eHealth Overview

Riyadh 18th March 2008

What is an EHR?

Electronic Medical Record (EMR)

- Owned by provider, not readily accessible by others
- The detailed, longitudinal medicolegal record

Personal Health Record (PHR)

- Person-centric record maintained by the patient
- Housed by a third party secure provider
- Issues with noncompliance, security, loss, versioning

Electronic Health Record (EHR)

- Shared summary of the patient
- Distributed ownership
- What's relevant right now plus longitudinal summary
- Not the medicolegal record

** Actual implementations may combine two or more of these components*

International EHR Drivers

1. **Diagnostic error**
   - Major error in 15-30% of cases at autopsy
   - Unexpected major finding in up to 35% of cases
2. **Therapeutic error**
   - Management errors in up to 24% of cases at autopsy
   - Medication error in 1:25 admissions (US), with high cost:
     - Cost up to US $37 Billion pa, up to 70% preventable
     - 100,000 deaths pa – 8th highest cause of death – in US!
     - 1,500 deaths pa in NZ! *(DHBNZ Safe and Quality Use of Medicines Group)*
   - Of preventable errors, 56% relate to treatment selection and ordering, 33% to administration
   - In US, you're only likely to get 40-70% of recommended care for your problem, and this holds true from backwaters to major centres

International EHR Drivers

2. **Therapeutic error (ctd)**
   - Medicare 60% variation in resource use intensity for equivalent age-, risk- and severity-adjusted populations
   - JCAHO: 63% of reported medication errors resulting in death or injury were caused by lapses in communication, and about half of these would have been avoided through effective medicines reconciliation
3. **Wasted Resources**
   - 30% of US healthcare costs spent on redundant or unnecessary treatments
   - Opportunity to reduce paperwork, duplicate data entry, time spent chasing old records
   - Opportunity to improve efficiency of booking systems

International EHR Drivers

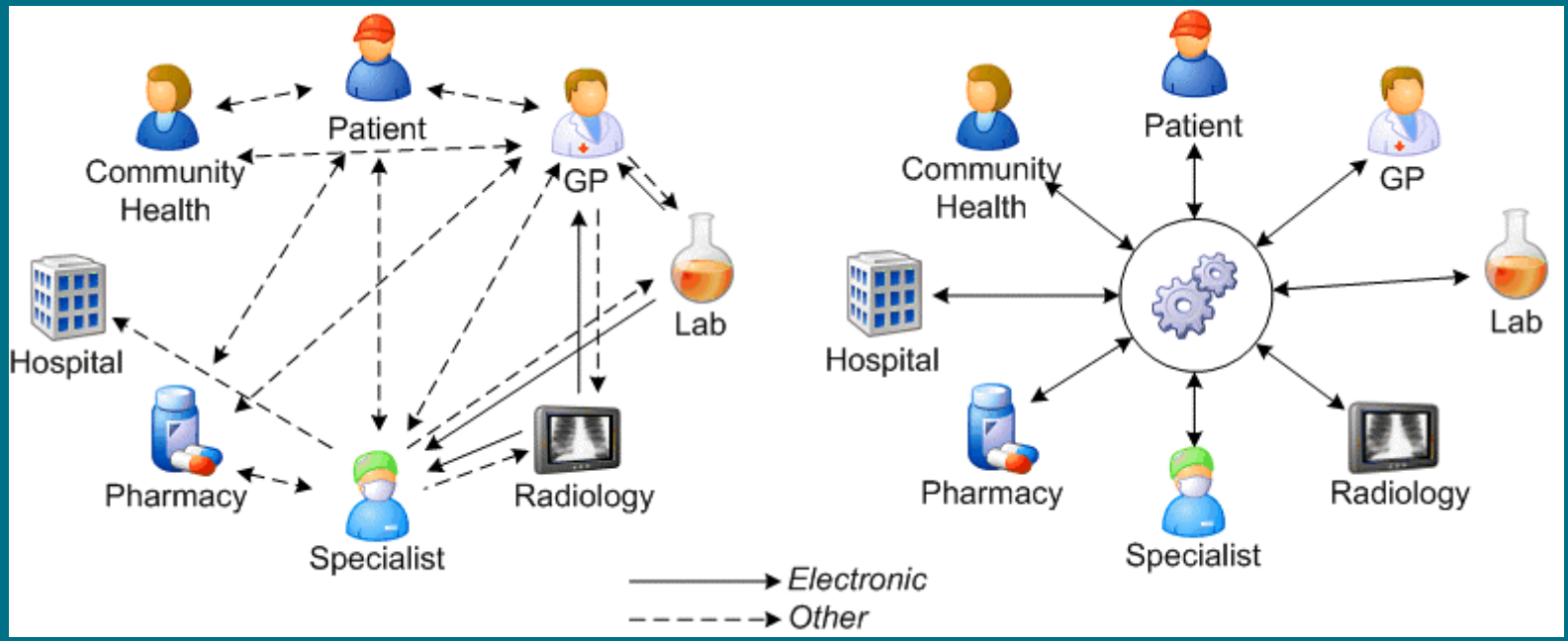
4. **Poor decisions resulting from inadequate access to patient data**
   - JAMA study of 1614 charts found that missing information could, 44% of the time, adversely impact patient's well-being
   - Patients interact with many different providers
   - Patients are mobile and their data needs to move with them
   - Quality of care, safety, access to care, and cost are impacted by highly fragmented data across the health system
5. **Increasing burden of cost for chronic disease management**
   - Need to move cost from secondary to primary sector; integrated care
   - Focus on preventative care

International EHR Drivers

6. **Public Health, Biosurveillance**
   - Strategic opportunity, if combined with pattern recognition, for biosurveillance and accelerated response to disease outbreaks
   - Bioterrorism concerns
   - Epidemological studies

International EHR Drivers

The challenge is to connect the disparate islands of care, information, organisation and knowledge that patients encounter:



Global Initiatives of Note in EHR

- **Canada** – Health Infoway
- **Australia** – HealthConnect, NSW EHR
- **USA** – NHIN, RHIOs, CDC, VA, DoD
- **UK** – NHS Connecting for Health
- **Japan** – SuperDolphin
- **Europe** – French national EHR, German smartcard, others

How do you Build an EHR?

Content

- Free text, PDFs, Word documents
- Forms
- DICOM images
- CDA documents
- HL7 messages
- 13606 XML
- Other

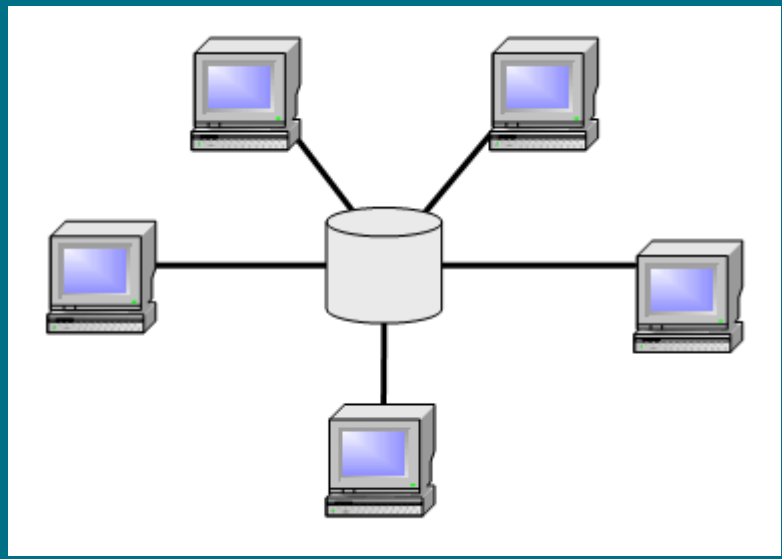
Components

- EMPI
- HPI
- Domain Repositories
- User authentication / security
- Secure messaging
- Information Governance Framework
- Terminology services
- Decision support system
- Portal / EHR Viewer / interface to EMR
- Filtered view of “relevant” data

How do you put it all together?

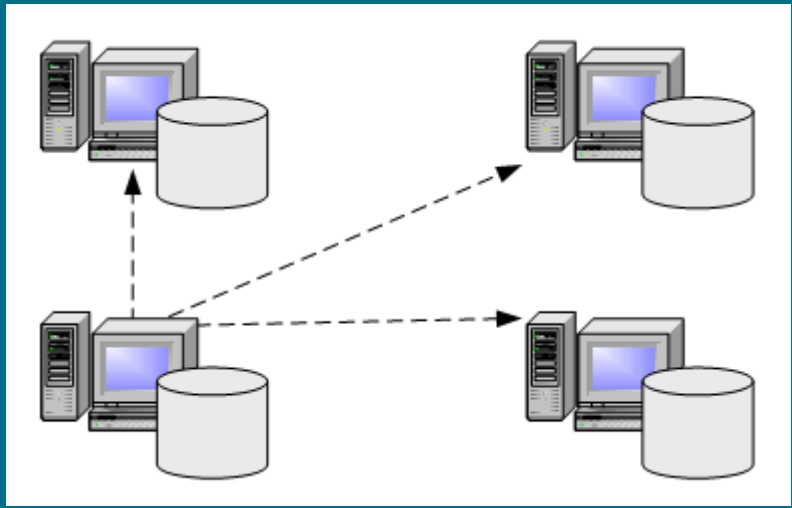
EHR Architectural Models

1. **EMR application implementation throughout a region**
   - Highly standardised, easy to integrate, but costly and doesn't take advantage of existing systems.



EHR Architectural Models

2. **Broadcast replicated data from one system to all other relevant systems**
   - Every Point of Service system holds same data.



EHR Architectural Models

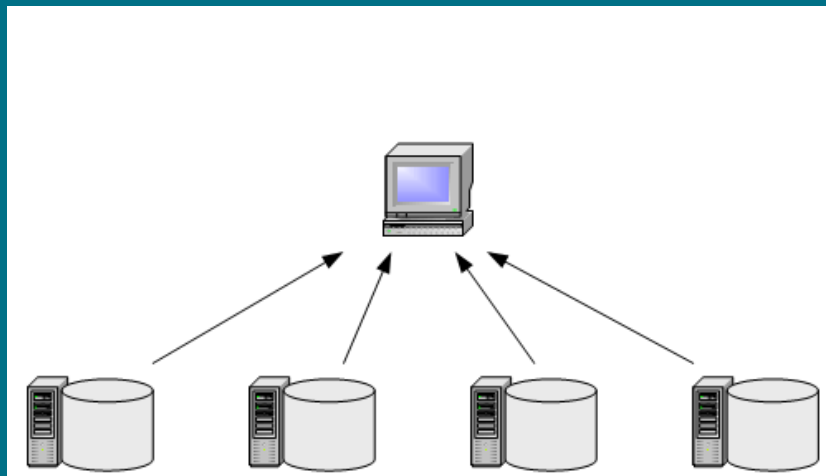
3. Data sharing

- "Virtual EHR" – extracts originated from different sources.
- Initially easier to implement, takes advantage of existing systems, can be built incrementally
- No central data storage, so limits long-term outcomes/reporting analysis
- Needs functional *and* semantic interoperability
- Two versions:
  a) Direct access to source systems
  b) Query source systems via a central broker / record locator service

EHR Architectural Models

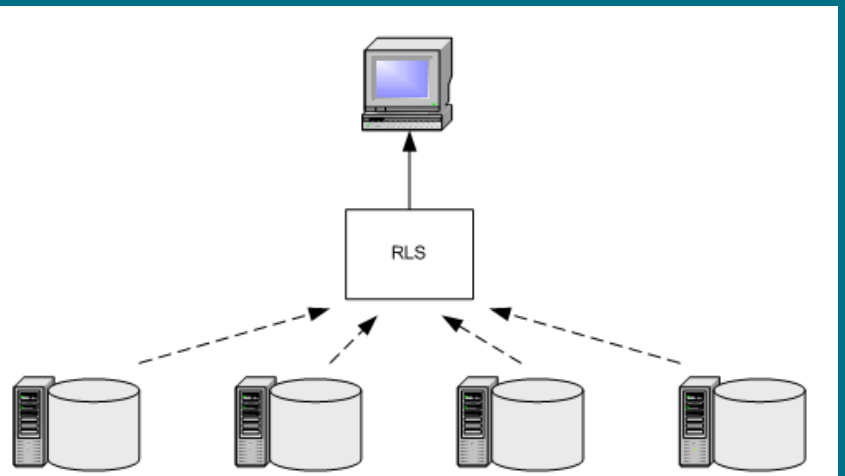
3. Data sharing

Direct Access



- Geometric explosion in number of interfaces
- Hard and expensive to maintain

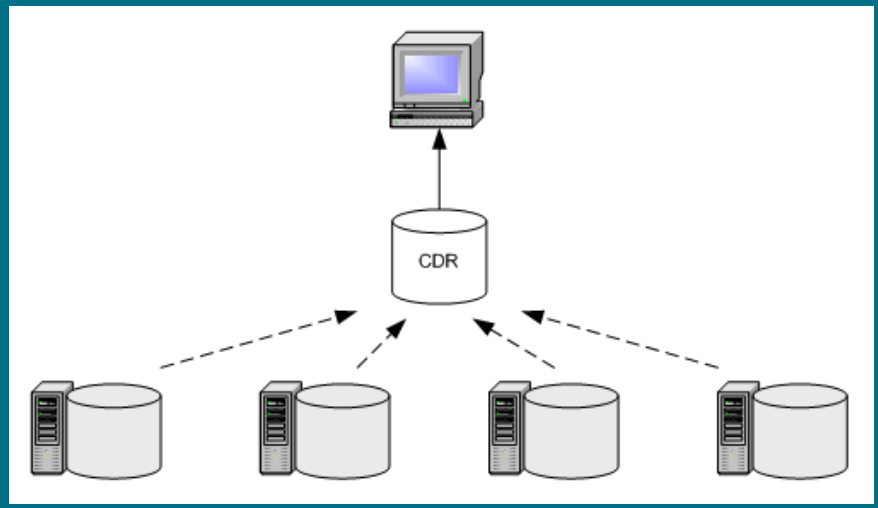
Record Locator Service



- One service queries source systems and returns response
- Has some of the advantages of central storage

EHR Architectural Models

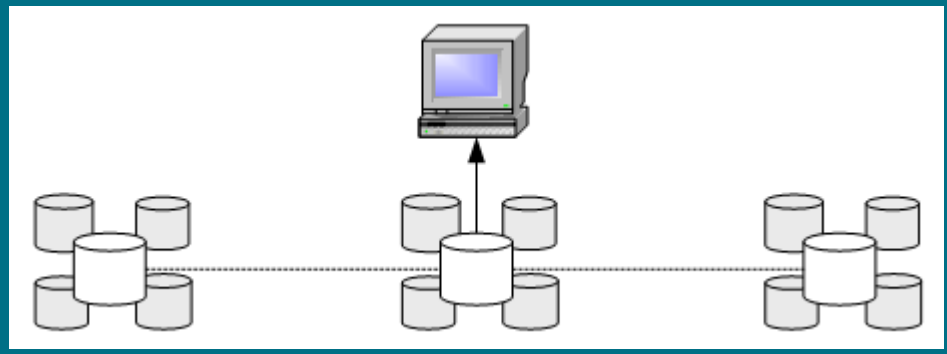
4. **Data sharing with central storage (CDR) – a shared reference information source**
   - Takes into account existing systems
   - Stored data allows greater analysis over time
   - Greater complexity to define/agree upon data ownership and governance



EHR Architectural Models

5. Federated Repositories

- Peer-to-peer access between a network of nodes
- Multiple, regionally distributed instances of the central CDR
- Centralisation should be geographically appropriate, given the density and movement of population, with federated connections between regions



EHR Architectural Models

The key question is whether the data should be centralised into a repository or left distributed across multiple source systems.

- Both architectural and political issues
- Governance – Primary care organisations? Local health authorities? Other trusted bodies?
- Patient in charge of consent

Benefits of Distributed Architecture

- Avoids governance issues
- No legal or consent issues about ownership of data, as it remains with source system (a single contributor)
- Not reliant on fidelity of PMS – EHR synchronisation
- Latest data is supplied as data sources queried in real time
- No duplication of source data so single place to make updates

BUT:

- Does require source systems to accommodate the remote query
- Is only as responsive as the slowest system
- Does require sources to be available, and may have detrimental affect on the performance of those systems
- Semantic congruence is delivered ‘on the fly’
- Unable to offer an authoritative current single view of the patient (problem list, meds list, etc)

Benefits of Centralised Architecture

- Standardised access to longitudinal database; data can be supplied with normalised vocabulary and structure, in real time
- Only one place needs to have reliable technology for nonrepudiation
- Data is available even if source systems unavailable
- Historical data is available even if purged from source systems
- Response times faster as not having to query multiple remote systems
- Reporting easier (one system, one data model)
- Easier to ensure availability, with clustering and fail-over of central repository
- Single, authoritative source for problem lists, medication lists, allergies etc

Benefits of Centralised Architecture (ctd)

- Duplicate information eliminated (but must handle merging/unmerging of records obtained from individual systems)
- Access, control, security and audit can be centrally managed
- The shareable EHR is put together when it is created and updated, not when it is requested
- Value-added activities possible if have semantically normalised longitudinal clinical data:
  - Decision support acting on retrospective data
  - Complex workflow support, integrated care
  - Intelligent prescribing, alerts

Central vs Distributed: Conclusions

Distributed

- Appealing in theory, but many implementation and performance difficulties in practice, particularly for large systems with many records and many different federated data sources

Central

- Faster access to federated, normalised data
- Can offer authoritative single view of the patient
- Much more opportunities for “smart” use of data – decision support, workflow, integrated care
- Public Health and biosurveillance opportunities

The Big Issue: Interoperability

We've got the data, but what is it saying?

Interoperability = the ability of different systems to communicate seamlessly with one another.

- ***Functional****:* systems able to *exchange* information (through interfacing and messaging)
- ***Semantic****:* systems able to *interpret* information
- Analogous to sharing an MS Office file (which you can change) vs sharing a PDF file (which you can't)

Semantic Interoperability

Semantic interoperability is the gold standard but will require

- Ubiquitous, accepted/enforced national standards addressing:
  - Shared understanding of clinical concepts (Ontology + Data Dictionary): *Grammar*
  - Shared terminology (SNOMED, LOINC, ICD, etc): *Vocabulary*
  - *Language = Vocabulary + Grammar*

- *Either* significant retrofitting *or* "smart" systems that can act as wrappers to "interpret" legacy system data: a "machine-readable portal".

Current Approaches to Interoperability

Data approaches Include:

- HL7 v2
- HL7 v3: RIM, CDA, v3 Messages
- CEN13606
- GEHR
- openEHR
- SNOMED CT

... like VHS vs Beta, Java vs C++, Windows vs Mac

Global EHR Best Practice - Infoway

Federally funded, not for profit programme for a pan-Canada EHR across the 14 territories

- Participate in health care renewal
- Collaborate with our partners
- Target the investments
- Support solution deployment
- Promote solution adoption and benefits realization

Identify the content, structure, architecture and use cases of the national EHR, for semantic interoperability