Opportunities and Challenges using AI/Data Science to Improve Healthcare Delivery

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Outline

• Opportunity for AI/data science to improve health care delivery

• Highlight 3 Challenges
  1. Privacy & Cybersecurity
  2. Interoperability
  3. Clinical workflow integration

• Discussion
## Exciting Time in Healthcare

<table>
<thead>
<tr>
<th></th>
<th>Old World</th>
<th>New World</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Payment</strong></td>
<td>Fee-for-service</td>
<td>Outcome-based</td>
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<tr>
<td><strong>Incentive</strong></td>
<td>Volume</td>
<td>Value</td>
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<tr>
<td><strong>Focus</strong></td>
<td>Acute episodes</td>
<td>Population health</td>
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<tr>
<td><strong>Role of Provider</strong></td>
<td>Single episodes</td>
<td>Care continuum</td>
</tr>
<tr>
<td><strong>Information</strong></td>
<td>Retrospective</td>
<td>Predictive</td>
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</table>

Source: Cleveland Clinic Global Cardiovascular Innovation Center
The Health Opportunity: The Quadruple Aim

Population Health

Experience of Care

Per Capita Cost

Improving Clinician Experience

Health Affairs 27, no.3 (2008):759-769
https://www.ahah.net/who-we-are/tripleaim.png
Digital Transformation

Other Industries 2020

Healthcare 2020
## US Adoption of Health IT from 2008 to 2015

<table>
<thead>
<tr>
<th></th>
<th>2008</th>
<th>2015</th>
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<tbody>
<tr>
<td><strong>Hospital</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basic EHR</td>
<td>9%</td>
<td>84%</td>
</tr>
<tr>
<td>Certified EHR</td>
<td>--</td>
<td>96%</td>
</tr>
<tr>
<td><strong>Ambulatory</strong></td>
<td></td>
<td></td>
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<tr>
<td>Basic EHR</td>
<td>16.9%</td>
<td>53.9%</td>
</tr>
<tr>
<td>Any EHR</td>
<td>42%</td>
<td>86.9%</td>
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Office of the National Coordinator for Health Information Technology. 'Non-federal Acute Care Hospital Electronic Health Record Adoption,' Health IT Quick-Stat #47. dashboard.healthit.gov/quickstats/pages/FIG-Hospital-EHR-Adoption.php. May 2016.
Where We’re Headed

FUTURE: DIGITAL HEALTH

CLINICAL INFORMATICS 1.0
Collection of data
EHR adoptions
Optimizing EHR

CLINICAL INFORMATICS 2.0
Data presentation/visualization
Interoperability – data from all care venues
Support for population health and quality improvement
Usability and clinician experience

George Reynolds, M.D., CIO and CMIO of Children’s Hospital Medical Center in Omaha.
Digital Health

No Single Definition:
Convergence of digital technologies with health and healthcare data with the goals of reducing inefficiencies in healthcare delivery, improving access, reducing costs, increasing quality

Sonnier, P. Story of Digital Health: https://www.youtube.com/watch?v=HSOhdmV8WsY
Machine Learning in Healthcare

**Machine Learning** – “a program that learns to perform a task or make a decision automatically based on data”

Example: Diabetic Retinopathy

- Deep learning algorithm capable of interpreting signs of DR in retinal photographs
- 2 validation sets of 9963 images and 1748 images
- At operating point selected for high sensitivity, the algorithm had 97.5% and 96.1% sensitivity and 93.4% and 93.9% specificity

Clinical, Ethical, and Legal Challenges
as we move to real-world implementation

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Privacy & Cybersecurity

Things aren't as bad as you think, they are far worse...
Privacy

• Patients, customers and subjects expect you to handle confidential data in a secure manner

• In the United States, health privacy is largely regulated by the Health Insurance Portability and Accountability Act (HIPAA)
  • Limits who can view and use patient information and who the data can be shared with
  • Fully identifiable information cannot be shared without the patient or research subject's consent unless for Treatment, Payment, or Operations
Why HIPAA Matters?

- Report confirmed breaches of protected health information to HHS
- Notify affected patients in writing
- Notify the media for breaches affecting 500+ patients

The average cost per breached medical record: $150-$250

Yearly cost to the healthcare industry, due to breaches: $5.6 billion
Cybersecurity as a Public Health Threat

- As clinicians, we see cybersecurity as a public health and patient safety concern
  - Canceled surgeries and appointments
  - Diverted ambulances
  - Disruption in access to clinical information
  - Device security
  - Manipulated clinical information
Interoperability
Example: COVID-19 Patient Screener (Chatbot)

Okay, let me ask you some more questions. Are you experiencing any of the following symptoms?

- A fever or feeling feverish
- A new cough
- Sore throat
- Shortness of breath
- Muscle aches
- New runny nose
- New loss of taste or smell

https://covid.partners.org/
Interoperability & Integration

Interoperability

“Enables the secure exchange of electronic health information (EHI) with, and use of EHI from, other health IT without special effort on the part of the user”

Integration

https://www.healthit.gov/sites/default/files/nprm/ONCCuresNPRMImplementation.pdf
John Pappas, Dan Fuchs, Chris Custer, Dan Higgins, Mass General Brigham Healthcare Information Systems
Fast Healthcare Interoperability Resources

• Application Programming Interface (API)
  • allows software to electronically access data and services from another software program

• **Open** Health Level 7 Standard
  • Leverages previous HL7 expertise

• Fast and easy to implement
  • Specifications are free
  • Based on web standards (HTTP, OAuth, XML, JSON)
  • Supports RESTful architectures
FHIR Enables Innovation Across EHRs

- FHIR API
  - Authentication/Authorization (OAuth2)
  - Ability to launch and embed apps
- FHIR Data Profiles
- Apps

Electronic Health Record

- Epic
- Cerner
- athenahealth
- Other EHR Systems

Will EHR Vendors Support APIs?

• Stage 3 Meaningful Use requires APIs within EHRs be made available to third party applications or devices by patients
  • As a result, most major EHR vendors have built functionality to support requirement, including Epic and Cerner
  • Apple’s Health Records on iPhone leverages FHIR APIs
• EHR vendors are also creating “app stores” for third-party products for health care providers

Workflow Integration
Example: Predicting COVID-19 Critical Events & Mortality

Clinical Decision Support (CDS)

- “any computer-based system that presents information in a manner that helps clinicians, patients, or other interested parties make optimal clinical decisions”


http://motorcycleguy.blogspot.com/2008/06/clinical-decision-support.html
CDS Can Suggest Safer, Less Expensive Drugs

In community-acquired pneumonia the relevant organisms covered by a 3rd generation cephalosporin can be well covered with cefuroxime (a 2nd generation cephalosporin). This switch will help delay the emergence of multi-drug resistant organisms and reduce the cost of treatment by half.

In patients who do not need broad spectrum gram-positive and gram-negative coverage, regimens such as TMP/SMX or ampicillin are appropriate.

<change order to cefuroxime (2nd generation cephalosporin)>

< Keep the original order > CEFOTAXIME
< order Other > (e.g. TMP/SMX, ampicillin)

Enter all or part of the route (PO, NG, IV, etc).
Decision Support Doesn’t Have to be “In Your Face”
CDS Can Be Difficult to Implement Effectively

- Often ignored, or overridden by clinicians (“alert fatigue”)
  - 49-96% overrides
- Often incorrect (false positives)
  - 20% inappropriate
- Interrupts clinicians’ workflow, train of thought, clinical routine
- Requires clinical and IT personnel to create, test, and maintain
Ten Commandments for Effective CDS

• **RIGHT INFORMATION**
  - Quality of knowledgebase
  - Provide recommendations, not just assessments

• **RIGHT PERSON**
  - Who needs/will use the information

• **RIGHT FORMAT / IMPLEMENTATION OF CDS**
  - Speed, comprehensibility, ease of use

• **RIGHT CHANNEL / MODE**

• **RIGHT TIME AND LOCATION**
  - Workflow integration
  - Intervene at the time/location of the decision
  - Facilitate activation of the recommendations

The Path Forward

• Collaboration across organizations and disciplines is critical to advancing digital health
Conclusions

• Exciting opportunity and time for technology to improve health care delivery

• Data science/AI will play critical and increasingly role in healthcare

• To be successful, AI solutions need to carefully consider privacy, interoperability, and workflow (among other factors)
Thank You

Digital will be at the core of everything we do

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