



# Clinical Documentation: EHR Deployment Techniques

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## Introduction

This investigation and analysis of clinical documentation and structured text is the second in a series of tactically oriented issue briefs arising from the California Networks for EHR Adoption (CNEA) initiative. The CNEA program was begun in 2006 to speed adoption and lower the overall cost of electronic health records (EHR) in California community clinics and health centers (CCHCs).<sup>1</sup> In August, 2008, eight grantees representing four models of EHR deployment were funded to advance the adoption of EHRs in the safety net and to share their experiences. Through this health IT collaboration, an array of services is provided to support the adoption of EHR and other applications. The CNEA models/grantees include:

1. **National network:** Build or leverage existing EHR networks, often national in scope, to provide for individual or groups of clinics in California. Grantees:

- Open Door Community Health Center (ODCHC) in partnership with Our Community Health Information Network (OCHIN)
- Next Generation Health Network (NGHN)

2. **Clinic consortia:** Work with California clinic consortia to expand their existing EHR product and implementation services to at least three of their members. Grantees:

- Redwood Community Health Coalition (RCHC)

- California Rural Indian Health Board (CRIHB)

3. **Multi-site expansion:** Support multi-site clinics to expand adoption of their existing EHR product and implementation services to at least three additional clinic sites. Grantees:

- Golden Valley Health Centers (GVHC)
- Shasta Community Health Center (SCHC)

4. **Hospital-based regional extension:** Work with local hospitals to extend their existing EHR product and implementation services to CCHCs in a region or service area. Grantees:

- San Mateo Medical Center (SMMC)
- The Children's Clinic, Serving Children and Their Families (TCC), Long Beach, California

For additional information about the CNEA initiative and the collaborative models of adoption, please see *"Making a Connection: Clinics Collaborate on EHR Deployment"* from the California HealthCare Foundation.<sup>2</sup>

## Clinical Documentation Overview

For most of the history of modern medicine, clinical notes about a patient's case have been circulated locally within a team of primary care providers. For those doctors, nurses, and assistants who are generally all in the same place, and who share a technical vocabulary and a set of assumptions, handwritten clinical notes are generally adequate. There are a few drawbacks: The chart may not be available at the point of

care; the handwriting may not be legible; it may be difficult to aggregate data about a subgroup of patients; and the information may not be complete (for example, tests and vaccinations may not be included).

With electronic health records (EHRs), the information can be accurately disseminated to multiple users, including specialists, behavioral care providers, labs and pharmacies, insurers, public health entities, and research organizations. In an important departure from paper records, EHRs also can provide decision support at the point of care and aggregate data across large populations to identify health trends and potential adverse effects from new treatments. To fully exploit these capabilities, EHRs must move beyond simply transferring free-text notes into an electronic format; they must capture clinical information with structured data and vocabularies. See Figure 1.

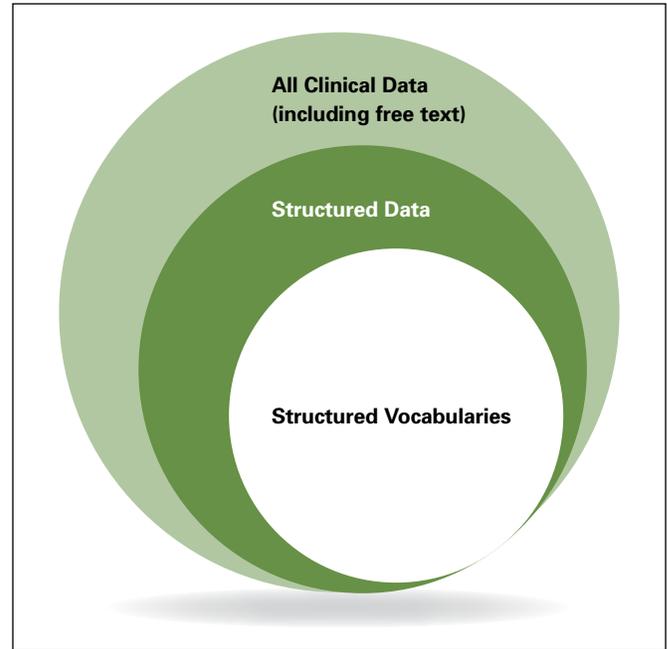
This issue brief explores the clinical documentation options available to users of most EHR systems, the pros and cons of various structured and free-form methods of capturing data, and the impact on efficiency and effectiveness of EHR use.

### Methods for Capturing Data

The capture of clinical data exists along a broad continuum from free-form typed clinical notes to various levels of structured or coded vocabulary and constrained choices. Constrained choices might take the form of drop-down lists, check boxes, radio buttons, and other data entry devices. Any software that requires data to be entered in this kind of specific way is creating structured data.

The use of structured vocabulary to record diagnoses, symptoms, surgical procedures, treatments, and drugs<sup>3</sup> multiplies the benefits of EHRs by capturing clinical data in words or phrases that have standardized definitions. Unlike handwritten, dictated, or typed free text, structured vocabulary enables the computerized analysis of data for patient care, research, and evidence-based medicine.

**Figure 1. Structured Vocabularies as Subset of Structured Data**



For example, a provider recording a visit with a diabetic patient using pre-filled templates, drop-down lists, radio buttons, and other pre-determined choices would be advancing patient care in several ways:

- The data are recorded in a searchable format, in which various diabetes-related terms are intelligently linked to each other. The provider or clinic could then find out how many diabetic patients have current HbA1C test results, or how many need foot exams. Structured vocabulary allows users to measure the effectiveness of specific treatments.
- The structured vocabulary can be linked to clinician-written decision trees, which prompt additional actions by the provider. For example, in response to a particular clinical term entered by the provider, the EHR might prompt a referral to a podiatrist, or it might automatically call up the latest linked lab results. In this way, the EHR can support best practices.
- The data can be linked to other tables, such as the ICD9 billing codes.

- Data can be aggregated and searched, revealing patterns and trends on multiple levels: for an individual provider, for a clinic, for disease tracking for public health, and for population health management.

### Free-form Versus Structured

The following examples of a history of present illness (HPI) summarize the same encounter between a provider and a patient. The first is written as a free-form clinical note (whether captured on paper or electronically):

*Mr. P is a 58 y/o AAM with DM2, HTN, CAD with CABG who presents now with atypical chest pain, a benign physical exam except for SBP of 160, negative cardiac enzymes and chest x-ray, and nonspecific ST changes on EKG. However, given his multiple cardiac risk factors, MI cannot be excluded.*

The second HPI is captured through an EHR using structured vocabulary terms (in this case SNOMED). The codes in parentheses are mapped to the vocabulary terms so that they appear automatically:

*Mr. P is a 58 y/o AAM with “Diabetes Mellitus II” (CID 44054006), “Essential Hypertension” (CID 59621000), “Coronary Arteriosclerosis” (CID 53741008) with Coronary Artery Bypass Grafts x 4 (CID 232772009) who presents now with Atypical Chest Pain (CID 102589003), a benign physical exam except for SBP of 160, Normal Cardiac Enzymes (CID 166662009) and Standard Chest X-Ray Normal (CID 168733007), and Nonspecific ST-T Abnormality on Electrocardiogram (CID 42875005). However, given his multiple cardiac risk factors, Acute Myocardial Infarction (CID 57054005) cannot be excluded.*

Entering free text, as in the first example, allows the provider to note clinical or intuitive connections that might not be anticipated by structured vocabulary. Free text also allows the provider to easily add notes about different conditions in the same patient, in this case diabetes and CABG. However, automated reporting systems and clinical decision support would have

difficulty with the clinical shorthand (DM2, HTN, MI), and would probably miss the significance of a note that contained a misspelling.

Using a standardized vocabulary, as in the second case, the physician is prompted to select certain terms that are mapped to codes and to tables of related clinical terms. Automated clinical decision support or reporting systems would already know the following elements about this patient without needing any further information.

Disorders:

- Diabetes Mellitus II
- Essential Hypertension
- Coronary Arteriosclerosis
- Acute Myocardial Infarction

Procedures:

- Coronary Artery Bypass Graft x 4

Findings:

- Atypical Chest Pain
- Non-specific ST-T Abnormality on Electrocardiogram

Because the structured vocabulary understands synonyms, other providers caring for this patient could use the phrases “heart attack,” “cardiac infarction,” or “MI” instead of acute myocardial infarction. This eases the challenge of providing automated clinical decision support, and helps improve the coordination of care. Furthermore, because SNOMED has a detailed set of relationships behind each term, a report could be run to identify all patients with “Heart Disease” (CID 56265001).

### Challenges of Structured Vocabularies

However, there are significant challenges with using structured vocabularies. The process of capturing all findings in SNOMED terms can be time-consuming, depending on the user interface and the availability of shortcuts like “favorites” to ease data entry. In addition, there would need to be additional clarification to help the

### Coded Terminology and Mapping

Most health care providers are familiar with other examples of coded terminology, such as the International Classification of Diseases (ICD), Current Procedural Terminology (CPT), and Diagnostic and Statistical Manual of Mental Disorders (DSM). Each standard serves a different purpose. The ICD and CPT are used in the United States primarily for billing purposes, while DSM is a classification of mental illnesses, diagnostic criteria, and treatment options.

There are two main standards for structured vocabulary in EHRs: the Systematized Nomenclature of Medical Clinical Terms (SNOMED CT) and the MEDCIN system. SNOMED is managed by the International Health Terminology Standards Development Organization (IHTSDO), and is used by the U.S. Department of Health and Human Services. MEDCIN, created by Medcomp Systems, Inc., is the foundation for Medcomp products, such as the EMR systems they developed. MEDCIN maps its terms to SNOMED as well as to CPT, ICD, and others.

Each of these systems provides coded medical terminology that can be mapped to other indexes, codes, or tables. Such mapping makes clinical data available to parts of the health care system beyond the first circle of caregivers by linking data to other structured vocabulary standards. For example, ICD-9 codes can be linked to CPT codes for billing and other administrative tasks. Structured vocabulary can also be mapped to research criteria for utilization reviews, population health research, and vaccination registries.

In structured vocabulary, a word or phrase can be linked to several other terms and to detailed associated information. For example, Myocardial Infarction has an ID number that is associated with other terms, such as Cardiac Infarction, Heart Attack, and Infarction of the Heart. (In a configurable EHR, clinicians can add other terms and tag them with the appropriate ID number.) On other axes, those terms are linked to detailed information such as signs and symptoms, procedures, drugs, and therapies. This information can be used to provide decision support for the provider at the point of care.

system recognize that “Acute Myocardial Infarction” was mentioned as a disorder “that cannot be excluded,” rather than as one that is present. Without such additional context, the information captured by structured vocabularies is occasionally quite misleading.

It should be noted that free-form text and structured vocabulary are not mutually exclusive. An EHR that uses structured vocabulary might also have a text box for entering a free-form section of the clinical note. Further, the level of detail that is appropriate in a clinical note differs depending on who will be using the EHR and what data users will want to search for and aggregate. For example, a drop-down list for headache symptoms for a system used by a neurologist will be far more detailed than in a system used by an internist. Discussions about the best technological solution will inevitably lead to discussions about best medical practices and about shared uses for clinical data.

### Balancing Structure and Flexibility

While structured vocabulary enables efficient decision support and analysis of patient data, flexibility is also important. It is often useful for the clinician to note aspects of a patient’s history or correlations of symptoms not anticipated by a pre-determined structure, and to follow his or her own thought process during the examination, uninterrupted by questions or prompts from a structured EHR. In some cases, free-form clinical notes may be faster than using an EHR, as even the most thoughtfully designed template will not be appropriate to every clinical situation. Too little detail constrains the diagnosis, while too much slows the clinician down. Finding the right balance is particularly difficult when the patient has multiple chronic conditions.

The table shows some of the trade-offs to consider when developing an EHR system.

**Table 1. Documentation Methods Compared**

Method	Structured Templates
Description	Structured templates are partially filled-in notes created in advance for the most common cases seen by a clinic, department, and/or doctor. Such templates allow clinicians to create a note that not only serves as the medical record, but also stores the data as structured vocabulary, which can drive clinical decision-support functions (such as alerts and/or treatment suggestions based on established care guidelines).
Advantages	Structured templates ease note-taking by presenting a draft to the clinician, who then modifies portions of the note to reflect the current patient’s condition. Depending on the values and content of data fields, additional forms may pop up (as determined by care guidelines of the health center) to ensure a thorough exam. For example, a symptom of chest pain could prompt questions about exertion, family history of heart disease, and history of smoking. Standardized templates allow for uniformity in data capture and in the standards of care provided. Over time, templates improve speed of note-taking and can drive the billing process directly from the clinical record.
Disadvantages	Physicians often complain that notes from structured templates are difficult to read as a narrative of the patient’s condition, as they appear more as lists than as prose. A “chart by exception” approach, where all findings are pre-populated as negative unless the provider explicitly checks and documents a positive finding, brings its own problem of seeming to provide data the clinician may not have actually captured. Considerable preparation is required to develop structured templates that present enough structured vocabulary to cover the types of patients and conditions seen in the practice, but not so much that clinicians are hobbled, or that the data cannot be classified. Structured templates can be unwieldy for notes about patients with multiple chronic conditions.
Best Suited For	Structured templates work well for clinical scenarios with an isolated problem that fits a clear framework with a limited number of easily predictable variations. For example, a template for a patient with a chief complaint of headache can present to the provider a set of signs, symptoms, and physical exam findings that should be checked and listed as either present or absent. Similarly, structured templates work well for acute episodes of care for which there are clear clinical guidelines, for specialty care in which the range of diagnoses and conditions is limited, and for predictable well care checkups or OB cases that follow a regular schedule.
Method	Radio Buttons, Drop-down Lists, Check Boxes
Description	These data entry methods provide clinicians with a variety of ways to enter structured data. A drop-down list presents suitable alternatives to clinicians and usually offers menu options based on data entered in an earlier part of the note. Radio buttons help enter mutually exclusive data options such as gender or yes/no answers. Check boxes help in maintaining and tracking quality of care by signaling exams performed or questions asked. Each entry selected is encoded and stored as a discrete data element that can be aggregated or can drive other clinical protocols and decision support. Check boxes, drop-down menus, and radio buttons can also be embedded within sections of templates.
Advantages	These devices allow for rapid point-and-click selection of structured data elements and are especially useful when, through logic imbedded in the EHR, only the appropriate subset of available data selections is displayed. For example, only medications commonly associated with diabetes would be displayed in a drop-down list for a diabetic patient.
Disadvantages	Some providers complain of too much “clicking” and about the inconvenience of moving from keyboard to mouse to keyboard when documenting their plan of care or clinical note. As with any structured template, careful thought must be given to the appropriate level of detail for choices in lists, check boxes, etc. In addition, there has been some concern that not enough research has been done to determine the optimal spacing between items in a drop-down list to prevent accidental selection of the wrong data element.
Best Suited For	Radio buttons and check boxes are best suited for yes/no questions such as those about smoking, drinking, or I.V. drug use. Drop-down lists are appropriate for parts of the clinical note where there are only a few possible descriptions, and for ruling out symptoms (e.g., no upper respiratory symptoms, no G.I. symptoms).

**Table 1. Documentation Methods Compared (cont.)**

Method	Manual Data Entry (Typing, Stylus, Free-Text Templates)
Description	Manual data entry is referred to as free text in EHR parlance and can be accomplished by typing on the keyboard or, in some applications, by handwriting with a stylus. Free-text templates allow providers to type in notes in any format.
Advantages	If the provider is a fast typist, text can be entered quickly and the note will be expressed in the provider’s preferred style of writing. Free-text templates capture notes that can be retrieved electronically and allow providers to include information that doesn’t have a predetermined place in structured vocabulary.
Disadvantages	Free-text templates are not coded or linked, so they will not trigger prompts or additional information, and they will not show up in searches of linked terms.
Best Suited For	Free-text templates work well for capturing additional data or interpretations not covered by structured vocabulary, such as parts of the note where there is a significant degree of variation that does not easily lend itself to a pre-defined template. The History of Present Illness and the Past Medical History sections are examples.
Method	Voice Dictation, Dictation/Transcription
Description	Traditional dictation/transcription is streamlined in many modern EHRs by having the provider dictate directly into a microphone attached to a computer. A .wav or audio file is created and embedded at the point in the chart that the dictation took place. The .wav file is then sent to a transcriptionist, typed, and uploaded back into the chart as a free-text note. Voice dictation systems translate the spoken word directly into written text within the EHR.
Advantages	Dictation offers the most rapid method for capturing a fully detailed narrative with the least effort expended.
Disadvantages	Like free text, dictated information is not structured vocabulary, although recent advances may lead to the ability to capture certain dictated phrases as encoded data. Current voice dictation systems must be “trained” to the provider’s voice, accent, common phrases, and medical specialty terminology.
Best Suited For	Like free text or manual typing, dictation works well for parts of the note where there is a significant degree of variation that does not easily lend itself to a pre-defined template.

### Experiences from CNEA Grantees

The following examples from four CNEA grantees illustrate several of the points discussed above, including the tension between free clinical expression and structured data capture. They also demonstrate that the transition from paper records to electronic standardized documentation is a process that evolves over time and requires constant attention.

- Dr. Robert Moore, medical director of RCHC and Clinic Ole, noted that the process of configuring the system never ends; staff is always evaluating templates and building new ones. Dr. Moore anticipates hiring a mid-level provider whose primary responsibility will be to manage the use and configuration of documentation templates. “It’s easy for providers to subvert the system by just entering things in free text rather than using pre-defined sets of orders or structured text,” he

said. RCHC hopes to create specialized audit reports to identify when this happens and to provide support that will encourage providers to use the templates. Emphasizing the need to keep all consumers of clinical data in mind, Dr. Moore acknowledged that templates are hard to build. “Doctors tend to build templates according to their personal preferences and to meet their specific needs and vision,” he said. However, he added, this can sometimes derail the effort to keep more strategic data collection goals at the forefront of the documentation process.

- John Giambruno of Planned Parenthood Mar Monte, a member of the NGHN, described an enlightening moment during the development of a standard configuration for their EHR: “One of the very first ‘Ah ha’ moments was when we took the pregnancy testing and counseling

visit, the most basic visit we have, took all the affiliates' forms, and found that there was only 30 percent commonality. There's no reason that an organization like ours with a standardized set of protocols needed such a customized approach." Seeing that a common template would make it easier to implement the EHR and analyze the data led them to secure funding for developing a set of standard templates.

- Shasta Community Health Center took an evolutionary approach to standardizing templates and clinical documentation. CIO Charles Kitman said, "Without standardization, you don't get true quality. Constant variation will never give you a picture about what really works." Initially when they went live with their EHR the focus was simply on getting staff comfortable with the new system. Standardization and structured data entry was the next step. Kitman said they were surprised at the many factors that cause "exceptions to the rule," such as homeless patients and patients with multiple insurance carriers—which require capturing unique data elements. The solution for Shasta was listening and testing refinements and revisions over multiple cycles.
- Several grantees reported convening a clinical standards committee or clinical steering committee to define and vet clinical templates and documentation standards. Golden Valley Health Centers, Shasta, San Mateo Medical Center, and NGHJ all adopted this approach. While time-consuming initially, it proved to be essential in gaining consensus and buy-in for the new system.

## Conclusion

A smoothly running EHR offers many benefits, but comes with some costs: Productivity drops during the implementation period, and the system is only as good as the information entered into it. Structured vocabulary must be a balance between pre-determined data and choices, and the flexibility that is a key to good health

care. A thoughtful design process is crucial to developing an EHR that meets the needs of disparate groups without adding too many new tasks to an individual's workflow. That design process needs to result in agreements about standards of care; it will be most successful if it includes representatives from all the groups who will be using the system—those entering clinical notes and those retrieving, classifying, and linking to the data contained in the notes.

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## ABOUT THE FOUNDATION

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## ENDNOTES

1. The Blue Shield of California Foundation (BSCF), the California HealthCare Foundation (CHCF), and the Community Clinics Initiative (CCI), a joint project of the Tides Foundation and The California Endowment, are funding this project.
2. [www.chcf.org/topics/view.cfm?itemid=134138](http://www.chcf.org/topics/view.cfm?itemid=134138).
3. Structured vocabulary is sometimes called coded terminology or controlled vocabulary.