Value of Structured Data Capture for Cardiology Reporting

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Objectives

• Discriminate structured reporting (process) from the structured report (document)
• Describe the multidisciplinary, workflow-oriented structured data capture paradigm
• Identify use cases advantaged by structured data capture, using cardiac cath reporting as an archetype
• Acknowledge barriers to clinician adoption
• Summarize the roles and responsibilities of professional societies, vendors, and others to accomplish structured reporting
Structured Reporting in the Cath Lab

- The need for data healthcare delivery, quality measurement, performance improvement, device surveillance
- Structured reporting - what and why?
- ACC/AHA/SCAI Health Policy Statement on Structured Reporting
- Details, details, details
- Perspectives
Percutaneous Coronary Intervention (PCI)
It’s first “world registry” – circa 1979-80
<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
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<tbody>
<tr>
<td>1990’s</td>
<td>Beginning of conversion from film, VCR tape to digital PACS → proliferation of modality-specific PACS</td>
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<tr>
<td></td>
<td>Vendor-authored procedure reporting systems → data capture from modalities, used for operational purposes</td>
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<td>Rise of randomized clinical mega-trials → evidence generation, guidelines</td>
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<td>Emergence of registries, quality measurement</td>
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<td>Emergence of CVIS (PACS + reporting) systems</td>
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<tr>
<td>2009</td>
<td>ARRA HITECH Act → catalyst for EHR adoption</td>
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<tr>
<td>Today</td>
<td>Where’s the data?</td>
</tr>
<tr>
<td></td>
<td>• Failure of the EHR model (replicates dictation paradigm)</td>
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<tr>
<td></td>
<td>• Adoption of structured reporting still nascent</td>
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<td></td>
<td>• Data only via manual abstraction (i.e., RCT model) for quality assessment and metrics, registries, etc.</td>
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Grand Challenge: Multiple Masters

- Government
- Public Health
- Payers
- Regulators
- Patients
- Industry
- Research
- Lawyers
- Oh yes … clinicians

Recipients

Producers
Clinician Documentation 2015

- Mired in ancient paradigms
  - Authoring of novella encouraged (starts in med school)
  - Play by play description – fear of malpractice
  - Demonstration of physician prowess
  - Justification of actions

- 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)
Clinician Desired State

- **Best approach** for the task – defined by usability, efficiency and effectiveness – not regulation!
  - Meld technical approach to best-practice workflow – even if this means disruptive change
  - Consistency at the task level (e.g., procedure reporting), rather than the system level (e.g., EHR) – one size does NOT fit all

- Capture **information as data** – but only where “data” are actually useful (e.g., conveying clinical / administrative info, risk calculation / stratification, predictive modeling)

- **Procedures** a “natural” for the process of **structured reporting**
  - For device implants, this is where it all starts
What is Structured Reporting?

- Data management integrated into workflow
- Data acquisition by those closest to (handling) the data → also improves data quality
- Multiple authors contribute to documents
- Reduced MD time to report completion, MD focuses on cognitive activities
- Improved clinical communication with care team, physicians, patients
- Paradigm: collect once, use many times (e.g., clinical report, PI analysis, data to registries, distributed analysis → device surveillance)
What is Needed for Structured Reporting?

- **Vocabulary & data interoperability standards**
  - From SDOs through registries to the clinical arena

- **Best-practice workflows** *(industrial engineering)*
  - From cath order through data use

- **New professionalism standards for clinicians**
  - Conversion from dictation to structured data model
  - Expected content and format
    - Procedure documentation *(technical/procedure log)*
    - Physician report *(structured report)*

- **IT systems (vendors)**
  - Information model, systems aligned with clinical model
Standardized Cardiovascular Data for Clinical Research, Registries, and Patient Care

A Report From the Data Standards Workgroup of the National Cardiovascular Research Infrastructure Project

H. Vernon Anderson, MD,* William S. Weintraub, MD,† Martha J. Radford, MD,‡ Mark S. Kremer, MD,§ Matthew T. Roe, MD, MHS,‖ Richard E. Shaw, PhD,¶ Dana M. Pinchotti, BS,# James E. Tcheng, MD||

Houston, Texas; Newark, Delaware; New York, New York; Charlotte and Durham, North Carolina; San Francisco, California; and Washington, DC

- CV vocabularies – NCRI
- Balloted via HL7 CIC
- Available on NCI-EVS (caDSR)

J Am Coll Cardiology 2013;61: 1835
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

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<tbody>
<tr>
<td>Information Sources</td>
<td>History &amp; Physical Other documents Laboratories</td>
<td>Existing clinical data History &amp; Physical Other documents Laboratories</td>
<td>History &amp; Physical Other documents Laboratories Consents</td>
<td>Pre-procedure evaluation packet Hemodynamics Catheterization images</td>
<td>Hemodynamics Catheterization images Measurements Calculations</td>
</tr>
<tr>
<td>Information Captured as Digital Data</td>
<td>Patient identifiers Demographics Diagnosis Laboratories Insurance</td>
<td>Patient identifiers Demographics History Physical Exam Previous studies Laboratories Diagnosis</td>
<td>Patient identifiers History &amp; Physical Other documents Laboratories</td>
<td>Patient identifiers Procedures Hemodynamics Findings Measurements Medications Inventory</td>
<td>Patient identifiers Cath results Interpretation Tree diagram</td>
</tr>
<tr>
<td>Actors</td>
<td>Physician requestor Scheduling hub / Communications Center</td>
<td>Advanced Practice practitioners Physician operator</td>
<td>Outpatient / inpatient nurses</td>
<td>Physician operator Cath lab nurses Cath lab technologists</td>
<td>Physician operator</td>
</tr>
<tr>
<td>Information Systems</td>
<td>Registration system Scheduling app Electronic Health Record</td>
<td>Electronic Health Record Procedure Reporting system</td>
<td>Electronic Health Record</td>
<td>Radiography Modality Hemodynamic Monitoring system Procedure Documentation / Reporting system</td>
<td>Procedure reporting system</td>
</tr>
<tr>
<td>Form Factor (for Actors)</td>
<td>Desktop workstation</td>
<td>Mobile tablet</td>
<td>Bedside workstation</td>
<td>Multiple workstations: Radiography Modality Hemodynamic Monitoring Procedure Documentation</td>
<td>Desktop workstation</td>
</tr>
<tr>
<td>Data Output</td>
<td>Schedule – to scheduling app Orders – to Electronic Health Record (EHR) system</td>
<td>Clinical data – to procedure reporting system (history section) Patient status – to scheduling system → electronic schedule Orders → to EHR</td>
<td>Nursing documentation – to EHR Patient status – to scheduling system → electronic schedule</td>
<td>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]</td>
<td>Procedure results – to procedure reporting system (results section) → structured procedure report</td>
</tr>
</tbody>
</table>
Pre-Procedure

• **Who**
  – Ordering physician
  – Pre-procedure evaluation by operator

• **What information**
  – Patient demographics, requested procedure, scheduling logistics, procedure indications, clinical history

• **What information as data**
  – Demographics, ICD-9 indications, structured history

• **Output**
  – Structured H&P (data for risk modeling, quality measurement, and registry submission)
**Patient Information**

- **MRN:** Q45678
- **Last:** Testpatient
- **Suffix:**
- **First:** Dummy
- **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 (w/in 2 weeks):
    - CCS I
    - CCS II
    - CCS III
    - CCS IV
- ☐ Cardiogenic shock within 24 hrs
- ☐ Cardiac arrest within 24 hrs

**Stress testing:**

- Test: ☐ ETT (no imaging)
- ☐ Stress echo
- Stress nuclear
- Stress MR
- Result: ☑ Positive
- ☐ Negative
- ☐ Indeterminate
- ☐ Unavailable
- Ischemia: ☑ Low
- ☐ Intermediate
- ☐ High
- ☐ Unavailable

**Pre procedure EF:** 65%

**Pre procedure EF modality:**

- ☑ Echo
- ☐ Nuclear
- ☑ Cath
- ☐ MR

**Anti-anginal meds:**

- ☑ Beta blockers
- ☑ Calcium channel blockers
- ☐ Nitrate
- ☐ Ranolazine
- ☐ Other anti-anginals

**CAD Risk Factors**

- ☑ Cigarette smoking, current or recent (< 1 year)
- ☐ Type 1 diabetes
- ☐ Type 2 diabetes
- ☑ 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):
During the Procedure

- **Who**
  - CV Technologist / Nurse

- **What information**
  - Procedure log (play by play), procedure data

- **What information as data**
  - Hemodynamics, medications, procedures performed, devices used / implanted, medications – basically everything

- **Output**
  - Structured procedure data (in tables)
Analyze and Recompile

• **Who**
  – Physician (with the aid of the computer)

• **What information**
  – Findings and interpretations (physician)

• **What information as data**
  – Compiled H&P, compiled procedure data
  – Structured findings

• **Output**
  – Procedure log
  – Procedure report
Native Diagnostic Summary

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

Left Main
**NORMAL**

Left Circumflex Artery
- OM1: small
- LPL1: small
- LPL2: small
- LPDA: large
**NORMAL**

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

Comment: distal LAD with intramyocardial segment
Cardiac Catheterization Procedure Report

SUMMARY

Procedures
- Left heart catheterization
- Percutaneous coronary intervention: prox LAD, mid-distal RCA
- Intra-aortic balloon pump

History
A 57-year old man with hyperlipidemia, hypertension, and a positive family history who presents with typical chest discomfort with exertion relieved with rest. A stress echocardiogram was positive for ischemia in the anterior and inferior distributions.

Encounter category
- Elective cath, possible PCI
Data by staff, from hemo system

Key diagnostic findings
Right heart
- RA: 10 (mean)
- PA: 42/18, 26 (mean)
- Wedge: 16
- AV O2\Delta: 4.5 vol%
- CO: 4.5 L/min
- CI: 2.5 L/min-m2

Coronary artery disease (significant)
- Left dominant
  - Prox LAD: 90%
  - Mid-distal RCA: diffuse 80%
  - OM3: 60%

Left ventricle
- EF: 48%
- EDP: 12
- Wall motion: mod anterior hypokinesis, mild inferior hypokinesis
- MR: 1+ mild

Interventions
1. 90% prox LAD: Integrity 3.0mm x 20mm stent (bare metal)
2. 80% mid-distal RCA: Xience 3.0mm x 28mm stent (drug eluting)

Complications
- Ventricular fibrillation

Notes
- Anterior takeoff of the RCA, unable to seat JR catheter, required AL1 guide. VE with cannulation of conus branch with AL1 guide. RCA lesion opened at 18 ATM. Successful PCI x2, recommend thienopyridine indefinitely.

Catheters
- JL 4, JR4, Pigtail, Amplatz 1, XB 3.5

Signature / eSignature / attestation
Pages 3+ – Everything Else

Patient demographics
Healthcare facility information
Operators, staff
Referring care provider information
History and physical (categorical) data
Previous procedures
High risk allergies (e.g., contrast)
Laboratory data
ICD diagnoses
AUC indications

Procedures performed
Logistics (e.g., time in, time out)
Baseline data (e.g. height, weight, eGFR)
Vascular access details
Hemodynamic support
... and the rest of the details ...
CVIS Vendors

Roles and Responsibilities

- Best practice: data handling integrated with workflow; team-based documentation
- Usability: interfaces designed and built for maximum efficiency and effectiveness (human factors design)
- Input devices: specific to role (e.g. mobile devices, workstations, hemo system interfaces)
- Graphics: graphical input and display of anatomic findings and treatment results
- Data management: use of controlled vocabularies including permissible values, range / consistency / validation checking; use of common data model
CVIS Vendors
Roles and Responsibilities

- Outputs: structured report per HPS specifications
- Interoperability: adherence to the IHE Cath Report Content (CRC) profile, Cardiac Cath Workflow (CATH) profile, and ACCF/AHA Task Force on Data Standards key data elements for cardiac imaging documents
- Partnership: with professional societies on developing the structured reporting environment
- Point person role: dissemination of best practices in structured reporting to the clinical community
What Did We Accomplish?

- **Problem: inaccurate data, incomplete reports**
  - Distributed responsibility for acquiring data to those closest to the data
  - Eliminated double documentation (prelim + final report)
  - Focused the physician on cognitive work (assessment, recommendations) – computer compiles 90% of report

- **Problem: inefficient use of human resources**
  - Each group captures data at point of care
  - Each group responsible for accuracy, quality of data

- **Problem: poor / redundant communication**
  - Was: 4+ days on average to produce final report
  - Now: before the end of the procedure (no prelim report)
Artifacts at @ACC.org

Health Policy Statement
Informatics and Health IT Committee
Clinical Quality Committee

Prototype procedure report
Style guide
IHE profile
Task Force on Data Standards documents
CVIS – Future State?

Enterprise Information Systems

- Clinical Data Repository (EHR)
- Decision Support Repository
- Registration (ADT), Accounts, Scheduling, Labs, Pharmacy, CPOE, Inventory, Interfaces …

Cardiovascular Information System

- MD task worklist, reporting, eSignature, communications engine, administration
- MD task worklist, reporting, eSignature, communications
- Data一致的MD体验
- Pre-cert / LCD / Appropriate use
- Clinical decision support
- Scheduling / “White Board”
- Registry / quality reporting
- Modality “Plug and Play”

Integration Broker

- ALL Modality Management
  - Measurements
  - Analysis
  - Reports
  - Image processing

OP → Admission → Discharge → OP
History, ECG, medications, events

Meta-data / resources
CV Informatics

- ACC/AHA “Top 100” EHR Terminology
  - Weintraub WS et al., JACC 2011; 5:202-22

- NCRI Cardiology Clinical Trials Terminology
  - Anderson HV et al., JACC 2013; 61:1835-46

- ACC/AHA/FDA CV Endpoints Terminology
  - Hicks KA et al., JACC 2014 Dec (epub ahead of print)

- ACC/AHA/SCAI Cardiac Cath Structured Reporting
  - Sanborn TA et al., JACC ePub: 28 March 2014
  - IHE Cath Report Content (CRC-technical supplement)
    - [http://www.ihe.net/Technical_Frameworks/#cardiology](http://www.ihe.net/Technical_Frameworks/#cardiology)

- Coming soon:
  - Echo controlled vocabulary, HRS Health Policy Statement on EP Structured Reporting, NCDR Consolidated Data Dictionary