

**Perceived Impact of Computerized Physician
Documentation on Education and Clinical
Practice in a Teaching Hospital**

A Thesis

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Abstract

Introduction: As the information contained in paper-based records increasingly migrates over to comprehensive computer-based systems, clinical documentation activities also move from paper to electronic form. Direct computerized physician documentation (CPD) has been implemented in the nation's Veterans Affairs Medical Centers (VAMCs) and is likely to become the norm in other institutions over the coming years.

Comprehensive systems like the VAMCs Clinical Patient Record System (CPRS) incorporate features that facilitate the creation of clinical notes. The use of these tools and their features may have unanticipated impacts on educational and clinical activities and environments in teaching hospitals, and this deserves study. This study assesses the perceived impacts that CPD has had at one VAMC from the perspective of clinician-educators and housestaff.

Methods: A cross sectional study was performed employing qualitative methods. A series of 10 semi-structured interviews with clinician educators and a group semi-structured interview with housestaff physicians were conducted at a VAMC. Field and post-interview notes were taken and audiotapes of the sessions were transcribed. Two independent reviewers analyzed the data using an iterative process by which they categorized the comments and identified major themes that emerged from the data. Findings were verified using member-checking and peer-debriefing techniques. External validation was enhanced by analysis of related data collected initially for a different purpose at another VAMC in the Northwestern US.

Results: Four major themes of CPD impacts emerged from the data. These were: 1) Change in work process 2) Change in documentation characteristics 3) Change in availability and 4) Change in confidence. While participants noted the change in availability to be of benefit, most perceived the other impacts of CPD as adversely affecting documentation, workflow, education and perhaps even patient care.

Conclusion: CPD is perceived to have had significant impacts on clinical and educational environments in the institution studied. While the overall effect of CPD may be an improvement due to the enhanced availability of documentation, many negative impacts were also identified in this study. Care should be taken when designing and implementing such systems to avoid or minimize any harmful impacts. More research is needed to assess the extent of the impacts identified in this study and to determine the best strategies to effectively deal with them.

Introduction

Background and Significance

The patient record is the primary repository of information relevant to the care of a patient in a hospital or health care system. Physician documentation of clinical care serves as the core of this record and has a comprehensive purpose: “to recall observations, to inform others, to instruct students, to gain knowledge, to monitor performance, and to justify interventions.” [1]

Brief History of the Clinical Record

Throughout its long history, physician clinical documentation has undergone many changes and shifts in purpose. The development of the clinical record parallels that of the science and practice of medicine.

As far back as the fifth century B.C.E., Hippocrates and his disciples kept case records in order to demonstrate the natural causes of illness and portray the clinical course of illness through accurate observations of patients’ symptoms. During the nineteenth century, a vital innovation called the stethoscope was invented, and along with it, a change in the content and nature of the medical record followed. Whereas previously, the documentation had consisted mainly of patients’ reported symptoms, physicians’ observations began to contribute significantly to the content. In the twentieth century, additional technological advances led to the inclusion of even more objective information in the record. It was at this time that numbers derived from laboratory

reports, blood pressure readings, and temperature charts found their way into the record.

[1]

While clinical documentation played a significant role in advancing the practice and science of medicine throughout the nineteenth century, the twentieth century also saw the recognition of the record for another purpose, that of medical education. Through the work of Walter Cannon, a student at Harvard Medical School who borrowed the approach from a Harvard law professor, the use of case histories abstracted from the medical record allowed students to take a more active role in analyzing the logic used and actions taken in treating a particular patient. In 1910, another teaching innovation based on the clinical record was developed, this time to instruct practitioners. Richard C. Cabot, a clinician, and James Homer Wright, a pathologist, both at the Massachusetts General Hospital, began a series of weekly conferences that drew upon the evidence contained in the record. A physician who had not treated the patient would comment on clinical logic and present diagnostic conclusions drawn from details in the clinical record. A pathologist would follow and present autopsy findings to either confirm or deny the clinician's analysis. A few years later, these exercises began to be published in the *Boston Medical and Surgical Journal*, later renamed the *New England Journal of Medicine*, where they drew great praise from physicians worldwide. One physician in 1918 wrote, "To a great many of us, these cases are the only postgraduate work we have at the present time." [1]

Even while clinical case records were assuming an increasingly important role in the advancement of medical science and education, the state of the clinical record was still quite poor. It was noted in the early twentieth century that, with a few exceptions,

neither hospitals nor physicians tended to keep reliable and detailed clinical records. In a 1917 commentary on the state of medical records in American hospitals, the editor of *The Modern Hospital* reported that, “the record as it is kept today is practically valueless,” as these files contain scant data. Due in part to a poor understanding of the record’s significance and to the pressure of patient care on their time, physicians of the day tended to rely on memory and brief notations to recall patient histories. [2]

Over the succeeding decades, reforms followed in an attempt to improve the collection, maintenance, and usefulness of data in the clinical record. The Flexner report on medical education offered one of the first formal statements on the function and content of the medical record. In the 1940’s, hospital accreditation bodies began to insist that medical records be accurate and well organized as a condition for accreditation. [3] Despite all of these efforts, even as recently as the late 1960’s early 1970’s, there were calls for better organization of the record. When Lawrence L. Weed published his classic article in which he described the need for a more organized approach to the internal structure of the clinical record and proposed a problem-oriented organization to the medical record, physician clinical documentation was still variably useful at best. [4]

The theoretical utility of such innovations as the development of a hospital unit record, standardized data-formatting, and the problem-oriented medical record could only be fully realized by solving the problems inherent in managing the vast amounts of information pouring into such a multipurpose record in an ever-increasing technologically-oriented medical practice. The problems of organizing, storing, and rapidly retrieving larges amounts of data might ultimately be solved by the use of computers. [2] Unfortunately, this solution proved not so simple as had been hoped in the

1960's when computers were first becoming available. However, more recently, computers have found their way into that very fundamental aspect of practicing medicine, clinical documentation.

From Paper-based to Computer-based Clinical Documentation

One only need think for a moment about the modern daily practice of medicine to recognize some of the obvious limitations inherent in using a paper-based medical record. Access is limited to the single copy of a record, especially in a large health-care system where many individuals might have a need to simultaneously access its contents. Although likely not as bad as it is reputed to be, the variable legibility of physician handwriting is so well recognized a limitation as to be a cliché. [5, 6] The minimal structuring and formatting of the data entered is another limitation as it can make retrieval of data cumbersome and time consuming. These and other limitations of paper were the impetus for the move to computer-based patient records over the last two to three decades. [3]

The relatively recent development and deployment of more comprehensive computer-based patient record *systems* has offered additional advantages to the many users of such information. Such systems allow the user access to vast and varied patient information from a single interface, incorporate information management tools to provide clinical reminders and alerts, allow analyses of aggregate data, and provide linkages to knowledge sources for health-care decision support. [3] These systems provide benefit not only to the clinician but also to the administrative and support personnel who have a

need for the record's information, and in that way, offer many potential benefits to health-care systems.

One very important motivation implied in the points above is the desire to improve patient outcomes by moving from paper-based to computer-based patient records. A recent, frequently quoted report from the Institute of Medicine indicated that there are likely many adverse patient events caused by medication prescribing errors. [7] One response has been a move toward allowing direct computerized physician order entry (CPOE) through use of computer-based patient record systems in the hopes that many of these adverse events might be averted.

Such activities represent a fundamental change in the way physicians have traditionally interacted with such computer-based patient record systems. No longer are they merely the recipients of information contained in the computer-based record, but they are now contributing directly to it by engaging in activities like CPOE.

As the information contained in paper-based records migrates over into such comprehensive computer-based systems, clinical documentation also moves from paper to electronic form. While some transitional systems allow for scanning of printed documents in order to enter their content in the computer-based record, other systems are beginning to do away with paper-based clinical documentation all together. One such system is the Veterans Administration's Computerized Patient Record System (CPRS) that allows direct entry of clinical notes via computerized physician documentation (CPD). This feature takes the interaction between physician and computer one step further. [8]

While migration from paper-based to computer-based physician order entry has as one of its motivations the improvement of patient care, it is not clear that this motivation drives the move to computer-based clinical documentation. Although it hasn't been well described in the literature as yet, two potential driving forces behind a move toward CPD are the desires to improve efficiency and decrease costs associated with transcription of physician dictation. This move also appears to be occurring with seemingly less consideration of the effects it might have on the quality of clinical documentation than was the case with CPOE.

Possible Benefits of Paper-based Documentation Over CPD

While some of the better-recognized limitations of the paper-based record are stated above, there is reason to believe that paper-based physician clinical documentation may hold some advantages over CPD as it currently exists. Research into how physicians review a clinical record indicate that interpretation of format, layout, and other textural features are critical to guiding the physician in the process of searching, reading and assessing the relevance of different items of information in the record. [9]

In addition to normal reading, knowledge can be gained by pattern recognition and encoding characteristics of the information media. This can occur in a relatively effortless manner, and the knowledge gained can help one with orientation, navigation, and detection of changes as a complement to normal reading. When information is computerized and read from a screen, many of the conditions that allow for this automatic cognitive processing of information are often radically changed, requiring the reader to gain the knowledge by effortful cognitive processes, thereby adding to the

cognitive load of the task. For example, in one study, when physicians were presented with computer-generated laboratory reports that were “pattern-dead”, meaning that test results were tightly packed with no easily discernable pattern, they required more time and effort to interpret the reports when compared to pattern-formatted data, even when they were very familiar with the “pattern-dead” computer report. [10, 11] It is reasonable to conclude that without careful attention to human-computer interface design issues, migration from paper-based documentation to CPD may result in some unintended negative consequences.

Although perceived impacts of components such as CPOE have undergone evaluation since being implemented [12-15], and some research has been done looking at the perceived “completeness” of documentation in computerized patient records [16], the range of potential impacts of CPD on the quality of physician documentation have not been studied to my knowledge. Unanticipated impacts on educational and clinical environments, and the likelihood that this technology will proliferate and be implemented in ever increasing numbers of institutions justify studying these issues.

Preliminary Observations

While the Department of Veterans Affairs’ clinical information system, CPRS, was first deployed nationally in 1998, all CPRS components were not implemented at all VA medical centers (VAMCs) around the country at the same time. Some VAMCs were “test-sites” and therefore have had more experience with the system than have others. In addition, various features of the system including the ability to perform CPD, while available in some form since the earliest released

versions of CPRS, were also implemented at various VAMCs at different times. While certain VAMCs have had as much as two years experience using CPD to document all inpatient progress notes, only recently has this been implemented at the majority of VAMCs around the country. [17]

The migration from paper-based creation of inpatient documentation to computer-based creation of inpatient documentation at the Portland VAMC occurred on July 1, 2001. From that point forward, all such documentation occurred via CPD into CPRS. Following this transition, through unsolicited opinions from local and remote VA physicians, I became aware of some perceptions regarding possible impacts related to the change.

For example, certain features of CPRS facilitate the CPD process. These include the ability to copy-and-paste information from previous clinical notes and to automatically insert clinical information like laboratory or medication data into the note. Preliminary observations suggested that some people were concerned about the impact of these features on the quality of the clinical record and on the educational process. Preliminary observations also indicated that one's perceptions of the beneficial or detrimental effects of such features may relate to one's role in the training hierarchy (i.e. intern v. resident v. attending physician) or in the task that one is performing (i.e. composing notes v. reading them, and engaging in patient care v. education).

I hypothesized that there were likely additional perceived impacts of this new documentation method on medical education and clinical care and that it would be useful to gain a better understanding of the issues raised by these preliminary observations. I therefore took such observations into account as I planned the investigation.

Research Question

What do clinician-educators and housestaff physicians perceive to be the clinical and educational impacts of using computerized physician documentation (CPD) as compared to paper-based physician documentation in the inpatient setting of a teaching hospital?

Perspective, Purpose & Objectives

As computer-based medical record systems proliferate, it is likely that the use of CPD will increase as well. CPD has already become the standard method of performing certain kinds of clinical documentation at the nation's VA medical centers.

Creation and review of clinical documentation is integral not only to the practice of medicine, but also to the teaching and learning of it. [4] A change to the way this documentation occurs, as with CPD, might plausibly affect the product and thereby affect clinical practice, patient care, and education.

In designing this study, I employed Chelimsky's framework for defining the perspective and purpose of an evaluation study [18]. In brief, her framework can be applied to evaluations of healthcare information systems in order to categorize them as done from any of three perspectives. First, *Development*, relates to performing an evaluation in order to determine how best to improve a product or process. Second, *Knowledge*, relates to performing an evaluation in order to generate insight and/or develop methods. Third, *Accountability*, relates to performing an evaluation in order to measure value, results, and/or cost.

As the VAMC is at the forefront of implementing this technology, it offered an excellent opportunity to identify issues that might eventually prove relevant to other similar institutions as they follow in implementing CPD. Therefore, according to Chelimsky's framework, this could be considered an evaluation of an informatics intervention performed from the *knowledge* perspective. In addition, because my evaluation was concerned with determining perceived impacts or results of implementing CPD, this could be considered an evaluation of an informatics intervention from the *accountability* perspective.

Although, I admittedly entered into this research project with some preconceived assumptions as is noted above in "Preliminary Observations", the purpose of this research, as evidenced by my use of qualitative methods, is to develop hypotheses and illuminate issues based on the collected data rather than to test hypotheses and make judgments based on them. As stated by Friedman and Wyatt, "an illuminative approach seeks to represent the viewpoints of those who are users of the resource or an otherwise significant part of the clinical environment where the resource operates. The goal is understanding, or "illumination," rather than judgment. [19]

My research objectives were:

To identify and categorize the range of possible educational and clinical impacts that are perceived to have resulted from the migration to computerized physician documentation in a teaching hospital, and then to generate a list of the critical issues and impacts identified.

Methods

Design and Qualitative Methods

Given the early stage of knowledge in this domain and the lack of clear definition of exactly what are all the important questions or pertinent variables, I chose to use qualitative methods appropriately suited to answering my research question. As stated above, the intent of employing such methods was to gather a comprehensive range of perceptions from the study population and generate insights based on the data gathered.

I employed a cross-sectional study design. Specifically, I conducted a series of individual semi-structured interviews with Internal Medicine clinician-educator physicians and a semi-structured group-interview with Internal Medicine housestaff physicians. The setting for all of these interviews was the Portland VAMC.

Populations

As described by Hulley and Cummings, et al., I defined the “target”, “accessible” and “sample” populations for this study. [20] The target population for this study, or the population to whom the results of this study might be applicable and of interest, was defined as all clinician educators and housestaff physicians in the country’s teaching hospitals who work in the inpatient setting during and after the transition to CPD. The accessible population was that subset who were internists at the Portland VAMC.

The sample population of clinician-educator subjects for my study was drawn from those Internal Medicine clinician-educators at the Portland VAMC who had served as attending physicians in a supervisory role. In addition, they had to have served either

on a General Medicine ward teaching service or on an Inpatient Subspecialty Consult teaching service at the Portland VAMC for at least two consecutive weeks both prior to and since implementation of CPRS-based CPD on July 1st, 2001. Eligibility also required the clinician educator subjects to have a faculty appointment (i.e. no Fellows or Chief Residents) preceding the transition to CPD.

Similarly, the sample population of intern and resident was chosen from all Internal Medicine interns and residents who had spent an entire rotation on either a General Medicine inpatient ward service or a Subspecialty consultation service prior to (for the residents) and since the implementation of CPD on July 1st, 2001 (interns and residents).

Selection of Sample Units

When conducting qualitative research, it is important to have an adequate number of participants in order to assure a comprehensive understanding of the issues involved. Ideally, one would conduct successive interviews with all suitable subjects until new issues are no longer raised, or theoretical saturation is achieved. However, practical issues such as time and cost constraints require that a limit be set. While it is often difficult to prospectively predict what the ideal number of participants is in order to achieve adequate variability and comprehensiveness in responses, one must be chosen. I therefore chose the following numbers.

For the clinician-educator sample, I chose a sample of 10 clinician-educators from the population defined above using a purposive sampling method with the intent of achieving a balance between General Medicine and Subspecialty service attending roles,

male and female gender, and extent of experience. For the intern and resident group samples, I chose a sample of 10 interns and residents from the population defined above using a convenience sampling method. An attempt was made to balance ward and consultation service experience and gender.

Only subjects who were willing and able to participate were ultimately recruited. The appropriate institutional review boards (IRBs) approved the study.

Consent, Protection and IRB Approval

As this study involved human subjects and the findings produced may contribute to generalizable knowledge, IRB approval was sought and granted prior to beginning any data collection. Given that the study was conducted by a Fellow of the Portland VAMC, at the Portland VAMC, involving Portland VAMC personnel, the primary IRB overseeing the study was that of the Portland VAMC. In addition, IRB approval was sought from OHSU given that the researcher was also a student at OHSU and that the results of this work served as the basis for an OHSU Master's thesis. For the reasons stated above, the OHSU IRB opted to waive authoritative oversight for this study and defer to the Portland VAMC for IRB review, approval and oversight under the Portland VAMC's assurance that they would do so.

In keeping with the directives of the IRB, every participant taking part in this study was given and had explained to them by the primary researcher a three page description of the study including any possible benefits and harms that might result from their participation (Appendix A). Each participant who agreed to participate acknowledged his or her understanding of the document by signing the consent form.

Every effort has been made to protect the rights, safety, privacy, and dignity of the participants in this study.

Data gathered in the course of this study have been and will be kept strictly confidential to the full extent permitted by law. All publications and reports derived from this study and its data will be based on aggregate data and will not identify individuals. No individual information has been or will be released to anyone without prior written consent.

Data Collection

I conducted the individual and group semi-structured interviews as a participant-observer given my experience as a clinician-educator at the institution where the study was conducted. While being a participant-observer has the disadvantage of possible bias, it also has the advantages of knowledge of the subject matter, intent of the research, and a mastery of the domain vocabulary that allows for better communication with study subjects. In addition, my current role (medical informatics fellow and attending physician) and historical roles (resident and chief resident) at the institution may have given me some credibility and allowed me to more easily gain the confidence of those being interviewed.

I used a semi-structured interview technique in order not to overly constrain the conversation and allow for the emergence of unanticipated relevant issues, attitudes, or themes while still assuring that certain issues were covered. The goal was to elicit each respondent's views and perceptions in his or her own words and to allow exploration and clarification of issues as they arose.

Three pilot interviews were conducted with non-study subjects who fit the study criteria prior to conducting any interviews with study subjects. This was done in order to allow me an opportunity to practice my interviewing method and to augment a list of pre-defined questions that had been based on preliminary observations. The list of possibly pertinent questions and issues developed served to assure that anticipated issues were addressed during the course of the interviews. Any new issues that arose during the subsequent study interviews were also added to the pre-defined list in order to prompt their further exploration at successive sessions.

I began each study interview session by describing to the interviewee that the focus of the session was to gather the interviewee's perceptions of CPD, as opposed to other aspects of CPRS like CPOE or Results Reporting capabilities. This was followed by an open ended question asking the interviewee to comment on his or her perceptions regarding any possible impacts that CPD may be having on clinical and educational activities at the institution. As necessary to delve more deeply into a particular subject area, I asked further questions, always beginning in an open ended, non-leading manner. Only when these techniques were not successful did I employ the use of closed-ended questions to further explore issues of potential importance as identified during the pilot and prior study interviews.

Each interview lasted less than one hour in duration. Field notes were taken during and immediately following each interview, and interviews were tape-recorded. I transcribed the audiotapes after all interviews were completed.

Data Analysis

Analysis of the data occurred in stages. As the primary researcher, my analysis began during the interviews themselves through careful listening and notation of participants' responses and gestures. I also analyzed field notes and post-interview debrief notes, totaling about 31 handwritten pages. Transcripts of the audiotapes from the 11 individual and one group interview sessions totaled 84 single-spaced typewritten pages.

Two independent reviewers conducted the analysis of the transcripts. In addition to myself, Thomas Yackel, MD, MPH, an internist by training and a medical informatics fellow at OHSU conducted the second independent review. Dr. Yackel was not affiliated with the Portland VAMC nor did he have experience using the features of the VA CPRS system being studied.

The transcribed comments were independently reviewed and coded into descriptions based on participants' utterances. The reviewers then began an iterative process involving review and discussion of these descriptions in order to determine agreed upon categorizations for the various utterances that could be directly linked to the raw data and their descriptions. Finally, summary interpretations were drawn from the data and categorizations, and were organized into common themes. The intent was to discern and come to agreement on underlying meanings and principles.

In order to enhance validity of the findings, post-analysis data verification was conducted. I performed member-checking by sending participants a summary of the final categorizations, themes, and conclusions via email and asking them to confirm the accuracy and comprehensiveness of the interpretations. I also performed peer-debriefing

via presentation of the findings and interpretations to a group of Internal Medicine clinician-educators at the OHSU/Portland VAMC General Medicine Research-in-Progress session.

In order to further enhance the validity of the findings, I also employed a method called triangulation. Triangulation, as defined by Friedman and Wyatt, means supporting an argument with data from different sources, different investigators, or both. [19] Anderson, Aydin, and Jay also refer triangulation. “Multiple sources and methods increase the robustness of results. Using more than one method of data collection allows findings to be strengthened by cross-validating them. This process generally is known as triangulation.” They go on to state, “When data of different kinds and sources converge and are found congruent, the results have greater credibility than when they are based on only one method or source.” [21] Michael Quinn Patton further clarifies triangulation by referring to Denzin’s identification of four basic types of triangulation: 1) *data triangulation*, the use of a variety of data sources in a study; 2) *investigator triangulation*, the use of several different researchers or evaluators; 3) *theory triangulation*, the use of multiple perspectives to interpret a single set of data, and 4) *methodological triangulation*, the use of multiple methods to study a single problem or program. [22]

In this study, I had the opportunity to analyze a subset of the qualitative data collected by Dr. Joan Ash and her group as they engage in related but distinct research at another VAMC teaching hospital in the Northwestern United States. Ash’s group investigated the impacts of CPRS-based CPOE at the VAMC using qualitative methods including primarily oral history taking and observation. Their sample population included faculty and housestaff physicians as well as nurses, and was also conducted primarily in

the inpatient setting. In the process of their data collection, subjects and observers made many spontaneous comments regarding CPD. While Dr. Ash's group will not be considering these data, they did transcribe them and categorize the comments and observations as broadly related to EMR rather than CPOE. Applying Denzin's classification of triangulation, these data provide three types of triangulation: data triangulation, investigator triangulation, and methodological triangulation.

In addition, because these data were gathered at another institution, congruence of the findings with those collected locally might enhance the external validity or generalizability of the findings beyond the primary institution.

Results

My sample population consisted of 10 clinician educators and 10 housestaff physicians who had the characteristics described in Table 1 below:

Table 1: Descriptive Statistics of Study Subjects

Clinician-Educators	Gender	Age – mean (range)	Generalist/ Subspecialist	Time on Faculty – mean (range)	Experience with inpatient CPD – mean (range)
10 total	30% Female	46.7 years (36-56 yrs)	50% Generalists	12.7 years (3-22 yrs)	2.25 months (1-7 months)
Housestaff	Gender	Age – mean (range)	Residency Program	Post Graduate Year (PGY) Training Level	Experience with inpatient CPD – mean (range)
10 total	60% Female	28 years (26-30 yrs)	Internal Medicine	60% PGY-1s 30% PGY-2s 10% PGY-3s	1.5 months (1-2 months)

Analysis of the data yielded many categories of comments and ultimately resulted in the identification of four major themes into which all comments fit. It is worth noting that participants required very little prompting or questioning beyond the open ended initial question regarding their perceptions about any impacts that CPD may have on the clinical and educational environment. Participants responded at length with little prompting during the interviews, and these responses yielded the majority of the data. It was clear that most participants were eager to discuss their perceptions of these issues.

Furthermore, the final 7 interview sessions did not reveal any new categories or themes not already identified in the first 4 interviews conducted. That is, in retrospect, it was possible to note that near complete *saturation* of the data was achieved by the end of interview number 4. This finding speaks to the relative similarity and overlap of

comments made during the interviews and serves to support the decision to interview this number and not more participants. In fact, fewer may have been acceptable.

As stated above in the data analysis section, identification of overriding themes was the result of an iterative process conducted as we reviewed the data. Our initial codings were quite similar and very little discussion was needed in order to achieve final agreement regarding categorization of the vast majority of the comments. Together, we proceeded to identify the major themes emerging from the data, and we ultimately felt confident that all comments made could be grouped into one of the final themes identified. While there was some overlap between themes and while some comments related to more than one category, we attempted to describe themes and categories that were comprehensive while expressing the unique concepts evident in data.

Analysis of the data identified four major impact themes, each with several subcategories. Three of these impacts we considered more tangible and distinct while the fourth one was more abstract and overarching.

The themes are:

- **Change in Work Process** – Relates to perceptions about changes to the way work is done by clinicians-educators, housestaff and nurses since the transition to CPD.
- **Change in Documentation Characteristics** – Relates to perceptions about changes in the documentation product itself.
- **Change in Availability** – Relates to perceptions about changes in the legibility, accessibility and organization of clinical documentation since the transition to CPD.

- **Change in Confidence** – Relates to perceptions that the tangible changes above are impacting the participants’ confidence in various aspects of the documentation since the transition to CPD.

Theme 1: Change in Work Process

Many of the comments made by participants addressed the theme we have termed “change in work process”. Every participant made at least some comments concerning the perception that using computers to create and review physician documentation has dramatically changed the way that physicians do work in the hospital. While some related comments were better categorized under the theme of availability, there was a clear subset related distinctly to changes in the work process.

The comment categories that were grouped into this theme shared the similarity of relating to perceived changes in time spent performing certain tasks, changes regarding where or when certain tasks were being performed, and changes to the way in which tasks were performed. Many such comments related to the issue noted by participants that having to sit in front of a computer terminal in order to work changes the way in which work is done.

Comments representing this theme were assigned the following categories:

1. **“Less interaction with colleagues”**
2. **“Increased time documenting”**
3. **“Less time at nurses station”**
4. **“Increased time in office”**

5. **“Documenting at different times”**
6. **“Documenting in different location”**
7. **“Less time with patients”**
8. **“Less dictation, more typing”** (relating to discharge summary creation)

Representative quotations:

Category: 1. Less interaction with colleagues

“...it’s like being in a steno-pool where you walk in [to the physician team office] and everybody’s typing; there’s no actual communication going on, no interaction with anybody else.”

Category: 1. Less interaction with colleagues

“I definitely notice we spend less time with the nurses [since the change]...we’re missing that “by the way” interaction that we had before.” (also coded as “Less time at nurses station”)

Category: 2. Increased time documenting

“We’re definitely spending more time in the hospital, especially if you’re a bad typist.”

Categories: **3. Less time at Nurses Station**

“ There’s none of the socialization happening at the nurses station where people come and talk to one another.” (also: “Less interaction with colleagues”)

Category: **4. Increased time in office**

The immediate thing I notice is that doctors are now confined to their offices for a huge amount of their time... [they] are in their offices working on their computers a good bulk of the time. I don’t know if that’s good or bad; it’s just different, and it’s made the wards seem like a different place. There’s a different milieu up there in general.”

Category: **5. Documenting at different times**

“...because you can only do it when you’re sitting right there, so you can’t write little bits of your note on the fly like we used to, you just have to write it in the one place. I suppose you could log into a computer somewhere else [to complete it], but it’s just too much of a hassle; logging in, logging out, logging in...” (also: “Documenting in different location”)

Category: **6. Documenting in different location**

“I remember having my piece of paper and my clipboard, filling in my H&P and talking to the patient at the same time, and getting my information and establishing a rapport, ...”

Category: **7. Less time with patients**

“... and now [the information] is like all gathered and you don’t sit with the patient as much.”

Category: **8. Less dictation, more typing**

“I saw this specifically with this new group of interns, where since nobody’s ever taught them how to do a discharge summary, they feel uncomfortable doing it, it’s too much work. It’s easier for them to cut-and-paste and type, and have their note be done and gone, and not have to worry about it, than to take the time to figure out how to dictate a true discharge summary.”

Theme 2: Change in Documentation Characteristics

Another impact identified by every participant related to what we’ve termed a “change in documentation characteristics”. While not all participants agreed on the extent or significance of these impacts, all commented on their perception that CPD had led to some qualitative and quantitative changes in inpatient documentation.

Comment categories grouped under this theme shared the similarity of relating to perceived changes in the content or formatting of the documentation itself. Nearly all participants felt that features unique to CPD, including **copy-and-paste**, **automated data insertion**, and **template-generated** notes or components of notes, were at the root of the issues noted under this theme.

Comments representing this theme were assigned the following categories:

1. **“Redundancy”**
2. **“Longer documents”**
3. **“Poor formatting”**
4. **“Increased data, decreased knowledge”**
5. **“More clutter”** (or “worsened signal-to-noise ratio”)
6. **“Plagiarism”**
7. **“Clinical issues often not updated”**

Representative quotations:

Category: 1. Redundancy

“You will see the same information repeated over and over again in notes; you will see the same misinformation repeated over and over again in notes; to the point you can’t easily identify where the misinformation began.”

Category: 2. Longer Documents

“You’re having to scroll down through so much information, sometimes 40-50 lines of laboratory data, of MCVs and MCHCs and Anion Gaps and this and that, you know, that’s been repeated a bunch of times.”

Category: 3. Poor formatting

“The current format [of automatically inserted medication and lab data] I find very difficult to read... It’s hard to see the forest for the trees sometimes.”

Category: 3. Poor formatting

“There’s a bunch of stuff you don’t care about and that kind of hides the stuff you do care about in the labs. I don’t like the format it comes in... and, there’s no way to like highlight what you think it important, or to put in a prioritized fashion easily.” (also: More clutter)

Category: 4. Increased data, decreased knowledge

“...cutting-and-pasting of prior histories and downloading of labs just from the electronic record without necessarily any organization or assessment of the labs if you will.”

Category: 4. Increased data, decreased knowledge

“You see vast reams of irrelevant data being imported... so the sheer mass of data basically overwhelms peoples ability to understand what’s going on.” (also: “Longer Documentation”)

Category: 5. More clutter

“So the information that you find in discharge summaries now is full of extraneous pieces of information making it more difficult for the primary care provider to sort through the detail trying to figure out what was actually the course, plan, and what still needs to be done.”

Category: 6. Plagiarism

“A medical student was having difficulty with the pace and actually plagiarized a whole note from one of the interns.”

Category: 7. Clinical issues often not updated

“You’ll see people, as a diagnosis changes during a hospitalization, people will not change their written diagnosis because they’re simply copying information from a previous note.”

Category: 7. Clinical issues often not updated

“I’ve been pretty concerned about the repetition in the assessments from day to day, and people building on their initial assessments by just adding to it as opposed to writing a new assessment each day for every problem.”

Theme 3: Change in Availability

Of the themes identified in this study, none was perceived by the participants to have had a greater impact on clinical and educational activities than the theme termed “change in availability”. The issues represented by this theme were seen by all participants as being vital to the impact, largely positive, that has occurred as a result of transitioning to CPD. In fact, most participants were eager to make it clear, without any prompting, that the benefits of improved availability far outweighed any possible harmful impacts that might result from implementation of CPD.

While some of the participants used the term availability as a synonym for accessibility, we have chosen to use it here to represent a broader concept. Availability in this sense refers to a few ideas commented on by most participants and initially categorized as distinct by the reviewers.

Comments representing this theme were assigned the following categories:

1. **“Accessibility”**
2. **“Legibility”**
3. **“Chart organization”**

While we ultimately categorized all such comments under one of the above three categories, it is important to note that the participants eagerly commented on the implications of these perceived impacts as well. Many of these perceptions are illustrated in the quotations below. Participants felt that due to improvements in availability, they were more likely to review the clinical documents created by the trainees under their supervision and of the patients under their care. They also reported that they were no longer concerned about “finding the chart”.

Regarding our choice of the term “availability”, it is notable that the term has previously been used in a similar context. Connelly et al. defined the term “availability” with regard to knowledge resources in a way that fits well with my purpose. They defined it as relating to physical availability (i.e. how close the resource is to the site of clinical practice), functional availability or searchability (i.e. how easy it is to find the needed knowledge in the resource once it is at hand), and intellectual availability or understandability (i.e. how easy it is to read and understand the information). [23] These features of “availability” are analogous to those present in my data.

In addition to the largely positive aspects of availability stated above, there were a couple of negative ones commented on by the participants. One relates to the third of Connelly’s definitions stated above, that of “Intellectual availability”. The issue of “More clutter” or a “poor signal-to-noise ratio” reported above under theme 2 can be seen as relating to a decline in the “availability” of documentation content to the “intellect” of the user. In that sense, there were certainly some comments relating to this theme that were cross-categorized under theme 2 as well.

The other category of negative comments related to availability had to do with the lack of accessibility in certain areas like the patient’s bedside, especially at key times such as during critical situations like patient “codes” or cardiopulmonary arrests. A few subjects commented that review of clinical documentation at the bedside was often easier with the paper chart than it is with the computerized chart.

Representative quotations:

Categories: **1. Accessibility** (Improved Physical Availability)

“I’m more likely to read notes now because of accessibility and legibility, from the peace of my own office, so I spend more time looking at them now.” (also: Legibility)

Categories: **1. Accessibility** (Improved Physical Availability)

“I can even log in from home and sort of review what kind of patients are coming in, what the issues are. If I feel there’s something that needs to be addressed before morning, I can query the housestaff without them even knowing that I’ve actually been looking at their notes. I might call in at 10pm and say how are things going, anybody you want to run past me, and usually, something will come up, but I’ve had a preview. Having a preview is really sometimes helpful.”

Category: **1. Accessibility** (Improved Physical Availability)

“It’s also easier for me to document because I don’t have to try to find the chart.”

Category: **1. Accessibility** (Improved Physical Availability)

“It’s improved [teaching] rounds a bit for me. I’m not so pushed because I know the period of time I have to do my own documentation goes more quickly than before. It was interesting. I couldn’t figure out what was

going on for a while. Then, I realized, I don't have this sense of time pressure that I used to have, because I don't have to try and find the charts."

Category: **1. Accessibility** (Worsened Physical Availability)

"[During a critical situation]...there aren't monitors in every room, so you can look for information and relay it back to the room, but it's not the same as having the chart in the room."

Category: **1. Accessibility** (Worsened Intellectual Availability)

"The subspecialists, when we come by, we sometimes have trouble figuring out exactly what's happened. It may all be there, but it's buried in this huge mass of data."

Category: **2. Legibility** (Improved Intellectual Availability)

"Back in the old days, sometimes you couldn't read peoples' handwriting, and at least in the electronic note its going to be forced to look a certain way; you'll be able to see that an 'a' is and 'a'."

Category: **3. Chart Organization** (Improved Functional Availability)

"One clear advantage is organization. It's easy to pick and choose which notes to read..."

Categories: **Legibility; Accessibility; Chart organization** (Improved)

“The beauty though, is that they’re legible; I can get to a note no matter where I’m at. It’s just fantastic. I can be sitting anywhere, at home, here, and I can pull up the note and see what the team is thinking about that patient, and I’m sure the resident can do the same by looking at the intern’s note; you don’t have to be on the ward; you’re not looking for that chart like you always were before; I can’t even remember how much time we wasted looking for charts and getting frustrated because we couldn’t find them, and loose pieces of paper getting lost, and that just doesn’t happen anymore. It’s all there, and there’s just something so beautiful about it. I love the way it’s all organized on the computer; it’s just so easy to access everything.”

Theme 4: Change in Confidence

The final theme that emerged from the data is one we termed “change in confidence”. As noted above, this theme encompasses comments that overlap significantly with those of the preceding themes. After much review of the data, we came to recognize that comments initially categorized under seemingly unrelated categories were in fact addressing this broader, overarching theme. It also became apparent from our analysis that this perceived impact was contributed to by the impacts noted under the preceding themes.

The categories that constitute this overarching theme are similar in that they all relate to the worry, concern or questioning expressed by the participants regarding the

state of clinical documentation since the transition to CPD. While some used the term “quality” in their comments and while for a time it seemed there might emerge a theme of “change in quality” from the data, we ultimately did not find support in the data for identification of such a theme unto itself.

Although there were a few comments concerning a perceived deterioration in quality of the documentation, those participants further clarified such comments by referring to issues categorized in the themes above. For instance, perceptions of deterioration in quality regarding the formatting and organization of documents fit well under theme number 2, “change in documentation characteristics”. Also, those who commented on a perceived change in the quality of documentation content qualified their characterization by stating that they might very well be noting persistence of poor quality that was present, if not as readily apparent, in paper-based documentation (e.g. less evidence of analysis of data presented).

So, while an overarching theme of change in quality did not emerge, it was clear that there was a perceived change in confidence expressed by the participants.

Comments representing this theme were assigned the following categories:

1. **“Uncertain whether data have been analyzed”** (i.e. by trainees)
2. **“Uncertain whether pertinent findings noted”** (i.e. by authors, due to clutter/formatting issues)
3. **“Uncertain whether information is reliable”** (e.g. in problem list, history, exam, and assessment, due to copy/paste)

Representative quotations:

Category: 1. Uncertain whether data have been analyzed

“[In the past] I could tell what they [trainees, other clinicians] thought was important, and I could tell how aggressive they’d been in verifying and what they chose to include was theirs, not just pulled from someone else.”

Category: 1. Uncertain whether data have been analyzed

“So, I was more confident before. Now, unless they [housestaff physicians] modified it, you don’t know if they just pulled it in and didn’t look at it, or whether they looked at it and noted it was all correct and moved on.”

Category: 1. Uncertain whether data have been analyzed

“In the past, at least they circled it, you knew they noted it was abnormal even if they didn’t address it in the assessment, but now you don’t know if they just didn’t think it was worth mentioning or they just didn’t notice it....”

Category: 1. Uncertain whether data has been analyzed

“But the other quality issue is, I just worry that people aren’t thinking the way they used to.”

Category: 2. Uncertain whether pertinent findings noted

“Also, the act of writing them makes you think about them. Pulling them in, I can’t tell you the number of times I’ve missed something because it’s just this blur of data.”

Category: 2. Uncertain whether pertinent findings noted

“The primary care team, I think, sometimes gets lost in the mass of data itself.”

Category: 3. Uncertain whether information is reliable

“They don’t take medication histories anymore [relying on pharmacy data]...but, what the computer thinks is not what the patient’s actually putting in their mouth or injecting into themselves or whatever.”

Category: 3. Uncertain whether information is reliable

“I’m absolutely positive that there are cut-and-paste errors occurring.”

Category: 3. Uncertain whether information is reliable

“The quality issues are pretty much what I’ve talked about. I worry that people don’t actually do their own history and physicals, but the notes imply that they have. But, really what they’ve done is copying and pasting. I know that people don’t do their own medication histories.”

Member-checking and Peer-Debriefing

First, I conducted member-checking as described in the methods section. Nine of ten clinician-educators subjects and eight of ten housestaff subjects responded to the request for feedback regarding the results. All respondents agreed that the coding accurately represented their perceptions.

Second, I conducted peer-debriefing as described in the methods section. The feedback gathered at that session indicated that the findings and categorizations were appropriate.

Triangulation and External Validation

As stated in the methods section, I also interpreted data collected by Dr. Joan Ash and her group during their evaluation of impacts of CPEO at another VAMC teaching hospital in the Northwest US. The group made available to me the transcribed comments relating to CPD collected from physicians and nurses using oral history and observation methods. There were 7 single spaced pages of transcribed comments and observations from participants and observers. Analysis of their data revealed overlap with the data collected in my study, and all comments and observations conformed one of the four themes identified above.

Examples of these data include:

Theme #1: Change in Work Process

“There really doesn’t seem to be any real interaction with the nurses”

“And you move that away from the ward into a room. And now you eliminate the sense of a team, and the kind of human communication that really was essential to taking good care of patients.”

Theme #2: Change in Documentation Characteristics

“There are problems with the cut and paste, however, when yesterday’s note is brought forward and minimally edited. The notes then become template and formulaic. This can make it more difficult to understand and figure out what is new about the situation. The notes are more formula and less synthesis. The note should be more about thought process than data.”

“What they may end up doing is copying and pasting, and we see duplicates.”

Theme #3: Change in Availability

“...communication has decreased but improved access is very positive”

Theme #4: Change in Confidence:

“Physical exam is a classic one. You can’t just cut and paste a physical exam, you’ve got to do it. The same thing with the history.”

“And, instead of taking the pertinent facts from a laboratory report or from another clinician’s progress note, they will cut and paste a whole laboratory report, cut and paste somebody else’s thinking process into their own note and sign it. And sometimes they’re naïve enough to even cut and paste that electronic signature.”

Discussion

Four themes related to the impacts of CPD emerged from the data: 1) Change in Work Process 2) Change in Documentation Characteristics 3) Change in Availability and 4) Change in Confidence.

These findings suggest that faculty and resident physicians perceived the implementation of CPD in the setting studied to have a number of impacts on various aspects of the inpatient training and patient care environments. While many such impacts were described as positive, such as those associated with improved availability, and while there was variability among respondents regarding the perceived significance of impacts noted, there were also many negative and potentially detrimental impacts noted by the participants as attributable to CPD use.

Themes

Work Process Impacts

Reported impacts to the work process were abundant in the data. It appears that use of CPD leads to an alteration in the way in which work is done by those who author and review clinical documentation including clinician-educators, housestaff physicians, and perhaps even nurses. Several of the perceptions noted by the participants raise interesting questions.

Do physicians interact significantly less with colleagues due to CPD? Do physicians actually spend more time documenting as a result of CPD or does the ability

to copy-and-paste and use the other features of CPD results in faster documentation time?

Do physicians spend less time with patients because they can no longer perform documentation tasks in patient rooms?

The contentions that CPD may lead to physicians spending more time documenting, less time interacting with colleagues, and less time in patients rooms should be studied further insofar as they might indicate an impact on patient care. Similarly, such changes in work process might impact the training of physicians and this deserves further consideration.

Therefore, additional questions should be considered. If physicians do interact less with their nursing colleagues when using CPD, what is the reason? Does CPD improve communication and thereby lead to a decreased need for interaction between colleagues, or does the use of CPD lessen the discussion of cases and care plans between team members and thereby worsen communication? Does CPD have an impact on a clinician's ability to provide optimal care to his or her patients? If physicians do spend more time documenting due to CPD, does this occur at the expense of their other clinical duties? If physicians do spend less time in patient rooms, is this due to pressure to find a computer for CPD purposes or is this due to improved access to clinical documentation that might make physicians more efficient during patient interactions? Furthermore, is this detrimental to patient care? And, what do patients perceive to be the impact, if any, after implementation of CPD?

Document Characteristics Impacts

Participants also reported several perceived quantitative and qualitative changes to the characteristics of clinical documentation since the introduction of CPD. They felt that features including copy-and-paste and automated data entry led to fundamental alterations in the appearance and content of clinical documents when compared to paper-based ones. Most respondents commented on redundancy in the record, unnecessarily lengthy documents, and poorly formatted documents. In addition, there were many comments concerning increased presentation of raw data at the expense of its thoughtful analysis, diminished updating of clinical issues in daily documentation, and even concerning outright plagiarism resulting from the easy ability to copy-and-paste document content.

As with the potential changes in work process, these data also lead to some interesting questions. Are these perceived changes in the clinical documentation actually significant when compared to paper-based documentation? More importantly, do these changes in documentation characteristics impact the usefulness of the clinical record as a communications tool between clinicians as they provide care for patients? In other words, again, is patient care affected by these changes? In addition, if there are such changes in documentation characteristics, do they have a detrimental effect on trainee education or on the ability of clinician-educators to evaluate the competence of trainees? If true, these perceived impacts suggest a need to proceed cautiously with implementation of CPD and beg further study.

Availability Impacts

The impact termed “change in availability” was another noted by all participants as important. Improvements in the accessibility of the record, in the legibility of the clinical documents, and in the organization of the chart were seen by all as significant. While there were a few comments relating to the lack of accessibility in certain areas during critical situations (e.g. patient rooms during “code” situations), and while some commented on a possible deterioration in “intellectual availability” resulting from changes to documentation characteristics like “poor formatting” and “more clutter”, the majority of comments regarding availability were largely positive. In fact, as noted above, several respondents reported spontaneously that this impact was significant enough to override any of the possible negative impacts caused by CPD.

One possible explanation for this finding is that availability of the clinical record is so important as to be a threshold concept. Availability issues may be so fundamental as to make any other impacts secondary. While beneficial effects of availability might be at the root of this, there may be other explanations. Another possibility is that external pressures on trainees and clinician-educators to perform their expected education-related duties of documentation and supervision, and on clinicians to meet the expectations set forth by administrative and regulatory entities regarding documentation requirements, are so strong that chart availability is seen as necessary for getting work done, whatever the cost.

Therefore, several questions are raised by these findings regarding CPD’s impacts on chart availability. To what degree is availability actually impacted by CPD? Why is this impact seen as so positive that it outweighs any possible detrimental aspects of CPD?

What is the extent, if any, of the impacts to availability on patient care? Regarding education, does improved availability impact supervision of trainees by clinician-educators as many suggested? Moreover, if there is increased supervision due to change in availability, how does this impact education? Are clinician-educators better able to evaluate their trainees as a result of improved chart availability?

Confidence Impacts

This brings me to the final theme identified by analysis of the data, the overarching impact termed “change in confidence”. As noted in the results section, most participants made comments about their concerns and uncertainty regarding aspects of clinical documentation since the transition to CPD. The changes in confidence fell into three categories related to the perspective assumed by the respondent.

As authors of clinical documents, they found that features of CPD, such as automated data entry, impacted their ability to note pertinent findings. While in the past the very act of writing each item down on paper forced clinicians to consider the data, even if for a moment, the ability to automate insertion of data like laboratory values while using CPD made them less confident that they had noticed pertinent findings. Exacerbating this was the poor formatting of that automatically inserted data.

As reviewers of documents created using such CPD features, respondents found that they were less confident about whether the author of a document had analyzed the data presented. Also, due to CPD features like copy-and-paste, reviewers had less confidence in the reliability of document content like historical or physical examination data that may have simply been copied from previous documents in the record.

Several interesting questions follow from these findings. Are clinicians, in fact, missing pertinent information now that they have the ability to copy-and-paste or automate insertion of data that previously had to be hand-entered? Does the formatting of data significantly impact the clinician's ability to analyze it in the clinical environment as suggested by my participants and supported by the previous work of Nygren et al.? [9, 10, 11] Are clinicians in fact analyzing data less than they were prior to CPD? Is the expression of a clinician's thought process being replaced by increased data representation? Has there actually been a decline in the quality of documentation content and representation or is this simply being recognized now due to the improved availability? And, do any of these changes impact patient care?

Other Suggested Impacts

These data serve to elucidate some possible impacts that CPD users have observed and to suggest that such impacts may occur when implementing CPD in similar settings. Furthermore, these findings suggest that transitioning to CPD may have significant impacts on the experiences of several groups of people, and this deserves further consideration. Four groups appear to be impacted in various ways based on these findings.

Clinician-educators make up the first group apparently impacted by CPD in what they perceive to be a significant way. The clinician-educator respondents suggested that the improved availability of trainee documentation allowed them the ability to review the documentation more often and more carefully than was possible prior to CPD. While Baker et al. recently reported their inability to evaluate trainee diagnostic reasoning via

review of outpatient dictated clinical documentation, several of my respondents felt that the improved availability augmented their ability to monitor and provide feedback to trainees [24]. Furthermore, they reported an enhanced ability to oversee the patient care being delivered by the trainees under their supervision suggesting that they may more easily be able to react to patient-care issues as a result. While such impacts have to be tested further, these data suggest that potential impacts of CPD, including improved availability, may alter the way in which clinician-educators supervise trainees and may even impact the nature of feedback.

The second group whose experiences are seemingly affected by the impacts of CPD are physician trainees. One suggestion from the data is that this change in the method of documentation adds yet another “hat”, that of transcriptionist, to those of doctor, teacher (trainees teach each other throughout their work day), and ward clerk (in the case where they are also responsible for performing CPOE). One possible explanation for what is seen as change in work process occurring after implementation of CPD is that housestaff physicians may be taking advantage of any way to efficiently complete the many tasks assigned to them. In the case of CPD, this might involve relying on features built into such systems like copy-paste and automated data insertion and putting less emphasis on the editing of documents for preferred formatting. Another explanation may be that trainees are simply adapting in the way they think is appropriate given the minimal education provided them on the proper use CPD tools to create clinical documents.

While housestaff work experience may be impacted, another issue suggested by these data relates to the impact this change may be having on their educational

development. The suggestion that there is increased reporting of data rather than interpretation of data or expression of management plans in the clinical record causes one to wonder if this change in documentation may be having an unexpected impact on the intellectual development of physician trainees.

One explanation for the comments made is that, in fact, trainees do express their thought process, or lack of one, in their documentation, and CPD is somehow inhibiting this thought process. Another is that CPD is cumbersome and that trainees are simply not willing to take the extra time involved to overcome the technology and express their thought process as well as they did when using paper. A third possibility is that their representation is just the same as it always has been, that they are progressing in just the same manner as when using paper-based documentation, and that this concern only arises now because clinician-educators are now actually reviewing clinical documentation and noticing the discrepancy between what the physician trainee knows and what he or she expresses in the clinical document. Whatever the explanation, one of these or some alternative, the findings indicate that there is concern over the possibility that CPD may be negatively impacting physician trainees development, and this deserves further study.

The third group whose experience might be impacted by CPD as evidenced by the comments made by my participants is nurses. If in fact there is less interaction between nurses and doctors resulting from this technological intervention, the effects of these impacts on patient care will be important to investigate further.

The fourth and most important group whose experience might be impacted by CPD is patients. While it is possible that the overall care of patients will be improved by enhanced availability of clinical documentation, there is also the suggestion in the data

that doctors may be spending less time with patients as a result of CPD, and that access to data may inadvertently be reduced in certain key areas at critical times as stated above. In addition, there is the suggestion that some clinical data may be missed due to changes including automated data insertion, poor formatting and increased length, and that this may adversely impact patient care. Should these prove to be true on further investigation, addressing the issues will be vitally important, and further study is indicated to determine the significance of these suggestions.

Possible Future Research

It is worth noting that my review of the literature to date has revealed very little systematic research focusing on the impacts of Computerized Physician Documentation. I hope that the findings noted here will serve as a starting point for further research into such impacts in similar and varied settings.

In order to learn more about the degree and extent of such impacts, it may be useful to conduct studies that employ quantitative methodologies. Additional qualitative studies may also be useful in determining the meaning of additional findings noted by future research and in order to illuminate the impacts of CPD, especially on groups such as nurses, patients and others affected by the clinical record.

It will also be important to learn more about the processes that are altered when such systems are implemented. Focus should be paid to understanding current work processes in institutions considering implementation of CPD. By learning what the current processes are, we may be better able to anticipate impacts to them and avoid automation of obsolete or inappropriate processes as we change the way we work. We

should also develop a better sense of what documentation characteristics are at baseline in order to facilitate the evaluation any impacts that might occur.

These findings also remind us that we have an opportunity and a need to carefully address some issues related to clinical documentation in general. For instance, what is the purpose of the clinical record today? Should the process of documentation continue to be done in the same way it has been for decades given that we are now working with a comprehensive computerized patient record system? Does it make sense to include all the data we have traditionally included in clinical documents when said data is included elsewhere in the system?

As we move into the era of the computerized patient record and implementation of CPD, we have an opportunity to reevaluate what should be the ideal format, structure and content of clinical documentation, especially when all other patient data is only a mouse-click away. In addition, it will also be important to readdress and emphasize the education of physicians and other health care providers regarding how to properly perform clinical documentation in this new era.

Finally, as an informatics community, we should strive to determine the ideal feature sets of CPD generation software in order to assist clinicians in easily and effectively creating the best documentation possible to suit its varied purposes. By addressing the issues noted above, will be in a better position to develop and implement CPD systems that have positive impacts on the health care environment into which they are introduced.

Limitations

My study has several limitations. The majority of the data was collected at a single institution from a small sample of physicians. While the congruence of findings collected by Dr. Ash's group at another institution using different methods lend credibility to the findings, the results may not be generalizable beyond the two institutions involved. In fact, even within the primary institution studied, it is possible that the findings would not be applicable to non-Internal Medicine physicians. Similarly, these findings may not apply to outpatient as opposed to inpatient settings, or to non-teaching settings.

Finally, while I was aware, as the interviewer-researcher, of the potential for biasing responses and attempted not to unduly influence the course or direction of the conversation, and while the use of a second independent reviewer, member checking, and peer-debriefing lend validity to the analysis of these findings, it is possible that biases were introduced in the collection or analysis phases of this study.

Conclusion

The use of computerized physician documentation (CPD) as opposed to paper-based documentation was noted to have significant impacts on the clinical and educational environments and personnel of the teaching hospital studied. While changes in the availability of clinical documentation were largely positive, participants also perceived many potentially detrimental changes to documentation characteristics, to the work process, and to the confidence of the authors and reviewers of clinical documentation. Care should be taken when designing and implementing such systems to avoid or minimize any potentially harmful impacts. More research is needed to assess the extent of the impacts identified in this study and to determine the best strategies to effectively deal with them.

References

1. Reiser SJ. *The Clinical Record in Medicine. Part 1: Learning from Cases*. Annals of Internal Medicine 1991; 114:902-907
2. Reiser SJ. *The Clinical Record in Medicine. Part 2: Reforming Content and Purpose*. Annals of Internal Medicine 1991; 114:980-985
3. Tang PC, McDonald, CJ. *Computer-based Patient Record Systems*. In: Shortliffe EH, Perreault LE editors. Medical Informatics: Computer Applications in Health Care and Biomedicine. 2nd Ed. New York: Springer-Verlag; 2001: p. 327-334.
4. Weed LL. *Medical Records That Guide and Teach*. New England Journal of Medicine 1968; 278:593-600.
5. Berwick DM, Winickoff DE. *The truth about doctors' handwriting: a prospective study*. BMJ. 1996;313(7072):1657-8.
6. Kozak EA, Dittus RS, Smith WR, Fitzgerald JF, Langfeld CD. *Deciphering the physician note*. J Gen Intern Med. 1994;9(1):52-4
7. Kohn LT, Corrigan JM, Donaldson M, editors. *To Err is Human: Building a Safer Health System*. Washington, DC: Institute of Medicine; 1999, 77.
8. Kolodner RM, editor. Computerized Large Integrated Health Networks. The VA Success. New York: Springer-Verlag; 1997.
9. Nygren E, Henriksson P. *Reading the Medical Record I. Analysis of Physicians' Ways of Reading the Medical Record*. Computer Methods and Programs in Biomedicine 1992; 39:1-12

10. Nygren E, Lind M, Johnson M, Sandblad B. *The Art of the Obvious: Automatically Processed Components of the Task of Reading Frequently Used Documents. Implications for Task Analysis and Interface Design.* ACM (Association for Computing Machinery) 1992; May: 235-239.
11. Nygren E, Wyatt JC, Wright P. *Helping clinicians to find data and avoid delays.* Lancet 1998; 352:1462-66
12. Ash JS, Gorman PN, Lavelle M, Lyman J. *Multiple perspectives on physician order entry.* Proc AMIA Symp. 2000;:27-31.
13. Ash JS, Gorman PN, Hersh WR, Lavelle M, Poulsen SB. *Perceptions of house officers who use physician order entry.* Proc AMIA Symp. 1999;:471-5.
14. Ash JS, Gorman PN, Hersh WR. *Physician order entry in U.S. hospitals.* Proc AMIA Symp. 1998;:235-9.
15. Bates DW, Boyle DL, Teich JM. *Impact of Computerized Physician Order Entry on Physician Time.* Proc Annu Symp Comput Appl Med Care 1994:996.
16. Tang PC, LaRosa MP, Gorden SM. *Use of Computer-based Records, Completeness of Documentation, and Appropriateness of Documented Clinical Decisions.* JAMIA 1999; 6:245-251
17. Payne TH. *The transition to automated practitioner order entry in a teaching hospital: the VA Puget Sound experience.* Proc AMIA Annu Symp. 1999:589-93.
18. Chelimsky, E Shadish, WR (Eds.). Evaluation for the 21st century. Thousand Oaks, California: Newbury Park, Sage; 1997.
19. Friedman CP, Wyatt JC. Evaluation Methods in Medical Informatics. New York: Springer-Verlag; 1997.

20. Hulley SB, Cummings SR, Browner WS. Designing Clinical Research, 2nd Ed.
Philadelphia, Pennsylvania: Lippincott Williams & Wilkins; 2001
21. Anderson JG, Aydin CE, Jay SJ. Evaluation of Health Care Information Systems.
Thousand Oaks, California: Sage; 1994
22. Patton MQ. Qualitative Research & Evaluation Methods, 3rd Ed. Thousand Oaks,
California: Sage; 2002.
23. Connelly DP, Rich EC, Curley SP, Kelly JT. *Knowledge Resource Preferences of
Family Physicians.* Journal of Family Practice. 1990; 30: 353-59.
24. Baker EA, Connell KJ, Bordage G, Sinacore J. *Can diagnostic semantic
competence be assessed from the medical record?* Acad Med. 1999; 74(10
Suppl): S13-5.



Subject Name: _____ Date: _____

Title of Study: Perceived impact of CPRS-based Inpatient Physician Clinical Documentation Entry on Education and Clinical Practice in a Teaching Hospital

Principal Investigator: Peter J. Embi, MD

VAMC: 648 – Portland, OR

Description of the study and its procedures:

This study involves research. The primary purpose of this research is to gather information regarding your perceptions of direct physician clinical documentation entry (e.g. daily inpatient progress notes) into the VAMC's Computerized Patient Record System (CPRS).

Potential study subjects were selected by the researcher from a pool of faculty and resident physicians who have had experience using or supervising the use of the inpatient physician clinical documentation features of CPRS at the Portland VAMC. Once identified by the researcher, potential study subjects like you were contacted by the researcher by email or telephone and asked if they would like to take part in this study.

If you agree to take part in this study, you will be the subject of an interview that should last approximately 30 minutes. Dr. Embi, the primary researcher, will conduct the interview during which he will ask you questions, take notes, and tape record the interview. The sole purpose of the tape recording is for the interviewer/researcher's future reference during the analysis of your responses and comments. The tapes will be destroyed once the research is completed. You may also be contacted and asked for an additional brief meeting in the future for the purpose of verifying the researcher's understanding of your statements.

As stated below, your identity will be kept confidential by the interviewer/researcher, and will not knowingly be disclosed to any other party. Dr. Embi will be present to obtain this informed consent and to answer any questions you may have regarding it or the study.

Potential Risks of the study:

While every effort will be made to protect your confidentiality by maintaining anonymous notes and tapes in a secure location accessible only to the researcher, loss of confidentiality is a risk of this study.

Potential Benefits of the study:

This study may help to provide the benefit of better clinical practice, clinical education, and ultimately patient care by our improving our understanding of any impacts that computerized physician documentation entry may have.

Withdrawal from the study:

Your participation in this research study is voluntary, and you may withdraw from this study at any time without prejudice to yourself or to any future medical care or employment with this institution or with the Department of Veterans Affairs (DVA).

Subject's Identification (I.D. plate or give Name – first, last, middle

Subject Name: _____ Date: _____

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Principal Investigator: Peter J. Embi, MD

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Treatment in case of injury, source of additional information:

Every reasonable effort to prevent any injury that could result from this study will be taken. In the event of physical injuries resulting from the study, medical care and treatment will be available at this institution. For eligible veterans, compensation damages may be payable under 38 USC 1151. For all study participants, compensation damages resulting from the negligence of federal government employees may be available in accordance with the provisions of the Federal Tort Claims Act. For additional information concerning claims for damages, you may contact VA Regional Counsel at (503) 326-2441. You have not waived any legal rights or released the hospital or its agents from liability for negligence by signing this form.

Any patient participating in a study at the Department of Veterans Affairs Medical Center, Portland, Oregon is encouraged to contact Dr. Dennis J. Mazur, Chairman, Institutional Review Board, to discuss any issues related to their research study participation. Dr. Mazur can be reached through the Research Service, (503) 273-5122.

Your signature below indicates that you understand that the Department of Veterans Affairs Medical Center, your investigators, and the sponsors of this research bear no responsibility for any costs you may incur at other hospitals, clinics, or care institutions related to this study or to any of your medical conditions.

Confidentiality:

The results of your participation in this study may be used for publication or for scientific purposes, but your identity will not be disclosed unless you give separate, specific consent to this, or unless as required by law. As stated above in "Risks", loss of confidentiality is a risk of this study.

Subject's Identification (I.D. plate or give Name – first, last, middle

Subject Name: _____ Date: _____

Title of Study: Perceived impact of CPRS-based Inpatient Physician Clinical Documentation Entry on Education and Clinical Practice in a Teaching Hospital

Principal Investigator: Peter J. Embi, MD

VAMC: 648 – Portland, OR

RESEARCH SUBJECT'S RIGHTS: I have read or have had read to me all of the above.

Dr. Embi has explained the study to me and answered all of my questions. I have been told of the risks and/or discomforts and possible benefits of the study. I have been told of other choices of treatment available to me.

I understand that I do not have to take part in this study, and my refusal to participate will involve no penalty or loss of VA or other benefits to which I am entitled.

The results of this study may be published, but my records will not be revealed unless required by law.

In case there are medical problems or questions, I have been told I can call Dr. Embi at 503-494-7435 during the day and after hours. If any medical problems occur in connection with this study, the VA will provide emergency care.

I understand my rights as a research subject, and I voluntarily consent to participate in this study. I understand what the study is about and how and why it is being done. I will receive a copy of this consent form.

Signature of Subject Date Time

Signature of Witness

Signature of Investigator or Investigator Representative

Subject's Identification (I.D. plate or give Name – first, last, middle