Methods for Data Capture, Integration, Exchange, & Management

-- Core and Supplemental Clinical Data
<table>
<thead>
<tr>
<th>Envisioned</th>
<th>Reality</th>
</tr>
</thead>
<tbody>
<tr>
<td>EHR “Meaningful Use”</td>
<td>EHR meaningless burden</td>
</tr>
<tr>
<td>Usability and productivity</td>
<td>Death by clicking</td>
</tr>
<tr>
<td>Patient engagement</td>
<td>AVS drivel</td>
</tr>
<tr>
<td>Effective clinical care</td>
<td>CDS trivial pursuit</td>
</tr>
<tr>
<td>Population health</td>
<td>Resource consumption focus</td>
</tr>
<tr>
<td>Bending healthcare cost curve</td>
<td>Penalties and uncertainty</td>
</tr>
<tr>
<td>Better provider work life</td>
<td>NOT!</td>
</tr>
<tr>
<td>Torrent of real world data</td>
<td>Puddles of document exchange</td>
</tr>
<tr>
<td>Big data analytics</td>
<td>Small transactions data</td>
</tr>
<tr>
<td>Leveraged RCTs via registries</td>
<td>20\textsuperscript{th} century paradigms</td>
</tr>
</tbody>
</table>
Every Interoperability Project is a Semantic Harmonization Project

- Evaluate, compare, map, and agree on meaning for all information and events communicated between systems...
- Multiple levels of rigor
  - Document (text) model, chart abstraction (CRF)
  - Electronic data capture (typically data to text documents)
  - EDC to structured documents
  - Structured reporting: workflow integrated, team-based documentation
- What is interoperability with standards?
  - Map each EHI system to standards, communicate using standards
  - Results in linear (not exponential) number of harmonization tasks (essence of FHIR)
Data Challenge: Multiple Masters

- Clinical care (incl. CDS)
- Health system
- Payers
- Patients
- Federal, state programs
- FDA
- Registries
- Research
- Oh yes ... clinicians

... who are time-challenged, short-staffed, overloaded with information and have increasing expectations placed upon them.
Challenges to Interoperable Health IT

1. Not enough standardization
2. Standards that are not fully used
3. Unique patient identification, matching
4. Privacy and security
5. Misalignment of incentives, funds flow
6. Existing provider workflow
7. Larger eco-system
8. Costs

- Need: transformation of healthcare processes
- Need: leadership, governance

ONCHIT: Overview of Interoperable Health IT
Unit 3, 2017
“Dammit, Jim, I’m a Doctor, Not a Computer!”
Clinician Documentation 2017

• Mired in ancient paradigms
  – Authoring of descriptive play-by-play novella encouraged (starts in med school)
  – Demonstration of physician prowess, justification of actions
  – (Misbelief) that it will be a good defense in case of malpractice

• 75% is garbage – E&M coding requirements, EHR MU
  – Fosters cut and paste

• Team-based documentation actively discouraged
  – By regulation
  – By job description
  – By HIT (built to enhance the ancient paradigms)
Where’s Waldo?

- The left ventricle is small in size due to severe left ventricular hypertrophy, but has normal overall contractility. Diastolic relaxation is about as expected. The estimated ejection fraction is >55%. The anterior and apical walls have normal systolic motion. The inferior, posterior, and lateral walls also contract normally.

| LEFT VENTRICLE | Anterior: Normal |
|               | Lateral: Normal |
| Size: SMALL   | Septal: Normal  |
| Contraction: Normal | Apical: Normal |
| Closest EF: >55% (Estimated) | Inferior: Normal |
| LV masses: No Masses | Posterior: Normal |
| LVH: SEVERE LVH CONCENTRIC | Dias.FxClass: N/A |
What is Structured Reporting?

• Specific data captured by the person closest to that data, integrated into clinical workflow (e.g. MA, tech, RN, pt)

• Informatics formalisms: universal, well-defined common data elements; data model that parallels (i.e., is representational of) clinical care model

• Data is compiled by the computer to produce most of the content in a report; MD focuses on assessment of data quality, cognitive interpretation

• Output: the structured document

• ROI: ↑ data quality /quantity, ↓ redundancy / repetition, time to final reports, FTE requirements → augmented knowledge, financial gains
<table>
<thead>
<tr>
<th>Process</th>
<th>Information Sources</th>
<th>Information Captured as Digital Data</th>
<th>Actors</th>
<th>Information Systems</th>
<th>Form Factor (for Actors)</th>
<th>Data Output</th>
</tr>
</thead>
</table>
| Schedule Patient for Cath Procedure | History & Physical Other documents Laboratories                                    | Patient identifiers Demographics Diagnosis Laboratories                                              | Physician requestor Scheduling hub / Communications Center            | Registration system Scheduling app Electronic Health Record     | Desktop workstation                                      | Schedule – to scheduling app Orders – to Electronic Health Record (EHR) system  
Patient status – to scheduling system ➔ electronic schedule Orders – to EHR                                                                                              |
| Physician Pre-Procedural Evaluation and Consent | Existing clinical data History & Physical Other documents Laboratories               | Patient identifiers Demographics History Physical Exam Previous studies Laboratories Diagnosis       | Advanced Practice practitioners Physician operator                    | Electronic Health Record Procedure Reporting system             | Mobile tablet                                              | Clinical data – to procedure reporting system (history section)  
Patient status – to scheduling system ➔ electronic schedule                                                                                                                          |
| Nursing Pre-Procedural Evaluation | History & Physical Other documents Laboratories Consents                             | Patient identifiers Procedures Hemodynamics Findings Measurements Medications Inventory             | Outpatient / inpatient nurses                                          | Electronic Health Record                                      | Bedside workstation                                      | Nursing documentation – to EHR  
Patient status – to scheduling system ➔ electronic schedule                                                                                                                          |
| Cardiac Catheterization Procedure | Pre-procedure evaluation packet Hemodynamics Catheterization images                 | Patient identifiers Catheterization images                                                           | Physician operator Cath lab nurses Cath lab technologists            | Procedure documentation / Reporting system                    | Multiple workstations: Radiography Modality Hemodynamic Monitoring Procedure Documentation | DICOM Modality Worklist to Modality, Hemodynamic, and Procedure Documentation systems ➔ procedure log report; and data for procedure report (procedure section)  
[See also IHE CATH, CRC profiles]                                                                                                                                  |
| Analysis and Report Generation | Hemodynamics Catheterization images Measurements Calculations                       | Patient identifiers Cath results Interpretation Tree diagram                                         | Physician operator                                                     | Procedure reporting system                                    | Desktop workstation                                      | Procedure results – to procedure reporting system (results section) ➔ structured procedure report                                                                 |
Patient information

- MRN: Q45678
- Last: Testpatient
- Suffix: Dummy
- First: 
- Middle: 
- Date of birth: 10/07/1971
- Age: 43
- Gender: Female
- Hispanic Ethnicity: 
- Race: 

Import Data From Prior History

- Admit source: 
  - Emergency Department
  - Transfer in from another acute care facility
  - Other
- Procedure priority: 
  - Elective
  - Urgent
  - Emergency
  - Salvage
- History: The patient is a 51 year old male who presented at the ED with chest pain.

Angina

- History of angina (ever)
- Onset month: March
- Year: 2015
- Not available
- Angina at any time during current hospitalization
- Angina within 2 weeks
- Current CCS class (within 2 weeks): CCS I, CCS II, CCS III, CCS IV

Heart Failure

- History of heart failure (ever but more than 2 weeks ago)
- Onset month: 
- Year: 2013
- Heart failure with acute ischemia
- Heart failure within 2 weeks
- Current NYHA class (within 2 weeks): I, II, III

Cardiogenic shock within 24 hrs
Cardiac arrest within 24 hrs

Stress testing (within 6 months)
- Test: ETT (no imaging), Stress echo, Stress nuclear, Stress MR
- Result: Positive, Negative, Indeterminant, Unavailable
- Ischemia: Low, Intermediate, High, Unavailable

Pre procedure EF: 65%
Pre procedure EF modality: Echo, Nuclear, Cath, MR

Anti-anginal meds (within 2 weeks)
- Beta blockers
- Calcium channel blockers
- Nitrates
- Ranolazine
- Other anti-anginals

CAD Risk Factors

- Cigarette smoking, current or recent (< 1 year)
- Type 1 diabetes
- Type 2 diabetes
- Therapy: Diet, Oral, Insulin, Other, None
- Prior MI
- Cerebrovascular disease
- Peripheral vascular disease
- Central (aorta, renal) vascular disease
- Cardiomyopathy / LV systolic dysfunction
- Chronic lung disease
- ESRD on dialysis (current)
- Prior valve surgery
- Date (most recent):
- Prior PCI
- Date (most recent):
- Prior CABG
- Date (most recent):
Native Diagnostic Summary

Right Coronary Artery
- Prox RCA: 30% Tubular, 30% Tubular

Left Main
- **NORMAL**

Left Circumflex Artery
- OML: small
- LPL1: small
- LPL2: small
- LPDA: large
- **NORMAL**

Left Anterior Descending
- Mid LAD: small
- D2: 40% Discrete
- D3: small

Comment: distal LAD with intramyocardial segment
What Does SR Fix?

• Single source of data (trust and verify level)
• Creates reusable data – “collect once, use many times”
• Explicitly prompts for presence / absence of data – not charting by exception
• MD emphasis on findings, results, interpretation, recommendations – not “art of medicine”
• ↑ Workforce, workflow efficiencies, clinical data completeness, data quality
What is Needed for **Structured Reporting**?

- Unified clinical vocabulary ➔ interoperable data standards (common data elements)
  -- clinical use to CVIS to EHR to registry
ACC/AHA/SCAI 2014 Health Policy Statement on Structured Reporting for the Cardiac Catheterization Laboratory

A Report of the American College of Cardiology Clinical Quality Committee

Developed in Collaboration With the American Association for Critical-Care Nurses, Asian Pacific Society of Cardiology, Canadian Cardiovascular Society, Health Level Seven International, Inter-American Society of Cardiology, Integrating the Healthcare Enterprise, Society of Thoracic Surgeons, and Society for Vascular Surgery

Writing Committee Members

Timothy A. Sanborn, MD, MS, FACC, FAHA, FSCAI, Chair*
James E. Tcheng, MD, FACC, FSCAI, Vice-Chair*

H. Vernon Anderson, MD, FACC, FSCAI*
Charles E. Chambers, MD, FACC, FSCAI†
Sharon L. Cheatham, PhD, APRN†
Matthew V. DeCaro, MD, FACC
Jeremy C. Durack, MD§
Allen D. Everett, MD, FACC*
John B. Gordon, MD, FACC*
William E. Hammond, PhD||
Ziyad M. Hijazi, MBBS, MPH, FACC‡
Vikram S. Kashyap, MD, FACS¶
Merrill Knudtson, MD, FRCP(C), CM#
Michael J. Landzberg, MD, FACC**

Marco A. Martinez-Rios, MD, FACC, FSCAI††
Lisa A. Riggs, CNS†††
Kui Hian Sim, MBBS, FACC§§
David J. Slotwiner, MD, FACC||||
Harry Solomon¶¶
Wilson Y. Szeto, MD##
Bonnie H. Weiner, MD, FACC, FSCAI†
William S. Weintraub, MD, FACC, FAHA
John R. Windle, MD, FACC*

*American College of Cardiology representative.
†Society for Cardiovascular Angiography and Interventions Foundation representative.
‡American Heart Association representative.
§Society of Interventional Radiology representative.
||Health Level Seven International representative.
¶Society for Vascular Surgery representative.
##Canadian Cardiovascular Society representative.
||International Society for Adult Congenital Heart Disease representative.
††Inter-American Society of Cardiology representative.
‡‡American Association for Critical-Care Nurses representative.
§§Asian Pacific Society of Cardiology representative.
|||Integrating the Healthcare Enterprise representative.
¶¶Digital Imaging and Communications in Medicine representative.
##Society of Thoracic Surgeons representative.
What is Needed for Ubiquitous Structured Reporting?

1. MD, staff transformation / professionalism standards -- conversion from document to information model

2. Government, payer, health systems transformation -- shift emphasis from payment to data

3. Informatics: controlled vocabularies $\rightarrow$ common data elements (CDE); common data model (CDM) with semantic data interoperability

4. Clinical industrial (process) engineering to describe, model, implement best-practice workflows -- who does what when, where, and how -- implementation science, change management

5. Partnership with IT vendors (platforms, solutions)
Core and Supplemental Clinical Data
What and Where?

• High quality EHR data
  – Administrative (transactions / encounters), demographics, labs, medication rxs, procedures

• Lower quality EHR data
  – Diagnosis (ICD), everything else ...

• RAPID core data elements (PAD / PVI focused)

• Clinical data

• And whither data standards / data models?
Questions?

Never, ever think outside of the box!!!