



Brainstorming about next-generation computer-based documentation: an AMIA clinical working group survey

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Summary Computer-based software to record histories, physical exams, and progress or procedure notes, known as computer-based documentation (CBD) software, has been touted as an important addition to the electronic health record. The functionality of CBD systems has remained static over the past 30 years, which may have contributed to the limited adoption of these tools. Early users of this technology, who have tried multiple products, may have insight into important features to be considered in next-generation CBD systems. *Objective and methods:* We conducted a cross-sectional, observational study of the clinical working group membership of the American Medical Informatics Association (AMIA) to generate a set of features that might improve adoption of next-generation systems. The study was conducted online over a 4-month period; 57% of the working group members completed the survey. *Results:* As anticipated, CBD tool use was higher (53%) in this population than in the US physician offices. The most common methods of data entry employed keyboard and mouse, with agreement that these modalities worked well. Many respondents had experience with pre-printed data collection forms before interacting with a CBD system. Respondents noted that CBD improved their ability to document large amounts of information, allowed timely sharing of information, enhanced patient care, and enhanced medical information with other clinicians (all $P < 0.001$). Respondents also noted some important but absent features in CBD, including the ability to add images, get help, and generate billing information. *Conclusions:* The latest generation of CBD systems is being used successfully by early adopters, who find that these tools confer many advantages over the approaches to documentation that they replaced. These users provide insights that may improve successive generations of CBD tools. Additional surveys of CBD non-users and failed

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adopters will be necessary to provide other useful insights that can address barriers to the adoption of CBD by less computer literate physicians.
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1. Introduction

In the past decade, the electronic health record (EHR) has become an important tool for the health-care provider [1–5,6]. Use of an EHR has been shown to produce more complete clinical documentation than the paper record [1], leading to more appropriate clinical decisions [1,4,7–9]. In addition, the EHR is recognized for its potential to implement guideline-based healthcare and to identify and limit medical errors [10–12]. The full potential of an EHR, however, is far from realized. In fact, the percentage of United States physicians that use this technology is between 3% and 20% [1–5,6]. This may be due to the well-recognized barrier of data entry into an EHR [13–17].

One of the more challenging areas of electronic health record development is integrating the EHR into the workflow of the clinician. In a typical day, as clinicians see patients, they document the patients' symptoms and any physical findings discovered during the encounter in the form of encounter summaries. These summaries may be initial history and physical reports, follow-up visit notes, progress notes, surgical procedure notes, or consult summaries, depending on the reason for the patient to be seeing the clinician. There are two key aspects of these notes that make them attractive and important for inclusion in the EHR. First, they represent a rich source of data about the patient. These data may be used to generate reports about the quality of care being delivered, and they may be useful for research or for billing. Second, the act of completing this documentation is typically associated with decision making. Therefore, integrating the EHR into the workflow is best accomplished by developing and encouraging the adoption of tools that support integrating the process of clinical documentation into the same system used to generate problem lists, reports, and laboratory/medication orders. These increasingly available computer-based documentation (CBD) software tools [18–25] typically allow the clinician to use keyboard entry, handwriting recognition, speech recognition, mouse selection, or a combination of these modalities to complete a medical encounter summary or procedure report.

Despite the increasing availability of CBD, anecdotal evidence suggests that its use has not been well accepted by physicians [2,3,26,27]. In part, this poor acceptance may be due to the static

evolution of these systems; most commercially available systems use a similar user interface (a window divided into a panel for selecting keywords and a panel for viewing the note as it is generated), similar processes to generate the note (using keyword selection and typing) and similar data input modalities (keyboard, mouse, discrete-utterance speech recognition).

Although early adopters represent a biased group, their opinions as organizational leaders may be very persuasive to potential adopters of technology [3,28]. This study was conducted to provide a general perception of CBD by a group of early adopters, as well as to prioritize features that they perceive should be present in next-generation systems.

2. Methods

2.1. Subjects

This investigation was a cross-sectional observational study of clinician members of the American Medical Informatics Association (AMIA), a group of over 3200 professionals with a special interest in applications of computers that enhance medical care. This group is clearly biased in favor of early adopters (or developers) of technology, but with a grounding in which technologies are likely to be feasible in widely deployed systems. Because the goal of the study was to survey subjects who were likely to have experience with CBD, we limited our sampling frame to members of three working groups representing the largest number of clinicians (family practice, clinical information systems, and medical imaging systems). Before beginning the study, e-mail address lists for each of the AMIA clinical working groups were obtained. All of the 603 clinical working group members were sent an e-mail describing the study, inviting them to complete the online survey, and informing them of the inducement (a \$3 gift certificate redeemable at a StarbucksTM Café or coffee stand, mailed to them after the survey was completed). Respondents were required to log on using their e-mail address and a specially designated password before being able to access the survey, and respondent's e-mail addresses were stored. Only responses from e-mail addresses that were part of the original working group lists were included in the analyses. The sur-

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