From Implementation to Analytics: The Future Work of Informatics

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Outline

- The world is making great strides in electronic health record (EHR) implementation
- "Will there be work for informatics after we are done implementing?"
- Toward analytics, business intelligence, and the learning health system
- Challenges in getting there

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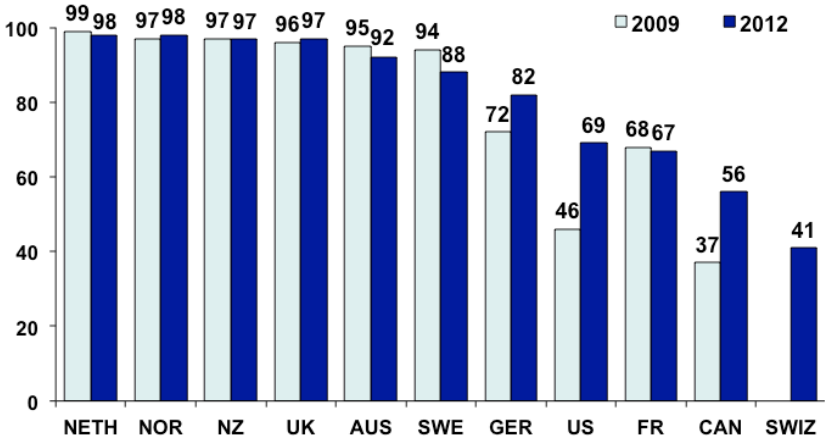
The world is adopting EHRs (Schoen, 2012)



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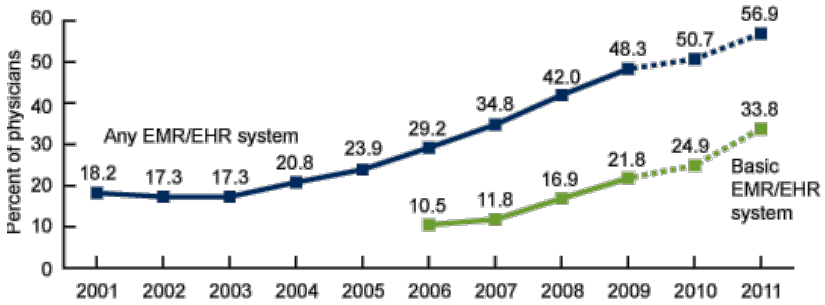
Even in the US (Hsaio, 2011)



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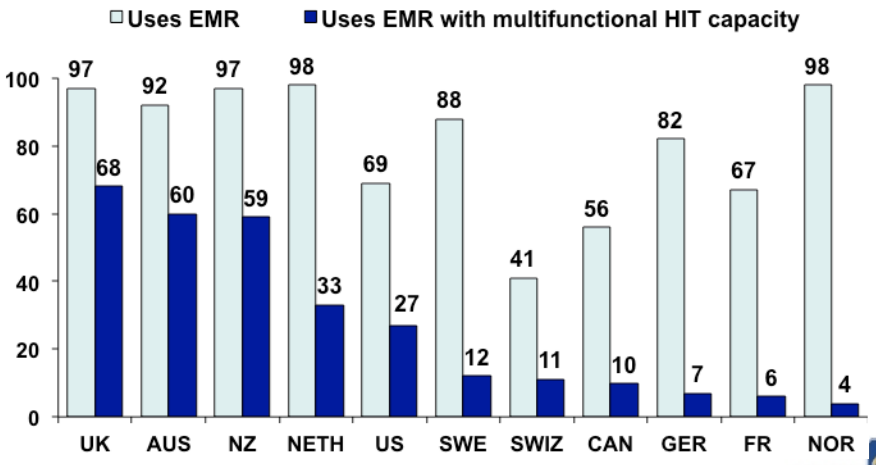
Although advanced functionality is less common (Schoen, 2012)



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US investment has been substantial

"To improve the quality of our health care while lowering its cost, we will make the immediate investments necessary to ensure that within five years, all of America's medical records are computerized … It just won't save billions of dollars and thousands of jobs – it will save lives by reducing the deadly but preventable medical errors that pervade our health care system."

January 5, 2009

Health Information Technology for Economic and Clinical Health (HITECH) Act of the American Recovery and Reinvestment Act (ARRA) (Blumenthal, 2011)

- Incentives for electronic health record (EHR) adoption by physicians and hospitals (up to $27B)
- Direct grants administered by federal agencies ($2B, including $118M for workforce development)

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But the US healthcare system is still in need of fixing

- Recent IOM report (Smith, 2012) analyzes data to find annual
  - $750B in waste (out of $2.5T system)
  - 75,000 premature deaths
- Sources of waste
  - Unnecessary services provided
  - Services inefficiently delivered
  - Prices too high relative to costs
  - Excess administrative costs
  - Missed opportunities for prevention
  - Fraud

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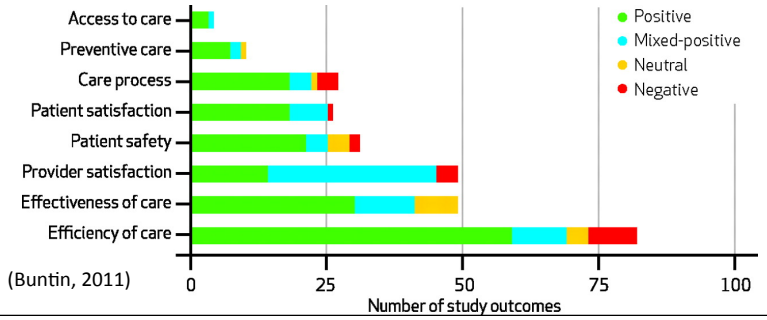
Health information technology (HIT) is part of solution

- Systematic reviews (Chaudhry, 2006; Goldzweig, 2009; Buntin, 2011) have identified benefits in a variety of areas
  - Although 18-25% of studies come from a small number of 'health IT leader" institutions



(Buntin, 2011)

Components of the learning healthcare system (Smith, 2012)

- Records immediately updated and available for use by patients
- Care delivered the has been proven "reliable at the core and tailored at the margins"
- Patient and family needs and preferences are a central part of the decision process
- All healthcare team members are fully informed about each other's activities in real time
- Prices and total costs are fully transparent to all participants in the care process
- Incentives for payment are structured to "reward outcomes and value, not volume"
- Errors are promptly identified and corrected
- Outcomes are routinely captured and used for continuous improvement

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IOM schematic for the learning healthcare system (Smith, 2012)

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A not-uncommon dialogue with a student

- Student: "Will there be any informatics work left to do once everyone has implemented EHRs?"
- Teacher: "The real interesting work is yet to come!"

Toward analytics and business intelligence for healthcare

- Analytics is the use of data collection and analysis to optimize decision-making (Davenport, 2010)
- Business intelligence (BI) is the "processes and technologies used to obtain timely, valuable insights into business and clinical data" (Adams, 2011)
- As in many areas of advanced information and technology, healthcare and biomedicine are behind the curve of other industries (Miller, 2011; Rhoads, 2012)

Who employs analytics outside of healthcare?

- Amazon and Netflix recommend books and movies with great precision
- Many sports teams, such as the Oakland Athletics and New England Patriots, have used analytics to select players, plays, strategies, etc. (Lewis, 2004; Davenport, 2006)
- Facebook can target advertising very precisely knowing your friends, your interests, where you go, etc. (Ugander, 2011)
- Twitter volume and other linkages can predict stock market prices (Ruiz, 2012)
- Recent US election: re-election of President Obama (Scherer, 2012) and predictive ability of Nate Silver (Salant, 2012)

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What about analytics in healthcare?

- With shift of payment from "volume to value," healthcare organizations will need to manage information better to provide better care (Diamond, 2009; Horner, 2012)
  - To realize this, they must achieve "analytic integration" starting with completing "implementing basic transaction data systems" (Davenport, 2012)
- Prediction not only of patient response but also behavior, e.g., regimen adherence (Steffes, 2012)
- A requirement of coming "precision medicine" (Mirnezami, 2012)
- HITECH investment and tools such as ONC QueryHealth may help
  - http://wiki.siframework.org/Query+Health

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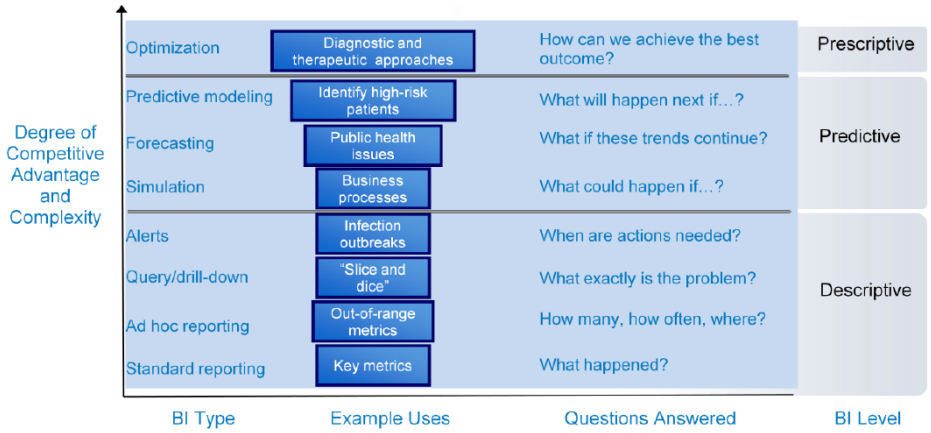
Levels of BI (Adams, 2011)



Analytics and BI part of larger "secondary use" of clinical data

- Many "secondary uses" or re-uses of electronic health record (EHR) data, including (Safran, 2007)
  - Personal health records (PHRs)
  - Clinical and translational research – generating hypotheses and facilitating research
  - Health information exchange (HIE)
  - Public health surveillance for emerging threats
  - Healthcare quality measurement and improvement
- Successful demonstration that the phenotype in the EHR can be used with the genotype to replicate known associations as well as identify new ones, e.g., eMERGE (Kho, 2011; Denny, 2010)

Challenges for secondary use of clinical data

- EHR data does not automatically lead to knowledge
  - Data quality and accuracy is not a top priority for busy clinicians
- Little research, but problems identified
  - EHR data can be incorrect and incomplete, especially for longitudinal assessment (Berlin, 2011)
  - Much data is "locked" in text (Hripcsak, 2012)
  - Many steps in ICD-9 coding can lead to incorrectness or incompleteness (O'Malley, 2005)
- There are also important "provocations" about use of "big data" for research (Boyd, 2011)

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Challenges (cont.)

- Many data "idiosyncrasies" (Weiner, 2011)
  - "Left censoring": First instance of disease in record may not be when first manifested
  - "Right censoring": Data source may not cover long enough time interval
  - Data might not be captured from other clinical (other hospitals or health systems) or non-clinical (OTC drugs) settings
  - Bias in testing or treatment
  - Institutional or personal variation in practice or documentation styles
  - Inconsistent use of coding or standards

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Patients also get care at multiple sites

- Study of 3.7M patients in Massachusetts found 31% visited 2 or more hospitals over 5 years (57% of all visits) and 1% visited 5 or more hospitals (10% of all visits) (Bourgeois, 2010)
- Study of 2.8M emergency department (ED) patients in Indiana found 40% of patients had data at multiple institutions, with all 81 EDs sharing patients in a completely connected network (Finnell, 2011)

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Other challenges for analytics and BI in healthcare

- Volume of information can be challenging
  - Average pediatric ICU patient generates 1348 information items per 24 hours (Manor-Shulman, 2008)
- Forecasting has always been difficult in healthcare (Wharam, 2012)

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How to leverage analytics and BI to improve healthcare

- Data standards and interoperability
- Data entry
- Ease of extraction while maintaining privacy and security
- Quality measures that are associated with improved outcomes
- Healthcare system that pays for value over quantity
- Research based on use cases
- Development of highly competent workforce

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Data standards and interoperability

- Standards and interoperability are "taking too long" (Versel, 2012)
  - Despite slow pace, many standards are mature and ready for use
- HealthStory project (www.healthstory.com) is taking incremental approach in HL7 Consolidated CDA (Alschuler, 2012)
  - Creating standardized templates for various EHR document types now, structured data later

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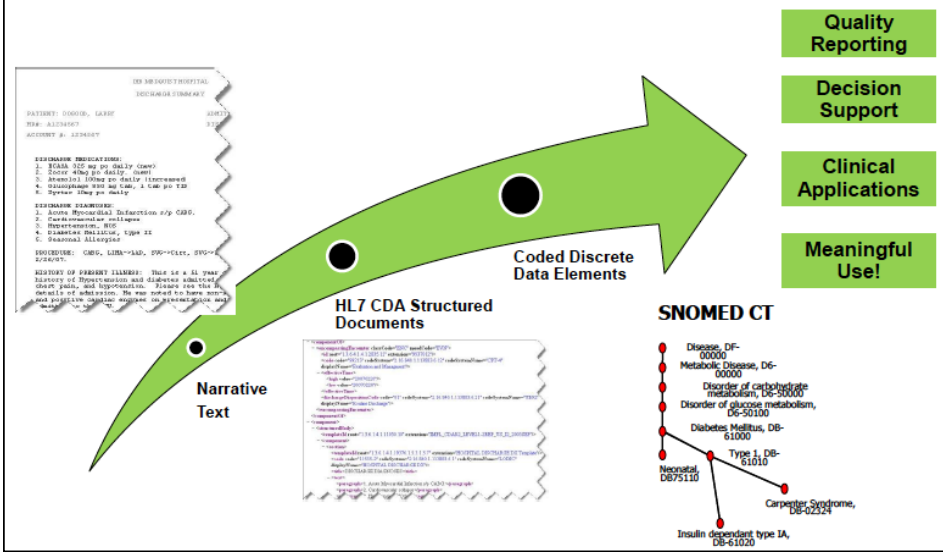
HealthStory approach to Consolidated CDA



Data entry

- Clinical documentation is not a top priority for clinicians
- Anecdotally, many clinicians complain that EHR systems prioritize charge capture over clinical value
- Need to reconcile "tension" of structured vs. flexible documentation (Rosenbloom, 2011)

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Ease of extraction while maintaining privacy and security

- Most EHR systems offer little in way of tools for clinicians and others to make use of data
- One concern for doing this is protecting patient privacy and confidentiality
  - One option is to try to de-identify, but can be difficult, especially for narrative records (Uzuner, 2007; Meystre, 2010)
  - However, even lab data can be difficult to truly de-identify (Cimino, 2012)

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Quality measures that are associated with improved outcomes

- Quality measures increasingly used in US and elsewhere
- Use has been more for process than outcome measures (Lee, 2011)
- In UK, pay for performance schemes achieved early value but no further gains (Serumaga, 2011)
- In US, some quality measures found to lead to improved patient outcomes (e.g., Wang, 2011), others not (e.g., Jha, 2012)

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Healthcare system that pays for value over quantity

- US healthcare system still mostly based on fee for service model
- Affordable Care Act (ACA, aka Obamacare) implements accountable care organizations (ACOs), which provide bundled payments for conditions (Longworth, 2011)

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Need research based on use cases

- Challenge evaluations provide common data sets and use cases
  - i2b2 – various natural language processing challenges (Uzuner, 2007-2012)
  - TREC Medical Records Track – information retrieval (IR) to identify potential patients for research (Voorhees, 2011-2012)
  - Text mining of scientific literature (Rebholz-Schuhmann, 2012)
- Research itself has challenges (Chapman, 2011)
  - Small and unrealistic data sets
  - Issues of de-identification and privacy of data sets

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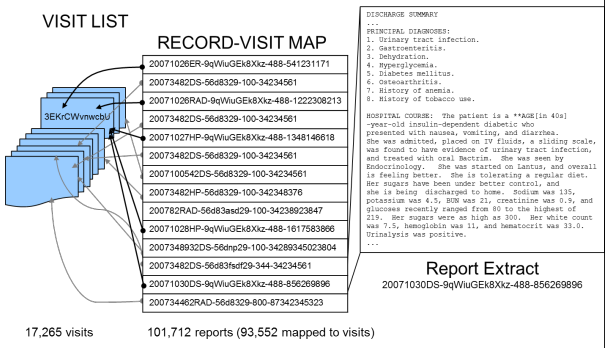
TREC Medical Records Track – applying IR (search) to medical records

- Use case: identify patients who are possible candidates for clinical studies
- Uses test collection developed at Univ. of Pittsburgh
- Initial results show mediocre performance
  - Typical IR approaches do not work well
  - Best performance from manual Boolean queries (Demner-Fushman, 2012; Bedrick, 2012)



(Voorhees, 2011; Voorhees, 2012)

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Need for a competent workforce

- Growing recognition of needs and competencies (Hersh, 2010)
- Coming certification, starting with physicians (Shortliffe, 2011)

- Back to student dialogue: "The work of informatics will transition from implementing systems and workflows to using data, information, and knowledge to improve individual health, healthcare, public health, and biomedical research"

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Conclusions

- A growing body of evidence supports EHR and other IT to improve health and healthcare
- The world is making great strides in adopting EHRs
- The next step is to make use of the increasing data through analytics and BI
- There are challenges, but also benefits, to this use of data
- The work of informatics will become more interesting and important as we enter this new era

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