The ASNR-ACR-RSNA Common Data Elements (CDE) Project

Challenges with Conventional Prose Reporting

- Radiologists prefer narrative reporting.
  - Because it's easier to produce.
- "Data" in the report is largely unstructured.
- Unstructured data is not informative; *difficult to re-purpose*
  - Variability in use of terminology.
- One rads report not comparable to another.
- A human brain (or a computer) is required to translate/ normalize the features that are described turning highly unstructured info into useable structured data.

Standardized Reporting: Not Such a New Idea…

- Preston Hickey early AJR editor, founder ARRS and proponent of standardized reporting.
- In the 1920s observed *"in only a few cases were [the reports] worded that the reader could form from the descriptions a diagnosis of the conditions present"*
- He also observed that surgeons concluded from these reports that radiography "could contribute very little"

Preston Hickey

Standardized Reporting: Not Such a New Idea…

- Hickey was a strong advocate for *standardization of roentgen ray reports.*
- Use of "standardized nomenclature".
- *Standard* format.
- Here is an example of one of his *standardized reports:* a list of expected features/observations and consistent responses.
- This is one of the earliest examples of a common data element set (CDE).
- Ironic that 100 years later we face the same issues.
  - Unstructured
  - Heterogeneous terms
  - Free-form narrative
  - Limited value

P Hickey AJR 1922

Principle Motivations

- Cross-roads - redefine our role as diagnostic radiologists where imaging is central to diagnosis, therapeutic planning and treatment response.
- Mantra – Value not volume.
- Performance initiatives: MACRA/MIPS, QPI, Physician Focused Payment Models.
- Evidence-based research that imaging adds value.
- Rewarded for work that is value-based.
- Opportunities in Precision medicine.
- ML/NLP *optimized* with annotated/validated data.
- The future is now: Many of the tools we need exist today.

So What is this CDE Thing?

- Fills a critical gap for standardized representation of imaging based observations, concepts and features that are human *and machine consumable.*
- A CDE or Common Data Element is the critical middle component between the vocabulary of Radiology (provided by RadLex® and SNOMED®) and reporting templates (RadReport®).
- CDEs are not reporting templates or complete reports.
  - They are sets of one or more related concepts, features or observations that should be represented in a consistent manner.

Common Data Elements (CDE)

- We have Radiology specific terminology – RadLex
- We have a set of best practice reporting templates – RadReport
- CDE is: Question, concept, measurement, feature or finding with a constrained response.
- Equivalent of *discrete data* which could be mined from a report repository for a variety of uses.
- More granular than a report.
- One or more CDEs could be incorporated into a report with free text.
- Reuseable!
- Ex: BI-RADS, PI-RADS, LI-RADS, HI-RADS etc.

Common Data Elements (CDE)

- We have Radiology sp...
- ...

Foraminal Stenosis?
- None
- Mild
- Moderate
- Severe

Enhancement Characteristics?
- None
- Thin incomplete
- Thin complete
- Nodular
- Mixed
- Thick

Tumor Crosses Midline?
- Yes
- No
- n/a

RANO Measurements

ASPECTS Score
- - 1 - 10

ASNR/ACR/RSNA CDE Workgroup Status

The team has been focusing on an initial batch of common clinical use cases to develop the process of cataloging the observations, validating the concepts and controlled responses and turning them into a useable product. Representative CDE sets for Brain, Spine and ENT.

- CT Stroke
- Brain MS
- Pituitary Microadenoma
- Pituitary Macroadenoma
- Lymph Nodes
- Inflammatory Sinus CT
- AO Spine TLICS
- AO Spine SLICS
- Spine MS
- MR Spinal Cord Injury
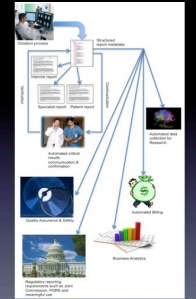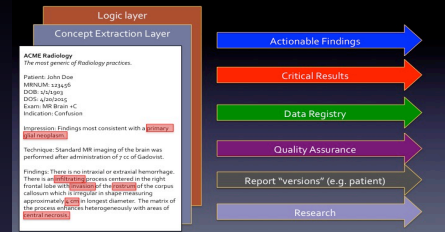- Metastatic Spine Instability Score
- Epidural Compression Score

ASNR/ACR/RSNA CDE Workgroup

- To address knowledge gaps:
- ASNR ExComm, Health Policy, Standards & Guidelines Committee endorsed creation of a Neuroimaging CDE Workgroup.
- Goals:
  - Devise "best practice" CDEs for common reporting scenarios
  - Utilize existing knowledge, literature and experience
  - Maintain clinical relevance
  - Focus on high-value features:
    - Evidence that features inform clinical decision making
  - Outreach/Education
  - Sponsor multisite demonstration pilot projects to assess compliance and clinical impact.
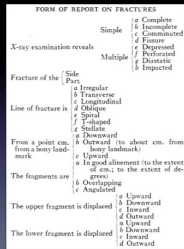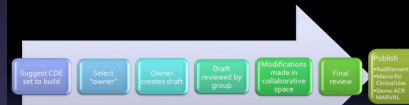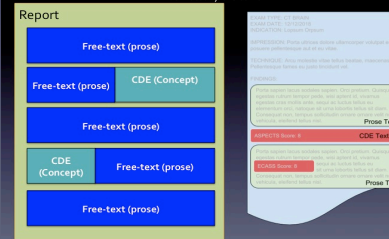
Current Processes for this Workgroup

- Develop a process for nominating (suggesting) a CDE set for development.
- Common goal is to promote clinical use cases found in a typical Neuroradiology practice.
- Nominate a CDE set "owner" who creates a draft of the CDE set.
- The CDE set then available (in a collaborative workspace) for workgroup members to modify, comment on.
- Modifications made based upon group suggestions.
- Guidelines to include only core pertinent negative/positive concepts that should be included in a report.
- Similar threshold for what we pass on to our trainees as essential concepts.
- "Publish" in Radelement for internal coding.

CDE Creation Process

- The ASNR-ACR-RSNA Neuroradiology CDE Workgroup is a voluntary activity that resides under the auspices of the ASNR Standards & Guidelines Committee.
- The process for development, authoring, review and curation is managed through monthly telephone conferences.
- Drafts and Deliverables are managed through a collaborative on-line workspace via GoogleDocs.

Reports can be more modular; containing interposed mixtures of both concepts and prose
Not mutually exclusive!

Rich Metadata in Structured Reports

- Actionable report
- Rich, consistent metadata in structured reports can spawn other processes.
- Annotated data for ML.
- Instantiate QA, Billing, BA, communication, regulatory and registry requirements.

Extracted Concepts in Radiology Reports Become Coded Metadata that Links to Automate Other Useful Processes

- Actionable Findings
- Critical Results
- Data Registry
- Quality Assurance
- Report "versions" (e.g. patient)
- Research

CDEs are ML Classifiers

- CDEs are concepts that are human consumable.
- When designed correctly, CDEs are machine consumable as well.
- DL/NLP algorithms can group or bin entities into categories known as "classifiers".
- Human experts need to create relevant classifiers for algorithms to train against.

ACR-ASNR-RSNA CDE Workgroup

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