roles in nursing documentation practices. We also observed social reproduction of these workarounds as new nurses became enculturated in common practices. We next describe these findings in detail.

Paper as a Transient Cognitive Aid

The nurse documenters used paper as a cognitive aid to record the information for two reasons: (1) navigational issues on electronic flowsheet, and (2) rigid system workflow requirements. First, the documenters found it difficult to navigate through multiple (sometimes

Interview Excerpts

Nurse 1: *"I always have scrap paper because sometimes the doctors rattle things off faster than I can type. If they are going too fast or screaming out like 15 medications and I can't find them on the computer, I just jot it down so I don't forget it and then I backchart it."*

Nurse 2: *"We were talking about medications that weren't ordered in the system yet. I can't sign out a medicine that's not yet ordered. However, it doesn't stop us from giving it. So I wanted to make sure that when we gave that medicine, the exact time was documented. So I wrote on paper to make sure I didn't miss the times that they were given."*

Table 1: Quotes from participant interviews.

hierarchical) flowsheet screens to record specific information in the correct fields or sections. This issue was especially evident during highly acute resuscitations, when nurses quickly switched to paper while trying to capture information from multiple sources (**Figure 1**), as described by a nurse (**Table 1**, Nurse 1). Second, the documenters explained that they use paper to record transient information when events occur in a sequence unanticipated by the system, such as medications or fluids administration before the order is placed. One nurse described how she writes the administered medications on paper with timestamps (**Table 1**, Nurse 2). The nurses normally transfer the information written on paper to the electronic flowsheet during idle times later in their shift, a process also known "backcharting."

Paper as a Tool for Effective Communication

All the entries on the electronic flowsheet are organized in a chronological order on the overview screen. Although this view is beneficial during patient handoffs, the documenters found it challenging to visualize the story of the resuscitation in real time, causing them to resort to paper. A nurse explained that she wrote all the information with timestamps on paper stretched out on a table to view all the items in a single glance (**Table 2**, Nurse 4). The documenter is responsible for communicating patient changes and alerting the team about skipped or oncoming activities. For example, a nurse may notify the team about patient vital signs that significantly changed in the last five minutes, or that it is time to administer the next medication dose, or that 15 minutes has elapsed since chest compressions started. The nurses described that the paper provided a better view for effective communication with the team.

To reduce manual documentation, the electronic flowsheet auto-populates data from sources such as vital signs monitor, blood and laboratory tests. However, a significant delay (>10 minutes) in the auto-population due to technical reasons, poses challenges, thus forcing the documenters to manually record the information with corresponding timestamps on paper to support team communication. An excerpt from our observation log describes the interaction between the two nurses: "One of the bedside nurses read aloud the blood gas values from the device. The documenter quickly wrote a few values on a piece of paper. She told another nurse standing behind her, *'these are going to come in later, but I am writing down in case the doc asks me for the values'*." (Nurse 3) (**Figure 1**, bottom).

Paper Use Becomes a Learned Practice

We are observing paper persistence not only in direct relation to the documentation practices but also as a result of social reproduction of paper use. We found that more experienced flowsheet users (superusers) influenced documentation practices of novice users during the training and shadowing sessions. Superusers encouraged novices to always carry paper, as stated by one superuser during a training session, *"This system is not here to entirely replace paper. I would always keep a scrap paper handy."* (Nurse 5). An excerpt from our observation log describes another scenario where a superuser encouraged documenting on paper during patient transport: "Nurse 6 began pushing the Workstation on Wheels (WOW) outside of the resuscitation bay to continue documentation as the patient is brought to radiology, but Nurse 7 asked her to write on paper and backchart it later."

Interview Excerpts (Cont'd).

Nurse 4: "I literally walk in and grab a small stack of papers and I write all the interventions. Everything is timed. If we were doing [medication], we can give it every three minutes. I write the time and the dose and I write a couple three minutes ahead, so I can say hey we can give it at this time. That way it's all literally right in front of my face and it is easier."

Table 2: Quotes from participant interviews.

Discussion and Conclusion

Our findings have highlighted that persistent use of paper is mainly due to the gaps between the nurses' documentation needs and the electronic flowsheet design. There are, however, challenges associated with paper use that may affect different aspects of documentation. Backcharting could cause real-time documentation delays, leading to inaccuracies in patient records. In cases where documenters did not record timestamps on paper, they estimated times when they documented post-event, which caused erroneous accounts of patient record. This finding resonates with the production of "perfect," but inaccurate accounts, as described by Pine and Mazmanian [9]. In addition, backcharting causes additional workload for nurses because they need to record the same information twice. Finally, during resuscitations, documenters often skip recording information due to distractions caused by simultaneous data entry on paper and computer.

As we continue this work, we will investigate the impact of paper use on communication, completion and error rates, timeliness of data entry, and the effects on patient outcomes. We further plan to investigate the social and organizational factors affecting documentation practices that could lead to improved design of electronic health records.

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