Computer-based Patient Records

Implications for the Clinical Research Information System of the NIH Clinical Center

Summary

The End First

Factors Favoring a Successful Implementation of a CPR at NIH

- CRC a single hospital serving the Institutes
- Institutes accustomed to funding the CRC
- Extensive experience with electronic medical records – 25 years with TDS (now Eclypsis)
- Extensive experience among physicians with computer-based order entry and results retrieval
- Extensive experience with clinical protocols
- Devotion to clinical research methods

Impediments to a Successful Implementation of a CPR at NIH

- Shortage of capital
- Lack of common data dictionary
- Hand-written and dictated physicians' notes without common structure or format
- Variability among the Institutes in the processes they use to manage inpatient and outpatient visits.
  - Move from Institute wards to functional wards in the new CRC will require considerable cultural change.

Impediments to Successful Implementation of a CPR at NIH

- Vendors' products have NOT been designed for the NIH CRC:
  - Complete charge capture VERY important
  - Physicians will NOT enter data
  - Protocols NOT important
- In all likelihood, no vendor will have a complete solution for the NIH CRC

Most Important Message

- Technologies WILL NOT be the primary determinant of the costs and benefits of CPR for the NIH CRC.
- Politics WILL determine the costs and benefits of the CPR for the CRC.
  - Without an inclusive process to define functional and technical requirements, then the leadership to implement a standardized solution, the CPR project will fail to achieve its goals.

The Story of the Tower of Babel

- God gave mankind knowledge, and a single language
- Mankind used knowledge and cooperation to begin to build a tower to Heaven
- God did not want Man to climb to Heaven
- God replaced the one language with many languages, and construction of the tower came to a confused halt.

What Do We Mean By Politics?

- Standards
  - Data definitions
  - Document formats
  - Technology standards
  - Policies and procedures for implementation and use of the CPR

What Do We Mean By Politics?

- Economics
  - How will the Institutes agree on the standards for the key issues defining a CPR
    - » Data standards
    - » Types of workstations
    - » Screen formats and data collected on them
    - » Security & confidentiality issues
    - » Design and Presentation of Procotols

The Vision

What is a CPR supposed to do?

The Vision

- Standardized electronic financial and clinical records using more efficient thin-client, Internet standard networks
- Observational data stored in transaction systems for transaction processing and in data warehouses for retrospective study
- Ad hoc data analysis to find causes in the processes of care for variation in the outcomes of care
- Systematic use of the scientific method to improve clinical and financial operations over time.

CRIS Project Goals & Objectives

- Promote
  - Excellence in Clinical Research
  - Quality of Patient Care
  - Cost Effectiveness & Efficiency

Excellence in Clinical Research

- Collect data once for research & clinical care
- Provide protocol-based data collection
- Provide research access to data
  - Research tools for retrieval and analysis
- Provide automated patient safety monitoring

Quality of Patient Care

- Create a single, continuous record of NIH-based care
- Provide access to patient care information for referring physicians
- Incorporate rules, alerts and references to aid in patient care decisions

Quality of Patient Care

- Protect patient privacy and confidentiality through comprehensive security
- Provide protocol-based ordering
- Minimize risk of clinical errors

Cost Effectiveness & Efficiency

- Adopt industry standards to allow for system interoperability and the appropriate reuse and sharing of information
- Acquire a flexible system that can adapt to a changing environment

Cost Effectiveness & Efficiency

- Establish the foundation for an electronic medical record
- Provide aggregate information to support cost effective use of NIH resources
- Streamline operational processes and improve productivity

CDR Definition

Clinical Data Repository (CDR)

- An electronic "data warehouse" for the Computerized Patient Record (CPR).
- May be a single data base, or more likely, a series of databases that are accessed by a combination of pointers and directories
- Clinical and financial information is integrated into a single longitudinal view of the patient

CPR Definition

- CPR: relates to data content, such as medical problems, diagnosis, observations, treatments, etc. The proper implementation of the CPR is the responsibility of the health care clinician.

CPR System Definition (cont.)

- <u>CPR System</u>: relates to the storage capacity, response time, reliability, security, etc. The proper implementation of the CPR system is the responsibility of the technical & engineering design professionals.

Requirements

- Universal patient identifier
- Data access across continuum of care
- Accessibility enterprise-wide
  - Easy access (Graphical User Interface-GUI)
  - Full access to clinical data
  - Custom user views

Requirements (cont.)

- Ad hoc query/reporting
  - Concurrent
  - Historical
  - Episode specific and cross episodic
  - Outcomes measurement

Requirements (cont.)

- Data from multiple systems/locations
- Data base design - multi-media (text, image, voice, data)
- Integration with feeder applications
  - Compliance with open systems integration standard
  - Support multiple work station types

Requirements (cont.)

- Privacy/confidentiality/security
- Decision support capabilities
- Support/maintenance requirements
  - On-going education/training support
  - Hardware/software support

CPR User Requirements

- Record Content
  - Uniform "core" data elements
  - Standardized coding systems and formats
  - Common data dictionary
  - Outcomes information
- Record Format
  - "Front-page" problem list
  - Ability to "flip through the record"
  - Integrated among disciplines and across sites of care

CPR User Requirements (cont.)

- System Performance
  - Rapid retrieval
  - 24-hour availability
  - Convenient access/Ease of use

CPR User Requirements (cont.)

- Linkages
  - Linkages with other information systems
  - Transferability/connectivity among specialties and disparate sites
  - Linkages with relevant scientific databases
  - Linkages with records of family members
  - Electronic billing/remittance

CPR User Requirements (cont.)

- Intelligence
  - Decision support
  - Clinician reminders
  - “Alarm” systems

CPR User Requirements (cont.)

- Reporting Capabilities
  - "Derived documents" (e.g., insurance forms)
  - Standard clinical reports (e.g., discharge summary)
  - Customized and ad hoc reports
  - Trend reports (graphical display)

CPR User Requirements (cont.)

- Control and Access
  - Easy access for patient and their advocates
  - Safeguards against violation of confidentiality
- Training and Implementation
  - Minimal training required
  - Phased implementation possible

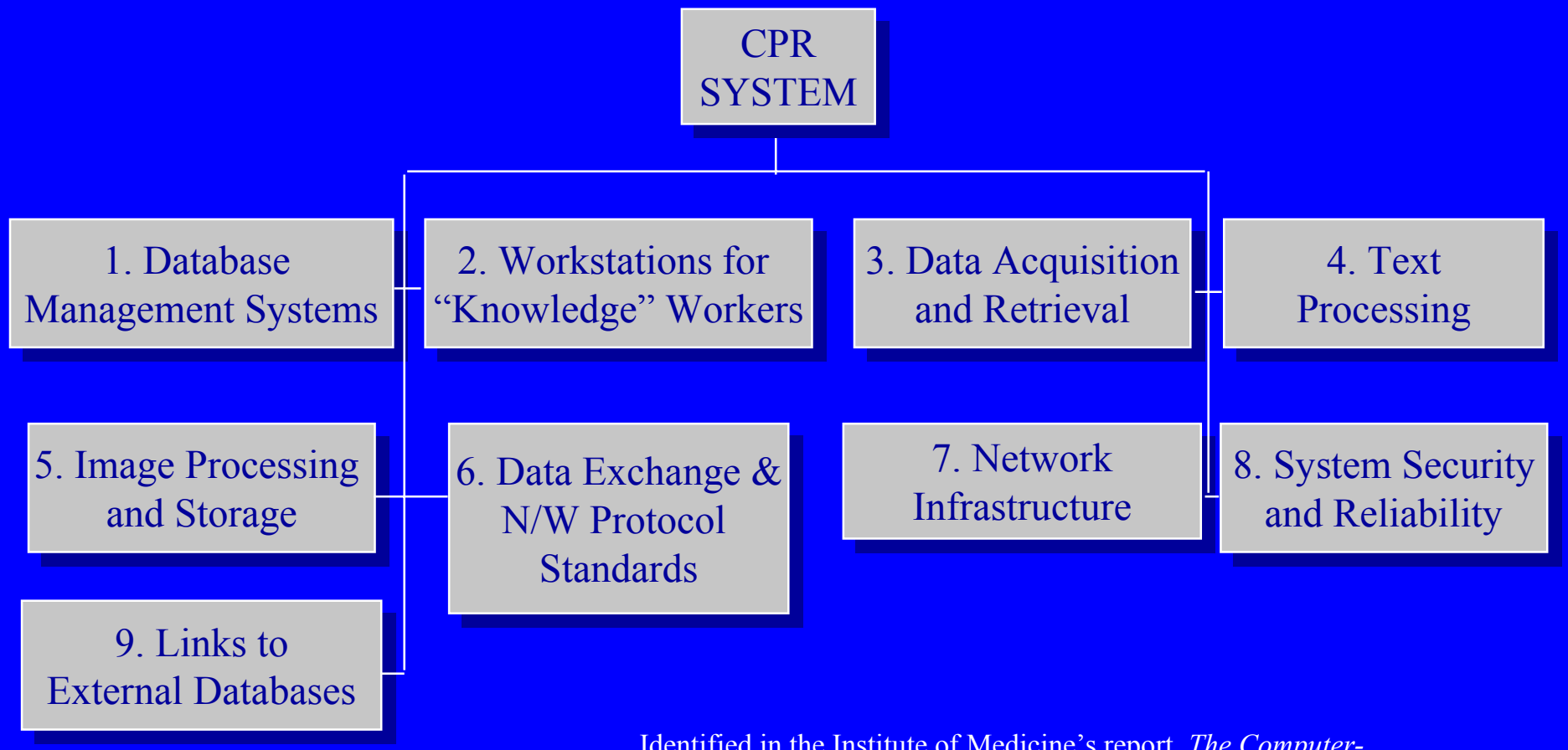
Increasing Demand for CPRs

- Demands for patient records growing
- More powerful, affordable technologies
- More people familiar with computers
- Aging population requiring coordinated care
- Pressure to reform the health care system

The Technologies

The Internet Changes Everything

CPR - Essential Technologies - According to a Report from the IOM



Identified in the Institute of Medicine's report, *The Computer-Based Patient Record: An Essential Technology for Health Care*

CPR Components

- Enterprise patient index
- System integration support
- Clinical data repository
- Workstations
- Transcription consolidation
- Clinical practice management
- Imaging

Enterprise Patient Index

- Access to patients across the continuum via a common index
  - Common medical record number throughout all systems
  - Integration software that provides a unique index for each patient regardless of medical record numbers

System Integration Support

- Application integration gateway
- Access security management
- Common user interface facility

Clinical Data Repository

- Clinical data
  - Diagnostic results, point-of-care data
- Patient data
  - Demographics, ADT, financial
- Care provider data
  - Physician and nurse notes/documentation
  - Discipline-specific views
- Outcomes reporting
- Decision support

Workstations

- Handheld devices
  - Palm, Motorola, IBM, Apple, many others
- Clinician workstations
  - Fast, inexpensive desktops w/ flat panel displays
- Imaging workstations
  - 21” +, millions of colors, 2,000 by 2,000 pixels

Transcription Consolidation

- Centralized transcription.
  - Implement same clinical word processing/transcription system throughout the organization.

Transcription Consolidation

- It is essential to have all the clinically-relevant dictated notes in CPR, otherwise physicians will have to use two medical records (paper and digital).
  - Inova health system implemented a CPR, to discover to its dismay it had > 50 separate transcription systems for cardiac cath lab, pulmonary function lab, nutrition, EMG, EKG, EEG, physical therapy, occupational therapy, etc.
  - Converting all to WordPerfect was a huge task.

Clinical Practice Management

- Patient assessment
- Plans of care
- Charting by exception
- Exception alerts
- Clinical pathway/practice guideline
- Other clinical documentation
- Problem lists

Imaging

- Clinical imaging
- Document imaging - medical records
  - Not a substitute for a CPR with coded text
  - Cannot search an image

Imaging

- Technology the same:
  - Optical disk arrays
  - Fast networks
    - 100 megabit Ethernet today
    - Gigabit Ethernet tomorrow (standards set)
    - ATM at terabit speeds
  - Distributed object database management systems

Data Elements In the CPR

- Demographic
- Financial
- Basic clinical information & history
- Specialty specific clinical information
- Functional status
- Satisfaction

Demographic

- Name
- Birth date
- Place of birth
- Relatives
- Employer
- Race
- Religion
- Addresses
- Insurance
- Guarantor
- Financial history

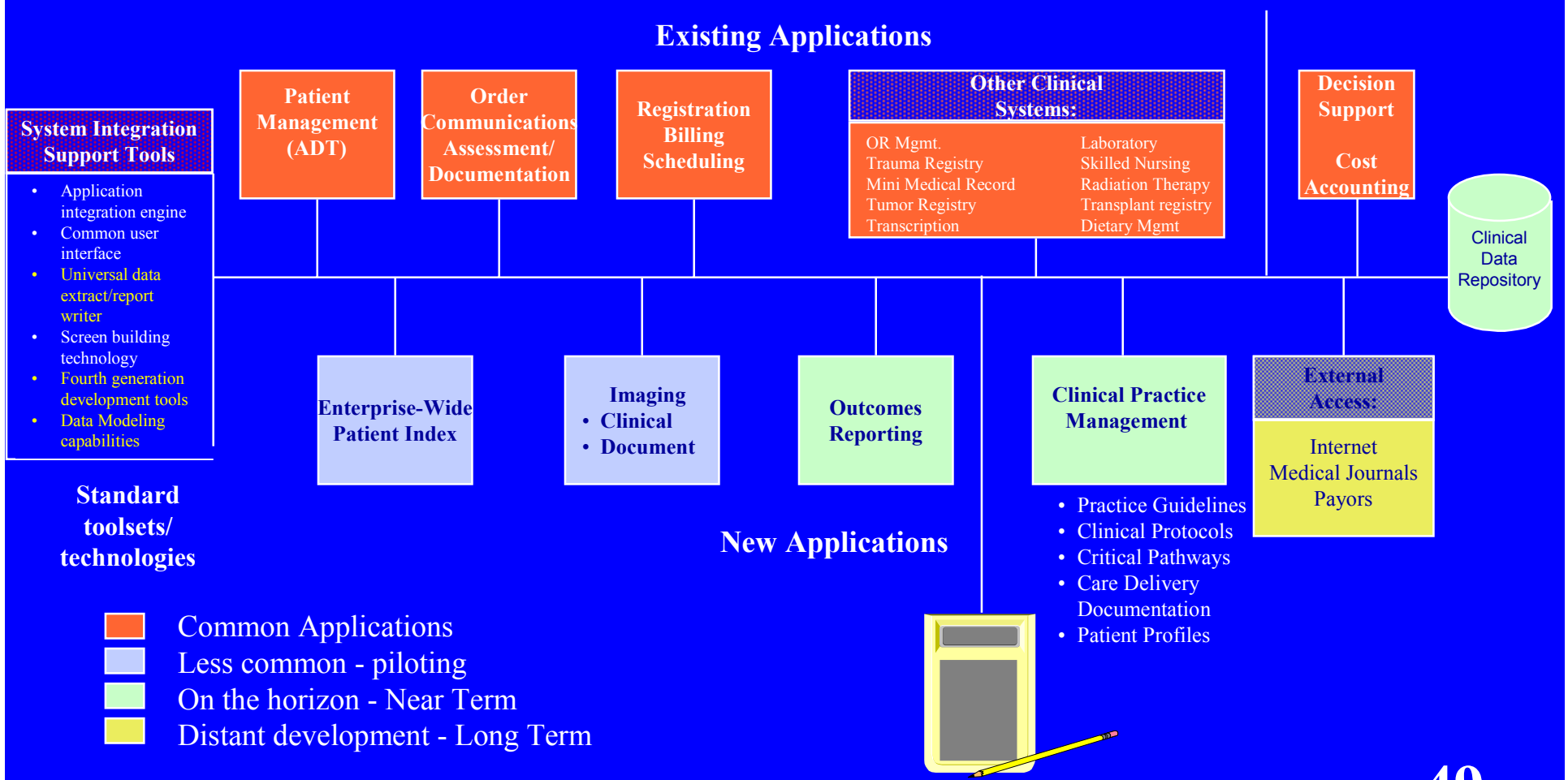
Basic Clinical Information

- Visit history
- Allergies
- Height & weight
- Change in weight
- Problem list
- History
- Physical
- Assessments
- Laboratory results

Specialty Specific Clinical Data

- Trauma registry
- Tumor registry
- Transplant registry
- Clinical Consults
- EKG
- EEG
- EMG
- Dietary
- Physical therapy
- Occupational therapy
- Nutrition
- Immunology
- Blood bank

CPR Conceptual Model: Source Systems



The CPR from IT Perspective

- Network infrastructure
- Network management
- Network services
- Application integration engine
- Common user interface
- Data architecture and data modeling

Network Infrastructure

- Cabling
  - NIH moving to fiber optic cabling for Internet 2
- Routers
- Hubs
- Bridges
- Gateways

Network Management

- Fault detection
- Software version control
- Peaks and troughs
- Firewalls
- Redundancy and backups

Network Services

- Security
  - ID numbers, passwords, call back, audit trails, encryption
- Directory services
- Messaging

Application Integration Engine

- Interface gateway
- Routes data over corporate network to proper recipient computer
- Translates data from format of computer computer system to different format of another.

Common User Interface

- Client Server
  - Windows, X-Windows or Macintosh
- Thin client
  - Web browser
  - XML

Data Architecture & Data Modeling

- Distributed or centralized data
- Hierarchical or relational or object models
- Programming language that holds the data
  - Third generation imperative language
  - Fourth generation relational language
- Data standards

Health Insurance Portability and Accountability Act of 1996

- Standardize data for electronic exchange of financial and administrative information
  - Electronic claims and claim status
  - Enrollment and eligibility
  - Payment and remittance
  - First report of injury
  - Referral certification and authorization

Unique Identifiers

- Standard unique health identifier for:
  - "The Secretary shall adopt standards providing for a standard unique health identifier for each individual, employer, health plan, and health care provider for use in the health care system."
- The patient brings the medical record number, the provider does not assign it.

Regulations Not Implemented

- National Committee on Vital and Health Statistics recommending to Dr. Shalala (head of DHHS) that HIPAA not be enforced until Congress passes confidentiality legislation.
- Since Congress did not act by August, 1999, confidentiality regulations written by the NCVHS will be implemented automatically in 2000.

Unified Medical Language System

- UMLS is a major continuing project of the National Library of Medicine
- Meant to help health care workers retrieve and integrate biomedical information, from many sources of information, with many lexicons and many representations of knowledge

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Healthcare Informatics Standards

The Tower of Babel

WELCOME

This site is a catalog of information about healthcare informatics standards. Its scope will provide valuable information to those who regularly work in this area, but it also features introductory material for healthcare professionals who are new to informatics or standards.

Click HERE to search this site.

NEW! Click HERE to find out what's new on this site.

Links to Standards Developers

Internet

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Links to Standards Developers

Links to medical informatics standards groups located in the U.S., and to the messaging standards they develop.

Links to Coding Systems

Information on national and international standards for the codes that represent healthcare concepts. Without these systems it would be impossible to share information in large venues.

Links to Other Informatics Organizations

Organizations that focus on informatics but not directly on creating standards.

Links to Other Standards Organizations

Information about umbrella organizations and links to treaty organizations.

Links to Data Sets

Internet

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Links to Standards Developers

HL7	Health Level-7 for exchanging data among clinical systems
X12N	X12N for exchanging insurance, eligibility, and managed care information
DICOM	DICOM for exchanging clinical images
ASTM	ASTM for exchanging messages about clinical observations, medical logic, and electrophysiologic signals. There are other standards about healthcare identifiers, system functionality, etc.
NCPDP	NCPDP for exchanging data processing standards to the pharmacy services

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HL7 and Other Standards - Microsoft Internet Explorer

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HL7

HL7 and other Standards

HL7 Transactions

The current standard defines transactions for transmitting data about patient registration, admission, discharge and transfers, insurance, charges and payors, orders and results for laboratory tests, image studies, nursing and physician observations, diet orders, pharmacy orders, supply orders, and master files. HL7 is currently developing transactions for exchanging information about appointment scheduling, problem lists, clinical trial enrollments, patient permissions, voice dictations, advanced directives, and physiologic signals. Task forces in HL7 are also busy developing prototype transactions with new state of the art technologies such as CORBA and Microsoft's OLE objects.

Cooperation with Other Standards Developing Organizations

HL7 has a pure focus on health care informatics standards and cooperates closely with other standards developers such as American Society for Testing and Materials (ASTM), Accredited Standards Committee X12N (ASC X12N), American College of Radiology (ACR), National Electrical Manufacturers Association (NEMA), National Council for Prescription Drug Programs

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Address http://www.hl7.org/ Go

View HL7's 1999 HIMSS Demo
Click Here

Register for HL7's Spring Working Group Meeting
Click Here

Health Level Seven

ABOUT HL7	EVENTS	MEMBERS ONLY	MEMBERSHIP	RESOURCES	COMMITTEES
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NEWS

HL7 demonstrates XML capabilities at HIMSS

Register today for HL7's Spring Working Group Meeting

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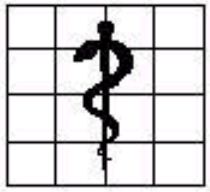
Links to Coding Systems

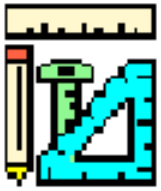
Coding Systems

These links lead to information on national and international standards for the codes that represent healthcare concepts. Without these systems it would be impossible to share information in large venues.



Read Codes

A comprehensive set of codes used to



LOINC

Standard codes and nomenclature for identifying

SNOMED

A large and comprehensive mutil-axial code system for medical vocabulary developed by the College of

Px

CPT4 Codes

Procedure codes developed by the AMA for

Internet

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IUPAC Codes International standardisation of chemical weights, measures, names and symbols	**NDC** National Drug Codes - very detailed code produced by the FDA to identify drug products down to the packaging.	**NANDA** North American Nursing Diagnosis Assocation code set of nursing diagnoses	**DSM-IV** Diagnostic codes maintained by the American Psychiatric Association
ECRI Codes for identifying medical equipment	**Arden Syntax** Arden Syntax for Medical Logic Modules	**Other Code Sets** Links to codes for units of measure and identifiers for code systems.	

Internet

Explosion Of The Internet

- ARPANET started at UCLA in 1969
- World Wide Web standards created by Tim Berners-Lee at CERN about ten years ago.
- In 2000, about 50% US population has ready access to the Internet at home and/or office.
- The “browser” gives people access to multimedia documents on the WWW with little concern for hardware and operating system.

Independence from Hardware & Operating Systems Cuts Costs

- The WWW standards of HTML, HTTP define standards for document formats
  - Hypertext markup language
  - Hypertext transfer protocol
- XML defines standards for data formats
  - Extensible markup language
- Developers of CPRs can write programs for heterogeneous computers and operating systems, yet have them all access information on the WWW.

The Future According to Intel

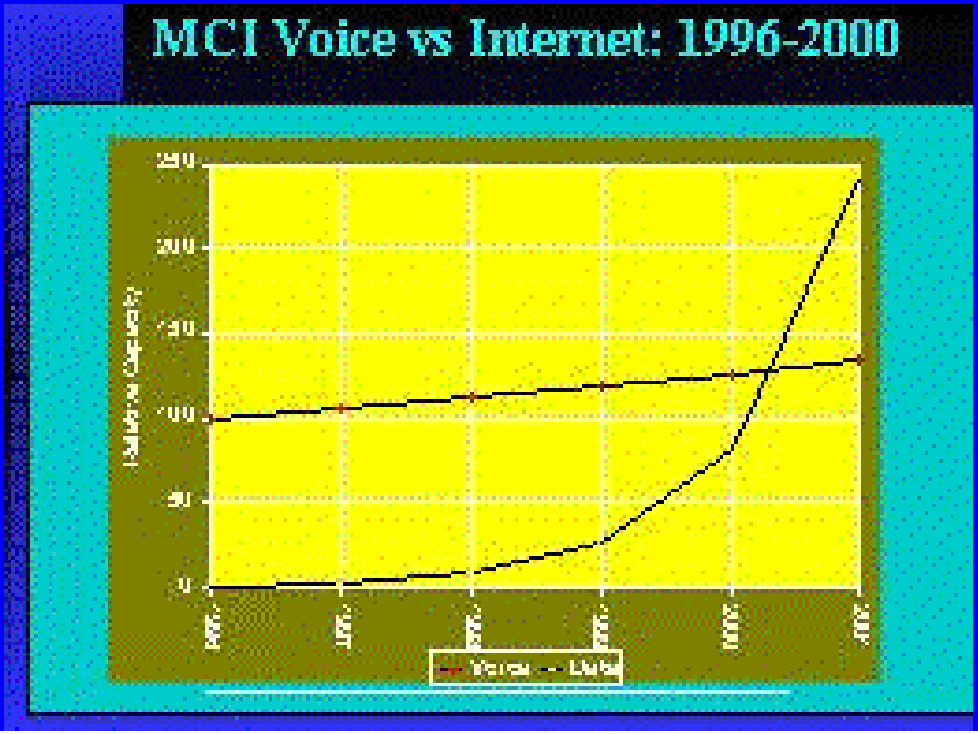
- "The Internet revolution requires a wholesale reengineering of the infrastructure for commerce and communications. In five to eight years, we believe the world will be linked by one billion connected computers, through tens of millions of servers, generating trillions of dollars of e-commerce."
  - Intel annual report for 1999, page 3.

MCI Traffic Explosion

- October, 1994 - January, 1996
  - 5600% increase in packets over MCI portion of the Internet
- January, 1996 - January, 1997
  - 15% per month increase in packets
- Year 2000, MCI assumes a 300%/year growth rate
  - Factor of 9 every two years
  - Factor of 729 in six years

MCI Voice Vs. Internet 1996-2000

- Voice traffic less than 5% per year
- Internet traffic surpassed voice in 1999, growing at exponential rate



Infinite Capacity

- Fiber's capacity to carry data nearly infinite
- Can send 1,000 *billion* bits/second
- Compression routines improving amazingly
- Transmit the entire 30 volumes of the Encyclopedia Britannica, or all the issues of the Wall Street Journal, in less than one second.

Internet 2

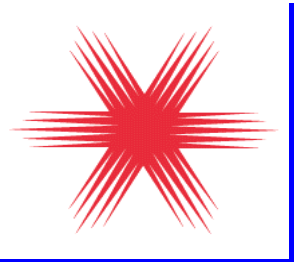
- Successor to Internet 1 architecture
- Very high capacity OC-12 (622 megabit/second) packet switches
- Switches support IPv4 and IPv6
- Multicasting of advanced multimedia
- gigaPoP = Gigabit capacity point of presence

Internet 2

- Not enough IP addresses
  - IPV4 has 256^4 addresses (4.3×10^9)
    - 255.255.255.255
  - IPV6 fixes that: 256^6 addresses (2.8×10^{14})
    - 255.255.255.255.255.255
      - For every electrical outlet on earth
- Rapidly growing traffic
  - Faster fiber (more bits per second)

Defining the eHealth Market Space

- No one will own the eHealth market space,
- Large payer and provider organizations will help to define the space.
- So will the Internet service providers:
  - AOL, MSN, MCI, Sprint, AT&T, UUNET, etc.
- So will government agencies.
  - NIH, HHS, FCC, DoD, etc.



The Challenge

Use the Technologies to Improve Health Care

Where Is All The Money For Health Care Going?

- Most health plans are losing money
- Health care costs continue to rise faster than inflation
- Are payers paying too much for health care services?

Where Is All The Money For Health Care Going?

- Organizations of providers are not making any profits on patient care
- Their returns on assets are usually very low
- Are payers paying too little for health care services?

Health Care Industry Is Huge

- $1,100,000,000,000 in 1998
- $2,100,000,000,000 in 2007 (predicted)
- Estimates of waste and inefficiency in 1999
  - $250,000,000,000 to $300,000,000,000
    - Including clinical errors
- Other industries have benefited substantially from systematic study and standardization of operations.

Recent Study Finds Huge Potential Savings in eHealth Care

- $30,000,000,000 + potential savings in electronic communication of administrative health care data alone.
  - Arthur D. Little study.
- Substantial benefits in improved clinical outcomes from the use by clinicians of order entry systems, alerts and reminders.
  - Institute of Medicine patient safety study.

Primary Impediments to eHealth

- Data collected in analog (paper) form
- Lack of standardized digital data formats
- Providers disaggregated and unable to finance shared systems & standardized data
- Sunk costs of existing inconsistent digital office practice and medical record systems
- Expensive processes to transform data to standard formats

Observation and Hypothesis

- **Observation:**
  - Health care organizations that deliver health care services generally have low intellectual capital values - as determined by the market.
- **Hypothesis:**
  - Health care organizations that deliver health care services can have high intellectual capital values if they standardize and continuously improve their services by systematically applying the health evaluation sciences to their work.

Intellectual Capital

- "Intellectual capital is the sum of everything everybody in a company knows that gives it a competitive edge. Unlike the assets with which business people and accountants are familiar - land, factories, equipment, cash - intellectual capital is intangible. It is the knowledge of a workforce."
  - Intellectual Capital, the New Wealth of Organizations, Stewart, Doubleday, 1997.

Intellectual Capital

- The knowledge of an organization that helps it compete for business and grow profitably.
- Intellectual capital equals the premium above book value that the market assigns the stock of a company, <u>less its cash assets</u>.
- Market value equals the market's estimate of the value of the future stream of earnings from all of a company's assets.

Types of Intellectual Capital

- Human capital
  - Knowledge, expertise and competence of employees and affiliated physicians
- Structural capital
  - databases, networks (intranet & extranet), documentation, publications, guidelines, policies and procedures
- Customer capital
  - relationships with customers

Tobin's Q Scale - A Measure of Intellectual Capital

- Tobin's **Q**: The Measure of Intellectual Capital
  - » To grasp the importance of why it is necessary to value intellectual capital, the concept of Tobin's **Q** should be understood. Developed by the Nobel Prize-winning economist James Tobin, this ratio measures the relationship between a company's market value and its replacement value (the cost of replacing its assets). In the long run, this ratio will tend toward 1.00, but empirical evidence shows that it can differ significantly from 1.00 for long periods of time. For example, companies in the software industry, where intellectual capital is abundant, tend to have Tobin's **Q** ratios of 7.00 or higher, whereas firms in capital-intensive industries, noted for their large physical assets, have Tobin's **Q** ratios of nearly 1.00.
- Nick Bontis. "There A Price On Your Head: Managing Intellectual Capital Strategically." *Business Quarterly* 60(4) (June 22, 1996): 40.

Measuring Intellectual Capital

- Equation depends on publicly available data about market value of a company

$$\frac{\text{Market value}}{\text{Book value}}$$

- Market value is share price times number of outstanding shares
- Book value measures current value of tangible assets on balance sheet of the company

Tobin's Q and Profitability

- Without current profits, or likelihood of profits in the future, a company has low market value.
  - Market value may be below book value
- A company can be profitable with a large amount of tangible assets, and still have a Tobin's Q ratio of more than 1.0 provided the firm has prospects for profitability in the future.

Measuring Intellectual Capital

- On July 14, 2000 Microsoft stock traded at 10.4 times its book value.
  - $415.4 billion market capitalization.
  - Price $78.94/share.
  - Book value $7.59/share.
  - Cash $4.04/share.
- Subtracting cash from price and book value, the Tobin Q is 21.

On the Other Hand . . .

- Recent Tobin's Q scale measures for selected health care organizations:

– Columbia/HCA	2.9
– Tenent	1.7
– PhyCor	0.4
– Caremark RX (aka Medpartners)	(0.6)
– Healthsouth	0.6
– Ameripath	0.9
– Aetna	0.8
– United Healthcare	2.3

Mayo Clinic Jacksonville

- Comprehensive electronic medical record
- Improving patient care
- Reducing costs of care
- Making Mayo Clinic Jacksonville more successful clinically and financially

Informatics Will Be The Key

- The amount of intellectual capital produced by the Mayo Clinic will depend on the extent it can adopt and fully use standardize digital information management technologies to prove it provides better care than its competitors at the same or lower prices than its competitors charge.

Measurement and Management

"You cannot manage what you cannot measure."

- Peter Drucker.
- Bill Hewlett.
- Tom Peters.
- Others.

Information Is Your Lifeblood

- "How you gather, manage, and use information will determine whether you win or lose."
- "The winners will be the ones who develop a world-class digital nervous system so that information can easily flow through their companies for maximum and constant learning."
  - Business @ The Speed of Thought, Bill Gates, 1999, Warner Books.

Importance of Standards Cannot Be Overstated

- Necessary to:
  - pool data from collaborating organizations
  - benchmark performance
  - establish norms for process & outcome measures
- Necessary for:
  - the practice of evidence-based medicine
  - effective communication and corporate learning
  - development of intellectual capital

Economic Benefits of an Electronic Data Warehouse

- Clinical data are collected in clinical transaction systems
  - Pharmacy, laboratory, radiology, electronic medical records, health risk assessments
  - Those data can be copied to a data warehouse where they are available for retrospective study at minimal marginal cost (after the cost of creating the warehouse)

Economic Benefits of an Electronic Data Warehouse

- On the other hand, if those data are printed to paper, the costs of manual data abstraction later are about $75/chart for 200 data elements
  - A study of 1,000 patients costs $75,000 just to collect the data, even before analyzing them

Health Care Lags Other Industries Electronic Records & Data Warehousing

- Other industries have multiple similar operating units that can pool data
- Other industries have simpler data needs
  - But, there are many opportunities for benefits from data warehousing in health care
- Standardization of data has been difficult in health care – without Uniform Product Codes - UPC codes
- But, organizations of providers can fund the adoption of standardized medical nomenclatures that do exist and are available for use.
  - Including the various Institutes that share the CRC.

The Opportunities Are Here Now

- Standardized Data
  - HIPAA
  - Unified Medical Language System
  - JCAHO (ORYX) and NCQA (HEDIS)
- Standardized Networking
  - Internet
- Organizations of Providers to Pool Capital
  - Organized delivery systems founded by providers and payers

Who Uses A CPR?

Primary Care Groups

- Primary care physicians in the USA and Europe adopt CPRs first
  - By 1996, 50%+ of GPs in the Netherlands and Great Britain used a CPR
- Why?
  - Costs of the CPRs are subsidized by the government
  - GPs set standards for information systems
  - GPs trained to use CPRs
    - Several years to enter 2,300 patients' data into a CPR
      - Takes additional several minutes per visit
  - GPs coordinate care for populations of patients

Examples in the USA

- Many single specialty groups use MedicaLogic Logician
- More difficult to tailor a system to a multi-specialty group with many choices
- EpiCare popular among large groups that also use the Epic practice management system.
- Mayo Clinic Jacksonville uses a CPR and is practically “paperless” with substantial cost savings measured there.

Benefits of the CPR

- Automate Data Collection and Transfer
  - More Efficient Documentation
- Automate Data Analysis
  - More Efficient Health Services Research
- Automate Clinical Guidelines
  - More Efficient Rule-Based Logic for Advice
- More Effective Health Care
  - Provide the Right Services More Often

Benefits of the CPR

PROBLEM	SOLUTION
Excessive Costs : • Physician Practice Patterns • Practice of Defensive Medicine • Patient Expectations • Administrative Costs • Nursing Costs • Waste & Inappropriate Care • Inappropriate Incentives	CPR Addresses Major Cost Drivers in Health Care : • Cost-effective Clinical Decisions • Reduce Medical Malpractice • Support for Patient Education • Reduce Nursing Costs • Reduce Waste & Inappropriate Care • Reform Incentive Structure to Support Payment by Clinical Outcomes

Benefits of the CPR

PROBLEM	SOLUTION
Compromised Quality: • Lack of Objective Data on Treatment Efficacy • Little Incentive to Respond to Clinical Protocol Development	CPR Fosters Quality Enhancement: • Integration with Medical Knowledge Base • Complete, Accurate Data For Clinical Response
Inadequate Access to Care : • Large Population Segment with No Coverage	Improved Access For All Citizens : • Appropriate Allocation of Limited Healthcare Resources

Obstacles to the CPR

- Tradition of Autonomous Operating Units
  - Many Baronies (Effects of Reorganization?)
- Lack of Federalism in Governance
- Sunk Costs in Incompatible Systems
  - Emotional Content of Changing Systems
- Shortage of Capital

Obstacles to the CPR

- Unfamiliarity with Informatics
  - Limitations of Current Technologies
- Immaturity of Current Vendors' Products
- Existing Incompatible Systems
  - Incompatibility at Software and data
  - Data Incompatibility More Important Than Differences in Vendors

Obstacles to the CPR

- Lack of Standardized Networks
  - Local, Wide-Area and Regional Networks
- Lack of System-Wide Data Dictionary
  - No System-Wide Data Administration Function
- Technical Training of IS Staff
  - They Need to Know the New Technologies
  - Training Costs Are Always Underestimated

Selecting a Vendor

Compromise, Collaboration
And Standards Are Essential

Everyone's Definition Of The CPR Is Different

- Transcription or coded data?
- Clinical charting or retrieval of laboratory results and orders or both?
- Integrated with practice management system or stand-alone?
- Shared with other physicians and facilities?
- Client-server or thin client (WWW)?

General Design Attributes to Consider in CPR

- Data elements
- Structure and Organization
- Ease of use
- Accessibility
- Interfaces
- Electronic mail
- Training
- Confidentiality
- Accuracy and integrity

Costs of CPRs

- Costs depend on the type of CPR selected:
  - Hardware
  - Software
  - Networks
  - Education
  - Training
  - Decline in clinicians' productivity

Costs of a CPR

- Costs from a low of $10,000 per physician, to a high of $50,000 per physician, or more.
  - At low end, relatively simple transcription systems.
  - At the high end, complex, windows-based systems with point and click interfaces to capture coded text for most data entry.
- Costs include hardware, software, interfaces, education and training.

CRIS System Selection

- Critical success factors
  - Functionality
  - Technology
  - Vendor
  - Cost/benefit

Functionality

- Supports features and functions of current systems
- Supports NIH workflow requirements
- Supports protocols-centered care
- Includes standards-based data dictionary with classification systems that link to commercially available medical knowledge-bases
- Incorporates rules and alerts utilizing standards-based rules engine
- Creates a continuous record of patient care at NIH

Technology

- Includes easy-to-use, intuitive navigation, single sign-on and seamless access to all appropriate applications
- Includes easy-to-use set of user query and reporting tools with robust functions technology
- Providers high system availability, rapid response time, and robust management tools

Technology

- Utilizes “industry-standard” technology platforms
- Provides for synchronization and normalization of data from disparate systems into well organized transaction and historical data repositories

Technology

- Populates a historical data repository that supports research and provides tools for end user queries and reporting
- Enables patient privacy and confidentiality in accordance with government regulations and “industry best practices”

Vendor

- Has proven implementation and ongoing support methodology
- Has high customer satisfaction at client sites
- Demonstrates business record of stability and financial viability
- Demonstrates strategic vision consistent with the vision of NIH

Cost/Benefit

- Provides best functional and technical fit, at reasonable long-term cost

Evaluation and Selection Process

- Establish project organization
- Identify vendor potentials and issue RFI
- Develop requirements and establish criteria
- Review RFI and determine vendor short-list
- Issue RFP
- Release scenarios

Evaluation and Selection Process

- Conduct demos
- Analyze RFP
- On-site visits/reference checks
- Risk analysis
- Vendor of choice

Criteria for Vendor Evaluation and Selection

- Vendor Profile
  - Years in Business
  - Financial Status
  - Office Location
  - Number of Clinicians in Company
  - $ to Research and Development

Selection Criteria

- Vendor Stability
- Functionality
- Support & Partnership
- Costs
- Technology
- Future Vision

Illustrative Vendor of Hospital-based CPRs

- All vendors are trying to extend the hospital based CPR to the ambulatory setting, either by adding modules themselves or integrating with ambulatory care products

Cerner: Electronic Medical Records (EMR/CDR) - Microsoft Internet Explorer

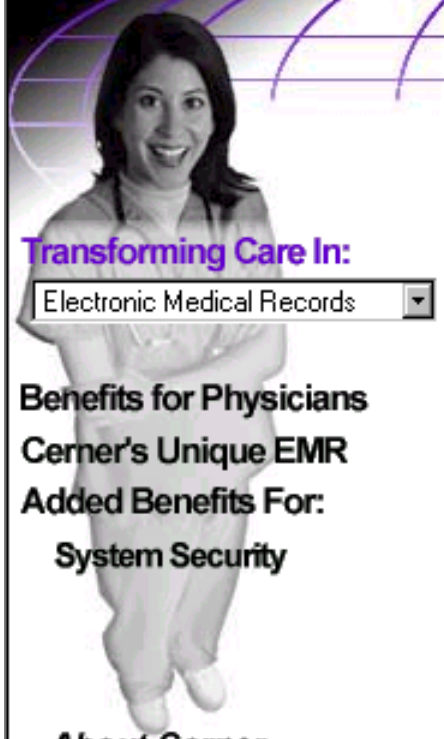
File Edit View Favorites Tools Help

Back Links Address http://www.cerner.com/459-9907.asp Go

CERNER

Clinical Team Consumers Investors
Health Executives IT Professionals Career Explorers

CLINICAL Team



Transforming Care In:

Electronic Medical Records

Benefits for Physicians
Cerner's Unique EMR
Added Benefits For:
System Security

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PowerChart® Electronic Medical Record Solutions

Delivering quality patient care not only takes clinical expertise, it also requires timely knowledge of a patient's pertinent clinical information to make informed decisions. With Cerner's *PowerChart Electronic Medical Record (EMR)* solutions, you can unlock the power of clinical automation and truly manage your clinical operations and patients in a manner that is more effective and quality conscious than ever before.

Improving Quality

PowerChart gives you the right information at the right time for achieving optimal health outcomes. With *PowerChart*, you can:

- Instantly access a longitudinal patient record that spans the continuum of care, including lab results, radiology reports, emergency room records, and more.
- Have more time to spend on direct patient care.
- Make more informed clinical decisions by having a complete patient history and results at your fingertips.
- Access data that is displayed in the *EMR* to best meet the needs of caregivers.
- Improve compliance with care and regulatory standards such as HCFA and HIPAA.

Done Internet

PowerChart

- Client-server design
- Graphical user interface
- Relational database management system – uses Oracle
- Cerner recently acquired the Oceania medical knowledge base
- Designed for large-scale, integrated delivery systems.

Oceania's Home Page - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Refresh Home Search Favorites History Mail Print Edit Links Best of the Web

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Internet

Oceania Acquired by Cerner

- Oceania a Windows-based, client-server designed, CPR that supports structured data collection for history and physical with SNOMED nomenclature.
  - Notes Writer implements a structured method of capturing clinicians' notes.
- U.S. military tested Oceania, then abandoned it in favor of 3M product for CHCS II.
  - Oceania fell apart, and sold its assets to Cerner

MedicaLogic

- The most popular CPR in the USA, in terms of number of physicians using it (> 20,000 licenses)
  - Logician
    - Client-server
    - Windows graphical user interface
  - Logician Internet
    - ASP architecture
- MedicaLogic held an IPO early in 2000 and raised more than $200 million.
  - Merging with Medscape
  - Competition for Healtheon/WebMD

Logician Internet -- Chart Room

Back | Forward

CHART ROOM
DESKTOP
DEMOGRAPHICS
CHART SUMMARY
PREVIOUS NOTE
CHART NOTE

ACCESS CHARTS

Search - Type the patient's name (or part of it) and click Search. * - Summary accessible through 98point6

Search for:

By: Last name

Search

Patient Name	Sex	Date of Birth	Status

Add to Pull List | View... | Undo Chart Pull

Pull List - These charts are ready to be transferred to your Desktop. * - Summary accessible through 98point6

Click "Pull Charts" to transfer the charts to your desktop.

Pull Charts

Patient Name	Sex	Date of Birth	Status

Remove from Pull List | View...

Help

Lock Screen

Logician Internet -- Chart Note

Dr. Marshall Ruffin
47 year old male, DOB: 10/08/1952

View Note | Print...

CHART ROOM
DESKTOP
DEMOGRAPHICS
CHART SUMMARY
PREVIOUS NOTE
CHART NOTE
HPI
Histories/Habits
Allerg./Directives
Review of Systems
Vital Signs
Eye/ENT/Neck
Resp/CV/GI
GU/Lymph/MSK
Skin/Neuro/MSE
Assessment
Medications
Orders/Disposition
Service Coding
Help
Lock Screen

Summary: diarrhea | Clinical date: 6/18/2000 | Note format: Visit Note | Templates...

REVIEW OF SYSTEMS

Review of Systems — n Normal unless otherwise specified

General:	n	denies sweats, anorexia, weight loss
Eyes:	n	denies blurring, diplopia, irritation, discharge, vision loss, eye pain, photophob
Ears / Nose / Throat:	n	denies ear pain or discharge, tinnitus, decreased hearing, nasal obstruction c
Cardiovascular:	n	denies chest pains, palpitations, syncope, dyspnea on exertion, orthopnea, PN
Respiratory:	n	denies cough, dyspnea, excessive sputum, hemoptysis, wheezing
Gastrointestinal:	n	diarrhea
Genitourinary:	n	denies dysuria, nocturia, hematuria, impotence, discharge, hesitancy, incontir
Musculoskeletal:	n	denies back pain, joint pain, joint swelling, muscle cramps, muscle weakness
Skin:	n	denies rash, itching, dryness, suspicious lesions
Neurologic:	n	denies transient paralysis, weakness, paresthesias, seizures, syncope, tremo
Psychiatric:	n	denies depression, anxiety, memory loss, mental disturbance, suicidal ideatic
Endocrine:	n	denies cold intolerance, heat intolerance, polydipsia, polyphagia, polyuria, wei
Heme / Lymphatic:	n	denies abnormal bruising, bleeding, enlarged lymph nodes
Allergic / Immunologic:	n	denies urticaria, hay fever, persistent infections, HIV exposure

Additional comments:

Conclusion

Rapid Technological Progress

1. The Internet
2. Continuous speech recognition
3. Wireless computing
4. Security
5. Network computing and thin clients

Rapid Technological Progress

6. Components and object technologies
7. Telemedicine
8. Data warehousing
9. Enterprise-wide computing
10. Virtual private networks

Politics of Informatics

- Architecture is everything.
- Architecture defines standards for data, hardware, software and networks.
- Setting standards is inherently political, because they force people to change.
- Adopting standards costs money, because old ways of working must give way to new.

Politics of Standards

- If the leaders of your organization do not have the courage to expect and pay for successful standardization of data, hardware, software and networks, don't bother trying to implement digital documents.

Fundamental Trends to Consider

- Patients will want more health information.
  - About the likely processes and outcomes of care before and after treatment.
  - 40% of use of the Internet for health information now.
    - » More than pornography!

Fundamental Trends to Consider

- Payers are moving from prior certification to profiling physicians' performance and reducing the size of their panels of contracting physicians
  - United Healthcare
    - Ingenics
  - Aetna US Healthcare (USQA)
    - 500 employees, 10 terabytes of data
- HIPAA (1996) will give us standards
  - To integrate health care data into large electronic data sets

Fundamental Trends to Consider

- The Internet and electronic transaction systems make feasible creation of and access to large shared databases.
  - At <u>much lower cost</u> than five years ago.
  - Standards for electronic data are emerging.
    - » HIPAA, SNOMED, ICD10, UMLS, LOINC.

Fundamental Trends to Consider

- To become more profitable, provider organizations must control their costs
  - Clinical costs largely determined by physicians
- Health care organizations can hold substantial intellectual value above and beyond the book value of assets they own.

Summary

- Intellectual capital comes from expertise of employees, relations with customers, and information management technologies.
- Without standardized data collection and retrospective study intellectual capital will be hard to create in a buyers' market for health care services.

Summary

- Data standardization difficult, but essential.
- Technologies for electronic medical records are here today, none has to be invented.
- Standardization is the key to success.

Summary Objectives for CPRs

- Support patient care and improve its quality.
- Enhance productivity of clinicians.
  - Reduce administrative costs of care.
- Support clinical and health services research.
- Accommodate future developments in health care technology, policy, management and finance.
- Have mechanisms in place to ensure patient data confidentiality at all times.