The ACR-SIR Fluoroscopy Dose Index Registry Pilot

A. Kyle Jones, Ph.D., FAAPM
MD Anderson Cancer Center
Disclosure

• A. Kyle Jones is President of FluoroSafety, a company that produces CME on quality and safety in medical imaging

• FluoroSafety will not be discussed in this talk (but a bit of artwork will be used)
In the beginning

• On the way to Grouse Mountain in Vancouver during WAIS 2015

• Jeremy Durack asked a few basic questions about dose indices for the IR Registry

• One thing led to another...
The ACR NRDR
Normative datasets

• Comparison of facility data to a normative dataset allows a practice to understand their performance relative to their peers

• The most well-known normative dataset is probably the ACR CT DIR
  • Currently more than 80M exams in the CT DIR
The need for a registry

• The RAD-IR study is the largest normative dataset for FGI

• Data for RAD-IR was collected in the mid- to late 1990s
  • 2,142 procedures
  • Single fluoroscope make and model (Siemens Multistar/Neurostar, pulsed/continuous fluoro, fixed 0.2 mm Cu filter for fluoro and small ACQ beam paths, XRII)
  • Herculean manual effort

• Substantial changes since the data collection period of RAD-IR
  • Scope and number of FGI
  • Mandatory reporting of $K_{a,r}$
  • RDSR
  • Technological advances, including variable added filtration, FPD, etc.
Integrating with the DIR

• Directly through the ACR Triad server

• Via RDIM system as an intermediary
  • RDIM may not, by default, simply pass through the RDSR

• Connecting systems to an RDIM
  • Auto-forward from PACS
  • Send directly from modalities
  • May require vendor assistance for back-end configuration
Radiation dose structured report (RDSR)

- Granular, detailed information
  - Every exposure event
  - Can soon contain calibration information for dose measuring device (NEMA XR-27)

- Often sent to Radiation Dose Index Monitoring (RDIM) system
  - PACS do not display in useful way

- Sites participating in DIR send RDSR to ACR via Triad
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| 1 | Radiation Event Transition Precursors Area Product (Geometry $(\text{deg})$) Orientation Primary Angle Inner Secondary Angle R-Rect Filter Material lay Filter Thickness Minimum (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Modal'' Rate (``Remote Mode
NEMA XR-27

• X-ray Equipment for Interventional Procedures User Quality Control Mode
  • Manual selection of X-ray parameters
  • Access to and export of FOR PROCESSING and FOR PRESENTATION images
  • \textbf{Single point calibration factor for dose indices}
  • Electronic documentation of system configuration
  • Access to RDSR in all scenarios

• Report of AAPM TG 190 provides the method for measuring the calibration factor

• Not universally available at the current time
Mechanics

- Participate in the ACR NRDR
  - Participation agreement and registry application signed
  - Triad server installed and configured

- Configure your IR fluoroscopes to send data to the Triad server
  - Directly or via RDIM
  - RDSR only

- Map your procedures to ACR Common™
ACR Common

• Ontology for radiology procedures
  • Leverages existing ontologies and coding schemes
  • Organized around fundamental and derived axes such as scenario, procedure, and finding
  • Includes indications and more details about the procedure

• Updated based on experience during the pilot phase
Will ACR Common replace or compete with existing taxonomies such as Radlex?

No. ACR Common will link where possible and appropriate to existing terminologies. However, it will evolve continuously to meet market demand, maintaining linkages to existing terminologies where possible and informing those efforts along the way.

What's the difference between RSNA RADLEX Playbook and the ACR Common Procedure dimension?

By design, they are close with the intention of maintaining a crosswalk for those standardizing on Playbook terminology. However, because ACR Common is tied heavily to heterogeneous production systems and dynamic products and services, it will continue to evolve at a rate that will exceed the processes employed by consensus-driven standards bodies. That community standards process is a long-run necessity but typically a short-run challenge.

In the case of Playbook, the procedure axis of ACR Common fills the immediate market gap for those not standardized on Playbook and can serve to inform the evolution of Playbook over time so that effort continues to evolve to meet market demand.

This iterative development process is a reflection of market reality and the balance between solving immediate production problems while charting a long-run path for the industry. Similar coordination will occur along the other axes of Common with other consensus-driven standards bodies.

Because we map to Playbook, organizations that adopt Playbook as their charge master will not have to do any additional mappings to consume ACR Common-enabled products and services.
Not perfect

- Interpretation of data in a registry must take into account how the data is collected, processed, and what the data represents
  - Design and configure to reduce variability as much as possible

- E.g., CTDI$_{vol}$ and DLP for CT Chest in ACR CT DIR; combined procedures; what is a “Tumor Embolization – Liver”
Common problems

• Mapping is not 1:1 (in both directions)

• Combined procedures

• Study Description vs. Requested Procedure Description

• Change in procedure after case is started
The pilot phase

• The pilot of the ACR-SIR Fluoroscopy Dose Index Registry has 10 sites, including several sites performing substantial numbers of pediatric interventions

• Data collection began in early 2018 and is ongoing

• As of April 2019 we have collected 58,344 procedures
IR Registry

- Also part of NRDR
- Structured reporting templates for 60+ IR procedures
  - Designed to include structured information related to the clinical aspects of the procedure
- Desirable that dose indices be included in this report
  - Procedural dose indices are best understood in the context of procedural and patient factors
How do they fit together?

• Both registries use the ACR Triad server infrastructure

• IR Registry collects clinical data related to the procedure
  • Performing physician
  • Total procedural dose metrics, which are either dictated (common) or populated via HL7 feed from RDIM system (uncommon)

• Fluoroscopy Dose Index Registry collects dose data related to the procedure
  • From the Radiation Dose Structured Report, which includes detailed information about each irradiation event
  • RDSR also includes summary information, metadata, and correction factors

• It is desirable to link both data sources for a complete understanding of an interventional procedure
Including dose metrics in procedure report

• Manual dictation is cumbersome

• HL7 feed from RDIM system
  • Costs additional $$ to build out

• Link on the Triad server
Acknowledgments

• ACR Registries team, Department of Quality and Safety, IT
  • Chao Yen
  • Kay Zacharias-Andrews
  • Judy Burleson
  • Dustin Gress
  • Mike Simanowith

• Kevin Wunderle

• Don Miller and Steve Balter

• Pilot sites
ACR-SIR Fluoroscopy Dose Index Registry Pilot Sites

• University of Texas MD Anderson Cancer Center (A. Kyle Jones)
• Cleveland Clinic (Kevin Wunderle)
• Memorial Sloan Kettering Cancer Center (Usman Mahmood)
• Montefiore Medical Center (Alan Schoenfeld)
• Boston Children’s Hospital (Don-Soo Kim)
• University of Washington (Jeff Moirano)
• Emory University (Shalmali Dharmadhikari)
• University of Texas Southwestern (Xinhui Duan)
• Duke University (Steve Mann)
• New York Presbyterian/Weill-Cornell (Wendy Kresge)