Health Informatics

Health care Integration

How to integrate healthcare data?

<Revision>

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Why is sharing or exchanging of Clinical Data needed ?

- Patients moves!?
  - When a patient moves to another location, their Patient Record should go with them and be immediately useable.
    - Ability to Transfer EMR between independent sites, to allow new clinicians abilities to append to the record

- Care at multiple sites
  - typical in healthcare, patient uses multiple sites
    - A real (or virtual) summary record with real time remote access to patient records
  - for patient referrals
    - Access to specialised consultancy or special healthcare centres

- For health management purposes at organizational or national levels.

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EHR data interoperability

- To achieve level (7) of shareable EHR adoption model, EHR data must be *interoperable*.

- EHR *data interoperability* refers to the ability of HISs (that create, exchange and consume EHR data) to have clear shared expectations or understanding about:
  - the contents (its structure and data-model)
  - the context (the circumstances of how it was taken), and
  - the meaning of that data.

What does Interoperability mean?

- Interoperability
  - Ability of two or more systems or components to **exchange** information *[functional interoperability]* and to **use** the information that has been exchanged *[semantic interoperability]*

    [IEEE and HL7]

- Two main types of interoperability:
  - *Syntactic interoperability*: *two systems can interoperate at technical levels, i.e. the two systems can communicate information or knowledge at technical details, including data structure or model.*
  - *Semantic interoperability*: *two systems can interoperate at content levels: i.e. the two systems have the same meaning of content (i.e. information) being shared.*

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EHR data interoperability

- Sharing can occur at multiple levels
  - Human readable form (e.g. free text)
  - Document level sharing (e.g. a structured document)
  - Messages (e.g. a message about specific medical issue, e.g. a lab test/pathology item)
  - Content
    - Document images
    - Free form data
    - Structured data

- Interoperability, to be efficient, should occur in a machine readable form, where machines can communicate without human intervention.

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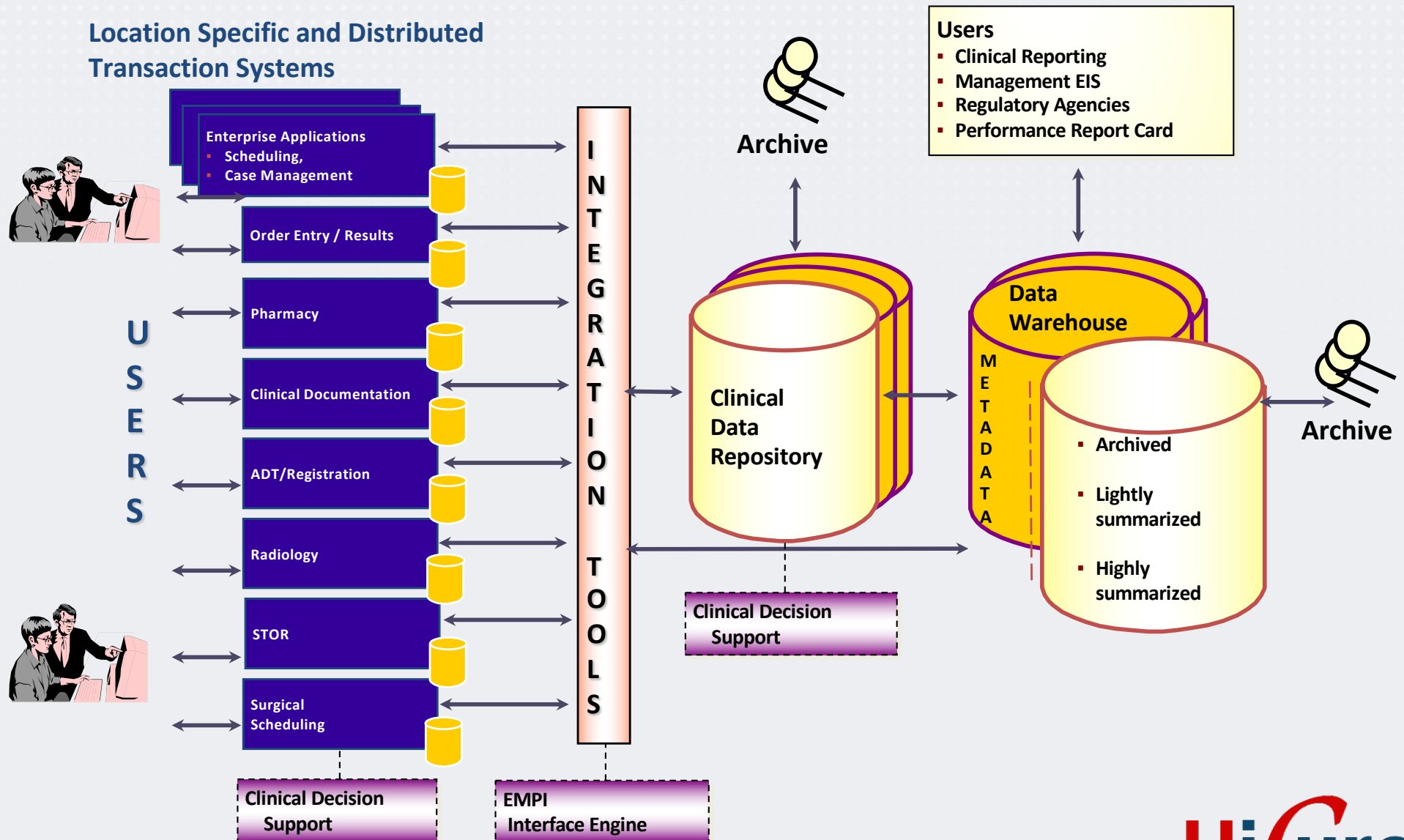Excellence in Health Information Integrated Contents

EHR data interoperability

- To achieve a machine readable form
  - Health information systems should have a **common repository**
  - Health information systems should communicate using a **common language & terminologies**.

- To achieve, a number of *Health standards* (HS) have been developed and used to achieve EHR data interoperability.

- To automate sharing or exchange of data, health Standards should be represented in a machine readable form, i.e. in a form machines or computers can read, process and act upon/make decisions about.

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How to achieved Integrated Healthcare?

- To <u>achieve</u> Integrated Healthcare, in which HISs seamlessly communication, standards must be developed to address both types of interoperability:

  - Syntactic interoperability: to address, we require standards developed that define an agreeable structure (or representation) of health data,
    - i.e. for health record/data-model, health data exchange/messaging, system/document architecture

  - Semantic interoperability: to address, we require standards developed that define the meaning of health content:
    - i.e. for health terminology, vocabulary or coding standards.

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Clinical Systems: Integration

Location Specific and Distributed Transaction Systems

USERS

- Enterprise Applications
  - Scheduling,
  - Case Management
- Order Entry / Results
- Pharmacy
- Clinical Documentation
- ADT/Registration
- Radiology
- STOR
- Surgical Scheduling

Clinical Decision Support

INTEGRATION TOOLS

EMPI Interface Engine

Archive

Clinical Data Repository

Clinical Decision Support

Users
- Clinical Reporting
- Management EIS
- Regulatory Agencies
- Performance Report Card

Data Warehouse

METADATA

Archive

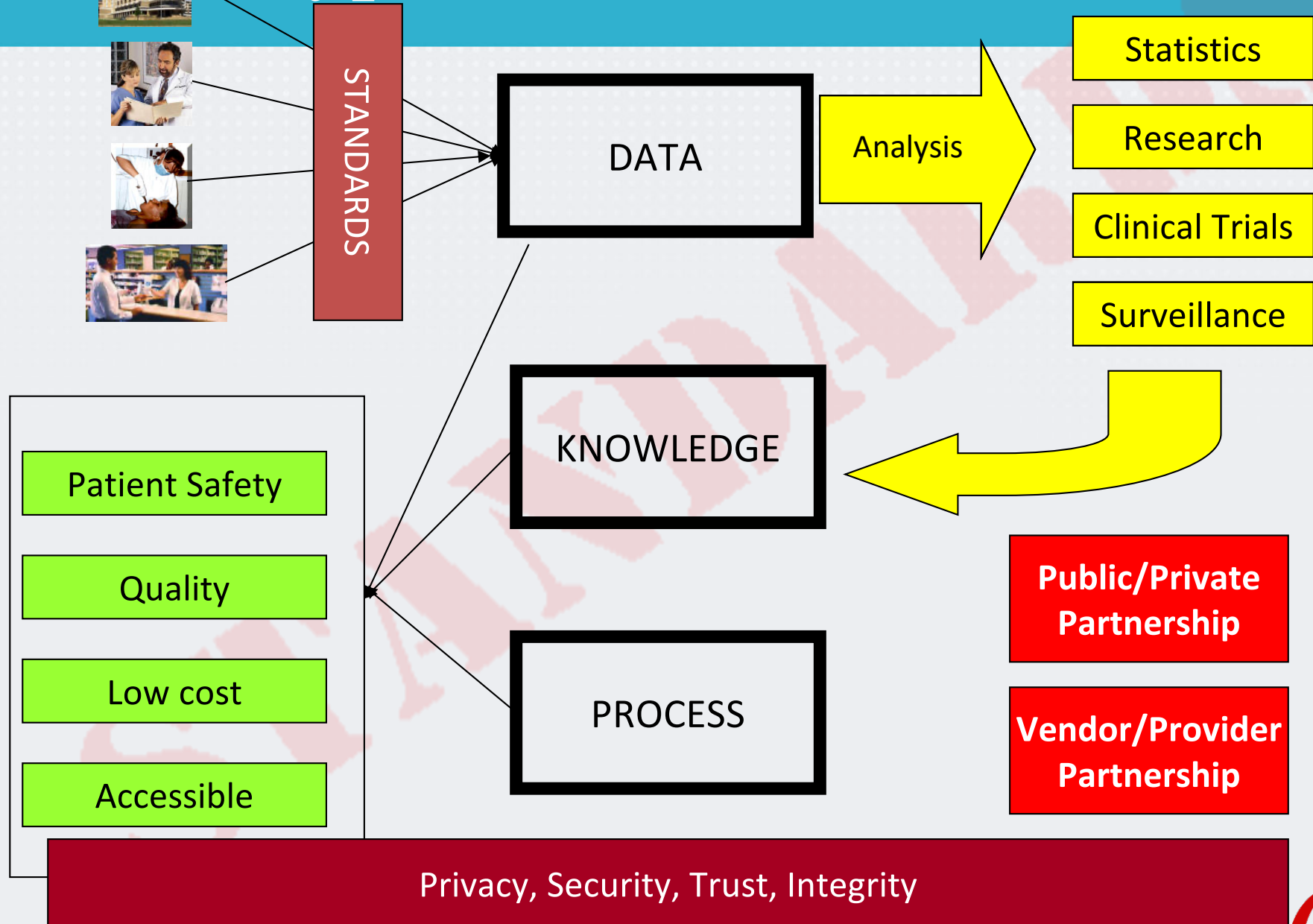- Archived
- Lightly summarized
- Highly summarized

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Purpose of Standards

- Maintaining long term, meaningful, comparable, and compatible information on both patient health and care

- Maintaining well defined information structure
  - which allows modular development and expandability of the health information systems

- Achieving flexibility and cost-effective evolution of information systems
  - Both in their design and development and with no information loss

- Can achieve integrated health information environment

- Ensuring security of data and information handling procedures in the systems

- Compatibility of hardware and software applications

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Types of health standards

STANDARDS

DATA

Analysis

Statistics

Research

Clinical Trials

Surveillance

KNOWLEDGE

PROCESS

Patient Safety

Quality

Low cost

Accessible

Public/Private Partnership

Vendor/Provider Partnership

Privacy, Security, Trust, Integrity

Types of Health Standards

1. **Medical terminology/vocabulary or coding standards**
   - Define standard code-sets for generally used concepts, terms, entity names, disease names, procedures, laboratory tests, observations, clinical findings, body structure names, etc.
   - e.g. ICD9/10, SNOMED-CT etc.

   WILL BE COVERED

2. **Electronic Health record or Data–model standards**
   - Define system modules and module structures, the interfaces   between modules, and operations/processes
   - openEHR/CEN 13606, etc.

   WILL BE COVERED

3. **Health data exchange or messaging standards**
   - Provide a comprehensive framework for **exchange, integration, sharing, and retrieval** of electronic health information
   - HL7 v2.x/v3.0,
   - ISO/HL7 27931 etc.

   WILL BE COVERED- partly

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Types of Health Standards

4. **Architecture or Model-oriented System** standards
   - Define elements of a health system architecture to support different health functions
   - e.g. CDA: Clinical Document Architecture
   - e.g. ISO 12967, ISO 10781, ENV 12443, etc.

   WILL BE COVERED-partly

5. **Data formats standards**
   - Define data formats for different types of health data for laboratory data, medical images
   - e.g. DICOM etc.

6. **Workflows and Process-oriented standards**
   - describe the semantics of **clinical concepts & processes** to support **continuous care** of an individual within an organisation and across organisations
   - CEN 13940 etc.

   WILL BE COVERED-partly

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Health Standard Organizations

Many **Not-for-profit organisations** are involved in Health Informatics standardisation process including:

- American Society for Testing and Materials (ASTM),
- Healthcare Information and Management Systems Society (HIMSS)
- CEN (European Committee for Standardisation) (e.g. CEN/TC215, CEN 13606)
- ISO (International Standard Organisation) (e.g. ISO/TC215)

- Health Level Seven International (HL7)

- ANSI (American National Standards Institute)

- Institute of Electrical and Electronic Engineers (IEEE)

- World Health Organisation (WHO)

- European Patients Smart Open Services (epSOS)

- GS1 Healthcare

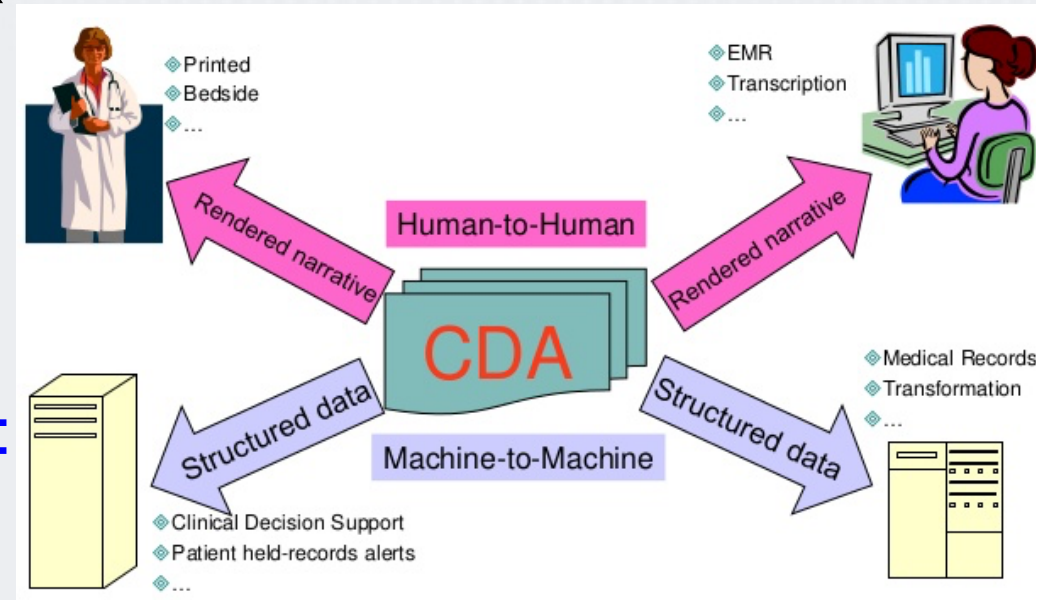- Digital Imaging and Communications in Medicine (DICOM)

Clinical Data Terminology/Vocabulary/Coding Standards

- **Controlled Medical Terminology/Vocabulary:**
  - **ICD9/ICD10** (International Classification of Diseases, ver. 9/ver. 10)
  - **SNOMED -CT** (Standardized Nomenclature of Medicine, Clinical Terms)
  - **LOINC** (Logical Observation, Identifiers, Names and Codes) – Lab results
  - **RxNorm** (normalized naming system for generic and branded drugs)
  - **RCT** (Read Codes Terms, ver. 2.x, ver. 3.x) – specific to the UK
  - **NLM UMLS** (Unified Medical Language System): inclusive of all coding systems, and mapping between them

Using Controlled Vocabulary

Health Vocabulary examples
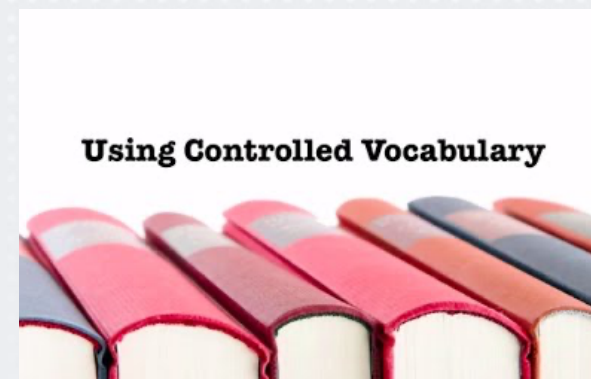
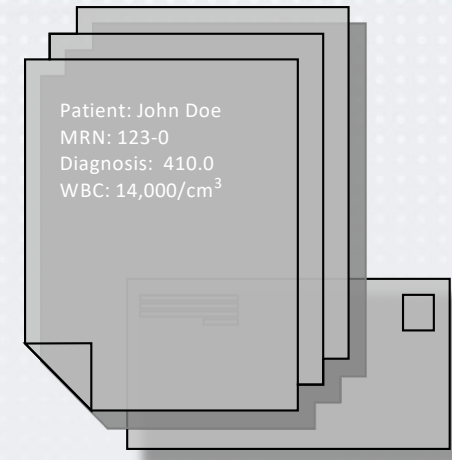# Clinical Data model and exchange Standards

- ## Data-model and Architectural standards:
  - *open*EHR/ **CEN 13606** (EHR Model standard)
  - **CDA** (Clinical Document Architecture)
  - CCR (Continuity Care Records)

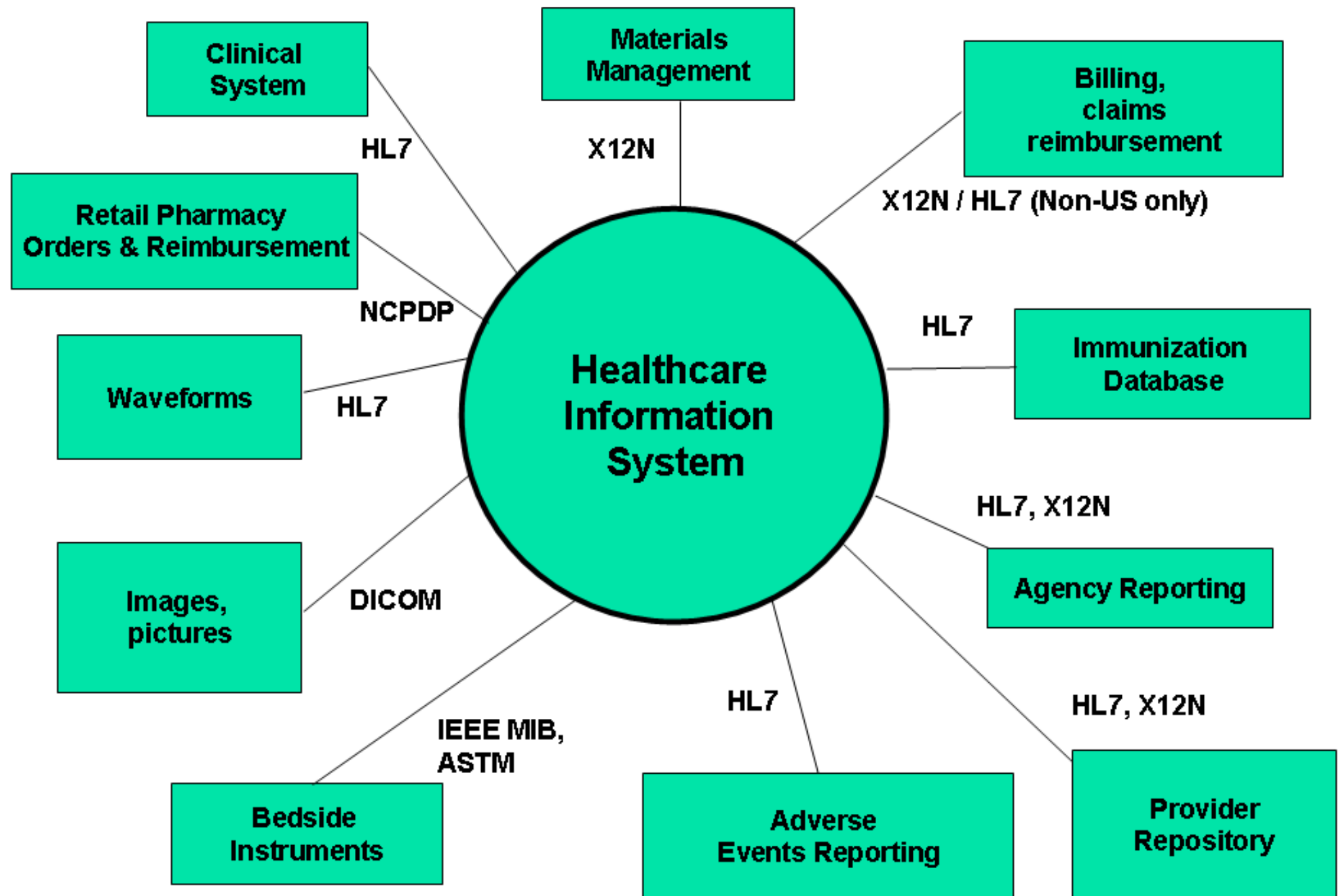- ## Data Exchange standards:
  - **HL7** (Health Level 7, v 2.x, v 3.x)

Clinical Data format and Privacy Standards

- ## Data Format standards:
  - DICOM (Digital Imaging and Communications in Medicine)- messages for images

- ## Privacy and Confidentiality:
  - **HIPPA** (Health Insurance Portability and Accountability Act)

Patient: John Doe
MRN: 123-0
Diagnosis: 410.0
WBC: 14,000/cm^3

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Healthcare Information System

Clinical System — HL7

Materials Management — X12N

Billing, claims reimbursement — X12N / HL7 (Non-US only)

Retail Pharmacy Orders & Reimbursement — NCPDP

Immunization Database — HL7

Waveforms — HL7

Agency Reporting — HL7, X12N

Images, pictures — DICOM

Bedside Instruments — IEEE MIB, ASTM

Adverse Events Reporting — HL7

Provider Repository — HL7, X12N

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Thanks!

Any questions?

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