MEDICAL RECORDS INSTITUTE

HEALTH IT ADVISORY REPORT

Terminologies: Services and Management

Volume 3, Number 10 Nov. - Dec. 2002 | e.healthrecord.news

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Editorial Advisors

Terminology Services[1]

Joan R. Duke, FHIMSS, MA[2]
John Crawford, PhD[3]

NCVHS, the National Committee on Vital and Health Statistics, has developed recommendations for uniform standards for patient medical record information. The report states that high quality health care depends on complete and comprehensive patient medical record information. This information is essential to support diagnosis and treatment, measure and improve quality of care, advance public health, enhance healthcare productivity, and facilitate reimbursement.

The NCVHS recommendations address issues unique to the sharing of medical information, including:

Interoperability of systems

Comparability of data

Data quality

Interoperability and comparability depend on functional interoperability (the ability to exchange information between systems) and semantic interoperability (the ability of data to have the same meaning among different systems). To share meaning, medical data must be interpreted using standard terminology, including the context (architecture, structure, and setting) in which the terminology is used. Data quality is supported by standards but also depends on the clinical task at hand and the resources available (human as well as tools, both of which are outside the scope of this paper).

NCVHS uses terminology as a collective term to include code sets, classifications, and nomenclature (or vocabulary).

Code sets are representations assigned to a term so that it may be more readily processed.

Classification terminologies arrange and aggregate terms by category for easy retrieval, such as the International Classification of Diseases (ICD) or Current Procedural Terminology (CPT).

A nomenclature (or vocabulary) is a set of specialized terms that facilitate precise communication by minimizing or eliminating ambiguity. The term "controlled vocabulary" indicates only the set of individual terms in the vocabulary. A "reference terminology" relates terms one to another (a set of relationships) and assigns qualities to them (a set of attributes) to promote precise and accurate interpretation. These relationships and attributes are represented in some type of an information model. Examples include LOINC for laboratory (Logical Observation Identifiers and Codes), National Health Service Clinical Terms (formerly known as the READ Codes) for primary care, Nursing Interventions Classification (NIC) for nursing interventions, and over 30 others identified by NCVHS.

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Medical Records Institute
Advisory Report

Editor-in-Chief
C. Peter Waegemann

Managing Editor
Kathleen Milholland Hunter, PhD, RN

Content Coordinator
Patrick Devitt

Published 10 times a year by the
Medical Records Institute
255 Washington Street
2 Newton Place, Suite 180
Newton, MA 02458
Telephone: (617) 964-3923
Fax: (617) 964-3926
email: cust_service@medrecinst.com
Web: www.medrecinst.com

Contributions and comments on newsletter subject matter are invited. Editorial correspondence should be directed to Kathleen Milholland Hunter newsletter@medrecinst.com.

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MEDICAL RECORDS INSTITUTE

Editor's Note

Kathleen M. Hunter

In our November issue, the primary focus is on terminology in healthcare and how healthcare information technology impacts the uses of terminology. In one article, Joan R. Duke and John Crawford examine several critical terminology-related issues in the sharing of healthcare information. They also discuss in depth the concept of terminology services and how terminology services affect these issues.

Tom McDonald and Robin Raiford provide an extensive discussion of issues related to achieving full terminology integration. They summarize the current state of healthcare terminologies, analyze challenges facing healthcare organizations, review the status of terminology standards, and present the key requirements of terminology management.

Dr. Carol Bickford's article, "A Potpourri of Issues Associated with the Computer-based Patient Record", is intended to stimulate discussion on several important points about computer-based patient records. We hope you will be interested in responding to these points and perspectives with an article.

Kathleen M. Hunter, PhD, RN, BC

Health IT Advisory Report is indexed in the Cumulative Index to Nursing and Allied Health Literature (CINAHL). Full text articles are available through CINAHL (www.cinahl.com).

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It is important to note that, in this definition of nomenclatures, two aspects are needed for medical communications: the reference terminology and the information model. The meaning of the term is dependent on its context, which is defined by the information model referenced to the subject matter vocabulary.

THE NEED FOR A STANDARD TERMINOLOGY

Adoption of a standard terminology goes a long way toward achieving comparability of data. Comparability requires that the meaning of data is consistent across sites and applications. Healthcare providers and vendors have developed numerous medical terminologies including code sets, classifications, and nomenclature (or vocabulary) to describe medical events. These terminologies permit the capture of discrete, coded clinical data and the sharing of observation data stored in patient data repositories and clinical trials databases.

Without the use of standard terminology, data are not comparable, cannot be interchanged among systems, cannot be linked to decision support resources for real time feedback to clinicians, and cannot be re-used for (1) aggregate data analysis, (2) building of medical knowledge, and (3) development of clinical guidelines. In summary, implementation of standard, controlled, structured terminologies[4] is required to:

Capture clinical information for standardized patient charts by coding medical concepts related to the patient

Improve access to the information needed to care for the patient and manage the healthcare enterprise

Support the development and use of clinical guidelines and protocols

Enable clinical decision support such as medical alerts, protocol advice, and other types of real-time analysis of a patient's data

Enable the flow of data that retains granularity and meaning between disparate computer systems

SNOMED Reference Table

Type	SNOMED Code	Alternate Code
Lab	SNO-1	1
Lab	SNO-2	2
Lab	SNO-3	3
Lab	SNO-4	4
Lab	SNO-5	5
Lab	SNO-6	6
Lab	SNO-7	7
Lab	SNO-8	8
Lab	SNO-9	9

Lab Result Table

Code	Component	Normal Range	Result	Abnormal
1	Na+	135-153	137	
2	K+	3.5-5.3	3.9	
3	Cl-	95-108	102	
4	HCO3	21-29	27	
5	Gluc	68-110	111	H
6	BUN	5-25	25	
7	Creat	0.5-1.4	1	
8	Ca	8.4-10.2	9.3	
9	Ph	7.38-7.46	5.1	L

Figure 1 Illustration of How Lab Data Are Stored

Physical Exam:

General: Dt=03/16/01, General: Young black male sitting up on edge of bed in NAD at rest, Head: Normocephalic, atraumatic, Eyes: PERRL, EOM intact, Sclera non-icteric, Neck: Supple, no rigidity, Resp/Lung: Lungs CTA, Chest/Thorax: Normal inspiratory movements, No masses, GI/Abdomen: Bowel sounds normal, Soft, non tender, Lymph: No edema, Musculoskeletal: Normal gait, Skin: Warm, Dry, Neuro: A&O x 3, Mental status normal, Psych: Mood & affect appropriate, GU: Deferred

Cardiovascular: Dt=03/16/01, JVD: 10 cmH20, JVD Waveform: normal, Hepatojugular Reflux: moderate, PMI Location: 7 cm lateral to MCL, 6 th interspace, PMI Size: 5 cm, PMI Character: diffuse (faint), RV Impulse: absent, Thrill(s): absent, S1: normal, S2: normal splitting, P2 Intensity: estimated PAsys pressure 45 mmHg, RVS3: absent, LVS3: moderate, RVS4: absent, LVS4: moderate, Murmur(s): Systolic (holo) 3/6 at apex c/w MR, Vascular: Radial pulses +2 bilat, PT +2 bilat.

Assessment/Plan:

Cardiomyopathy - Dilated. Diagnosed 3/2001. Assessment/Plan: 03/16/01-Tolerated increase in Coreg dose last evening w/ SBP in upper 80's to low 100's; HR has improved since addition of Coreg. Keep Coreg at present dose & monitor BP.

Congestive Heart Failure. Admitted 3/2001 with severe exacerbation. Assessment/Plan: 03/16/01-I & O's even over last 24 hrs; wt. trending up slowly; denies orthopnea; Class II CHF symptoms. Consider need to increase oral Lasix dose; continue to monitor daily wt's & I & O's closely.

Pre-Transplant Status. Assessment/Plan: 03/16/01-Evaluation process nearing conclusion. Await decision of clinical team.

Eczema. Assessment/Plan: 03/16/01-Improved slightly w/ topical treatment. Continue current regimen of Cleocin.

Obstructive Sleep Apnea. Uses CPAP at night. Assessment/Plan: 03/16/01-Controlled; rested well last night. Continue to use CPAP at night.

LV thrombus. Noted on echo 3/13/01. Assessment/Plan: 03/16/01-INR w/o bump after 2 doses of warfarin 10 mg the last 2 nights; anticoagulated on heparin drip; no clinical signs of distal embolization. Continue warfarin 10 mg po tonight & follow INR closely; continue heparin drip until INR over 2.0.

Figure 2: Example of Free Text Progress Note

Provide complete and comprehensive medical data for practice analysis to facilitate outcome research, clinical epidemiology, and continuous quality improvements

Permit sharing of information between organizations regardless of vendor system used

Optimize the use of medical knowledge resources

Increase the scope, efficiency, and effectiveness of clinical and health services research

CURRENT APPROACHES TO TERMINOLOGY DESIGN

Storage And Management Of Text-Based Information
Currently most patient data are stored as text or as coded tabular data. For example, lab component results may be stored in a table where one row is allocated for each result value. The result value, which can be either text or numeric, is usually stored in a text field (fig.1).

Storing the data in a specific table defines the context for the data and allows for linking to a reference table. However, much of the clinical data about patient is not tabular. Such data are currently stored as free text and are not amenable to query and analysis tools. Consider the above snippet of an actual cardiology inpatient daily progress note (fig.2).

In order to store this data in a manner that facilitates analysis, it must be stored as deeply structured text. Deeply structured text is organized as hierarchically structured data where there are a variable number of levels to the tree hierarchy, and the data nodes are dependent on the content. Note that the physical exam is divided into the general exam and the cardiovascular exam; these exams are divided into separate sections, and the examination observations are a series of phrases and terms that are combined to capture the clinician's meaning. Many of the terms, phrases, and concepts could be encoded using SNOMED-CT (Systematized Nomenclature of Medicine – Clinical Terminology), and the diagnosis and procedures could be classified by ICD and CPT codes. To accomplish this coding requires standards for the structure and content of the physical exam and assessment/plan sections of the documentation report. Examples of the different types of patient data and their storage requirements are summarized in Table 1.

Tabular Data	Deeply Structured Documentation Data
Patient demographics	Encounter statistics
Encounter statistics	Radiology results
Orders	Patient histories
Lab results	Problems
Medication orders and administration	Exams
Vital signs	Assessments
Fluid	Plans
	Progress notes

Table 1: Different Types of Patient Data and Their Storage Requirements

Entry Terminology – The Human Interface
Ideally, patient data should be captured once at the point of care. However, in concert with the purpose of the terminology encoding, consideration must be given to the human interface.

Historically, coding has been a backend process performed by medical records and quality assurance staff and primarily designed to support reimbursement and external reporting requirements. This method is adequate for evaluation of clinical outcomes and the expansion in the number of multi-facility clinical trials and associated data capture and data sharing requirements. However, real-time capture of information is needed for the use of clinical decision support tools to improve patient care and integration of care delivery with evolving medical knowledge bases

Methods of data collection include document scanning, optical character recognition, medical transcription, speech recognition, and structured data entry. Any suitable data capture methods require completeness and ease of use. To translate automatically the captured text data to coded data requires natural language processing (NLP) or human intervention, unless the data are captured with structured data entry (SDE). Since there are few commercially available products for NLP, almost all systems that require real-time coding use some form of SDE or SDE in concert with NLP.

Examples of SDE include Medcin from Medicomp; healthcare information system vendors such as Cerner, IBM and 3M; and healthcare organizations such as Columbia Presbyterian Medical Center, Kaiser-Permanente, and Latter Day Saints Hospital. These organizations have developed their own structured data collection templates and template development tools that define the user interface in proprietary formats. Building standardized human interfaces and document templates will be an area of significant industry effort in the upcoming years.

Limitations of Terminology Efforts to Date
Regardless of whether data can be stored as tabular data or deeply structured data, it cannot be transmitted from one system to another or aggregated across sites unless there is functional and semantic interoperability, including comparable data context. Standardization efforts have made some progress, but the limits to these efforts that hinder automated analysis and aggregation of patient data include:

Incompleteness
There are medical concepts that are not included in any of the standard coding systems.

Ambiguity
Some of the code sets allow a medical concept to be mapped to different codes.

Change
Since medicine is always changing, new codes are required.

Usability
The establishment of a coding standard that effectively records medical conditions and is usable by clinicians when recording medical data is needed. There is a difference between the need for developing a scientifically valid classification structure for epidemiological purposes and the need for developing a nomenclature suitable for the recording clinician. Agreement is needed to know which coding systems are appropriate under which circumstances and to provide valid communications between the various coding systems.

Integration of disciplines
Coding systems have been developed to meet the needs of specific disciplines. Within the medical and nursing disciplines, there are code sets from home health, perioperative care, anesthesiology, long-term care, acute care, etc,. and there are multiple coding systems within each discipline or specialty.

Agreement
Agreement on the reference terminology SNOMED-CT (Clinical Terminology), which converged several terminologies into one system using SNOMED as the base, may be the best bet for a comprehensive standard terminology. But other terminologies will still be needed to serve different care settings and care providers.

Context
Codes must be understood in the context of a particular patient record architecture.

Type of communication (e.g., patient admission, patient assessment, order for service, record results)

Information reference defining type of data and attributes (e.g., order includes locations, participants, actions, etc.)

Domains or subject areas defining data and constraints (e.g., tables, master files, vocabularies)

Document types (e.g., cardiology progress note, perioperative report, discharge summary), and structure of documents (e.g., ambulatory encounter document: chief complaint, family history, life style, history of present illness, etc.)

Event or temporal quality (e.g., admission assessment, preliminary result, discharge referral)

Relationships between terms
Terms combined with other terms, connectors, modifiers, and qualifiers in expressions for phrases and sentences

Multiaxial systems
Differences in terminology hierarchies to organize and classify why a term is used (i.e., disease, body part, chemical, drug, procedure, general modifier, etc.)

There is a need for convergence among the coding systems and for maps, rules, and organizations to define the agreed-upon structure or patient record architecture.

DESCRIPTION OF TERMINOLOGY SERVICES

Terminology services, as defined in this paper, reside in separate modules or applications designed to address many of the problems derived from the multiple coding systems in existence today and facilitate encoding of data for analysis, aggregation, and interoperability. Terminology services may run within a vendor's application or run on a separate machine or server included with the vendor's application. Terminology services typically have the following capabilities:

Metadata services
Retrieve information about terminology and properties of terms and concepts within a specific terminology domain

Medical concepts
Assign and validate unique identifiers for individual medical concepts. These concepts are organized into a network that links medical concepts in a variety of ways, such as parts of the body, synonyms, generalization, and specialization.

Pre-loaded medical concepts
So that an organization does not start from ground zero in building its medical terminology. It will contain medical content to facilitate capture of deeply structured text and coding behind the scene.

Concept mapping
Allows mapping of medical concepts to standard coding and concept systems such as ICD9, CPT, LOINC, SNOMED-RT, or proprietary codes used by an organization to code terms and phrases. Those mappings may be built into the server and also may be the responsibility of the healthcare organization.

Authoring
Allows the user organization to add to and modify the medical concept database and associated mappings.

Local mapping
Allows mapping of medical concepts to the locally developed code systems that may have been in use for a number of years.

Query mechanism
May be an API (application programming interface) or 'stored procedures' for reading tables where terminology data are stored. The means of retrieving elements may be:

Lexically based - Using actual words or synonyms of words containing a phrase in a term list (search for a string 'cardiac', 'heart', or 'cardi' as suffix or prefix)

Concept-based - Using the meaning of the phrase (e.g., search for a concept whose declared meaning has something to do with the 'heart' concept). This look-up requires understanding of language, lexicon, and grammar.

Support of rules - The ability to attach rules to concepts

There are a variety of potential applications for terminology services. In online applications, uses include:

- Coding, controlling, and managing code sets
- Enabling pick lists
- Enabling order and order sets including medications
- Enabling alerts and warnings
- Coding protocols and guidelines (clinical actions and decisions)
- Capturing of highly structured text such as exams, medical histories, assessment, and treatment plans
- Accessing medical knowledge bases

Backend uses of a terminology server with an existing clinical data repository might include:

- Translation of coding in standard terminologies (e.g., SNOMED)
- Indexing and retrieval of documents (e.g., MESH)
- Sharing of data among repositories
- Retrieval and analysis of clinical data based on medical concepts

STATE OF THE INDUSTRY

Terminology services as an integral part of vendor offerings have not yet come into general release. The approaches to implementing such services have been within individual organizations or within vendor products. Most of the vendor products and homegrown systems provide for the coding and translation of their repository data within their patient record architecture to support their proprietary clinical documentation, alert, and retrieval functions. Some vendors are now offering mappings to standard terminologies and licensing terminology software products.

As noted in previous sections, capturing of clinical data using structured text and standardized medical terms is one of the major obstacles in the path to the computerized patient record. The challenge is to be able to capture medical information in a consistent fashion for its timely **use** by the appropriate care providers, for intelligent processing by rules and alerts, and for its **re-use** in outcomes studies and research. There has been progress on a variety of fronts. Standards organizations, vendors, and leadership healthcare organizations have projects underway that attempt to address the problem. Below is a summary of some of the major efforts:

State of Standards Organizations

There are numerous standard message format developers such ASC X12N, ASTM, HL7, DICOM, IEEE and NCPDP. There are also many medical terminologies from classifications systems like ICD and CPT to more robust medical terminologies including nursing codes such as NIC and NANDA and clinically specific codes such as DSM, LOINC, and SNOMED.

SNOMED

SNOMED CT[5] has converged many different vocabularies under its standards. It includes a mapping to ICD-9-CM, Clinical Terms Version 3 (READ) from the United Kingdom, LOINC (Logical Observation, Identifiers, Names & Codes, and many other vocabularies.. With the July 2002 release, areas covered includes nursing from the Perioperative Nursing Data Set (PDNS), Nursing diagnoses from NANDA, veterinary medicine, ophthalmology, digital imaging (DICOM) and more. In addition, medical knowledge bases such as First Data Bank (a knowledge base of drug information) have embedded SNOMED codes as part of their knowledge base, and CAP's cancer protocol also has integrated SNOMED codes into its protocols.

National Library of Medicine

The National Library of Medicine Unified Medical Language System (UMLS) Metathesaurus is the largest domain-specific thesaurus containing information about biomedical concepts and terms from many controlled vocabularies and classifications used in patient records. It links medical terms (e.g., ICD, CPT, SNOMED, DSM, CO-STAR, and D-XPLAIN) to the NLM's medical index subject headings (MeSH codes) and to each other. The UMLS also contains a specialist lexicon, a semantic network, and an information sources map. Together, these elements should eventually represent all of the codes, vocabularies, terms, and concepts that will become the foundation for an emerging medical informatics.

To use the thesaurus to codify medical text, there must be close integration of the thesaurus with the query program. Studies[5] in using the thesaurus for concept matching have demonstrated problems in redundant concepts, homonyms, acronyms, abbreviations, spelling, and terminology gaps.

The UMLS, as a repository of over 30 vocabularies, serves to support research projects, but there are problems using the Metathesaurus, due to the different information content and structure, for different aspects of clinical documentation such as discharge summaries, assessments, treatment plans, etc. The organization, fields, and phrases vary based on the clinician completing the document and the type of document. (e.g., the diagnosis is conceptually different if found in family history versus in the discharge summary).

At Columbia Presbyterian Medical Center, an effort to code using a Medical Entities Dictionary (MED)[6] using terms and mappings from UMLS and LOINC for laboratory data, retrieval from knowledge-bases (MESH), and clinical decision support has demonstrated successful use in improved patient data, access to information sources, use of expert systems, and discovery of new medical knowledge. Use of the UMLS has also resulted in the development of Metaphase, a middleware component, developed to be accessed for descriptions and codes for medical problems. It contains a subset of the Metathesaurus and problems from the Mayo Clinic and Harvard Beth Israel Hospitals.

Health Level Seven (HL7)

Health Level Seven (HL7) is developing standards for the healthcare information model and the format and content of clinical documentation. In February 2002, NCVHS recommended HL7 Version 2 as the current patient medical record information (PMRI) standard for exchange of information. The Committee also recognized the emerging standards of HL7 Version 3 on its potential to provide superior levels of interoperability and data comparability.

HL7's reference information model (RIM) is the cornerstone of the HL7 Version 3 development process. The RIM is a standardized data model intended to define source clinical data and temporal quality of such data. Modeling efforts in Version 3 include the following:

Use case model describing healthcare communications (e.g., provide services including triage patient, order service, schedule service, and report results)

Reference information model and subsets of the RIM — domain information models (DIM) —defining subject matter, data, and data constraints (e.g. controlled vocabularies)

Interaction model defining trigger events and information flows

Message information model defining message content and message constraints, including content and structure of clinical documents

The HL7 clinical documentation architecture (CDA), previously known as the patient record architecture (PRA), provides a clinical document definition and classification and an exchange model for clinical documents (such as discharge summaries and progress notes); and a mechanism for transmitting the document. The CDA is an attempt to standardize clinical documents for exchange. The data format of the clinical document outside of the exchange context is not addressed in the CDA. Instead the RIM is referenced to define the clinical content. By leveraging the use of XML, the HL7 RIM, and coded vocabularies, the CDA makes documents both machine-readable, so they are easily parsed and processed electronically; and human-readable, so they can be easily retrieved and shared by the people who need them. The HL7 organization has approved the initial version of its CDA and in November 2000 received ANSI approval.

HL7 committees are actively working the data modeling and methodology, structured documents, vocabulary, and other aspects of the messages and transactions. This work will continue to further define the document structures such as lists, tables, and content elements that allow encoding of data and specific sections that are part of each type of clinical document.

Other NCVHS Standards Recommendations:

In addition to HL7, NCVHS recommended the following message format standards abased on their ability to address specific market segment needs:

Digital Imaging and Communications in Medicine (DICOM) – This standard supports retrieval of information form imaging devices/equipment to diagnostic and review workstations and to storage systems.

NCPDP SCRIPT – This standard communicates prescription information between prescribers and pharmacies.

Emerging standards recognized based on their potential for market acceptance include:

IEEE 1073 – This is a set of medical device communications standards to communicate patient data from medical devices typically found in acute and chronic-care environments (e.g. patient monitors, ventilators, infusion pumps, etc.)

Harmonization among PMRI Message Format Standards – HHS encourages harmonization of data elements and definition for future version so that they are consistent with HL7 RIM.

Human Genome Project and Bioinformatics

Human genome research is the sleeping giant in the world of terminology. That giant is about to wake up and change the scale and scope of the issues health care is facing in the area of terminology and vocabulary management. Initially, this impact will be felt most by academic and research-oriented facilities, but within the next several years, genetic information will likely become a standard part of healthcare delivery. A new field called bioinformatics has emerged out of this research. Bioinformatics is defined as the tools and technologies used to create and manage standard terminologies about and data representations in data repositories of gene sequence data, micro array data (genetic information involved in regulation of a specific body function/part), gene expression data, and protein or clone data. Without going into depth to describe this field in more detail, specific issues faced by healthcare delivery include:

Database size and change control – the repositories used to store data on gene sequences are huge and ever changing. To manage data quality, change control, and provide access tools and technologies, these repositories will likely reside outside the healthcare institution at research facilities or universities.

Access to external databases – as noted above, much of this data may reside outside the institution and in many cases will reside outside the United States. Terminology servers or the terminology management system will need the capability to access these datasets through application program interfaces (APIs), embedded programs, or other mechanisms.

Multiple database designs and tools – it should come as no surprise that this industry, like most other areas of health care, has yet to standardize tools and data structures. Each repository has its own set of tools and conventions. There are a number of efforts underway to create standards for data exchange and content.

State of the Vendors

The healthcare information system vendors have moved slowly in bringing products to the market that support capturing of structured text and incorporate standardized medical terminologies. Their products often have cross-links of one table to another, but products that use independent terminology servers do not exist as yet. There are reasons for this. The first is that introducing this capability represents a major software reengineering and development effort. Second, the customer community has been slow to demand these capabilities because the perception is that the biggest payoff is on back-end data analysis. Third, since no vendor really has the capability, the other vendors are not losing sales by not having the capability. Below are some efforts of note (this is not intended as complete list of vendors).

Eclipsys

Eclipsys has announced plans to integrate a terminology server provided by a separate company (Apelon) into its clinical system and has plans for the deployment of a vocabulary manager.

Cerner

Cerner utilizes an internal terminology server capability, implemented with a series of tables that allow the capturing of structured text and the use of medical concept terms. Coding is proprietary, but translation is available to some standard terminologies. . In August 2002, Cerner signed a licensing agreement with Health Language, Inc to use Cyber-LE as a tool and platform to develop and manage its controlled medical terminology within their Millennium solutions.

3M

3M has developed its own data dictionary, vocabulary servers, and knowledge base for rules and alerts. Its structured data entry templates are built on the Medcin templates from Medicomp. Their data model conforms somewhat to the data model developed by the HL7 RIM. The architecture provides for the separation of the terminology processing, but only when integrated with the 3M systems. It is not marketed on its own to integrate with other vendor products.

IBM

IBM worked with Kaiser Permanente (Kaiser) in the design of the their clinical information system (CIS) for ambulatory care, including the implementation of a terminology server. Kaiser initially used the services of the company, Cyber+ (now called Health Language), and then developed their own version for Kaiser in Colorado. IBM was engaged at the University of Michigan Hospital and Health Centers (UMHHC) to develop the CIS for the inpatient areas. They worked with Health Language to incorporate the database into the new clinical information system and the institution's existing medical records systems. IBM is also heavily involved in the nationwide implementation of Kaiser's outpatient clinical system, where now the terminology server vendor is the company, Apelon.

Niche Vendors

Several niche vendors offer products that facilitate deployment of clinical documentation. Since clinical documentation is an integral component of an HIS, these vendors must establish partnership relationships with HIS vendors in order to be successful. A selected group of niche vendors is described below.

Apelon. This terminology server vendor has been around since 1984. It supports many of the features defined for a terminology server and provides a back-end text document indexing and retrieval capability. Their product is used to author many of the standard coding systems such as SNOMED and CPT. It has a partnership relationship with the Eclipsys HealthVision product line to be included to support clinical documentation. It has been selected as the terminology server by Kaiser in its nationwide effort to capture outpatient clinical data.

Health Language. This company was spun off from Cyber+ in 2000. It offers a competing product to Apelon. It has no announced relationships with HIS vendors but has been selected by the University of Michigan to be implemented as part of an inpatient clinical documentation system and coding of existing clinical systems. The Cyber+LE database includes SNOMED, CPT, and ICD codes. It also provides a concept-based server that correlates the many terms and codes used to describe medical conditions, procedures, and treatments into a common, single set of concepts. The process unifies those codes with standard relationships to body structure, diagnosis, observations, conditions, and more.

Medicomp (Medcin). This product contains a proprietary user interface and medical content that can be used to create structured clinical documentation. Medcin contains proprietary data elements for symptoms, history, physical examination, tests, diagnoses, and therapy and links to CPT, ICD and DSM for standard coding. The Medcin system defines the concept organization, phrases, sentences, qualifiers, properties, and values in its proprietary charting system. The content is aimed primarily at the physician outpatient encounter, but 3M has used the software developers kit (SDK) as the basis of its inpatient documentation modules. This system does deal with qualifiers that alter terminology meaning. Medcin has been selected for incorporation into the CHCS-II system, and initial sites were installed in 2002.

State of Selected Health Care Organizations

The last important area of activity related to clinical documentation is projects by leading healthcare institutions. There are numerous efforts.

Kaiser Permanente

Kaiser in Colorado has successfully deployed a terminology server-based system for capturing outpatient clinical documentation. This has been in production for over two years. IBM provided technical support for the project. The terminology server used is not a commercially available product. Analysis and retrieval was not the primary goal of the system, and there have been some obstacles in analyzing the data retrospectively. It is very successful at capturing encoded data, enabling clinical decision support, and saving clinician time. It operates on a paperless basis. This project appears to be one of the most successful production implementations of structured text and a terminology server. Kaiser has decided to deploy the next generation of this system on a nationwide basis using a commercially available terminology server from Apelon.

University of Michigan Hospitals & Health Centers (UMHHC)

Michigan begun a project with IBM and Health Language to use a terminology server for its inpatient system. The effort developed a lexicon that provides SNOMED, First Data Bank, ICD, CPT, NANDA, and ICPC (International Classification of Primary Care) vocabularies. Orderable procedures in the clinical information system and ancillary systems are mapped to the lexicon so the clinical applications can interpret term, concept, facet, and relationship. The coded data are also stored in the clinical data repository (CDR) where it can be used to review care across populations and regions and to gain insights in how to deliver better care.

Columbia Presbyterian Medical Center (CPMC)

Columbia Presbyterian has developed a system called MEdical Dictionary (MED), which is a semantics network based on the UMLS. The MED includes terminology and knowledge used to classify codes and to prevent redundancy, ambiguity, and misclassification, express synonyms, identify explicit relationships, and map multiple classifications for a variety of projects at CPMC.

Mayo Clinic

Mayo's work with problem lists and interface design is based on use of a terminology server. Mayo has developed an object-oriented terminology server that navigates to clinical terminologies, provides synonyms, invokes word completion and spelling correction, provides intelligent lexical normalization, and invokes semantic local browsing. Mayo's enterprise lexicon is context sensitive, partitioned by use, and centrally maintained and distributed. The lexicon covers major terminologies identifying atomic clinical concepts and medical events. Mayo has also developed a natural language processing application, using clinical document architecture (CDA) and a speech-enabled human interface, which invokes the controlled terminology services.

Latter Day Saints Hospital

Latter Day Saints has developed a vocabulary server called VOSER.

Department of Defense

The Department of Defense (DOD) is working with Integic, 3M, and Medcin to deploy a clinical documentation system for ambulatory care as part of their new generation product, CHCS II.

ISSUES AND BARRIERS TO SUCCESSFUL IMPLEMENTATION

Data Must Be Encoded When Created

This requires integration into the clinical documentation process. The coding process must be either transparent to the clinician (i.e., handled by the software as a by-product of documentation) or the clinician must be trained on coding procedures. Clinicians traditionally have been resistant to separate coding processes and can introduce bias into the results if coding results in meeting other needs such as revenue, productivity enhancements. Integration into the documentation process means that terminology management must include the documentation solution.

Accommodation of Medical Idiosyncrasies

Different clinicians in different settings can express medical concepts differently, using synonyms, abbreviations, or different phraseology. This usually is not a problem for clinical users because of clinical training and experience. It is an obstacle for automated analysis and retrieval. Clinicians will resist draconian rules about the terms that are used. Systems must be tolerant of idiosyncratic expression but allow synonym matching at retrieval time.

Externally Created Data

Externally created data can create holes. Examples include radiology results from the radiology information system and discharge summaries from transcription system. Any system that creates free text data is a problem. Even coded data must be scrubbed to reflect standard codes.

Free Text and Dictated Data

If dictation or typing of free text is allowed, such data is only available for display, not analysis. Data capture systems must either be so easy to use they suppress the clinicians' desire to dictate or type free text, or other methods are needed to capture and codify this text. As it is unlikely that all clinicians will be accepting of structured data entry systems, such text must be codified by the data capture system. Newer pen tablets with voice and hand writing recognition may offer such an alternative for codification of text.

Legacy Data

Ideally, some approach is needed to medically encode the data that exists already. It will be disappointing to wait another 25 years to accumulate 25 years of data. On a practical level, however, it will be difficult and resource-intensive to undertake a back-coding effort. Because of the inconsistency with which text data have been entered, the value of this effort may be anecdotal at best.

Structure of Patient Data

There has been lots of work on the information model of clinical data. There is no agreement yet on the structure of clinical data within a clinical document. Structure varies by specialty, by provider, by type of notes, and so forth. For example, coronary disease may be in the problem list, the patient history, or in the diagnosis. Data structure is also difficult to transfer between systems.

Modifiers

Standard modifiers are generally not supported. In "denies smoking" and "history of smoking" the "denies" is very significant. The problem is that between not smoking ever and 4 packs/day there are a wide range of modifier choices. These can be captured in the clinical note, but retrieval and analysis is complicated by the lack of standardization of the modifiers.

Living Code Systems

The coding systems that are used in the clinical world are changing all the time. Any system that would be used should have to have a significant authoring capability so that changes could be easily made to the system without waiting for the next release of an entire coding system. This authoring capability would additionally need to support re-coding once standards for a particular concept are established and released.

Medical searching

The terminology hierarchy must facilitate the process of creating reports. It must have a common set of hierarchies that can be referenced for decision support and retrospective analysis. This would allow analysts to query data using terms that are understood by users and have the system query the database and select all exact matches and medical synonyms as well. If there are too many or too few records, the analyst can generalize or refine the search using the medical terminology hierarchy.

RECOMMENDED APPROACH

Terminology services are required to address the problems described in this paper. Below is a pictorial representation of terminology processing (fig. 2). The graphic describes clinical data capture and retrieval and terminology processing requirements. Specific recommendations for system requirements follow for each of the following categories:

Terminology services

Documentation capture

Structure and integration

Terminology Services Requirements

Integration With Documentation Module

To support coding at time of data creation, the system must be fully integrated into the documentation module.

Separate Server or Module

The terminology data shall be stored and retrieved in a separate server from the rest of the system or implemented in a dedicated module.

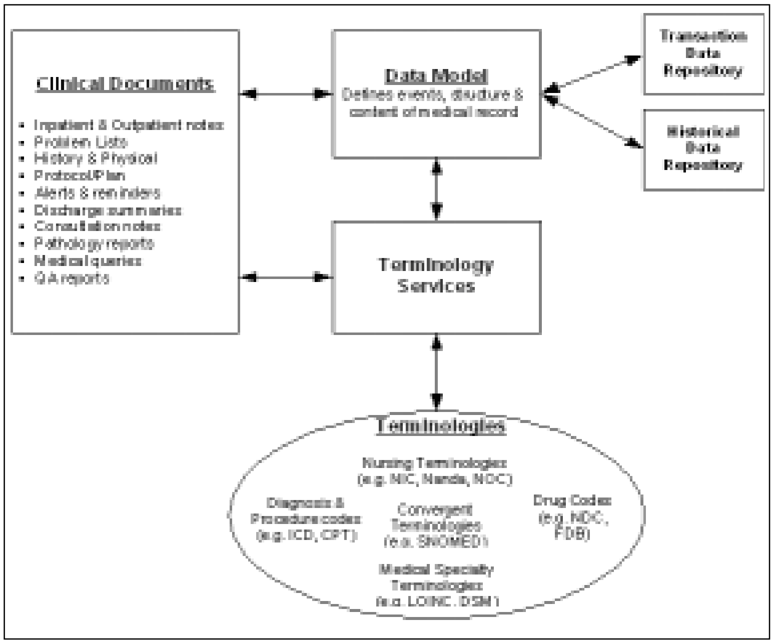

Figure 2 Clinical Data Capture and Retrieval and Terminology Processing Requirements

Medical Terms

Medical terms shall be assigned unique identifiers and have explicit definitions not tied to hierarchic position or other contexts. The terminology must completely address each segment of the healthcare process. It must also be comprehensive, addressing all segments of related medical disciplines.

Integration
Wherever possible, the terminology server should include cross-references to other terminologies. Where appropriate, such cross-references may also include integration into a common hierarchy. For example, a cardiology description of heart anatomy may also fall under a common anatomical hierarchy of human body parts.

Concept Linking
Medical terms shall be combined and linked to form medical concepts based on the following:

Generalization - Ability to find all parents of a concept in the medical concept network

Specialization - Ability to find all possible choices for a term.

Synonyms - Ability to find equivalent terms in the concept network.

Concept Mapping. - Medical concepts must provide links to terminologies.

The approach must support currently mandated classification and coding systems, such as CPT and ICD, message formats including ANSI, HL7, DICOM, and NCDCP, and clinical terminologies such as LOINC, NHS Clinical Terms, DSM and SNOMED. SNOMED-CT appears to be the best bet for medical terms, encompassing between 50 to 60% of medical terms, but even as SNOMED becomes more comprehensive, it will need to map to other disciplines with their specialty coding and knowledge-base systems including medications, nursing, perioperative care, mental health, etc.

Links To Outside Terminology Databases
The system shall have the capability to link to terminologies that reside outside the system. Examples include human genetics repositories for genome coding and the MeSH for literature searching.

Preloaded Concepts
The system shall include preloaded concepts necessary to minimally support SNOMED-CT , ICD9, CPT and other specialty code sets.

Concept Attributes
Each concept shall include a field that indicates what type of a concept it is (diagnosis, procedure, symptom, procedure, medication, allergy, etc.)

Each concept shall include the ability to determine if a concept when used in clinical documentation requires further specialization or not.

Each concept shall include the ability to define modifiers and other elaborating data. Possible response types might include dates, imprecise dates (e.g. 1991), numbers, text, or multiple-choice selections.

Authoring
The system shall allow the organization to add and modify the medical concept database and associated mappings. This shall include an online user interface for editing, viewing, and navigating the concept database.

Local Mapping
The system shall allow mapping of medical concepts to locally developed code systems that have been in use at the organization.

Obsolete Terms
The system shall provide the ability to indicate that a term should be no longer to be used in clinical documentation. However, all of that term's meaning and links shall be retained.

Content Reporting
The system shall have the ability to print reports by concept type and department that show the content of the concept database.

Input Tool
The system shall provide tools and user interfaces for clinician's data capture.

Data Model
There should be a data model, such as the HL7 RIM or a similar mechanism, which supports navigation, entry and retrieval. The model should identiy:

Temporal events

The activity or document

The document's relationships

The content of the document

The concepts, clinical domains and description of the data

Data structure

Logical rules

Other meta-data describing type, location, and use of data

Maintenance

Codes must not be reused

Updates and modifications must be maintained with version control and referable to a consistent version

Terms must have explicit definitions

Synonyms should support multiple languages

Updates should support frequent enough intervals to support medical needs.

Documentation Capture Recommendations

Integration
The capture of structured documentation shall be integrated into the clinical documentation process. Data capture shall be user friendly enough to be performed by the responsible clinician.

Existing Data
The system shall allow documents to include existing data in the system that may already be stored in tables. This might include lab data, medications, procedures, allergies, problems, and schedules.

Printing
The system shall be able to print a document that can be placed in the patient medical record. The system shall retain a copy of the document for later retrieval. Once signed, the document cannot be altered.

Templates
The system shall support standard templates (i.e., CDA templates) for creating clinical documents. System users shall also be able to build their own templates for clinical documents. Templates shall support the notion of sections, which can include other sections.

Free Text
The system shall allow clinicians to utilize free text when the concept database is inadequate to express their documentation needs. The system shall provide the capability to identify free text usage as a means of evaluating compliance and identifying potential need to add new concepts to the database.

Implementation
The focus on implementing terminology services should be in the following areas:

Outpatient encounter documentation

Patient protocols/care plans

Consult reports

Operative reports

Diagnostic reports (lab, radiology, cardiology, etc.)

Discharge summaries

Inpatient documents (assessments, treatments, charting of care, progress notes)

Structure and Integration Recommendations

Export
The system shall provide the ability to export clinical documents, using XML according to HL7's clinical document architecture.

Integration
The system shall allow integration with existing interfaces to accept inbound data and map the data to the database according to the medical terms supported in the concept dictionary.

Historical Documents
The system shall provide the ability to index existing historical documents according to medical concepts in the concept database.

External System Documents
The system shall support the indexing of documents received from external systems such as radiology results or surgical pathology reports.

Query and Retrieval
The system shall provide the ability to query data using concept mapping to retrieve synonyms.

Selected Terms and Definitions

ANSI Healthcare Informatics Standards Board (HISB) is a group within ANSI that coordinates the development of standards for the exchange of healthcare information.

ASC X12N (Accredited Standards Committee X12N) is the standards development organization charted by ANSI to develop uniform standards for inter-industry electronic interchange of business transactions – electronic data interchange (EDI), insurance subcommittee that develops standards for claims and other administrative transactions. (www.disa.org/x12)

ASTM is an ANSI-accredited standards development organization and is approved as an ANSI self-designator of American national standards. Committee E31 pertains to healthcare informatics and develops standards for health record content, structure, functionality, privacy, security, vocabularies, and selected healthcare information message formats. (www.astm.org)

CPT-4 (Current Procedural Terminology) is the official coding system for physicians to report their professional services and procedures to third parties for payment. It is produced by the American Medical Association.

Controlled clinical terminologies are standardized terms and their synonyms that capture patient findings, circumstances, events, and interventions with sufficient detail to support clinical care, decisions support, outcomes research and quality improvement; and can be efficiently mapped to broader classifications for administrative, regulatory oversight and fiscal requirements (from www.cpri-host.org)

DICOM (Digital Imaging and Communications in Medicine) is an ANSI-accredited standards development organization that has created a standard protocol for exchanging medical images among computer systems. (www.dicom.org)

DSM (Diagnostic and Statistical Manual of Mental Disorders) is produced by the American Psychiatric Association to facilitate communication among mental health clinicians, researchers, and administrators; to improve patient care by facilitating reliable and valid diagnoses and differential diagnoses, and to facilitate education and training

FDB (First Data Bank) is a supplier of knowledge bases and software concerning drug, medical, and nutrition information.

HHCC (Home Health Care Classification) is a code set and vocabulary representing nursing diagnoses, interventions, and outcomes for home health care.

HL7 (Health Level Seven) is an ANSI-accredited standards development organization that creates message format standards. Version 2.3 provides a protocol that enables the flow of data between systems. Version 3.0 is being developed through the use of a formalized methodology involving the creation of a reference information model (RIM) to encompass not only the ability to move data but to use data once it is moved. (www.hl7.org)

ICD (International Classification of Diseases) is produced by the World Health Organization. ICD-9-CM is a clinical modification of the 9th edition of ICD prepared by the US government, which incorporates a procedure coding system. The US also is preparing a clinical modification of the 10th edition of ICD (ICD-10-CM) and a procedure coding system (ICD-10-PCS).

Information model is a set of rules for describing, combining, and relating the units of a knowledge representation structure.

IOM (Institute of Medicine) is one of The National Academies. Its mission is to advance and disseminate scientific knowledge to improve human health. It provides objective, timely, authoritative information and advice concerning health and science policy to government, the corporate sector, the professions, and the public.

Knowledge bases are data tables, databases, and other tools designed to assist the process of care

LOINC (Logical Observation Identifiers, Names and Codes) provides a set of universal names and identifier codes for laboratory and clinical observations.

Medcin is a medical vocabulary incorporating natural language processing developed by Medicomp systems, Inc.

Multim Information Services is a subsidiary of Cerner Corporation and a developer of clinical drug information systems and a drug knowledge base.

NANDA (North American Nursing Diagnosis Association) is a set of nursing diagnoses that describes patient reactions to actual or potential alterations in health that can be treated by nurses. The North American Nursing Diagnosis Association maintains it.

NCPDP is the National Council for Prescription Drug Program (www.ncpdp.org)

NDC (National Drug Codes) is a 10-digit number that is developed and maintained by the U.S. Food and Drug Administration (FDA) to identify drug products marketed in the United States. NDC numbers are not assigned to drug products not marketed in the United States, blood products, medical devices, in vitro diagnostic products, dietary supplements, or drug products used only in pre-market approval investigations.

NIC (Nursing Interventions Classifications) is a comprehensive classification that names and describes treatments performed by nurses.

NOC (Nursing Outcomes Classification) provides a standard language with measures for patient outcomes influenced by nursing practice.

NMMDS (Nursing Management Minimum Data Set) is a minimum data set developed by the University of Iowa, which focuses on the data needed by nursing management.

Omaha System is comprised of a problem classification scheme, an intervention scheme, and a problem rating scale for outcomes developed by the VNA of Omaha.

PCDS (Patient Care Data Set) is a compilation of pre-coordinated terms used in patient records to record patient problems, therapeutic goals, and care action.

PNDS (Perioperative Nursing Data Set) was developed by the Association of Perioperative Registered Nurses, Inc as a minimum data set for nursing services in the perioperative area.

SNOMED (Systematized Nomenclature of Human and Veterinary Medicine) is terminology for indexing medical record information. It is produced by the College of American Pathologists.

UMLS (Unified Medical Language System) is a system designed by the National Library of Medicine (NLM) to help health professionals and researchers retrieve and integrate electronic biomedical information.

ENDNOTES

[1] This article is developed from material originally presented at TEPR 2002, May 2002., updated December, 2002

[2] Joan R. Duke, FHIMSS, MA is Managing Principal, Health Care Information Consultants, LLC

[3] John Crawford, PhD is Principal, Advanced Healthcare Networking Solutions

[4] Chute CG. Clinical Classification and Terminology. *Journal of the American Medical Informatics Association;* 2000;(7): 298-302

[5] Nadkarni P, Chen R, Brandt C,. UMLS Concept Indexing for Production Databases. *Journal of the American Medical Informatics Association;* 2001;(8):80-91

[6] Cimino JJ. From data to knowledge through concept-oriented terminologies: experience with the Medical Entities Dictionary. *Journal of the American Medical Informatics Association*; 2000;7(3):288-297.

Vocabulary Services and Their Role in Outcomes Improvements[1]

Tom McDonald, MD[2]
Robin S. Raiford, BSN, RN, BC, CPHIMS[3]

In the light of the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) and the 'Core Measure' initiative to integrate performance measurement into the accreditation process, the role of documenting outcomes improvements has become a priority at many healthcare organizations (HCO). The use of a standardized clinical vocabulary for describing clinical observations and interventions helps maximize the value of patient-specific rules and also enables the meaningful analysis of care at a population level. Without the use of a standardized terminology, data from different providers and different facilities lack comparability, and both internal distinctions and external benchmarking are impaired or completely prevented.

HCOs will need to achieve better integration of their information systems in order to realize more value from their information technology. In this context, integration may be viewed as a hierarchy:

Level I: Geographic — Supporting data access from multiple locations.

Level II: Syntactic — Supporting data exchange via agreement on syntax and structure.

Level III: Semantic — Supporting business rules via agreement on meaning.

Level IV: Management — Supporting distributed workflow via agreement on process(es).

CURRENT STATE OF STANDARDIZED CLINICAL VOCABULARY

Using standardized clinical vocabulary results in the generation of better knowledge through the analysis of patterns of care. Applying this knowledge back at the point of care requires that clinical data have consistent, well-defined meanings regardless of location, provider, or application. Achieving consistency in the meaning or "semantics" of data comprises semantic integration. And, as pointed out by the Institute of Medicine, having a standardized, authoritative vocabulary is essential for achieving semantic integration and in turn being able to apply our knowledge about best practice at the point of care.

After a prolonged gestation, standards in vocabulary have finally evolved to the point of reaching critical mass in terms of being robust enough to meet the needs of complex healthcare organizations. In particular, the Systematized Nomenclature of Medicine Clinical Terminology (SNOMED CT) has emerged as a solid foundation or clinical terminology capable of supporting and coordinating the administrative and user-interface terminologies employed by end-users. Although still immature and evolving rapidly, the state of the art has progressed enough to offer value to healthcare organizations with pressing needs to realize more value from their information technology (IT) investments.

Achieving true portability of clinical decision support rules requires that HCOs employ a consistent approach for defining the variables within their rules. In short, getting maximal sharing and reuse of decision-support knowledge requires the use of a common vocabulary as well as use of a common "grammar." Once HCOs begin the journey on the road to common clinical vocabulary, the sharing of "rules" and "alerts" will be unlimited. Using the HL7 standard for medical logic modules (MLM) — Arden syntax — means clinical information from different vendors' systems can now be shared more readily because the HCO does not have to rename the order item or the nursing observation item used in the building and logic of the rule.

Until recently, the only sharing of alerts or efforts on clinical decision support was done through the Columbia Presbyterian website for medical logic modules at http://cpmcnet.columbia.edu/texts/mlm/. This website is a vast library of Arden syntax rules, with over 150 rules posted to date. For example, there are nine JCAHO OB standards rules, as well as laboratory alerts and frequent medication alerts. When a physician realizes how rules can go far beyond the standard drug/drug, drug/allergy alerts of a drug database, the physician begins to see the huge value in MLMs.

Institute for Medical Knowledge Implementation

In July 2001, the Institute for Medical Knowledge Implementation (IMKI) was formed with a mission to take the process of implementing medical knowledge to a new level. IMKI is a not-for-profit, cross-vendor organization dedicated to translating the best of medical care into common clinical practice by enhancing and expediting the adoption of healthcare information systems and other technologies. IMKI constituencies include healthcare information technology (HIT) vendors, HCOs, hospitals, medical groups, medical specialty organizations, information technology managers, individual physicians, scientific researchers, healthcare plans, and employers.

To accomplish its mission, IMKI will operate a non-proprietary public library of medical informatics applications, standardized clinical terminology, and computer code that is available to, and that can be implemented and contributed to, by all healthcare information technology system vendors and individual users. Healthcare informatics applications will be evaluated for value and credibility using evidence-based criteria. Tools for authoring and submitting medical knowledge application content will be provided, starting in approximately 2003 via the IMKI website. More information on IMKI can be located on its website at www.imki.org.

CHALLENGES FACING HEALTHCARE ORGANIZATIONS

The challenges facing healthcare organizations are seemingly of never-ending depth and scope. Although the business model for managed care remains in flux as we enter the next decade, severe financial pressure on HCOs remains a constant theme. Both physician practice associations and hospitals face ongoing difficulty in coping with current levels of reimbursement while at the same time maintaining accountability for quality to consumers, regulators, and payers. HCOs continue to reorganize and consolidate as integrated delivery systems in the face of these pressures. Integration in name only needs to be replaced by integration in fact if HCOs are to derive real benefits from the formation of larger and more complex organizations. Improving the management of clinical information across multiple systems and across multiple entities is a recurrent strategic theme. Thus, leaders of HCOs are under increasing pressure to demonstrate that additional investment in information technology will generate adequate payback in terms of improved operational efficiencies and market opportunities.

Larger HCOs are able to realize some economies of scale by consolidating IT operations and by investing in scalable infrastructure technology (servers, networks, etc). However, realizing more substantial returns requires that improvements in information technology be translated into the delivery of higher value care. Scalable technology (servers, networks, etc) helps manage large numbers of bits and bytes but does not alone suffice to improve the delivery of care. The care delivery process involves the interaction of multiple customers and suppliers of services as part of a chain of care. These customer-supplier interactions are not only data-intensive but also are knowledge-intensive, resting upon sequences of decisions by knowledge workers at the point of care. Achieving functional scalability within HCOs requires that they focus their IT investments to meet the needs — for data and for knowledge — of those actually delivering care. It will be difficult for large HCOs to demonstrate that bigger is better until they offer their providers advantages in being able to access and share knowledge as well as data, regardless of location or specialty.

Revisiting the IOM Report on CPR

Given these challenges facing healthcare organizations, it is appropriate to revisit the seminal report, *The Computer-Based Patient Record*, issued nearly a decade ago by the Institute of Medicine (IOM)[4]. Reviewing some of the key findings and recommendations within that work may shed some light on the current landscape. Key functions of the computer-based patient record (CPR) per the IOM include: (a) improving the quality of patient care; (b) strengthening the scientific basis of clinical practice; and (c) helping manage and moderate healthcare costs. The IOM report identified 12 key attributes felt to be critical for achieving these goals, including: (a) linking CPR systems with both local and remote sources of reference knowledge; (b) providing clinicians with decision-support tools such as alerts and reminders; and (c) supporting the capture and storage of structured data using a defined vocabulary. Of the technological capabilities felt to be necessary for enabling these features, standards for data exchange and vocabulary were felt to be critical and were prioritized as an area needing additional research and development:

> "Effective retrieval and use of healthcare information in the CPR depend in large part on the consistency with which a CPR content names and describes clinical findings, clinical problems, procedures, and treatments"(IOM, pg. 142).

The IOM report also outlined the form a solution to the vocabulary issue might take:

> "Before an actual exchange of clinical data can take place, agreement must be reached on what is being transferred". Many vendors and government agencies have independently developed their own internal clinical data dictionaries. These data dictionaries differ in terms of the data elements included, naming conventions, definitions, and relationships among data elements. No attempt has been made to create a composite clinical data dictionary (CCDD) using input provided by these and other groups interested in the CPR. Because no CCDD yet exists, the evolution of data-exchange standards has been limited and will remain so until a CCDD or some other coordinating mechanism is developed. Once a CCDD is created, any number of relevant subsets can be generated from this defined universe of clinical content, such as the HCFA's Uniform Clinical Data Set"[5] (IOM, pg. 85-87).

The composite clinical data dictionary remained an unrealized vision until quite recently. Only in the last year or so have standards bodies, government agencies, and tools vendors combined forces to make this vision a reality. The time is now ripe for exploiting this progress within commercial applications.

STANDARDS AND REGULATIONS

HIPAA

Within the Healthcare Insurance Portability and Accountability Act of 1996 (HIPAA), a brief section, referred to as "Administrative Simplification", called for data standardization, starting with standardization of formats for electronic commerce (the automated submission of information for billing). These provisions regarding data standardization are intended to reduce the costs and administrative burdens of health care by making possible the standardized, electronic transmission of many administrative and financial transactions. The code sets that have been adopted as HIPAA standards include: (a) International Classification of Diseases, 9th Edition, Clinical Modification, (ICD-9-CM) for disease, injuries, other health issues, and hospital procedures; (b) National Drug Codes (NDC) for drugs and biologics; (c) Code on Dental Procedures and Nomenclature; (d) the combination of Healthcare Financing Administration Common Procedure Coding System (HCPCS) and the American Medical Association's Current Procedural Terminology, Fourth Edition (CPT-4) for physician services and other health-related services, and (e) the Healthcare Financing Administration Common Procedure Coding System (HCPCS) for all other substances, equipment, supplies, or other items used in healthcare services. These standards went into effect October 16, 2000, and the compliance date was set as October 16, 2002. The horizon in the short-term will be dominated by administrative transactions using the traditional coding systems (ICD, CPT, etc), but in the longer-term, HIPAA expands the horizon to include broad aspects of clinical data, including standards for electronic patient records. Thus, it is expected that government-mandated standards will eventually require the use of standardized vocabulary for documenting key clinical aspects of patient care.

Health Level Seven (HL7)

Health Level Seven is an ANSI[6]-accredited standards developing organization (SDO) operating in the healthcare arena. HL7 is also now a designated standards maintenance organization (DSMO) under HIPAA. HL7 has put increasing emphasis upon using standardized terminologies in the content of HL7 messages in order to facilitate the exchange of meaningful information among systems. Whereas the original HL7 standards emphasized how to exchange data among systems, the most recent standard (version 3, in draft) emphasizes how to use the data once it has been moved.

In order to exploit the full power of HL7 v3.0, HCOs will need to adopt standardized terminologies for use within their clinical information systems. HL7 now has a Vocabulary Technical Committee (the Vocab TC) that is charged with identifying, organizing, and maintaining the coded vocabulary terms used in HL7 messages. The use of a standardized, coded vocabulary within HL7 messages will help ensure that the data exchanged by communicating systems is well defined and unambiguous in meaning. The work of the Vocab TC focuses on making sure that data exchanged among systems also meet the needs of clinical decision support and practice analysis. The work of HL7 has moved from focusing on syntactic integration (agreement on field format) to emphasizing the next stage of integration, namely semantic integration (agreement on meaning). As noted previously, semantic integration is a prerequisite for achieving the goal of true interoperability in which not only data but also expertise and knowledge can be shared across heterogeneous systems.

SNOMED RT (Reference Terminology) to SNOMED CT (Clinical Terminology)

The code sets mandated by HIPAA address primarily administrative and management needs, not the needs of practicing clinicians. The SNOMED RT, or Reference Terminology, was released in 2000 and promised to provide clinicians with a robust standardized reference terminology designed to support patient care. SNOMED RT combined expressiveness (depth and breadth) with a much improved logical structure. The core logical structure of SNOMED RT, combined with rigorous editorial and review processes, helped ensure that SNOMED RT could serve as a sound foundation capable of supporting growth and extension over time.

The first release of SNOMED RT rapidly reached critical mass, not only by building upon detailed content derived from SNOMED 3.5 but also by providing linkages to other code sets such as LOINC and ICD-9. Collaborative projects to provide linkages with nursing terminology groups, such as the North American Nursing Diagnosis Association (NANDA), to incorporate nursing terms, and with the American Medical Association's Current Procedural Terminology (CPT) for procedural terminology were begun as well.

Finally, the College of American Pathologists and the United Kingdom's National Health Service (NHS) collaborated on the integration of SNOMED RT and NHS Clinical Terms Version 3 (sometimes called Read Codes) into a single comprehensive health terminology: SNOMED Clinical Terms (SNOMED CT). Overall, the state of the art in standardized vocabulary has improved dramatically over the last few years. SNOMED CT, always a work in progress, comes close to realizing the call by the Institute of Medicine in 1991 for a robust composite clinical data dictionary capable of meeting the needs of diverse constituencies. By providing a solid foundation for building useful application terminologies, the release of SNOMED CT should accelerate the adoption of standardized terminologies by HCOs and vendors alike.

KEY REQUIREMENTS OF TERMINOLOGY MANAGEMENT

In order to support coordinated care across the continuum, to support decisions with rules based upon best practices, and to support meaningful assessment of outcomes, clinical information products need to make use of a common controlled clinical vocabulary or lexicon. Use of a shared authoritative dictionary of clinical concepts and terms would help enhance the power of individual applications and would greatly facilitate achieving functional integration of these applications. At a high level, our requirements may be separated into our needs for lexicon content and our needs for lexical services.

Lexicon Content

In general, our requirements for the terminology content contained within an enterprise master lexicon stem from the "desiderata" articulated by professional organizations such as the Computer-based Patient Record Institute (CPRI) and the American Medical Informatics Association (AMIA) and by leaders in the field such as James Cimino and Christopher Chute[7,8,9]. Thus, our important desiderata for the content within an enterprise master lexicon include:

- Adequate depth and breadth
- Concept orientation
- Concept permanence (no deletion of "retired" concepts)
- Support for multiple hierarchies
- Flexible granularity (detailed vs. summarized views)
- Support for multiple synonyms
- Avoidance of redundancy
- Orderly evolution

Clinical Terminology And Core Semantic Model

Until very recently, much of the focus in developing controlled clinical vocabularies was upon achieving adequate coverage in both depth (granularity) and breadth (scope of coverage). In the last few years, consensus has emerged that existing vocabularies have begun to achieve critical mass in terms of coverage. Instead, more pressing issues include how to organize terms in a logically consistent way and how to manage change over time while maintaining logical consistency. In order to achieve coherency and extensibility, the CPRI/HL7 Joint Conference on Lexical Solutions (1998) recommended that a single vocabulary be selected to serve as a foundational or reference terminology[10].

The recently released clinical terminology, SNOMED CT, appears to represent a significant milestone in terms of meeting these desiderata, particularly in terms of employing a solid logical model capable of supporting growth over time. (SNOMED CT contains SNOMED RT – a robust reference terminology.) The reliability of the lexicon depends upon maintaining logical consistency in these linkages and relationships as the source terminologies evolve over time. Thus, maintaining the lexicon with rigorous attention to versioning and change control is an essential requirement for the integrity of the content within the lexicon. Given the importance of maintainability and extensibility, SNOMED CT is the only terminology currently robust enough to serve as the semantic core for our enterprise lexicon. The ability of lexicon content to meet the needs of clinical practice depends not only upon having the right content but also upon organizing the content in a useful and consistent fashion. Different types of users have needs for different degrees of granularity (detailed vs. general concepts). Thus, the lexicon should support not only mappings among related atomic terms but also explicit mappings from specific atomic terms to higher-level terms or supra-concepts.

Hierarchical relationships such as class/subclass relationships are particularly important for decision support at the point of care, such as alerts regarding drug allergies. Other types of nonhierarchical relationships (e.g., caused by or treated by) help link clinicians with the appropriate practice guidelines. One of SNOMED CT's strengths is that it has a robust enough semantic model to meet the needs of clinical inference and decision support.

Domain Coverage (Scope)

The terms and concepts contained within the enterprise master lexicon should suffice to describe the relevant attributes of patients and the care delivered to them (i.e., observations, assessments, and services). These terminologies and code sets should suffice to meet our customers' clinical needs while also meeting HIPAA requirements. SNOMED CT, directly or through its linkages (see below), goes a long way towards meeting our needs in terms of domain coverage. Although terminology to support the structured documentation of detailed clinical narrative (symptoms, history and findings) is not an immediate priority, our lexicon should provide a solid foundation for addressing this need in the near future. SNOMED CT also represents the beginning of an authoritative vocabulary to meet the needs of clinical documentation.

Coordination And Mapping

Given the broad scope of content needed to meet the needs of multiple stakeholders, a core reference terminology needs to provide a framework for linking and coordinating other terminologies. Our priorities for establishing linkages and mappings among terminologies within the lexicon should be driven by pragmatic clinical and business needs. Examples of high-priority needs include:

- Documenting a problem or diagnosis using a clinically sensible term from the lexicon should suffice to meet administrative needs for diagnostic information, such as generating billing codes or discharge abstract codes using ICD-9CM.
- Documenting a procedure or service using a clinically sensible term from the lexicon should suffice to meet administrative needs for information regarding professional services, e.g., CPT-4 codes used for billing.

Ordering a prescription (Rx) using a clinically sensible medication term from the lexicon should suffice to meet the needs of formulary management programs regarding covered medications.

Ordering tests or procedures by entering appropriate terms from the lexicon but once should suffice to meet the needs of utilization management programs for information regarding ordered services.

Exploiting The UMLS
The National Library of Medicine's Unified Medical Language System (UMLS) Metathesaurus currently provides mappings between more than forty source vocabularies, including the medical subject headings (MeSH) used to index Medline content. Although the semantic relationships among concepts contained within the UMLS sometimes lack the logical consistency of those within SNOMED CT, these relationships may nonetheless be extremely useful for particular purposes. For example, linking patient data with MeSH would facilitate the retrieval of relevant medical knowledge in the literature. SNOMED CT is one of the largest single source vocabularies contained in the Metathesaurus. It is straightforward to link most clinical concepts in SNOMED via the Metathesaurus to MeSH identifiers in order to facilitate lookups of reference literature via Medline.

Lexical Services
In terms of lexical services, terminology systems should offer facilities for managing and manipulating lexicon content for a number of important tasks. Examples of important vocabulary or lexical services include:

Search for a term (lookup).

Decoding and encoding (translation and normalization)

Semantic manipulation (retrieval of information about relationships among concepts)

Subsetting (queries to create desired subgroups of terms), etc.

Content mapping (to identify matches between local terms and existing lexicon content)

Such services may be provided to people (via a user interface) or software programs (via APIs) in order to facilitate the use of lexicon content for business purposes. These purposes may be operational (lookups, translations) or administrative (updates, extensions, access control, etc). The requirements below outline our priorities for lexical services.

Query, Browsing And Navigational Services
Services for querying, navigating, and browsing should facilitate use of the lexicon. Once a user has identified a concept of interest, the user should be able to explore the semantic neighborhood around the concept of interest. For example, the user should be able to browse branches of related concepts (tree walking) along multiple axes. Once the right branches within the semantic trees are located, users should be able to download desired content from the relevant branches (for example, concept identifiers, preferred terms, and synonyms).

Subsetting And Exporting Services
Users should be able to exploit the lexical query services to define subsets of terms and concepts that can then be exported for use by external applications. Users should be able to extract the results set of any query; for example, all concepts that are the descendents of a parent concept or all concepts derived from a particular source terminology. Exports should support standard file formats such as tab-delimited text and extensible markup language (XML). Updates in the master lexicon should be capable of triggering the creation of new extracts (see the subsection below on publishing and subscribing). The creation of extracts should generate a robust audit trail of who, when, and what.

Customization Services
Implementation of controlled terminology in the field must deal with two important and related issues: (a) support for local preferences in nomenclature (lexical variation) and (b) support for local concepts not contained in the standard lexicon. Customers invariably already have their own glossaries and dictionaries prior to adopting a standard lexicon (that is, they never start from a blank slate). The first step is to identify which of their local terms are already present in the master lexicon. Exact matches represent little difficulty — more challenging are incomplete matches in which a local term represents a new lexical variant of an existing concept. The goal is to avoid adding redundant concepts to the lexicon.

Occasionally, customers indeed have a local term that represents a new concept. In such cases, the concept may be identified as being a child of an existing parent concept within the lexicon (subsumption). To handle this related set of problems, customers need tools to analyze their existing terms, to map their terms to existing concepts where feasible, and, if necessary, to extend the lexicon with provisional concepts for local use.

Logical Design
We need enterprise terminology management tools that can function within the context of our current technology. If we were to design our applications from a blank slate, an intellectually elegant approach for achieving semantic integration would be to interface each application via a real-time API with a common vocabulary server (VOSER) containing a master lexicon. Any changes in the lexicon (concepts, terms,

codes and relationships) could immediately be exploited by the subscribing applications. In practice, changes in the master lexicon occur relatively infrequently (monthly or even weekly but not daily or hourly). So periodic updates from a master lexicon should suffice to meet the vast majority of business needs. Further, each application has somewhat different needs in terms of how data elements are structured within its system dictionaries and in terms of the scope of terms needed. With this context in mind, a VOSER that would provide a centralized place for maintaining a lexicon and that could publish extracts for use within the system dictionaries of our applications would offer significant value for the functioning of our applications with a minimum of risk and complexity.

CONCLUSIONS

Patient care involves a workflow consisting of linked and dependent processes. All but the simplest of care involves crossing organizational and functional boundaries. The functional integration of applications helps integrate these boundary-crossing processes. In turn, coordinating and informing these care processes leads to improvements in balanced outcomes by improving efficiency (less waste and rework) and quality (reduction in errors and defects).

ENDNOTES

[1]This article is based, in part, on a presentation at the Summer Institute on Nursing Informatics, July 2002, Baltimore, MD.

[2]Eclypsis Corporation

[3]Robin Raiford was employed by Eclypsis Corporation at the time this article was written.

[4]Institute of Medicine. The Computer-Based Patient Record. An Essential Technology for Healthcare. National Academy Press, 1991

[5]HCFA is now the Center for Medicare and Medicaid Services (CMMS)

[6]ANSI is the American National Standards Institute

[7]Chute CG, et al. A framework for comprehensive health terminology systems in the United States: development guidelines, criteria for selection, and public policy implications. ANSI Healthcare Informatics Standards Board Vocabulary Working Group and the Computer-Based Patient Records Institute Working Group on Codes and Structures. J Am Med Inform Assoc. 1998 Nov-Dec;5 (6):503-10.

[8]Chute CG, et al. The content coverage of clinical classifications. For The Computer-Based Patient Record Institute's Work Group on Codes & Structures. J Am Med Inform Assoc. 1996 May-Jun;3(3):224-33.

[9]Cimino J. Desiderata for controlled medical vocabularies in the twenty-first century. Methods Inf Med. 1998 Nov; 37(4-5):394-403.

[10]Chute CG, et al. A framework for comprehensive health terminology systems in the United States: development guidelines, criteria for selection, and public policy implications. ANSI Healthcare Informatics Standards Board Vocabulary Working Group and the Computer-Based Patient Records Institute Working Group on Codes and Structures. J Am Med Inform Assoc. 1998 Nov-Dec;5(6):503-10.

A Potpourri of Issues Associated With the Computer-based Patient Record

Carol Bickford, PhD, RN[1]

Bontis (2002, p. 16) wrote that "...scientific folklore in the early 1900s stated that all the information in the world doubled every thirty years." That might not overtax our paper-based health information management processes and indexing initiatives. He then presented an update indicating that as the 1970s arrived, the pace of information generation had increased to doubling every seven years. Take a moment to reflect on the state of our healthcare environment at that time. Laboratory reports bore handwritten values on multipage paper forms separated by carbon paper. Transcriptionists typed radiology reports on multipage forms with the carbon copy slipped into the file jacket with the radiographic study. Appointment scheduling involved names penciled in on pages of a specially printed logbook or within a black 3-ring binder notebook. Healthcare clinicians regularly complained about their inability to effectively manage their information burden in their primary roles as knowledge workers.

Some 20 years later, many welcomed the Institute of Medicine's 1991 report, *The Computer-based Patient Record: An Essential Technology for Health Care*, which called for prompt implementation of a technology solution — the computer-based patient record or CPR. By then, the process of doubling the world's information had completed three iterations, and we had absolutely no hope of getting ahead in managing our healthcare information explosion. The goal seemed to be to tread water and not drown in data and information. Just think about those simpler times – Microsoft hadn't yet invented Windows and electronic mail was not pervasive!

Unfortunately, the critical work describing the concept of the computer-based record as an information management tool and its components, boundaries, and linkages was never completed. Such an oversight continues to haunt us today as individuals, groups, organizations, and agencies complete their diverse, uncoordinated development and implementation activities purported to be for the CPR, electronic medical record (EMR), electronic health record (EHR), computerized patient record, or other entities recently discussed by Waegemann (2002). Even the federal government's National Committee on Vital and Health Statistics (NCVHS) weighed in on the discussion and enhanced the confusion by defining standards for patient medical record information (PMRI) and by describing the three interactive and interdependent dimensions of the National Health Information Infrastructure (NHII): personal health dimension, health provider dimension, and population health dimension (NCVHS, 2001). So where are we really headed in relation to managing and safeguarding a patient's health information?

Remember Bontis? Consider the implications of his third statement: "Prognosticators have pushed this notion further and state that by the year 2010 all the information in the world will double every eleven hours." (Bontis, 2002, p. 16) That certainly means our current environment would qualify as an information age, a glimpse we can begin to appreciate when viewing the biomedical digital information explosion associated with genomic and other molecular biology research. What's a clinician to do to survive in such an environment? And what about the consumer trying to make informed, appropriate personal healthcare decisions?

Perhaps a new healthcare corporate culture embracing the value of its intellectual capital can create an environment that helps reduce the sense of information overload. Bontis (2002) considers intellectual capital to be multidimensional with the three subdomains of human capital, structural capital, and relational capital. The tacit knowledge embedded in the minds of the employees constitutes the human capital. The structural capital is defined as the organizational routines of the business, while the knowledge embedded in the relationships established with the outside environment is the relational capital.

Within health care, communications about patients, assessments, diagnoses, plans of care, interventions, outcomes, and evaluation activities reflect the explication of tacit knowledge. Clinicians, administrators, and support staff constantly engage in decision making throughout their workday. The written communication documented in the patient record helps codify the knowledge — the perfect application for an appropriate electronic solution that would permit ubiquitous information availability. Legibility and quality of those communications can be significantly enhanced if such a solution has been carefully designed and implemented.

When considering the structural capital, successful leveraging of resources involves integrating appropriate information management solutions within the healthcare work setting. Bontis (2002, p. 33-34) identified that structural capital "...contains elements of efficiency, transaction times, procedural innovativeness, and access to information for codification into knowledge". This entails development of clinical and administrative information systems that include individualized and personalized views to support information seeking behavior for effective decision making. The information system must reflect a design based on the workflow of practice and comply with the "write once and read/use many times" mandate (Androwich, Bickford, Button, Hunter, Murphy, & Sensmeier, 2002). Additionally, the organizational culture must embrace and effectively use the technology as a tool, not a driver, a theme recently highlighted in several sessions at the 2002 AMIA Fall Symposium (Anderson & Kaplan; Fridsma & Gadd; Harris, Payton, Anderson & Freidman; Rauscher, 2002).

An organization with the best human capital and structural capital can not survive without carefully attending to the relational capita, comprised of the knowledge of market channels, customer and supplier relationships, and a sound understanding of governmental or industry association impacts. With healthcare consumers demonstrating increased reliance on information and resources resident on the web, a successful healthcare delivery system will be recognized by its electronic links to accommodate those information requests. That means healthcare information systems must support consumer decision making, as well as that of clinicians and administrators; thus, these become additional functional requirements for the design of information systems.

In its governmental efforts to promote development of information systems for the NHII and PMRI, the NCVHS Subcommittee on Standards and Security has heard testimony on designated standard terminologies and code sets focused primarily on those used by reimbursement entities and physicians. Recent testimony has begun to explore the expanded information content associated with all aspects of patient care delivery, with or without consideration of reimbursement. However, most discussions still return to payment issues of one sort or another.

The Subcommittee on Standards and Security has not yet begun to fully appreciate and carefully examine the information needs and representations of non-physician practitioners and complementary and alternative medicine healthcare delivery methods and models. Nor has this subcommittee addressed the necessity of information system design beyond database structures to ensure workflow support for all healthcare clinicians in all settings as they seek to engage in evidence-based practice and the delivery of quality care.

The Subcommittee on Standards and Security also will need to consider in their deliberations the diversity of what constitutes evidence-based practice for physicians and nurses. Lavin, Meyer, Krieger, McNary, Carlson, James and Civitan (2002) identified three areas of difference between evidence-based medicine and evidence-based nursing: focus of the research, research methods, and subject matter. Nursing research focuses on the patient or client to address such things as risks, needs, health, maintaining life processes, and comfort. Medicine reflects a disease or pathology model focused on establishing a diagnosis and treatment or prevention. Evidence-based medicine has relied heavily on quantitative measures with the gold standard being the double blind, randomized controlled trial. Although evidence-based nursing also uses the full complement of quantitative research methodologies, nurses also employ qualitative research methods to enhance discovery of the additional detailed richness expressed in human experience. Each profession must be supported in its practice, education, administration, and research domains, no small feat for information system solutions.

So what's the point in discussing the potpourri of issues associated with the CPR? Health care is a complex information intensive business that cannot rely on information system solutions grounded solely on a financial platform. Successful healthcare organizations with effective data, information, and knowledge management strategies identify, value, and enhance their intellectual capital represented by human capital, structural capital, and relational capital. These organizations incorporate workflow processes within the design and implementation of information systems, evaluating how best to "... support employees in their quest for optimal intellectual performance and therefore overall business performance" (Bontis, 2002, p. 33). Can such long-awaited successes ever materialize and even become the norm? What is your answer?

REFERENCES

Anderson, J. G., & Kaplan, B. (2002). Tutorial: "Evaluating the Impact of Health Care Information Systems" at AMIA 2002 Symposium on November 9, 2002.

Androwich, I. M., Bickford, C. J., Button, P., Hunter, K. M., Murphy, J., & Sensmeier, J. (2002). Clinical Information Systems: A Framework for Reaching the Vision. Washington, DC: American Nurses Publishing.

Bontis, N. (Ed.) (2002). World Congress on Intellectual Capital Readings. Boston: Butterworth Heineman.

Fridsma, D. B., & Gadd, C. S. (2002). Tutorial: "The Organizational Context of Information Technology: Perspectives, Tools and Challenges" at AMIA 2002 Symposium on November 10, 2002.

Harris, K. D., Payton, F., Anderson, J. G., & Friedman, P. (2002). Panel: "Implementation Strategies-Friend or Foe?" at AMIA 2002 Symposium on November 12, 2002.

Lavin, M. A., Meyer, G., Krieger, M., McNary, P., Carlson, J., Perry, A., James, D., & Civitan, T. (2002). Essential Differences Between Evidence-Based Nursing and Evidence-Based Medicine. International Journal of Nursing Terminologies and Classifications, 13(3), 101-106.

National Committee on Vital and Health Statistics. (2001). Information for Health: A Strategy for Building the National Health Information Infrastructure. Washington, DC: Author.

Rauscher, R. (2002). Tutorial: "Designing Reliable, Fault-Tolerant Systems in a Diverse health Care Environment" at AMIA 2002 Symposium on November 9, 2002.

Waegemann, C. P. (2002). Status Report 2002: Electronic Health Records. Health IT Advisory Report, 3(7).

ENDNOTE

[1]Carol Bickford is a Senior Policy Fellow with the American Nurses Association, Washington, DC (cbickfor@ana.org)

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