The Role of Digital Quality Measurement in Personalized Clinical Decision Support

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What are the Big Ideas?

The practice of medicine is evolving in fundamental ways

Gather clinical data once as a by-product of the clinical encounter – reduce physician burden

Reuse all data for all purposes: TPO, quality reporting, clinical decision support, operations improvement, public health, research/discovery

Patient at the center – deliver collaborative and coordinated care across diverse care settings

Engage the patient as a care collaborator – data acquisition, support self-care, shared-decision making

Create computable knowledge artifacts for all of the above – make them readily shareable and usable

Do all of this at scale – standardize, streamline, and simplify
What is Changing Now?

Changes in information and knowledge flow, clinical reasoning, and technology impacting care

Evolution of clinical reasoning – practice in the information -- and knowledge -- age

Evolution of Health IT and Knowledge Engineering

Impact of Clinical Information and Knowledge Management on an Industry Scale Platform
Reforming health care
This is going to hurt
Feb 17, 2009
ARRA / HITECH

President Obama SIGNS HITECH ACT as part of the STIMULUS PACKAGE

2011 – 2012: Data Capture and Sharing
• Accelerated adoption
• Data capture and exchange

2013 – 2014: Demonstrate Health System Improvement
• Widespread adoption and data exchange
• Process improvement

2015+: Transform Health Care and Population Health through Health IT
• Demonstrated improvements in care, efficiency, and population health
• Breakthrough examples of delivery and payment reform

STRAATEGIC GOALS

Achieve Adoption and Information Exchange through Meaningful Use of Health IT

Improve Care, Improve Population Health, and Reduce Health Care Costs through the Use of Health IT

Inspire Confidence and Trust in Health IT

Empower Individuals with Health IT to Improve their Health and the Health Care System

Achieve Rapid Learning and Technological Advancement

Beyond 2015: Transformed Health Care
Enhanced ability to study care delivery and payment systems
Empowered individuals and increased transparency
Improved care, efficiency, and population health outcomes
How is clinical reasoning evolving?

“More and more patients are going to the Internet for medical advice. To keep my practice going, I changed my name to Dr. Google.”
It's Here…

BIG DATA

HEALTH CARE

DOCTOR QUALITY

INTERNET BIGGEST

REPORT MAY

SENSORS MAY

COMPUTERIZED INFORMATION

MEASURE BACK

LARGE DANGER

COME SMALL

TINY DANGERS

KEEPING

PROJECTED

MUCH

POWER ANSWERS OPINIONS

Americans

Project

Seems

Way

Approximately

Medical

Including

Year

Tb

Correlation

Hospital

Billion

Pressure

Create

Deployment

 samtions

Saving

Useful

Laptops

Devices

Monitoring

Costs

Dramatic

Something

Earned

Everything

Become

Capital

Lots

User,
The Quantified Self

http://bit.ly/xMDwm2
Healthcare data on the rise

Quantity of digital information from clinical systems is soaring

Source: EMC Digital Universe with Research & Analysis by IDC
Individuals who accessed their online medical record used it to view test results, perform health-related tasks and communicate with health care providers.

Table 2: Reported online medical record functionalities used by individuals amongst those who were offered and accessed their record, 2017.

<table>
<thead>
<tr>
<th>How online medical record was used</th>
<th>% Individuals who accessed online medical record at least once</th>
</tr>
</thead>
<tbody>
<tr>
<td>View test results</td>
<td>85%</td>
</tr>
<tr>
<td>Performed one or more health-related tasks: Request refill prescriptions, complete paperwork, or make appointments</td>
<td>62%</td>
</tr>
<tr>
<td>Communicate with health care provider via secure messaging</td>
<td>48%</td>
</tr>
<tr>
<td>Monitor health or use for informing treatment decisions</td>
<td>39%</td>
</tr>
<tr>
<td>Update or correct medical record</td>
<td>23%</td>
</tr>
<tr>
<td>Download online medical record</td>
<td>17%</td>
</tr>
<tr>
<td>Transmit data to outside party (health care provider, caregiver or service or app)</td>
<td>14%</td>
</tr>
<tr>
<td>Transmit to another health care provider</td>
<td>10%</td>
</tr>
<tr>
<td>Transmit to caregiver</td>
<td>4%</td>
</tr>
<tr>
<td>Transmit to service or app</td>
<td>3%</td>
</tr>
</tbody>
</table>

Source: HINTS 5, Cycle 1, 2017

Note: Denominator represents individuals who were offered access to their online medical record and accessed their online medical records at least once within the last year. Please see Appendix Table 1 with full results available at the end of this data brief.
So what is happening?
“What information consumes is rather obvious: it consumes the attention of its recipients.

• *Hence a wealth of information creates a poverty of attention, and a need to allocate that attention efficiently among the overabundance of information sources that might consume it.*”

Changing clinician roles:

• From Omniscient Oracle... to Knowledge Broker.
"...The curse of medical education is the excessive number of schools. The situation can improve only as weaker and superfluous schools are extinguished."

“Society reaps at this moment but a small fraction of the advantage which current knowledge has the power to confer.”

Abraham Flexner,

Medical Education in the United States and Canada. Boston: Merrymount Press, 1910
### ADA Guideline Compliance

<table>
<thead>
<tr>
<th>ADA Guideline</th>
<th>Compliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measure blood pressure at every routine diabetes visit.</td>
<td>64.22%</td>
</tr>
<tr>
<td>Test for lipid disorders at least annually and more often as needed.</td>
<td>57.86%</td>
</tr>
<tr>
<td>Visual foot exam at every routine visit, comprehensive exam annually.</td>
<td>44.92%</td>
</tr>
<tr>
<td>Test for microalbuminuria in all type 2 diabetic patients at least annually.</td>
<td>23.62%</td>
</tr>
<tr>
<td>Dilated and comprehensive eye exam at diagnosis of Type 2 and annually.</td>
<td>14.21%</td>
</tr>
</tbody>
</table>

*On average, Patients receive 54.9% of recommended care*

The (Re-)Emerging Challenge

Blois’ Cognitive Funnel Revisited

Figure 1. The Cognitive Span Required during Diagnosis.
See text for discussion.

Middleton B, Szolovits P. Algorithms and AI Come to Medicine. Under review
Toward Digital Health

“Dumb” Healthcare

- EMR
- Patient Portal
- EDW
- Revenue Cycle Management System
- Customer Relationship Management/Call Center

“Smart” Healthcare

- Surveillance
- Discovery
- Prevention
- Prediction
- Anticipation
- Cognitive Aides
- Monitoring
- Feedback
- Learning
The Central Problem

Lack of shareable computable knowledge – quality measures and clinical decision support / ePathways

Why is it so hard to transform care with even the best health IT?

Simply put: the chasm which exists between published knowledge and clinical experience, and implemented knowledge in health IT, is too wide for the average clinician or healthcare delivery organization to manage.

This must be achieved at scale for all to benefit.
A System of Insight
The platform to implement a next generation architecture

Apervita is positioned to support HCOs and business networks at scale: supporting and providing leadership in the vision, design, and deployment of advanced applications and analytics across the healthcare industry.
CDS Consortium Demonstrations: 2008-13

Toward a National Knowledge Sharing Service

- Clinical Decision Support Consortium
  Middleton B, PI: 2008-13, AHRQ-funded:
  HHSA290200810010

- Major accomplishments:
  - Knowledge artifacts published: 11 clinical rules, 50+ classification rules and 375 immunization schedule rules
  - 8 clinical sites implemented using 5 different EHRs
  - More than 240 users utilize CDS services
  - Established legal framework for collaboration
  - Since 2010 more than 1.7M CCD transactions were processed
  - 31 entities (companies and academics) in a pre-competitive environment
  - Contributed to ONC-sponsored Health-e-Decisions efforts: KAS 1 and KAS 2
The principal finding relates to system-by-system variability. The best system in our analysis had only a single missing feature (from 42 total) while the worst had eighteen.

This dramatic variability in CDS capability among commercially available systems was unexpected and is a cause for concern.
Conclusion: If these well-designed commercially-available systems are coupled with the other key socio-technical concepts required for safe and effective EHR implementation and use, and organizations have access to implementable clinical knowledge, we expect that the transformation of the healthcare enterprise that so many have predicted, is achievable using commercially-available, state-of-the-art EHRs.
HISTORY: KNOWLEDGE TRANSLATION AND SPECIFICATION

Evidence → Guideline (s) → K Repres’n → Shareable K → Executable


CDS “UNIFIED THEORY” TOWARD PRACTICAL KNOWLEDGE SHARING

- Clinical guidelines
- Local protocols
- Experience

Clinical Knowledge

CDSC “L2”  
GEM Import

Structured Knowledge

CDSC “L3”  
Duodecim Import
GRADES Import

Encoded and Machine-Interpretable Knowledge

CDSC “L4”  
OpenCDS
CDS cloud service
Apervita

Decision Support Service

EHRs

CDS Performance Data

$25B

HeD KAS 1

HeD ELM  
CQL

HeD KAS 2

“CDSC” = CDS Consortium

“CDSC” = CDS Consortium
Apervita: Powering the Era of *Insight Driven Care*

A Platform-as-a-Service to rapidly Build, Deploy, and Scale Health Analytics
Healthcare is increasingly a connected, network industry

To get **paid**, improve **performance**, & provide better **care**, health enterprises must **work together**

Yet, today's health IT products have been built for single purposes

Integrate more diverse Data  
Apply more Analytics  
Get results to many Places  
Work across many Organizations
Healthcare is increasingly a connected, network industry

To get paid, improve performance, & provide better care, health enterprises must work together.
The Evolution of Analytics & Data

Recognizing value of data

1. Aggregate Data
   - Data management for select IT systems
   - Invest in EHR
   - Extract, transform, clean, standardize data
   - Data availability and access (e.g., trends, benchmarks)
   - Long data lags, highly specialized labor

2. Report using Analytics
   - Retrospective reporting (e.g., compliance, KPI dashboards)
   - Invest in EDW, BI, and reporting
   - Deliver dashboards to process owners
   - Common understanding
   - Elapsed-time data; limited actionability

3. Apply Analytics in Workflow
   - Interventions and improvement (e.g., CDS in workflow)
   - Invest in Analytics & Data platform and enterprise capability
   - From development projects to enterprise org and capability
   - Real-time insights delivered to many places, including workflow
   - Real-time data, analytics & data from many sources

4. Scale Analytics Across Enterprise
   - Management and scaling knowledge across enterprise (e.g., 1,000s analytics)
   - Invest in Knowledge Management & Delivery platform
   - Build tools and endpoints, drive governance
   - Efficiency from concept to production; self-service for enterprise
   - Streaming data, reusable tools and integrations, change mgt and lifecycle mgt

5. Knowledge Exchange Across Industry
   - Sharing, exchanging, building upon analytics and data between enterprises
   - Invest in Analytics & Data Marketplace and collaboration
   - Monetize, leverage best-of-breed, learn and improve
   - Huge leaps in choice & pace of innovation
   - Exchangeable data, evolution of "standards;" modularity and apps

Focus

Activities

Benefits (or limitations)

Here today
A System of Insight
The platform to implement a next generation architecture

Apervita is positioned to support HCOs and business networks at scale: supporting and providing leadership in the vision, design, and deployment of advanced applications and analytics across the healthcare industry.
Affiliations Across Organizations

A Multi-tenant, multi-affiliate platform to securely share & transact

- Collaborate across organizations & workspaces
- Publish & Subscribe in public or private marketplace
- Provision privately to partners & customer
- Orchestrate & Automate business processes across organizations
Apergvisa Platform Solutions

Focus on measures and metrics
Population <---> Patient

Focus on longitudinal care best practices
Cohort Compliance <---> Decision Support

**ePERFORMANCE**
- Focus on measures and metrics
  - Population <---> Patient
  - **Predict**
    - Early risk identification and predictive models
  - **Improve**
    - Continuous feedback and data-driven enhancement of knowledge and lifecycle
  - **Monitor**
    - Monitor signals and trends related to path or outcome
  - **Detect**
    - Detects when signals indicate an event in area of interest
  - **Act**
    - Actions taken after event of interest in support of desired outcome

**ePATHWAYS**
- Focus on longitudinal care best practices
  - Cohort Compliance <---> Decision Support
  - Eligibility & Enrollment
  - Evaluation Node
  - Decision Node
  - Executable
  - Cohort Criteria (Rules)
  - Trigger Event
  - Rule Evaluation (Condition)
  - Intervention Reminder
  - Rule Evaluation (Process)
  - Enriched Patient Data
  - Measure Execution
  - Enriched Data (Patient State)

**eCOLLABORATION**
- Federated data connection and sharing
  - Global View <---> Local Control
  - **Affiliation Admin**
  - **Affiliation Members**
Early risk stratification and predictive models

Determine when signals indicate an event in area of interest

Actions taken after incident of interest in support of desired outcome

Monitor signals and trends related to path or outcome

Focus on precursors in areas of interest

Continuous feedback and data-driven enhancement of knowledge and lifecycle

Determine when signals indicate an event in area of interest

Act

360° Insight: Apervita ePerformance Framework

The platform to implement a next generation approach to insight
PLATFORM SUPPORT FOR EVERY COMPONENT OF ePATHWAYS

Eligibility & Enrollment
- Cohort Criteria (Rules)
- Enriched Patient Data

Evaluation Node
- Trigger Event
- Rule Evaluation (Condition)
- Measure Execution

Decision Node
- Trigger Event
- Intervention Reminder
- Measure Execution

Action
- Trigger Event
- Rule Evaluation (Process)
- Enriched Data (Patient State)
- Measure Execution

CQL
Delivery Framework
Re-usable adapters and endpoints for flexible workflow integration
## Apervita Pathways Case Studies

| General | Build and maintain pathway applications, maintain pathway assets  
|         | Provision applications to third parties  
|         | Distribute measure packages privately or through the marketplace  
|         | Implementation pathway applications with data sources  
|         | Localize clinical decision support/interventions  
<table>
<thead>
<tr>
<th></th>
<th>Review performance across providers</th>
</tr>
</thead>
</table>
| **Case Study: CDC**  
Gonorrhea eCDS | Outpatient ePathway (Gonorrhea treatment guidelines)  
| Knowledge asset portability: All-standards based implementation  
| Trigger interventions in the users workflow (e.g., integration with EHR and existing applications) |
| **Case Study: The Joint Commission** | Outpatient ePathway (Traumatic Brain Injury Pathway)  
| Future proof platform architecture that allow unlimited pathways to be implemented at massive scale |
**CDC Gonorrhea ePathway**

Scalable, standards-based, ePathway

**WHAT WAS DONE**

Led an ambitious, first of its kind, undertaking with the CDC to implement a completely standards based ePathway from the 2015 CDC Gonorrhea guideline

**HOW IT WORKS**

- Knowledge Engineering: conversion of paper guideline to logic flow diagrams and CQL with CDC SME input
- Build: translation of the CQL to computable form on the Apervita platform
- Delivery: deployment of results into demo integrations into workflows (Cerner and SMARTonFHIR application)

**WHAT MAKES THE SOLUTION COMPELLING?**

- Faster building, testing, deployment of analytics.
- Standards-based knowledge assets allow for portability and scalability across any site
- Work continues today with the CDC to integrate the Gonorrhea ePathway into the EHR with a clinical partner
WHERE DOES CQL FIT IN TO THE KNOWLEDGE ENGINEERING PROCESS?

L1 Started with paper CDS STI Guideline

L2 Converted Guideline to a logic flow diagram

L3 Built standards-compliant CQL and FHIR Resources

L4 Implemented real-time CDS on Apervita

Implementation and Application Overview

Analytics Engine

EHR

EHRs

Smart on FHIR

Apervita

APR

Strategic Reporting

Population Health

EHR

SCM

Finance

APIs

Smart on FHIR elimu
The Joint Commission DDSP
Case Study: Nationwide platform for Quality Reporting

WHAT WE DID?

- Enable 3,000+ hospitals nationwide to process and submit electronic Clinical Quality Measures (eCQMs) results to The Joint Commission

HOW IT WORKS?

Standards-based clinical data ingestion and connection

Application built in 8 weeks and provisioned on-demand to customers at on-boarding

Direct, continuous engagement of thousands of customers across affiliation to share applications and data

WHAT MAKES THE SOLUTION COMPELLING?

- Transforms The Joint Commission to a customer-centric organization, and enables them to focus on quality improvement rather than the accreditation process

- Empowers the entire health system to better triage and diagnose data and quality challenges continuously, in time to act
Quality Measures and ePathways IN THE CLOUD: BUILD, TEST, DEPLOY, AND RE-USE RAPIDLY

Healthcare Delivery Organization

Quality Measure and CDS Specs / DATA

DASHBOARDS/ APPS / EPATHWAYS

apervita

CMS

The Joint Commission

NCQA

Healthcare Delivery Organization

Payers

Professional Registries

CDC
Recap the Big Ideas

Gather data once as a by product of the clinical encounter (and from other data system) – reduce physician burden

Reuse all data for all purposes: quality reporting, clinical decision support, TPO/operations improvement, public health, research/discovery

Patient at the center – deliver coordinated care across diverse care settings

Engage the patient as a care collaborator – data acquisition, support self-care, shared-decision making

Create computable knowledge artifacts for all of the above – make them readily shareable and usable

Do all of this at scale – standardize, streamline, simplify – with a System of Insight.
Thank You!

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