Health Information Exchanges
Part 2: Putting the HIE into Practice
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Introduction

To best understand a Healthcare Information Exchange (HIE), it is critical to understand basic HIE Definitions and Concepts. For example:

- Technical Models, service models and sustainability are critical for the longevity of HIEs.

- **State-Level HIEs (SLHIEs)** provide the opportunity for national adoption and deployment of exchange activities across the 56 states and territories that are supporting SLHIEs.

- **Emerging Services** are critical to the future of HIE. Since trends, models and efforts in care delivery continue to evolve, there are a measureable number of new technologies, systems and devices that can continue to support the intent and goals of an HIE. Emerging technologies hold the promise of new sustainability for HIE services, and support the widespread value of exchange across all stakeholders.
Health Information Exchange (HIE) / Health Information Organization (HIO)

Basic Definitions and Concepts

Anatomy of an HIE
HIE/HIO: Basic Definitions

Health Information Exchange (HIE) ~ the Verb
• The electronic movement of health-related information among disparate organizations according to nationally recognized standards in an authorized and secure manner.

Health Information Organization (HIO) ~ the Noun
• An organization that oversees and governs the exchange activities of health-related information among independent stakeholders and disparate organizations according to nationally recognized standards in an authorized and secure manner. The primary purpose is to facilitate exchange of relevant health information supporting patient care coordination, quality patient care outcomes and demonstration of meaningful use.

• An HIO can be described by many acronyms, including:
  – State Level Health Information Exchange (SLHIE)
  – Regional Health Information Exchange (RHIO)
  – Regional Health Information Network (RHIN)
  – Health Information Exchange (HIE) Networks

Source: “The National Alliance for Health Information Technology Report to the Office of the National Coordinator for Health Information Technology on Defining Key Health Information Technology Terms,” April 28, 2008 http://www.hhs.gov/healthit/documents/m20080603/10_2_hit_terms.pdf
There has been an emergence of other organizations implementing HIOs and HIE networks.

These are usually initiatives that are
1. Proprietary and driven by a single organization entity, a single EHR/HIE vendor, or
2. Non-proprietary, crossing multiple unaffiliated organizations and EHR vendors

Examples include, but are not limited to:
• Integrated Delivery Systems (IDNs)
• Physician practices that manage their own health information exchanges
• Payer-led health information exchange initiatives
• Disease-specific exchange initiatives

*This presentation will not focus on these types of organizations*
Health Information Exchange (HIE) Concepts

HIE – *the verb and the noun*

The process (*the verb*) of exchanging patient-centric electronic information between two or more healthcare organizations (*the noun*).

- **Stakeholders** can include *payers, physicians, specialty networks, IPAs, RHIOs, and other clinical data contributors/organizations*.

**Regional Health Information/Improvement Organization (RHIO)**

An independent organization with its own governance framework.

- Has the **same stakeholders as an HIO/HIE**

**Health Information Service Provider (HISP)**

Provides the technical services for an HIE including: system management services, integration services, data management services, data storage services, privacy and security services, RLS/MPI services, Hosted EMR/EHR/PHR services, and business management services.
HIE Architecture Models
What is Architecture?

Architecture is a formal description of a system or a detailed plan of the system at component level, used to guide its implementation.

It includes the structure of components, their interrelationships and the principles and guidelines governing their design and evolution over time.

Four commonly used subsets of an overall enterprise architecture:

- **Business** (or business process) architecture
- **Application** architecture
- **Data** architecture
- **Technical** architecture
HIEs: Technical Architecture Models

Three Types of HIE Models:

**Centralized**
- Data is accumulated and managed in a single, centralized repository.
- The state HIO has full control over the data and the ability to authenticate.
- HIO is responsible for the management of patient ID, data storage and privacy.

**Hybrid**
- Centralization or distribution is dependent on specific requirements.
- MPI is used to link patient records across databases.
- User interface brings together patient information from various sources.

**Federated**
- Peer-to-peer architecture.
- Network permits users access only when needed.
- Multiple patient id technologies: Master Patient Indices (MPI) and Record Locator Service (RLS).
HIEs: Technical Architecture Models

Centralized

HIEs: Technical Architecture Models

Decentralized EHR
Collection of clinically relevant data from all entities this person has data in, which the user has security clearance for, as determined from the security policies and consent. EHR is built "on the fly" by pulling all clinically relevant data from participating entities each time it is requested.

HIEs: Technical Architecture Models

Service Oriented Architecture (SOA) and Web Services (WS)

**Service Oriented Architecture (SOA)**

- An architectural style for building software applications that use services available in a network such as the web.
- A way to define and provide an IT infrastructure that facilitates application interoperability.

**Web Services (WS)**

- Work at a level of abstraction similar to the Internet. Can bridge any operating system, hardware platform or programming language, just as the web does.
- Has the ability to accommodate various implementation scenarios.

**Impact:**

*Flexible and adaptable architecture that meets current and evolving needs*
HIE Technical Architecture Models: An Example

HIE Architecture: Use Cases
Two Common Types of Exchange Models

Indirect Sharing: Query and Retrieve

- Participants send data to be shared
- HIE can index and/or store data
- Later, providers query for and retrieve records of interest
- Patient Consent and Data Sharing Agreements are important

Direct Sharing: Secure Messaging

- Participants (or their systems) send messages to recipients
- Recipients receive messages
- Data in messages may or may not be stored centrally
- Messages are generally exchanged for direct treatment purposes

HIE evolves to include both exchange models: Direct and Indirect, or Push and Pull
HIE Technical Architecture Models: An Example

HIE Architecture: Use Cases
Two Common Types of Exchange Models

Indirect Sharing: Query and Retrieve
- New patient in a practice
- Review past episodes of care
- View immunization records
- Patient transfers

Direct Sharing: Secure Messaging
- Results delivery
- Patient transfers
- Referrals
- Orders
- Physician-to-Physician consultations
- Scheduling
- Ad hoc messages
HIE Service Offerings
**HIE Commonly Offered Core Services**

| Services                                                                 | | Services                                                                 |
|-------------------------------------------------------------------------|-------------------------------------------------------------------------|
| - Audit logging and error handling for data access and exchange        | - Provider directory support of a non-redundant HIE-level methodology for managed identities |
| - Secure clinical and administrative data delivery, and confirmation of delivery, to EHRs, PHRs, and other systems and networks | - Patient portals / PHRs                                                  |
| - Data look-up, retrieval and data location/registries                  | - Testing and results reporting                                          |
| - Subject-data matching capabilities                                   | - Electronic Health Records (EHRs)                                      |
| - Summary patient record exchange                                       | - Administrative services (claims, authorization, payment systems)      |
| - Support for secondary use of clinical data including data provisioning and distribution of data transmission parameters | - Disease management services                                            |
|                                                                         | - Community and public health reporting                                 |
Note: Each HIE may have data services that vary based on defined requirements.
Core HIE Categories of Services: Detailed

**Presentation Services:**
Format data displays to meet end user interaction and display device requirements.
- *Examples:* login, patient look-up, request patient records, view data

**Business Application Services:**
Key functional components that house rules and execute business logic on clinical data to render.
- *Examples:* e-Prescribing, EMR, lab, radiology, eligibility checking, problem list/visit history

**Data Management Services:**
Manage application access to data storage and processing of data in the storage layer.
Isolate the business service layer from the details of the data storage service.
Support metadata management.
- *Examples:* data persistence/access, value/code sets, key management
Core HIE Categories of Services: Detailed

Data Storage Services:
Provide reliable, secure data storage for efficient access by data management services.
  • *Examples:* message logs, XML Schemas, Provider/User Directory

Integration Services:
Manage integration services across the different layers of the technology stack.
  • *Examples:* message translation/transport, HL7 mapping, EMR adapter

System Management Services:
Provide system and application administrative and management support.
  • *Examples:* system configuration, audit/logging, exception handling

Security Services:
Manage the implementation of security to control system access and protect confidentiality and integrity of data in the system.
  • *Examples:* authentication/authorization, consent management, user roles, policy management
### HIE Services & Data Sharing Examples

<table>
<thead>
<tr>
<th>Example of HIE/HIO Service Offerings</th>
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<tbody>
<tr>
<td>• Community viewer / Portal services</td>
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<tr>
<td>• Secure messaging services</td>
</tr>
<tr>
<td>• Record / document locator services</td>
</tr>
<tr>
<td>• Interoperability support services for member organizations</td>
</tr>
<tr>
<td>• Continuity of Care Documents (CCD/CDR) production and sharing services</td>
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<tr>
<td>• Data query services</td>
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<tr>
<td>• Direct / NwHIN connectivity services</td>
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<tr>
<td>• Security services (user authentication, etc.)</td>
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<tr>
<td>• Registry and directory services</td>
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<tr>
<td>• Provider indexing services</td>
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<tr>
<td>• SLHIE connectivity</td>
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<tr>
<td>• Electronic prescribing &amp; refill requests services</td>
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<tr>
<td>• Query services across member organizations</td>
</tr>
<tr>
<td>• EHR services and related support</td>
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</tbody>
</table>

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<tr>
<th>Examples of Data Exchange Supported by HIOs</th>
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<tbody>
<tr>
<td>• Clinical results delivery: Lab, Radiology, etc.</td>
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<tr>
<td>• Clinical information, notes &amp; documents: transcription notes, allergy, care summary notes, emergency dept notes, discharge summaries, referrals, consultation notes, etc.</td>
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<tr>
<td>• Medication history, summaries, alerts, etc.</td>
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<tr>
<td>• Immunizations, syndromic surveillance and public health data</td>
</tr>
<tr>
<td>• Electronic prescribing, refill information</td>
</tr>
<tr>
<td>• PHRs, patient-reported data</td>
</tr>
<tr>
<td>• EMT, 1st responder notes</td>
</tr>
<tr>
<td>• Claims transaction / electronic eligibility information</td>
</tr>
<tr>
<td>• Data quality and research support documents</td>
</tr>
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HIE Organization and Sustainability Models
HIE Organizational Models

Common Organizational Models include the following:

- For-profit entity
- Non-profit entity (501-C3 and other non-profit designations)
- State agency or other government agency (e.g., State Level HIE)

HIE stakeholders vary by the specific organization and are dependent on geographic market forces and the organizational model. These include but are not limited to:

- Hospitals, IDNs, critical access hospitals, physician practices, and ambulatory and outpatient offices
- Public health / community facilities
- Post acute providers, long-term care, home health, behavioral providers, etc.
- Pharmacies and other ancillary service providers
- State government and state agencies
- Community/business groups, employers, universities, banks, etc.
Many HIOs have been dependent on short-term funding resources such as:

- Federal grants, federally funded IT programs and other federally funded contract programs
- State grants and state funded contract programs
- Cash loans with scheduled payback
- In kind services
- Financial donations

HIOs often use these types of funding resources in combination with revenue services.
Revenue Types Defined

Membership Fees:
Stakeholders pay to support shared services for all users of the electronic HIE.

- Membership fees may be equal or tiered on the basis of some factor.
- Considerations of the relative value to each participant of the electronic HIE services are critical to determining the appropriate fee.
- Commitment from a critical mass of members is necessary to achieve success.

Transaction Fees:
Fees for data-exchange services.

- Unlike the Membership Fee model, dependence on this revenue source requires initial capital investments to build infrastructure and capabilities.
- Transaction Fee arrangements include: $ per clinical result delivered, $ per covered life PMPM, and $ per month for license to use a particular software package over the Web.
**Revenue Types Defined**

**Program and Service Fees:**
HIO acts in a programmatic capacity and charges stakeholders for their participation in, or on the outcomes from, broader-scope program activities undertaken by the electronic HIE organization.

**Combination of Sources:**
Most HIOs agree that a combination of revenue sources will be necessary to achieve long-term operational sustainability.

**Other Funding Streams:**
This includes providing value-added services in the form of “EHR-lite” functionality or HIT implementation support involving large employers.

- *Example:* Vermont has a one-of-a-kind electronic HIE sustainability business model.Legislatively mandated, each health insurer in Vermont will pay 0.199 percent on all medical claims into an HIT fund. The fund will raise approximately $32M over 7 years.
HIE Sustainability

To ensure the sustainability of an HIE, there are 10 challenges to be addressed:

1. Sustainability model
2. Addressing government policy and mandates
3. Defining the value of the HIE to stakeholders
4. HIPAA – privacy, consent, confidentiality, security and breach policies
5. Technical infrastructure – architecture, applications and connectivity
6. Governance issues / business structure
7. Legal issues
8. Systems integration
9. Cross-referencing patients / patient identity
10. Engaging Participants (varies by HIO and coverage area)
    • Examples include but are not limited to health plans, practicing clinicians/providers, laboratories, pharmacies, employers, etc.
Return on Investment (ROI)

- Many HIOs are challenged with defining and providing a solid ROI for their organization. ROI can represent many perspectives:
  - The HIO/HIE organization
  - Participating organizations/stakeholders
  - Patient/consumer satisfaction

- Common examples of ROI models used by HIOs include:
  - Reduced staff time for clerical and other administration duties
  - Reduced testing volumes and duplicate test volumes
    - Results in decreased costs
    - Increase staff time to focus on other work activities
State Level Health Information Exchange (SLHIE)
Anatomy of an HIE

The ONC-funded State HIE Cooperative Agreement Program promotes secure exchange of health information to enable patient-centered care and provider achievement of meaningful use requirements.

In March 2010, ONC completed the announcement of State HIE Cooperative Agreement Program awardees.

- 56 states, eligible territories, and qualified State Designated Entities (SDE) received awards.

The State HIE Cooperative Agreement Program funds states’ efforts to rapidly build capacity for exchanging health information across the healthcare system, both within and across states, while moving toward nationwide interoperability over a 4-year performance period.

On January 27, 2011, an additional $16 million was made available to states through ONC’s new Challenge Grants program. This program will provide funding to states to encourage breakthrough innovations for health information exchange that can be leveraged widely to support nationwide health information exchange and interoperability.

### State Level HIE Guiding Principles

<table>
<thead>
<tr>
<th>Patient-centric</th>
<th>Adaptability</th>
<th>Adoptability</th>
<th>Maintainability</th>
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<tbody>
<tr>
<td><strong>The HIE will enable better longitudinal, cross-organizational care for every individual in the state and provide access to and use of health information for those individuals.</strong></td>
<td><strong>The HIE will conform to all applicable state and federal laws, standards, policies and regulations.</strong></td>
<td><strong>The HIE will be able to be modified and expanded in order to integrate new components, services, interfaces and features as needed to accommodate more users, systems or networks.</strong></td>
<td><strong>The standards and requirements for participating in the HIE will be as simple as possible to allow greater participation throughout the community.</strong></td>
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</table>
State Level HIE Guiding Principles

Systems Integration
HIE adapters and connection mechanisms will be defined and developed for all HIE participants.

Scalability
HIE functionality will be added or updated with minimum impact to existing functions, ensuring that the infrastructure is scalable.

Data Aggregation
Information will be collected, transmitted and aggregated in standard, secure formats.
Basic Facts for SLHIEs

- Each state is charged with identifying a State Designated Entity (SDE) for HIE.
- Many plans have not yet been approved, with some not even submitted (as of 11/2011).
- Funding is low in context of all required investments (e.g., ≈ $1 dollar per person in Texas).
- HIE Models:
  a) Federated vs. centralized models being planned
  b) NwHIN Direct (secure email) gaining in popularity
- HIE services may vary from state to state, or even from HIE to HIE within the same state. Services will reflect the prioritized requirements of stakeholders.
- Alignment of architecture, technology and policy are critical.
An omnidirectional HIE also requires the alignment of

- Providers and their EHRs, and
- Enterprise, Regional, State, and Federal Networks.
One Example of SLHIE Organization and Interaction

[Note: Each state’s model and approach will vary.]

Source: www.HIPTN.org
Emerging Services

Next Generation Analytics, Population Health, Unique Populations and Mobile Services
Next Generation Analytics

- Data warehouse, data analytics and business intelligence
- Quality reporting support
- Performance management
- Fraud and abuse identification and prevention
- Population monitoring and predictive profiling
- Care gap identification
- Care and disease management
- Public health monitoring and analysis
Population Health

**Examples where HIEs can facilitate population health initiatives:**

- Disease registry
- Alerts & notifications
- Clinical research
- Other (to be defined over time)

**Examples of stakeholders participating in this effort:**

- CDC (Federal Public Health)
- Local and state departments of health
- Other (to be defined over time)
Addressing the Needs of Unique Populations

<table>
<thead>
<tr>
<th>Rural</th>
<th>Public Health</th>
<th>Diverse</th>
</tr>
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<tbody>
<tr>
<td>• Telemedicine</td>
<td>• Cancer registry</td>
<td>• Chronic disease management</td>
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<tr>
<td>• Personal Health Record (PHR)</td>
<td>• Immunizations registry</td>
<td></td>
</tr>
<tr>
<td>• Smartphone applications</td>
<td>• Birth defects registry</td>
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Many resources refer to the PHR as a vehicle to address issues related to various, unique populations, but this idea may be too simplistic.

The uptake of PHRs has greatly lagged from when they were introduced in the early 2000s.
Emerging Technologies and Devices

Emerging Services can be identified from the variety of technologies that are available in the market today and those that are under development at this time.

Types of Emerging Technologies and Devices:

- **Mobile Devices**
- **Medical Devices**
- **Smart Phones**
Mobile devices, such as the iPad and other types of tablets, have ignited the imagination of healthcare providers who have longed for a device that is light-weight and versatile.

- While this technology is being rapidly accepted by physicians, the number of applications are growing at a quick pace as well. There is already a history of using mobile devices for e-prescribing and providing access to knowledge databases.

- The footprint of mobile devices still poses a problem for the amount of data that a provider might want to access. This currently remains a challenge.
Emerging Technologies and Devices

Medical Devices

Numerous medical devices that collect data and typically use a phone line to transmit data to providers are already in place.

• When will technology move away from transmitting via phone lines, especially with the proliferation of mobile phone technology?

Smart Phones

The widespread adoption of smart mobile phones has led to the development of a plethora of applications. Some of the healthcare applications currently available include:

- **Protonix** (Pfizer) – allows consumers to pay co-payments through mobile devices

- **iTriage Symptom Check** – allows consumers to find the closest medical facility in times of emergency

- **Text in the City** (RipRoad) – texting program that allows patients to ask any health-related questions and have them answered by a doctor within 24 hours

Emerging Technologies and Devices

What Does the Future Hold?

- Nanotechnology
- More medical devices that remotely collect and transmit data to providers
- The Food and Drug Administration (FDA) has proposed new regulations to monitor medical smartphone applications (apps).

  - **Draft Proposal:** Any mobile app that is intended for use in performing a medical device function meets the definition of a medical device under the Federal Food, Drug, and Cosmetic Act. Specifically, these mobile medical apps must be either used as an accessory to a regulated medical device, or transform a mobile platform into a regulated medical device.

  - **Goal of Regulation:** Protect patient safety.

  - **Future Trend:** FDA expects that by 2015, 500 million smartphone users will rely on health care applications.
Mobile Services / Mobile Health (mHealth)

The explosive growth in demand for mobile healthcare solutions is matched only by a similar progression of health information exchanges (HIE) across the U.S.

mHealth application forecasts include among others:

- Electronic Health Records (EHR)
- Charge Capture
- Clinical Decision Support
- Computer Practitioner Order Entry (CPOE)

Examples of mHealth solutions:

- Help first responders access patient information from HIEs using a mobile device.
- Allow on-call specialists to consult with emergency department staff by allowing everyone involved to view HIE records using their mobile devices.
- Keep primary care physicians current on the status of their patients by delivering alerts to smart phones.
- Provide patients with the ability to receive alerts.
- Provide patients with access to data on mobile devices.
Innovation: Next Generation Applications

Managing Diabetes

External sensor worn by patient

Glucose reading sent to smart phone

Smart phone sends message to insulin pump

Patient enters notes, takes pictures of food, and sends messages

Smart phone sends message to contacts

Smart phone calls 911 and provides location
A Shared Responsibility

Healthcare Eco System

Success will be dependent upon all constituents taking on an active role in modernization.
The Future
Anatomy of an HIE
Technology and Its Future Impact on HIEs

Each HIE will be challenged by the pace of advancing technologies for the foreseeable future.

Questions to consider for the future:

• What is the level of risk that an HIE will assume to entertain incorporating emerging technologies?

• Will the sustainability model support investment in some technologies that might be transient in nature, relative to longer term adoption and their own sustainability from vendors?

• What will be the process to assess these new technologies and their potential benefits vis-à-vis their required investment, both short- and long-term?
HIEs: What Will Shape the Future?

- HIE will “happen” but will seldom follow the script.
- Established entities that can provide services “on the margin” will have a competitive advantage.
- The primary barrier to competitor entry is trust.
- Many geographic HIOs will become highly-valued CHINS (version 2.0).
- Under certain payment models, providers who fail to collaborate will be at a competitive disadvantage.
- Policy may not keep up with the pace of information use; enforcement of detailed policy is problematic.
HIEs: What Will Shape the Future?

- The **role of innovation** is an important component in shaping the future. “Beacon” Communities are one avenue through which innovation can be introduced to other HIEs.

- The **complexity** of the U.S. healthcare ecosystem **may hinder** some of the anticipated efforts to connect a variety of stakeholders.

- **Standards will continue to evolve** and each HIE must be resilient as these changes are introduced.
Other Future Trends

When looking back to the early 21st century, it is now clear that a coalescence of factors set the stage for a breakthrough and enabled the transition to a wellness-based approach to national and global health.

Additional Resources

HIMSS HIE Toolkit
http://www.himss.org/ASP/topics

HIMSS State HIT Dashboard
http://www.himss.org/statedashboard/

HIMSS Guide to Participating in an HIE
http://www.himss.org/ASP/topics_FocusDynamic.asp?faid=148
Funding Challenges:

• Start-up funding
  – State and federal grants will not cover all costs.

• Interfaces / Interoperability / Integration
  – Who pays for development, implementation and support?
  – Should vendors absorb any of this cost?
    ▪ *Could this result in lower quality and responsiveness to additional features and services?*

• Sustainability
  – Further proof of value is needed before providers, patients and/or payers will invest.
    ▪ *What is the “value add” to the participant? Why should they participate?*
  – Integration of the HIO into the provider workflow
    ▪ *What is the potential value that may be realized with integration of the HIO into business operations and clinical practice?*

Interoperability Challenges:

• Standards in evolution
Appendix A: HIE Sustainability - Challenges

Maintaining solid data integrity with data exchange

• Administrative data vs. controlled terminology data (e.g., ICD-9-CM vs. SNOMED CT)
• Natural language challenges
  – Negation and uncertainty
• Searching for the perfect HIE...

Privacy protection: Management of polices, regulations and laws

• Consent models
  – Proposal: Unrestricted provider-to-provider sharing of data.
  – Law: Patient has the right to prevent sharing of data if they pay for the visit.
  – State laws may not be consistent for cross border communications.
• Segmentation
  – Patient or advocate (might be physician) determines what information will be shared.
  – Technical and domain expert issues need to be addressed.