Clinical Analytics for the Practicing Healthcare Professional

Driving to the Future ‘11
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Agenda

- Clinical informatics as context for clinical analytics
- Uniqueness of medical data mining
- Define and describe the practice of clinical analytics
- Challenges facing use of clinical analytics
- Tools used to analyze clinical data
- Use of clinical analytics in different healthcare settings
- The future of clinical analytics
Domains of Clinical Informatics
Uniqueness of Medical Data Mining

• Heterogeneity of medical data
  ▫ Raw medical data are voluminous and heterogeneous
  ▫ Medical data may be collected from various images, interviews with the patient, laboratory data, and the physician’s observations and interpretations
  ▫ All these components may bear upon the diagnosis, prognosis, and treatment of the patient, and cannot be ignored

• Ethical, legal, and social issues
  ▫ Privacy and security considerations
  ▫ Fear of lawsuits
  ▫ Need to balance the expected benefits of research against any inconvenience or possible injury to the patient
Uniqueness of Medical Data Mining

• Statistical philosophy: Methods of medical data mining must address
  ▫ The heterogeneity of data sources
  ▫ Data structures
  ▫ The pervasiveness of missing values

• Special status of medicine
  ▫ Outcomes of medical care are life-or-death
  ▫ They apply to everybody
  ▫ Medicine is a necessity, not merely an optional luxury, pleasure, or convenience
Definition of Clinical Analytics (CA)

- Clinical analytics encompasses the capture and use of discrete clinical data to identify and measure quality, patient safety, or service line efficiencies and improvements
Promise of Clinical Analytics

• Through careful implementation of health analytics, hospitals can transform unwieldy amalgamations of data into information that can:
  ▫ Improve patient outcomes
  ▫ Increase safety
  ▫ Enhance operational efficiency
  ▫ Support public health efforts
Current Use of CA

• Collecting and leveraging clinical and claims data to enhance patient care cost, safety and efficiency

• Data is looked at on a variety of levels
  ▫ A specific patient
  ▫ Population-based, such as data specific to a particular physician or to a certain condition, such as diabetes or hypertension

• Using rule sets from a wide variety of organizations
  ▫ Voluntary programs (the Leapfrog Group)
  ▫ Government sources (the Hospital Compare Database)
  ▫ Trade organizations (the Council of Teaching Hospitals or the Society for Thoracic Surgeons)
Current Use of CA

• Much of the information that healthcare organizations ultimately choose to report is driven in one of three ways:
  ▫ Data that they are required to track by the government or other external organizations
  ▫ Data that healthcare organizations choose to look at that is driven by QA or cost containment opportunities
  ▫ Information that is required for recertification of professional staff
Types of CA Practitioners

- Pharmacists with formal informatics training (e.g., Masters or Doctorate in Medical Informatics or Informatics fellowship) or extensive clinical informatics experience to develop and maintain pharmacy content
- Physicians with informatics experience to translate clinical guidelines and study protocols into CDS interventions
- Doctoral-level medical informaticians
- Registered nurses (RNs) with informatics experience
- Dedicated software developers and project managers without a clinical background
CA Continuum

- Data extraction tools (Bottom)
  - Collect data from existing databases
- Data warehouses and data marts
- Formatting tools and techniques
  - Used to "cleanse" the data and convert it to formats that can easily be understood
CA Continuum

- Enterprise reporting and analytical tools
  - Online analytic process (OLAP) engines and analytical application development tools are for professionals who analyze data and perform business forecasting, modeling and trend analysis
- Human intelligence tools (Top)
  - Human expertise, opinions and observations
CA Challenges

- Modern medicine generates, almost daily, huge amounts of heterogeneous data. **Those who deal with such data understand that there is a widening gap between data collection and data comprehension.**
- In industry, data are typically viewed as a critical enterprise asset; medicine, in contrast, tends to view data as a byproduct of operations
CA Challenges

- Lack of use of tools to support the work of clinical knowledge management
- Lack of money to hire additional appropriately trained clinical informaticians
- Rapidly expanding regulatory reporting and compliance requirements along with increasing emphasis on quality measures
- Healthcare provider organizations are also struggling to understand how the government’s role in clinical analytics is going to evolve in the future
Inventory of Tools and Best Practices

• A multidisciplinary team responsible for creating and maintaining the clinical content
• An external repository of clinical content with web-based viewer that allows anyone to review it
• An online, interactive, Internet-based tool to facilitate content development and collaboration
Inventory of Tools and Best Practices

• An enterprise-wide tool to maintain the controlled clinical terminology concepts
  ▫ The availability of a robust, controlled clinical terminology (e.g., SNOMED for problems, LOINC for lab results and ICD-9 for billing diagnoses, etc.)
  ▫ Many controlled terminologies include some sort of semantic network that maintains various types of relationships among the clinical terms
Tools Used To Analyze Data

- Niche vendors that specialize in the development of data warehouses or data mining to assist in this type of analysis
  - Use of data warehouses for clinical purposes is not widespread
  - According to data from the HIMSS Analytics™ Database, approximately 25% of U.S. hospitals presently use a clinical data warehouse
  - Usage is more widespread among larger hospitals
Case Studies (Duke UHS)

- Leveraging enterprise data through computerized patient safety initiatives
  - Integrated data warehouse
  - Web-based safety dashboard
  - Proactive detection and subsequent amelioration of *Clostridium difficile* colitis rates
    - Prevented 158 potential cases of nosocomially acquired *C. difficile* colitis per year
    - Financial burden of *C. difficile* colitis to range from $3669 to $7234 in additional hospital costs per infected patient, which by conservative analysis translates into a total savings of $578,968
Case Studies (Duke UHS)

- Improving the business cycle: the Duke intensive care nursery
  - Current and projected losses in the ICNursery
  - Traditional cost-cutting not feasible
  - Analysis suggested 4 areas for targeted improvement: MD documentation, medical record coding, revenue modeling, and 3rd party payments
  - Current and retroactive profits recorded
Case Studies (Duke UHS)

- Leveraging health analytics for emerging health issues
  - Used its data warehouse to provide a highly refined estimate of patients likely to need H1N1 vaccine
    - Inpatient status
    - Diagnosis of chronic disease
    - High-risk mothers and children
  - Timely and accurate information to the state and to better define DUHS strategy for vaccine administration
Case Studies (Beth Israel Deaconess Medical Center)

- Challenge
  - Need for a CDS tool capable of identifying the most appropriate imaging test for a specific patient
    - BIDPO physicians had the capability to select from 2,000 orderable radiological studies, many of which were state of the art technologies
    - The abundance of such options also resulted in potentially inappropriate testing, false positives, and potential risk to patients (e.g., contrast injections, interventional procedures, and radiation exposure)
Case Studies (Beth Israel Deaconess Medical Center)

• Solution
  ▫ An advanced CDS system with computerized provider order entry (CPOE) and real-time insurer authorization
  ▫ Create a natural language ordering vocabulary
  ▫ A web-based, physician-designed user interface for Anvita Health’s imaging implementation was then seamlessly integrated into BIDMC’s existing EMR
Case Studies (Beth Israel Deaconess Medical Center)

- **Results**
  - CDS positively influenced up to 35% of all ordering decisions, and up to 10% of high-tech radiology decisions were changed
  - CDS decreased inappropriate imaging, which reduced overall cost trends for the hospital, patients, and the health plan while increasing quality
  - CDS identified testing contraindications (e.g., contrast dye use) in patients at high risk for adverse reactions
Future Considerations

• Early stages of a revolution in healthcare, as genomics, proteomics, pharmacogenomics, and point-of-care decision support converge in a new era of personalized medicine
• Active investment in health analytics, data integration, and data sharing are critical to creating efficiencies
• New approaches to data visualization and analysis are needed
Future Considerations