

The ACR Fluoroscopy Dose Index Registry Pilot



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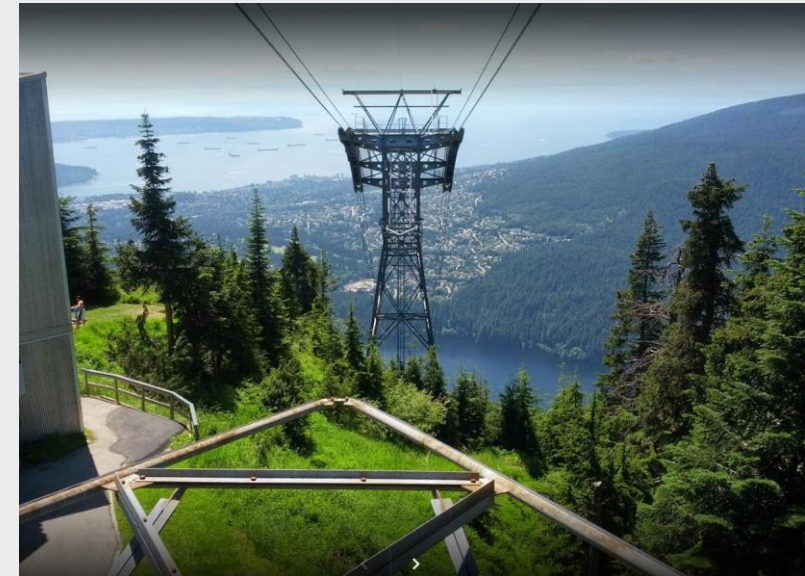


Disclosure

- 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

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



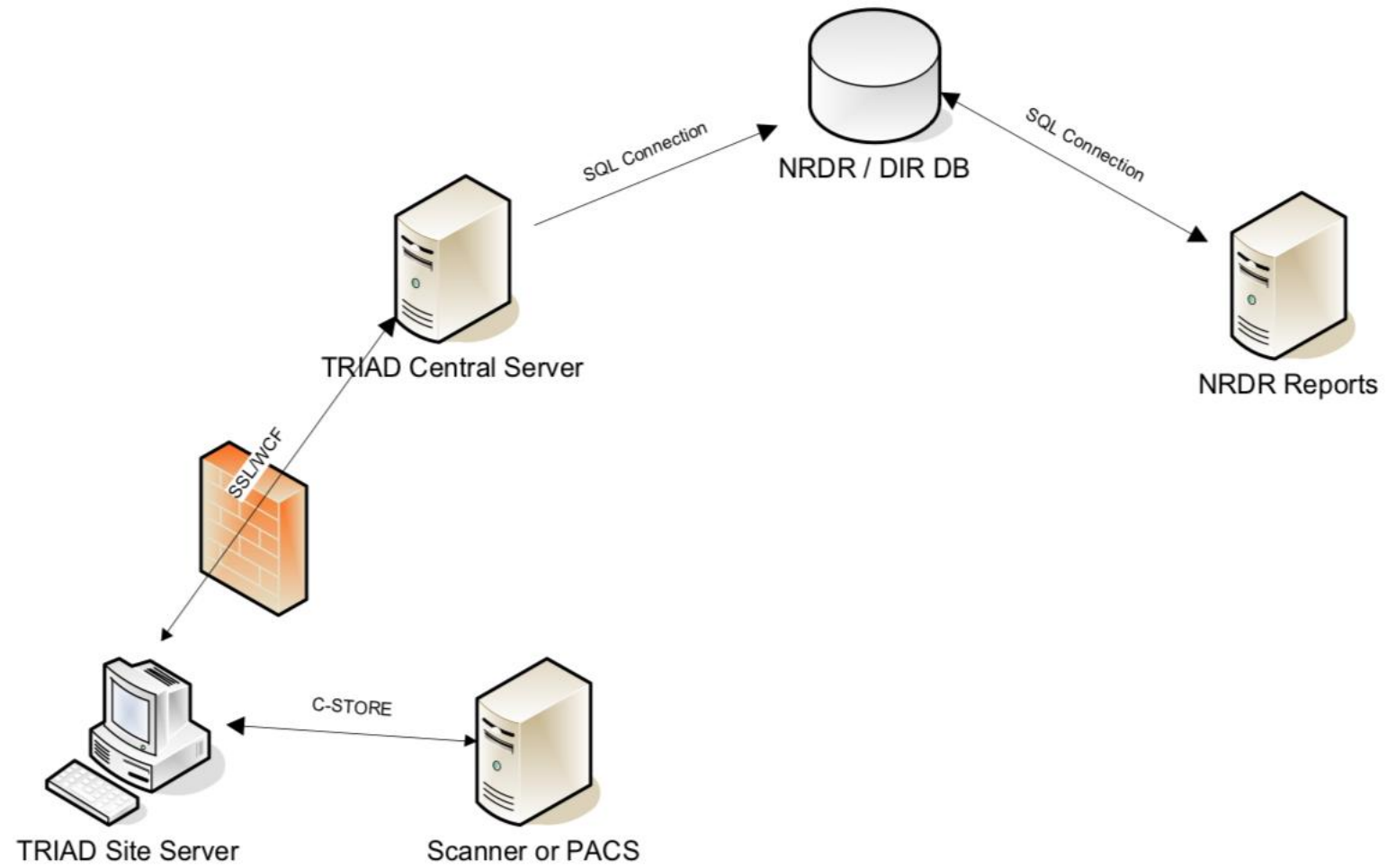
Normative datasets

- 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

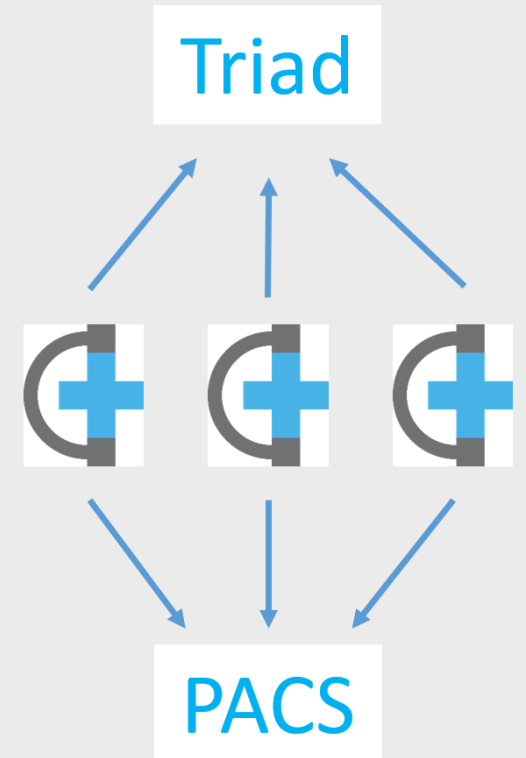
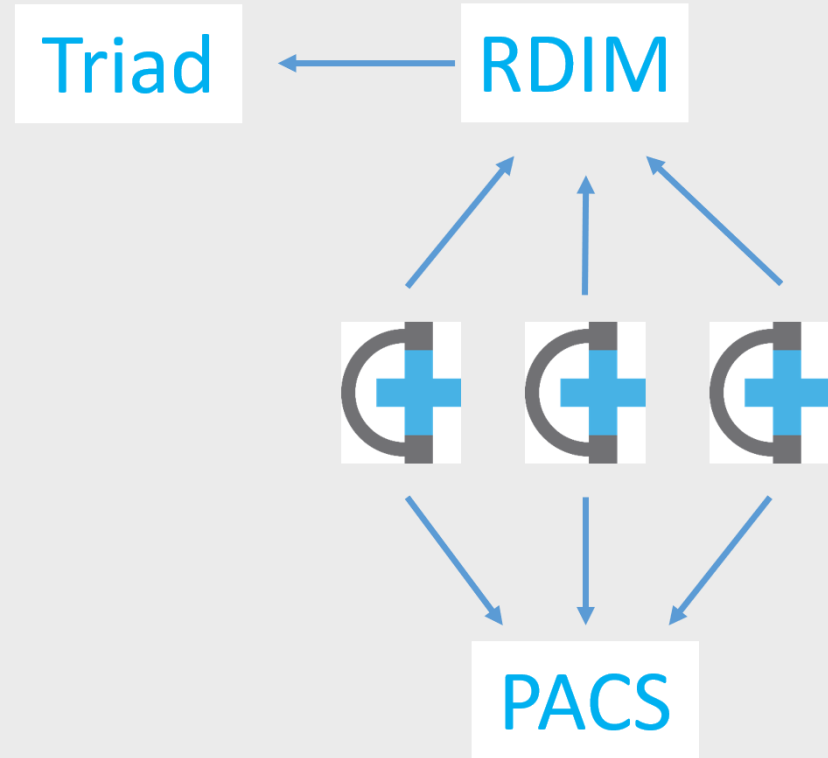
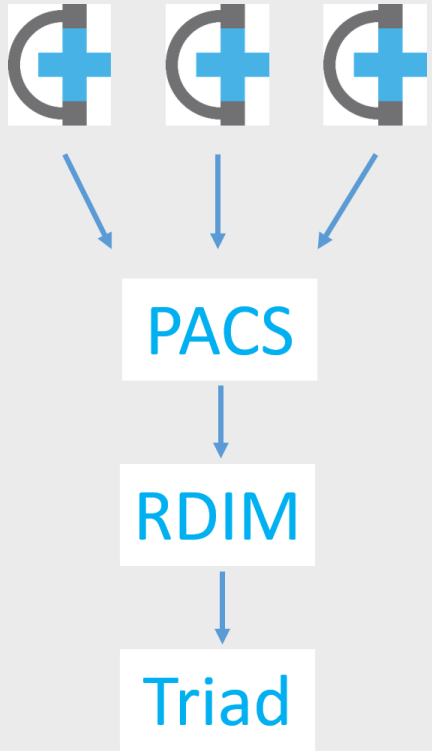


The need for a registry

- 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.



Triad User Guide



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
 - Only data format accepted

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
 - **Single point calibration factor for dose indices**
 - Stored and transmitted in the RDSR, but not applied to machine-reported 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™

RecordId	StudyDescription Requested Procedure Description	AcrCommonId	Status
6822	+++Native+++ IR GASTROSTOMY CATHETER EXCHANGE/RE-INSERTION	4011300 Inv-Fluoro, Gastrostomy Catheter Exchange, Abdomen, Stomach	Tagging Completed
85684	++Native++ IR PICC WITHOUT PORT/PUMP	4011653 Inv-Fluoro, Central Venous Catheter Placement, Peripherally Inserted, Unspecified	Tagging Completed
6849	++Pelvis++ IR EMBOLIZATION PELVIC	4011272 Inv-Fluoro, Artery Embolization, Pelvis, Pelvic Artery	Tagging Completed
85685	Abdomen IR JEJUNOSTOMY PLACEMENT DE NOVO	4011328 Inv-Fluoro, Jejunostomy Tube Placement, Abdomen-Pelvis, Jejunum	Tagging Completed
6863	BILIARY IR PLACEMENT BILIARY DRAINAGE CATHETER (INTERNAL-EXTERNAL)	4011338 Inv-Fluoro, Percutaneous Biliary Drainage Placement, Abdomen, Liver	Tagging Completed
6865	Biliary cath exchange 47536 Null	4011285 Inv-Fluoro, Biliary Catheter Exchange, Abdomen, Liver	Tagging Completed
6868	CENTRAL LINE PLACEMENT Null	4011269 Inv-Fluoro, Central Venous Catheter Placement, Tunneled, Chest	Tagging Completed
6870	CENTRAL VENOUS PLACEMENT Null	4011269 Inv-Fluoro, Central Venous Catheter Placement, Tunneled, Chest	Tagging Completed
6871	CHEST TUBE INSERTION Null	4011699 Inv-Fluoro, Chest Tube Placement, Chest, Lungs	Tagging Completed
6872	CHOLANGIOGRAM Null	4011342 Inv-Fluoro, Percutaneous Cholangiography, Abdomen, Liver	Tagging Completed
6873	CHOLE Null	4011292 Inv-Fluoro, Percutaneous Cholecystotomy Drain Placement, Abdomen, Gallbladder	Tagging Completed
43107	CT ABD BX NEEDLE IR SIR SPHERES-DIAGNOSTIC WITHOUT EMBO	4011596 Inv-Fluoro, Radioembolization Cir-Spheres, Abdomen-Pelvis, Visceral Arteries	Tagging Completed
6909	CT ABD BX NEEDLE IR RADIOEMBOLIZATION SIR SPHERES - TREATMENT	4011596 Inv-Fluoro, Radioembolization Cir-Spheres, Abdomen-Pelvis, Visceral Arteries	Tagging Completed
6910	CT ABD BX NEEDLE IR RADIOEMBOLIZATION THERASPHERES - DIAGNOSTIC	4011493 Inv-Fluoro, Radioembolization Theraspheres, Abdomen-Pelvis, Visceral Arteries	Tagging Completed
43202	CT ABD BX NEEDLE IR SIR SPHERES-TREATMENT	4011596 Inv-Fluoro, Radioembolization Cir-Spheres, Abdomen-Pelvis, Visceral Arteries	Tagging Completed
6890	CT ABD BX NEEDLE IR EMBOLIZATION RENAL ARTERY	4011275 Inv-Fluoro, Artery Embolization, Abdomen-Pelvis, Viscera	Tagging Completed
85689	CT ABD BX NEEDLE IR EMBOLIZATION SPINE	4011549 Inv-Fluoro, Tumor Arterial Embolization, Spine	Tagging Completed
6889	CT ABD BX NEEDLE IR EMBOLIZATION HEPATIC ARTERY	4011275 Inv-Fluoro, Artery Embolization, Abdomen-Pelvis, Viscera	Tagging Completed
6892	CT ABD BX NEEDLE IR EMBOLIZATION VISCERAL	4011275 Inv-Fluoro, Artery Embolization, Abdomen-Pelvis, Viscera	Tagging Completed
6891	CT ABD BX NEEDLE IR EMBOLIZATION SPLENIC ARTERY	4011387 Inv-Fluoro, Artery Embolization, Abdomen, Spleen	Tagging Completed
6901	CT ABD BX NEEDLE IR NEPHROSTOMY PLACEMENT	4011334 Inv-Fluoro, Nephrostomy Placement, Abdomen-Pelvis, Kidney	Tagging Completed
86229	CT GUIDE ABLAT IR THERASPHERES-DIAGNOSTIC WITHOUT EMBO	4011493 Inv-Fluoro, Radioembolization Theraspheres, Abdomen-Pelvis, Visceral Arteries	Tagging Completed
6931	CT GUIDE ABLAT IR EMBOLIZATION VISCERAL	4011275 Inv-Fluoro, Artery Embolization, Abdomen-Pelvis, Viscera	Tagging Completed

Search Exam

Exam:

	Exams
<input type="checkbox"/>	IR CT GUIDED VERTEBROPLASTY THORACIC&&IR CT GUIDED CRYOABLATION
<input type="checkbox"/>	IR DOBHOF TUBE PLACEMENT
<input type="checkbox"/>	IR DRAINAGE CATHETER EXCHANGE (RSI)
<input type="checkbox"/>	IR FL NON-TUNNELED CENTRAL VENOUS CATH PLCMNT&&IR EXTREMITY ARTE
<input type="checkbox"/>	IR FL SCLEROTHERAPY FLUID COLLECTION
<input checked="" type="checkbox"/>	IR INTRAPERITONEAL PLACEMENT (NON-TUNNELED)
<input type="checkbox"/>	IR OROGASTRIC FEEDING TUBE REPOSITION
<input type="checkbox"/>	NAILING FEMUR
<input type="checkbox"/>	OR 14 MASTECTOMY

Note: You can tag the selected exams by :
1) Assigning an ExamCode using the 'Search by Common Procedure'

Search by Common Procedure

Build your own mapping multiple

Mark selection as tagging completed

Search by Common Procedure

Search by Common Procedure

Anatomy

select

RPID

select

Body Area

Select options

Modality

select

Laterality

select

Modality Modifier

select

Synonym

select

Procedure Modifier

select

Search

Clear

		Exam Code	Short Name
<input checked="" type="radio"/>	<input type="radio"/>	4011269	Inv-Fluoro, Central Venous Catheter Placement, Tunneled, Chest
<input checked="" type="radio"/>	<input type="radio"/>	4011272	Inv-Fluoro, Artery Embolization, Pelvis, Pelvic Artery
<input checked="" type="radio"/>	<input type="radio"/>	4011275	Inv-Fluoro, Artery Embolization, Abdomen-Pelvis, Viscera
<input checked="" type="radio"/>	<input type="radio"/>	4011276	Inv-Fluoro, Artery Stent Placement, Neck-Chest, Common Carotid Artery
<input checked="" type="radio"/>	<input type="radio"/>	4011278	Inv-Fluoro, Artery Stent Placement, Lower Extremity, Femoral-Popliteal Artery
<input checked="" type="radio"/>	<input type="radio"/>	4011285	Inv-Fluoro, Biliary Catheter Exchange, Abdomen, Liver
<input checked="" type="radio"/>	<input type="radio"/>	4011286	Inv-Fluoro, Biliary Catheter Placement, Abdomen, Liver
<input checked="" type="radio"/>	<input type="radio"/>	4011288	Inv-Fluoro, Biliary Catheter Removal, Abdomen, Liver
<input checked="" type="radio"/>	<input type="radio"/>	4011290	Inv-Fluoro, Biliary Stricture Dilation With Stent Placement, Abdomen, Liver
<input checked="" type="radio"/>	<input type="radio"/>	4011292	Inv-Fluoro, Percutaneous Cholecystotomy Drain Placement, Abdomen, Gallbladder

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Assign procedure name

Common Procedure List

Export All To Excel

Export Audit Log

Search

Clear

Audit Log	Actions
<div>AuditLog</div>	Build your own mapping
<div>AuditLog</div>	Build your own mapping
<div>AuditLog</div>	Build your own mapping
<div>AuditLog</div>	Build your own mapping
<div>AuditLog</div>	Build your own mapping
<div>AuditLog</div>	Build your own mapping
<div>AuditLog</div>	Build your own mapping
<div>AuditLog</div>	Build your own mapping

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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
 - Tried our best to maintain synchronization with the SIR IR Registry

Site procedure	ACR Common name(s)	Requested change	Changes made to ACR Common Name(s)
Radioembolization	Sunset codes: 4011596 Inv-Fluoro, Radioembolization Cir-Spheres, Abdomen-Pelvis, Visceral Arteries 4011493 Inv-Fluoro, Radioembolization Theraspheres, Abdomen-Pelvis, Visceral Arteries	Create new codes: XXXXXXX Inv-Fluoro, Hepatic Radioembolization Prep, Abdomen, Liver XXXXXXX Inv-Fluoro, Hepatic Radioembolization Admin, Abdomen, Liver XXXXXXX Inv-Fluoro, Hepatic Radioembolization Combined, Abdomen, Liver	Codes requested to sunset have not been sunset
			<div>4012734 Inv-Fluoro, Hepatic Radioembolization Prep, Abdomen, Liver</div> <div>4012735 Inv-Fluoro, Hepatic Radioembolization Admin, Abdomen, Liver</div> <div>4012736 Inv-Fluoro, Hepatic Radioembolization Combined, Abdomen, Liver</div>
IR THORACIC DUCT EMBOLIZATION	Update code as described in Col C: 4011467 Inv-Fluoro, Lymphangiogram Cannulation, Chest-Neck, Thoracic Duct	Create new code: XXXXXXX Inv-Fluoro, Lymphangiography Interventions, Chest-Neck, Thoracic Duct Update code: 4011467 Inv-Fluoro, Lymphangiography, Chest-Neck, Thoracic Duct	
			<div>4012737 Inv-Fluoro, Lymphangiography, Thoracic embolization, Chest-Neck, Thoracic Duct</div>
			<div>4011467 INV-FLUOR, lymphangiography, chest-neck, thoracic duct</div>
IR ABDOMINAL AORTOGRAPHY	Update code as described in Col C: 4011572 Inv-Fluoro, Aortogram, Chest, Aorta	Update code: 4011572 Inv-Fluoro, Angiography Aorta, Chest-Abdomen-Pelvis, Aorta	<div>4011572 INV-FLUOR, aortography, chest-abdomen-pelvis, aorta</div>
IR CHOLECYSTOSTOMY TUBE EXCHANGE	does not exist	Create new code: XXXXXXXX Inv-Fluoro, Cholecystostomy Exchange, Abdomen, Gallbladder	<div>4012738 Inv-Fluoro, Cholecystostomy Exchange, Abdomen, Gallbladder</div>
BRONCHIAL ARTERY EMBOLIZATION	does not exist	Create new code: XXXXXXXX Inv-Fluoro, Bronchial artery embolization, Chest, Lungs	<div>4012739 Inv-Fluoro, Bronchial artery embolization, Chest, Lungs Bronchial arteries</div>
Renal artery embolization	This code exists but is not specific enough: 4011275 Inv-Fluoro, Artery Embolization, Abdomen-Pelvis, Viscera	Create code: XXXXXXX Inv-Fluoro, Renal Artery Embolization, Abdomen-Pelvis, Kidney	<div>4012740 Inv-Fluoro, Renal Artery Embolization, Abdomen-Pelvis, Kidney, Renal artery</div>
IR INTRAPERITONEAL PLACEMENT (NON-TUNNELED)	does not exist	Create code: XXXXXXX Inv-Fluoro, Peritoneal Catheter Placement, Non-Tunneled, Abdomen, Peritoneum	<div>4012741 Inv-Fluoro, Peritoneal Catheter Placement, Non-Tunneled, Abdomen, Peritoneum</div>
Biliary interventions	These seem to be duplicate codes: 4011286 Inv-Fluoro, Biliary Catheter Placement, Abdomen, Liver 4011338 Inv-Fluoro, Percutaneous Biliary Drainage Placement, Abdomen, Liver	Merge all procedures from 4011286 into 4011338 then Delete code: 4011286 Inv-Fluoro, Biliary Catheter Placement, Abdomen, Liver	4011286 Removed from ACR Common
Vena cava gram	These seem to be duplicate codes: 4011486 Inv-Fluoro, Venacavagram, Chest, Superior Vena Cava 4011601 Inv-Fluoro, Venogram, Chest, Superior Vena Cava	Merge all procedures from 4011486 into 4011601 then Delete code: 4011486 Inv-Fluoro, Venacavagram, Chest, Superior Vena Cava	4011486 Removed from ACR Common

Challenges with procedure mapping

- Mapping is not 1:1 (in both directions)
- Combined procedures
- Study Description vs. Requested Procedure Description
- Change in procedure after case is started
- Varying granularity in facility clinical procedure names

The pilot phase

- The pilot of the ACR-SIR Fluoroscopy Dose Index Registry has 9 sites, including several sites performing substantial numbers of pediatric interventions
- Data collection period ran from March 1, 2018 through December 31, 2019
- RDSR collected for over 100,000 procedures

First results: technical data

- 28 single plane and 10 biplane angiographic fluoroscopes
 - 16 Siemens
 - 14 Philips
 - 6 GE
 - 2 Toshiba/Canon
- Average year of manufacture: 2012 (2002 – 2019)

First results: technical data

- Correction Factors (actual/machine-reported) were stable over an 18 month period
 - Measured using TG 190 methods
- Mean difference between CF for FLU and ACQ was 0.03

Dose index (mode)	Mean (95% CI)
$K_{a,r}$ (FLU)	0.94 (0.92 – 0.96)
P_{KA} (FLU)	0.95 (0.93 – 0.96)
$K_{a,r}$ (ACQ)	0.96 (0.93 – 0.98)
P_{KA} (ACQ)	0.98 (0.95 – 1.00)

Participation guide white paper

- Directions to key NRDR resources on the ACR website
- Guidance for assembling your DIR team
- Pitfalls and pearls from the pilot

The next piece of the puzzle

- We knew going in that collecting data as part of a registry was going to be challenging
 - Varying states of facility clinical procedure names
 - Procedure can evolve during the case
 - Likely unable to collect data on operator, a major variable that affects procedural dose indices
- However, there are some exciting developments coming with ACR Connect

Acknowledgments

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