MetroHealth

Diagnostic Practice Models

Ryan Fisher – The MetroHealth System, Cleveland Ohio

David Gauntt – University of Alabama Birmingham Medical Center

Rebecca Milman – University of Colorado

Josh Wilson – Duke University Medical Center

Overview

Be the session you want to see in the conference…

I always appreciate "how I test X equipment" conference talks to see how other people do things.

Wanted to zoom out and look at how other physics groups at academic medical centers tackle their overall workload on a system-wide scale.
We all face similar issues, including:

- Annual testing
- Policies, procedures, protocols
- Other clinical duties
- Inspections
- Teaching
- Academics, research, volunteering

The goal of this session is to have a conversation between physicists to see how things are handled

MetroHealth

Cleveland!

Academic medical center, county hospital, & Level 1 Trauma Center, in downtown Cleveland, Ohio

Main campus hospital with ~ 850 beds
- 2 larger satellite medical centers
- ~ 17 smaller health centers with imaging
- 3 affiliated imaging centers outside of "MetroHealth"

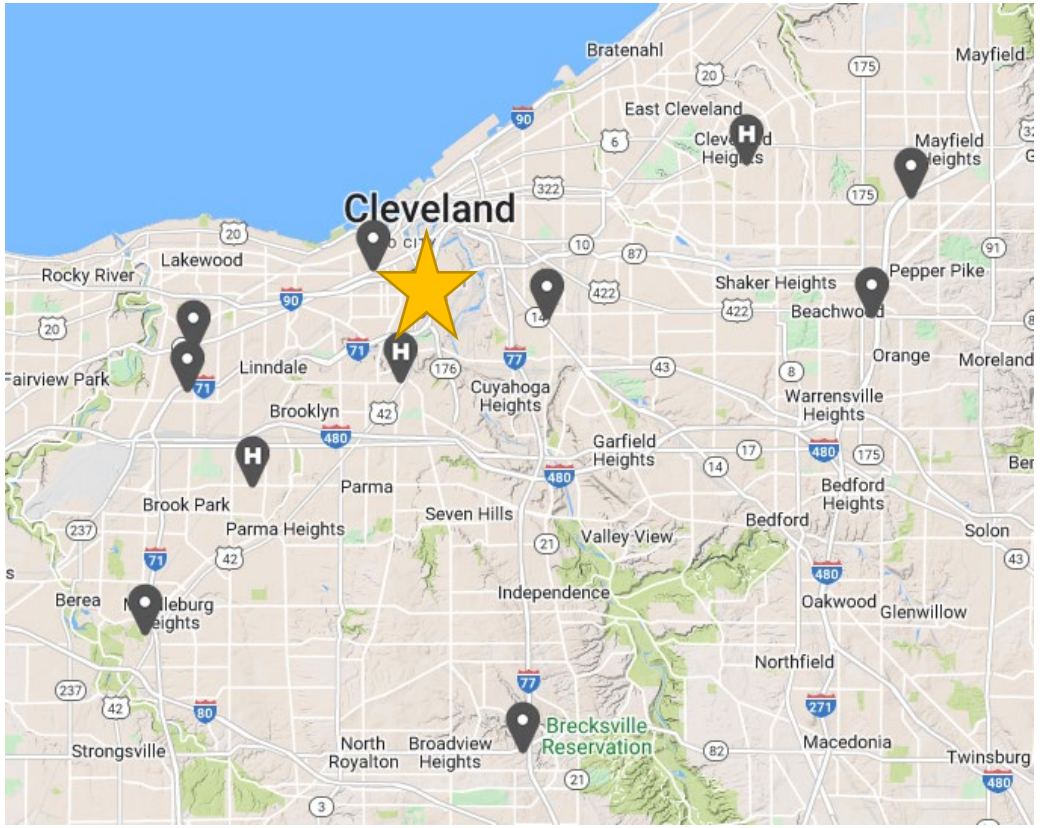
~ 35 Radiologists

~235 total pieces of imaging equipment
- ~ 90 of those at a Main Campus
- the rest scattered across satellites sites, most of which within ~ 20 min drive

Affiliated with Case Western Reserve University School of Medicine

Radiology residency with 20 residents & another 8 in IR/DR & ESIR shared program

No medical physics residency or graduate programs



~ 10 mi

MetroHealth

MetroHealth

Staffing etc.

Two full time physicists, housed in the Department of Radiology

Cover all x-ray imaging equipment in the system regardless of department.

3 affiliated imaging centers that are treated as if they were ours

No separate radiation safety group, We serve as the RSO & ARSO
Oversee occupational badging, RAM use, survey meter calibrations, etc.

Currently have a very squishy practice model, where we both cover all modalities and share pretty much all responsibilities

Me!

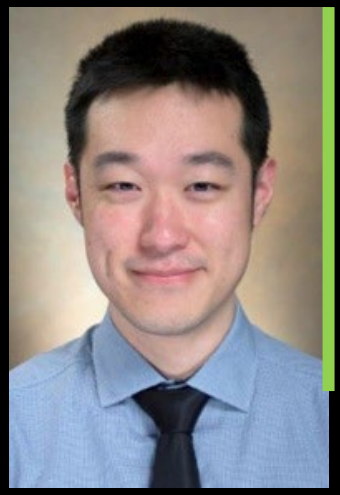
David Hoeprich!

MetroHealth

Anschutz

RAD SCIENCES

Mark Brown, Ph.D.



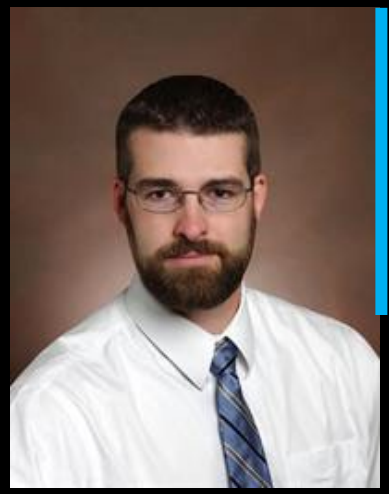
Henry Chen, Ph.D.

Harry Hu, Ph.D.

Donglai Huo, Ph.D.

Rebecca Milman, Ph.D.

Ann Scherzinger, Ph.D.



Mike Silosky, M.S.

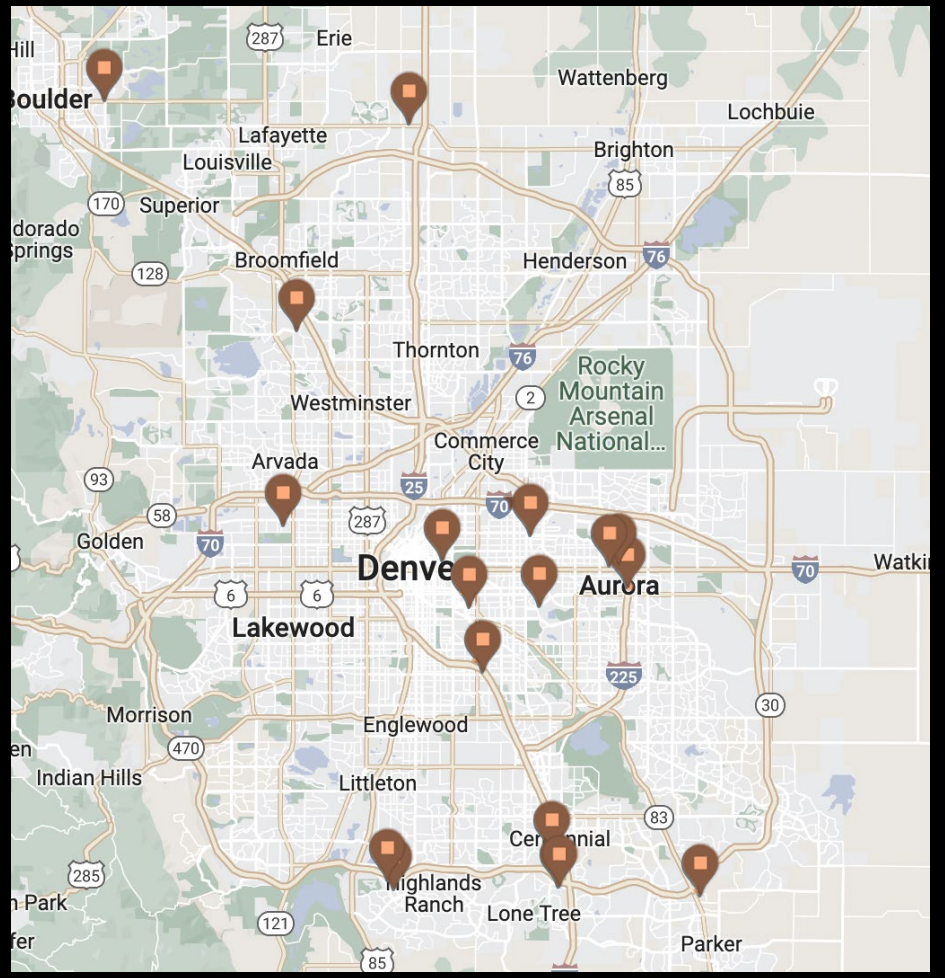
W. Siman, Ph.D.

Wei Zhou, Ph.D.

University of Colorado
Anschutz Medical Campus

CU Imaging Physics

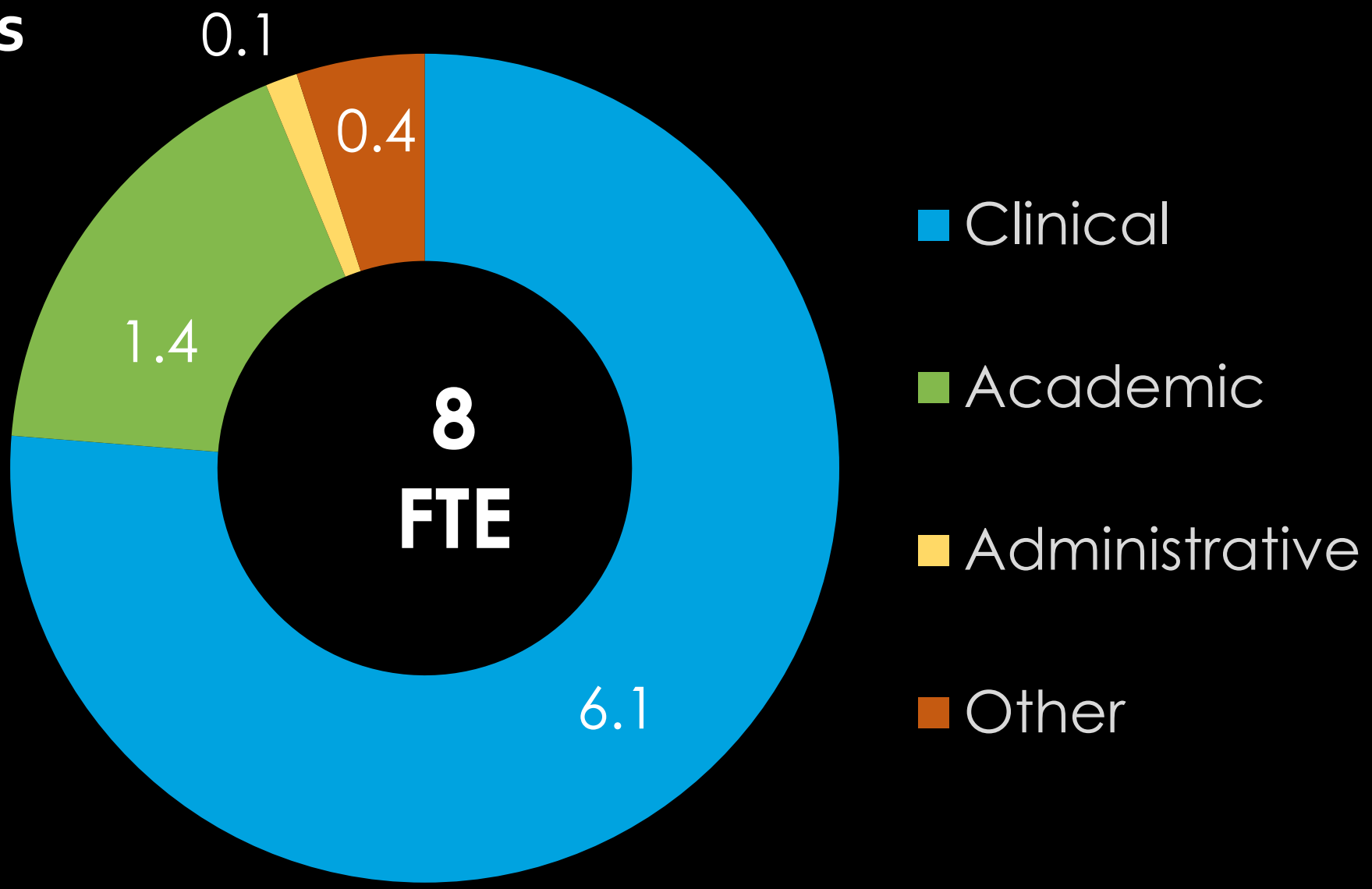
UCHealth	Anschutz	7
	South Metro	4
	Cherry Creek	1
CHCO	North	2
	South	3
	Anschutz	4



2 Health Systems — 21 Facilities — ~ 380 Pieces of Equipment

University of Colorado
Anschutz Medical Campus

CU Imaging Physics FTE Distribution



University of Colorado
Anschutz Medical Campus

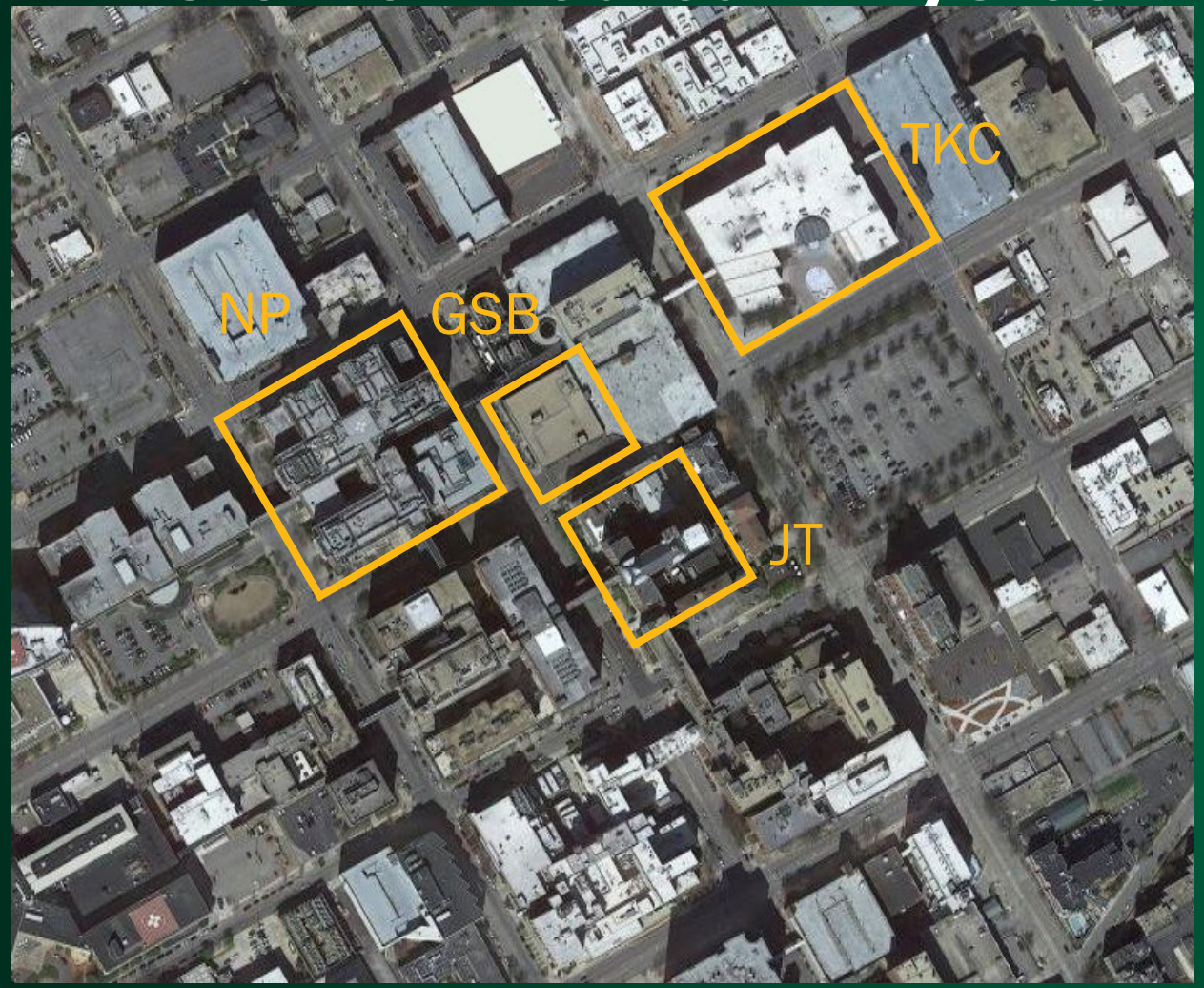
University of Alabama at Birmingham Medical Center
Division of Medical Physics

Department of Radiology
Divisions

Diagnostic Radiology	Molecular Imaging and Therapeutics	Medical Physics and Engineering	Advanced Medical Imaging Research
~ radiologists	7 MD Faculty	8 PhD Faculty	7 PhD Faculty
~75 MD Faculty & Fellows	1 Fellow	2 residents	
38 residents			

~107 modality units (x-ray, MRI, NM, etc)
134 diagnostic review workstations

University of Alabama at Birmingham Medical Center
Division of Medical Physics



GSB - General Services (MP offices)

TKC - Kirklin Clinic (outpatient)

NP - North Pavilion (main hospital)

JT - Jefferson Tower (MD offices, nuclear medicine)

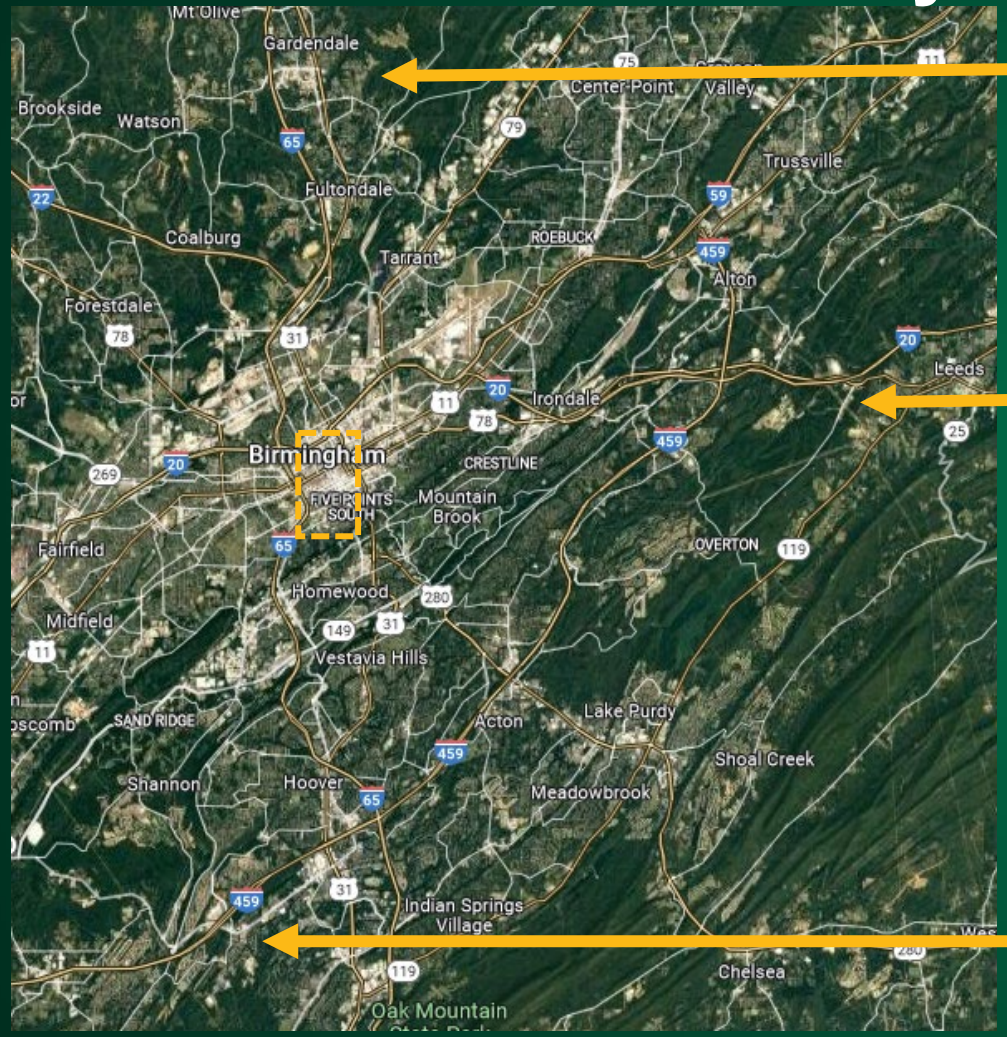
University of Alabama at Birmingham Medical Center Division of Medical Physics

Protective Stadium (UAB Football)

UAB Urgent Care

Highlands Hospital (Emegency, outpatient, orthopedics)

University of Alabama at Birmingham Medical Center
Division of Medical Physics



Gardendale Clinic (outpatient, emergency)

Leeds clinic (outpatient)

Hoover Clinic (outpatient)

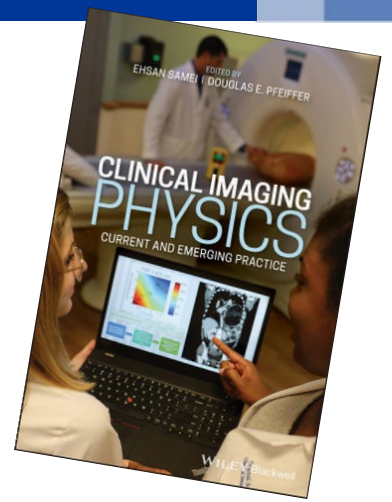
UAB MEDICINE

2008 Duke Clinical Imaging Physics Group (CIPG) Founded

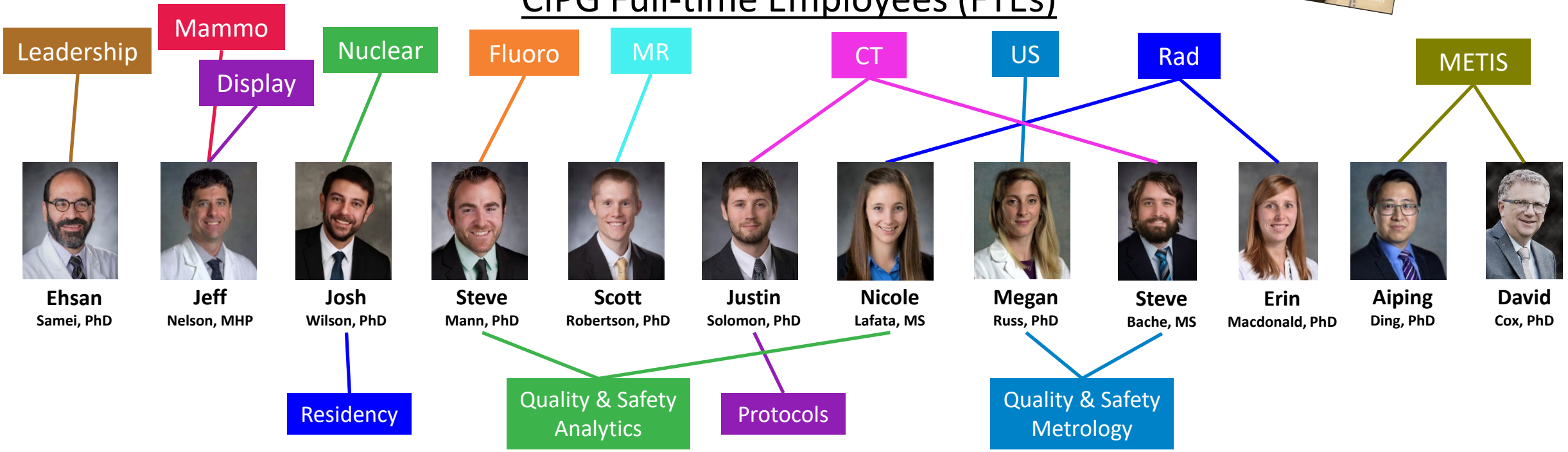
2010 Residency started

2016 Expand to Duke Raleigh and Duke Regional Hospital

2020 "Clinical Imaging Physics: Current and Emerging Practice" published

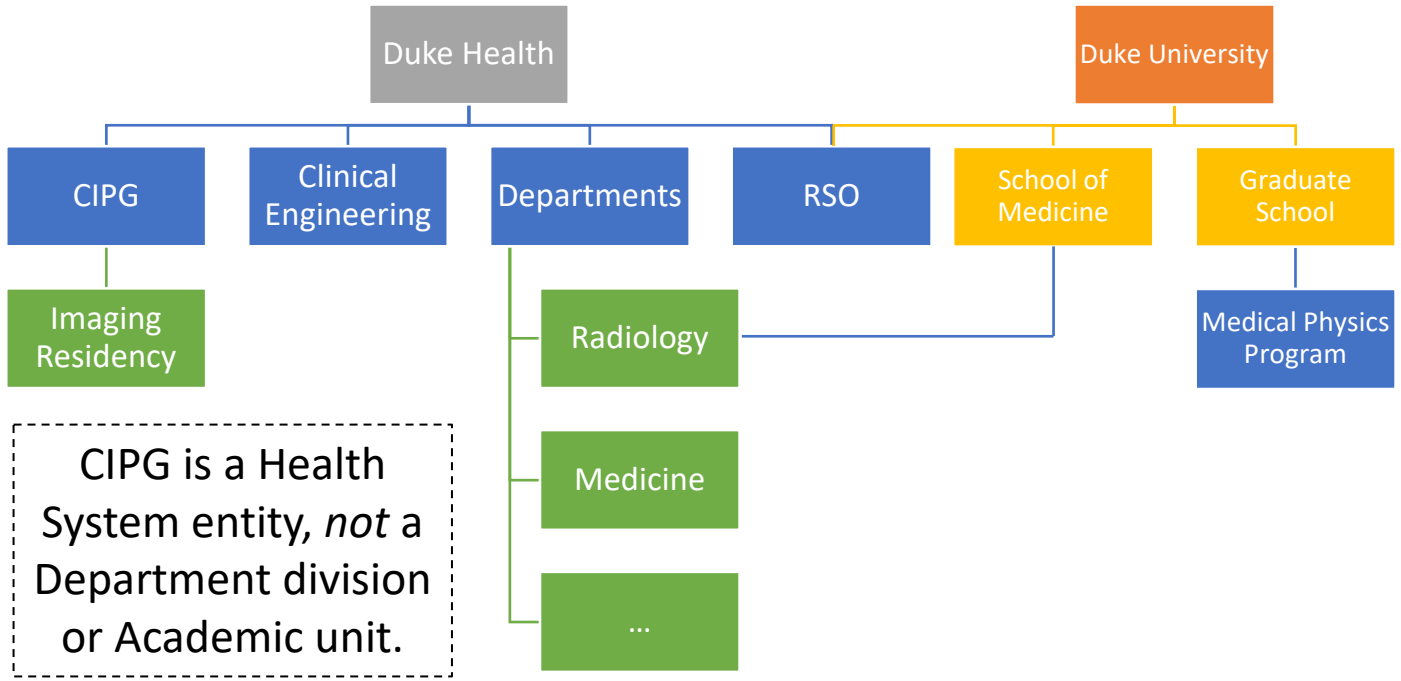


CIPG Full-time Employees (FTEs)



Also: 2 residents, 1 research associate, 5 graduate student interns

CIPG in Org Chart (approx.)



Duke Health

- One academic medical center
- Two community hospitals
- Twenty-one outpatient imaging centers
- Over 400 imaging systems

Department of Radiology

- Partially Health System, partially SOM

Radiation Safety Office

- Partially Health System, partially University

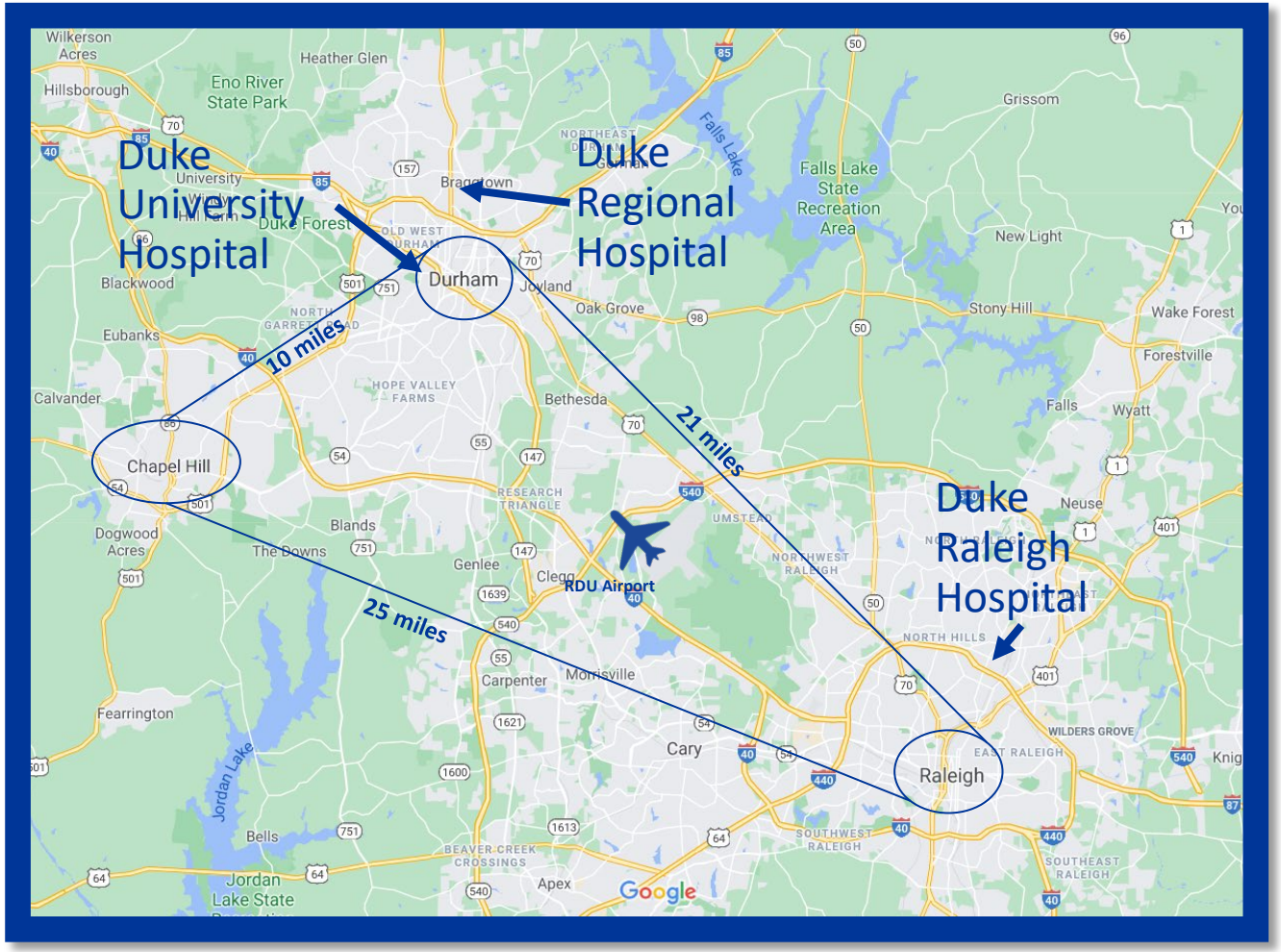
Med Phys Graduate Program

- 7 / 11 FTEs are Faculty

CIPG Coverage

Duke Hospitals in the Triangle

(>20 additional facilities with imaging not shown)



Ensuring precise quality, safety, & optimality

Prospective performance assessment

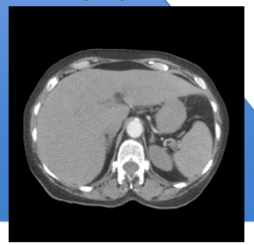
Quality by inference

Prospective protocol definition

Quality by prescription

Retrospective quality assessment

Quality by outcome



Institution Size

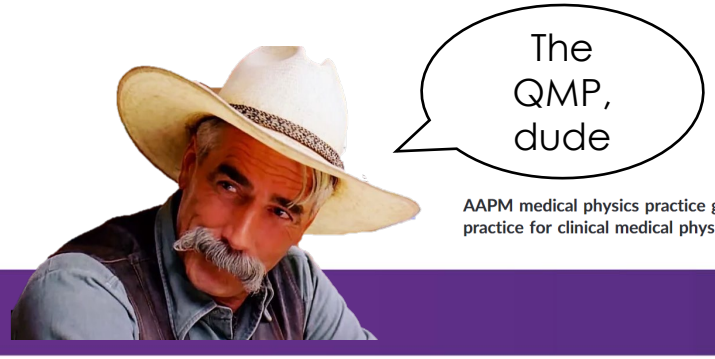
	MetroHealth	Colorado	Duke	UAB
# of Physical Sites Covered	23	21	39	7
Average distance from primary office	~ 10 miles	5 – 10 Miles	~ 10 – 20 miles	<1/2 mile
Furthest distance from primary office	30 miles	32 miles	41 miles	17 miles

Equipment

Equipment #s	MetroHealth	Colorado	Duke	UAB
CT Scanners	16	22	43	20
MRI Scanners	8	16	22	15
FGI Suites	7	23	29	27
Other Fluoroscopy Units	31	83	93	56
Mammography Units	8	10	20	9
Radiography Units	52	85	167	54

Physics Staffing

	MetroHealth	Colorado	Duke	UAB
# of FTE physicists	2	8	24	8
# of clinical FTE physicists	2	6.1	10	8
# Physics Residents	0	0	2	2
# of Medical Physics Assistants	0	0	0	0
Administrative support	0	0.2	2	1



AAPM medical physics practice guideline 10.a.: Scope of practice for clinical medical physics

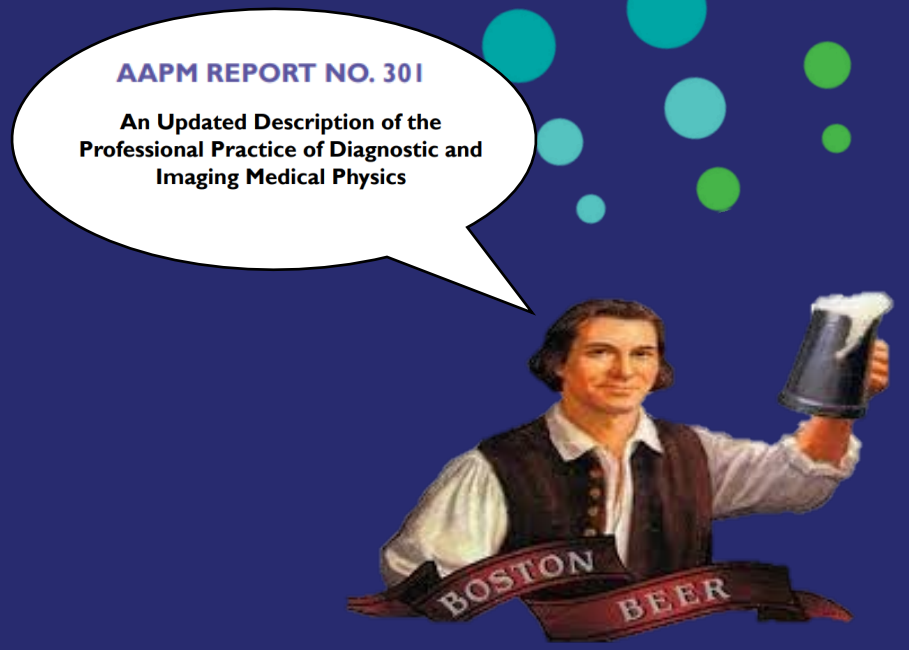
Radiation Safety Department

Is there a separate Radiation Safety group at your institution?

MetroHealth	Colorado	Duke	UAB
No separate Radiation Safety Dept. We cover all RAM, audits, survey meter calibrations, occupational dosimetry, etc.	Our group covers patient-related rad safety issues, and the Radiation Safety covers employee-related issues.	Radiation Safety is a separate division, covering both the university and health system.	Separate RSO office covers both the medical system and the university

Level 1 Services

Annual Testing



Annual Testing

How are annual testing duties divided among staff?

MetroHealth	Colorado	Duke	UAB
No specific designations. Right now, my colleague handles most general radiography and lower end fluoro. We split mammo to keep up on #s and often tag team CTs/MR/FGI testing.	Divided by both modality and site for non-MRI & NM. "Lead physicist" for each site who is responsible for dealing with admin. and ensuring testing is getting done. Also have "modality leads" serving as the "expert".	Primary physicist for each modality who oversees testing, training, QC, etc., with additional support depending on the pieces of equipment. They determine how system testing responsibilities are divided. We all work in more than 1 modality.	By modality. 2 specialize in MRI 1 specializes in NM 4 share US, R&F, FGI, and CT

Annual Testing – Non X-ray Modalities

MRI

What is your group's involvement in MRI beyond ACR/annual testing?

	MetroHealth	Colorado	Duke	UAB
Do you have any dedicated MR scientists?	No	Yes - 1 dedicated MR scientist and another physicist who provides MR support and other general diagnostic support.	Yes	Yes; two dedicated MR
Is anyone in your group serving as the MR safety expert/officer?	Yes. I'm MRSE, but we're both certified	Yes	Yes	No, Tech is MRSO

Annual Testing – Non X-ray Modalities

Nuclear Medicine

Does the physics group handle nuclear medicine testing?

MetroHealth	Colorado	Duke	UAB
Yes, we handle all annual equipment testing, survey meter calibrations, quarterly audits, etc. Have consultant help with audits	Board-certified NM physicist who does all of the annual equipment testing, quarterly hot lab testing, and other NM clinical support. He and another NM physicist support Y90 radioembolization procedures	All evaluations performed for imaging equipment (PET, SPECT, gamma camera); thyoid uptake probe, well counter, and dose calibrators evaluated annually. However, the RSO manages the routine dose calibrator checks and survey meter checks.	Yes, we test NM equipment.

Annual Testing – Non X-ray Modalities

Ultrasound

How is ultrasound testing handled at your facility?

MetroHealth	Colorado	Duke	UAB
US tech handles testing for radiology/accredited units and we review reports	We have a physicist who tests each of the ACR-accredited US units on an annual basis.	Transducer and units that are owned and operated in Departments that we service are tested by us.	Divided among 4 physicists

Annual Testing – Non X-ray Modalities

Radiologist Workstations

Does your group test non-mammo diagnostic workstations?

MetroHealth	Colorado	Duke	UAB
No. In the process of getting online QA set up and will have some oversight through that, but Radiology IT handles these	No annual testing. Acceptance testing & set up polices on Barco QA Web	Yes, all primary displays are evaluated per TG-18 recommendations.	Physics division tests all mammo units; Radiology Informatics test all other diagnostic workstations.

Annual Testing

Outside Departments

Does your group test imaging equipment outside of radiology? (cardiology, dentistry, etc)

MetroHealth	Colorado	Duke	UAB
Yes, all equipment in system & a few technically outside	We test everything except the CT sims and on-board imaging devices for linear accelerators.	Some. Cardiology has several MRIs and their own physicist. We do test some units in other departments on an a la carte arrangement	Yes, Cath labs, endoscopy, dental, CT simulator

Annual Testing

Nuts & Bolts

- What do you use to keep track of upcoming annual testing?
- Annual Testing Templates
  - Are they standardized across the group?
  - How are changes implemented, & how often?

Annual Testing

Text Box

Nuts & Bolts

Select Month:	March	22	Total units										
		7	Left to test										
All equipment due shows up down here:													
Site	Type	Manufacturer	Model	Serial #	Area / Location	Floor/Building	Room	Phys ID#	Contact	Last Year Eval Date	Done?	Days Left	< days left
Broadway	D01	Planmeca	Intra	IXRF98286	Dentistry	1st	1095	7	Carmen Pagen	3/29/2021	3/3/2022	--	
Broadway	D01	Progeny	Preva	L1047805	Dentistry	1st	1096/1097	8	Carmen Pagen	3/29/2021	3/3/2022	--	
Broadway	D01	Progeny	Preva	L1079444	Dentistry	1st	1116/1117	9	Carmen Pagen	3/29/2021	3/3/2022	--	
Broadway	D01	Progeny	Preva	L1079304	Dentistry	1st	1117/1118	10	Carmen Pagen	3/29/2021	3/3/2022	--	
Broadway	D01	Progeny	Preva	L1021690	Dentistry	1st	1118/1119	11	Carmen Pagen	3/29/2021	3/3/2022	--	
Broadway	D01	Progeny	Preva	DG04351	Dentistry	1st	1094	12	Carmen Pagen	3/29/2021	3/3/2022	--	
Broadway	D02	Planmeca	Promax	RPX251235	Dentistry	1st	1111	13	Carmen Pagen	3/29/2021	3/3/2022	--	
Correctional Health	D01	Progeny	Preva	DF 83290	Dentistry	6th	--	31	Carmen Pagen	3/31/2021		51	
Correctional Health	D02	Planmeca	Promax	RPX250910	Dentistry	6th	--	32	Carmen Pagen	3/31/2021		51	
Correctional Health	M01	Siemens	Multix Select DR	10558	Radiology	6th	6D20	33	Laurel Domanski-Diaz	3/31/2021		51	
Correctional Health	M02	GE	AMX+	138159TX9	Radiology	6	Mobile	239	Vicky	3/31/2021		51	
Main	M03	GE	Lunar Prodigy	65882	Radiology	Spec. Pav. 1	1318	74	Irina Tvardovskaya	3/1/2021	3/9/2022	--	
Main	M05	Hologic	Selenia Dimensions DBT	81009121806	Radiology	Spec. Pav. 1	1334	83	Kelly Vogel	3/30/2021	2/22/2022	--	
Main	M07	GE	Precision P500D	1027127WK8	Radiology	G Core	Room 10	84	Kim Poff	3/22/2021	3/8/2022	--	
Main	M07	GE	Precision P500D	1026729WK2	Radiology	G Core	Room 11	85	Kim Poff	3/24/2021	3/4/2022	--	
Main	M11	Hologic	Fluoroscan Insight FD	10-0713-13	Surgery	CCP 1	Mobile	101	Jackie Rodriguez	3/5/2021	3/9/2022	--	
Main	M10	OEC	Elite CFD 21cm	FAXXTE00272	Surgery	CCP1	Mobile	235	Jackie Rodriguez	3/9/2021	3/9/2022	--	
Main	M10	OEC	Elite CFD 21cm	FAXXTE00271	Surgery	CCP1	Mobile	236	Jackie Rodriguez	3/9/2021	3/9/2022	--	
Main	M11	OEC	Elite MiniView	3B5SU2100025H	Surgery	CCP 1	Mobile	238	Jackie Rodriguez	3/25/2021	3/9/2022	--	
Mobile Mammo	M05	Hologic	Selenia Dimensions	SDM131900693	Radiology	Van	1	190	Kelly Vogel	3/5/2021		25	
Parma	M11	OEC	Elite MiniView	3B5SU2100036H	Radiology	1st	Ortho	237	Megan Richards	3/25/2021		45	
West 150th	M10	OEC	9800 Plus 9"	8S-1988	Surgery	1st	Mobile	155	Vicky	3/10/2021		30	

Post Repair Testing

- What equipment/scenarios do you test prior to patient use?
  - Mammo fairly standardized
  - Others can depend on accreditation or state requirements (CT & MR by ACR, No fluoro accreditation)
- How deep is coverage for post repairs?

Level 2+ Services

Image Quality, Protocols, Policies, Procedures, Dose tracking, Etc.

Image Quality & Protocol Adjustments

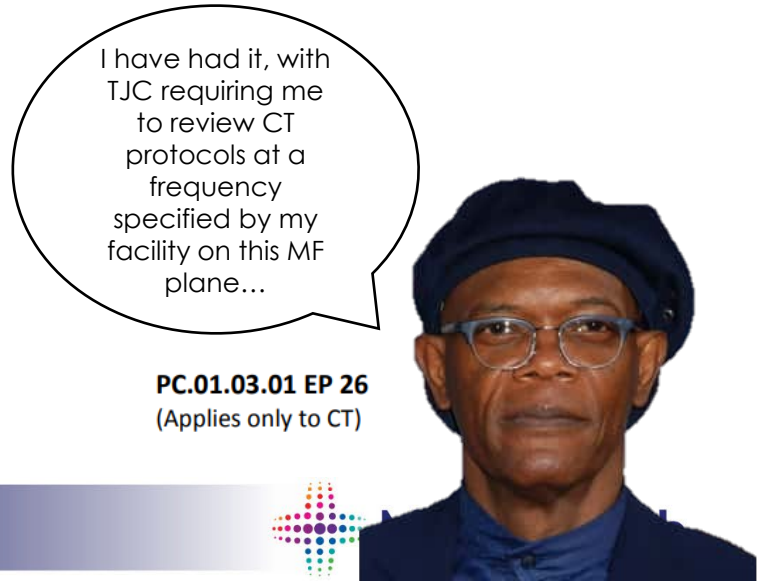
	MetroHealth	Colorado	Duke	UAB
How are modality specific image quality issues handled?	Shared based on current bandwidth	This is typically addressed by the modality lead. For gen rad, it's typically addressed by whoever covers that site.	These are shared within the modality groups. Each modality adopts their own strategies based on need.	Individual physicists specialize by modality
How are protocol issues or adjustments handled?	Changes flow through a protocol committee with rads, techs, physics, & admin. Both of us are on the committee	The modality leads typically deal with protocol issues. We often consult each other if needed.	Working group of physicists dedicated to protocol issues. They work with the department technologists and radiologists to develop and review protocols.	Individual physicists specialize by modality

CT Protocol Review

How are you handling CT protocol review?

- Do you have a process for verifying what's on the scanner?

Do you have a formal protocol review process for any other modalities?



Policy

- Who's responsible for making policy changes?
- Modality specific vs more general
  - Updating FGI patient follow up policy
  - Updating patient shielding policy
  - Pregnancy testing policy

Shielding Design & Verification

Text Box

Handled by the modality lead, site lead?

MetroHealth	Colorado	Duke	UAB
Shared based on current bandwidth	The lead physicist at the pediatric hospital typically does the shielding design for that facility, and I do most for all UCHealth facilities. Other physicists will help with larger projects (i.e., new sites).	Shielding is handled by the Radiation Safety office.	Some physicists do shielding; others do not

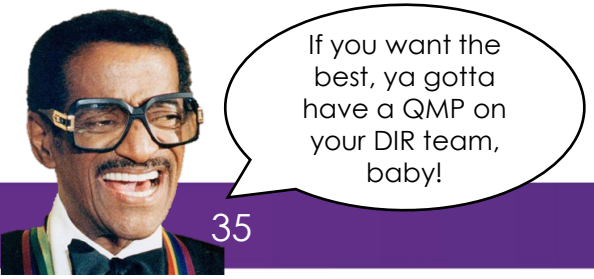
Patient Dose Estimates

Fetal dose estimates, Peak Skin Dose estimates, etc.

MetroHealth	Colorado	Duke	UAB
Shared based on current bandwidth	The peak skin dose & fetal dose estimates are divided similarly to the shielding design - the lead physicist for the pediatric hospital addresses those, and I address the UCHealth cases.	There is a working group of physicists from among the modalities who are dedicated to dose review and calculations. This is also partially shared with the Radiation Safety Office depending on the circumstances.	1 physicist does most patient dose estimates

Dose Tracking

	MetroHealth	Colorado	Duke	UAB
Do you have some sort of dose tracking program in place?	Yes. Not commercial. Excel/matlab/python based systems. Both works in progress	Yes (Imalogix at UCHealth, DoseMonitor at Children's Hospital)	Yes. A homegrown system, codename METIS. We also participate in the ACR DIR.	Yes. Philips DoseWise
Details of what modalities are included & who has access & responsibility	CT and FGI only. Shared responsibility. I made the FGI one, Dave made the CT one. In different programming languages	CT and angiography are included; physicists and radiation safety have access. The program is led by physics.	Modalities include Radiography, Fluoroscopy, Mammography, CT, Nuc Med. All MP staff have access.	CT, interventional fluoro. All MP faculty have access, one has primary responsibility



IT – Informatics Resources

- What type of IT/Informatics resources do you have?
  - Any specific to physics or Radiology more broadly?
- Issues with divisions between hospital and university sides of organization?
- What's in the scope of practice for a clinical physicist?

Inspection Support

- Do does your group provide inspection support?
  - On site during inspections?
  - Prep work ahead of time?

Group Communication

Text Box

Meetings, etc.

How does your group communicate?

MetroHealth	Colorado	Duke	UAB
Pretty straightforward with two people. Occasionally have "projects" type meeting where we review status of ongoing efforts	We used to meet in person every other week, but with COVID we switched to meeting remotely once a week. We recently went back to meeting every other week and plan to go back to meeting in person next month.	Verbally in shared office space, in-person staff meetings, virtual group meetings, email, Slack messaging, texting, and phone calls. We have discussed our respective preferred modes of communication and try to respect those preferences.	Both regular Zoom meetings and e-mail; in-person expected to resume. All offices in the same area.

Miscellaneous

	MetroHealth	Colorado	Duke	UAB
Favorite snack?	Nachos	Popcorn, but from the hot air popper NOT microwaved!!	Chex Mix (Bold)	Corn chips
Drink of choice?	Coffee, might not be a choice at this point. Manhattans.	Wine.	Coffee	Porter. The darker the better.
Favorite batman?	Keaton > West > Bale	Michael Keaton	Tom Holland (Marvel is superior to DC)	Adam West; Michael Keaton a close second.

Teaching

Medical Physics Graduate Program

Do you have one?

	Duke
Do you have a MP graduate program?	Yes
If yes, details on # of students, any student participation in clinical duties, etc.	The graduate program accepts about 15 MS and 2-4 PhD students per year. The majority are involved in radiation therapy or imaging research; only 1-2 do a clinical imaging internship with our group.
If yes, details on how graduate teaching responsibility is divided among MP staff	MP staff must apply to be faculty in the Graduate Program. MP staff can engage with the program as instructors based on personal interest.

Medical Physics Residency

Do you have one?

	Duke	UAB
Do you have a MP residency ?	Yes	Yes
Details on # of residents, length of program, resident contributions to annual testing, etc.	1 resident per year on average; 2 year program; Partial support during first of residency while in clinical rotations; Full support of a few systems during second year.	2 residents, 2 years. Residents do annual testing, some teaching and research, receive some didactic training
Details on how residency teaching responsibility is divided among MP staff	The residency program director, assistant director, and steering committee are drawn from 6 clinical MP staff. These 6 along with another handful conduct modality rotations, similar to how modality evaluations are divided.	All faculty teach all MP residents

Radiology Residency

Do you have one? Yes!

	MetroHealth	Colorado	Duke	UAB
# of residents	20 Rad residents, + 4 IR/DR residents & 4 IR fellows in shared program	About 45 residents.	52 (10 diagnostic plus 3 IR per class, PGY 1-4)	38 residents
# of annual lectures	~ 15-20 lectures a year	~ 40 lectures/year	Varies by physicist	135 lectures/year
How is teaching responsibility divided among MP staff?	1-2 lectures per month. Mostly me w/ colleague handling several	We each teach a handful of lectures. They're not divided evenly, but everyone does some teaching.	Physics teaching is shared between clinical MP staff and department research faculty.	All faculty teach all radiology residents, divided by modality specialization

Radiology Residency

Curriculum

	MetroHealth	Colorado	Duke	UAB
Curriculum layout	1 year curriculum that repeats every year. 1 -2 noon conference lectures per month to all residents, & more intensive 3rd year cram sessions for the core. Hands on modality demos as well	Content tailored to each resident year. 1st year is basics into and lots of equipment demos and building from there. Mix of in person and pre-recorded lectures.	Varies by physicist & includes research faculty as well.	1st years get 2-3 months of basics in daily lectures & labs 2nd year gets more in depth 3rd year board review classes

Research & Professional Society Activities

Research & Professional Society Activities

Publish or perish?

	MetroHealth	Colorado	Duke	UAB
Are MP staff encouraged or required to publish or volunteer time for professional organizations?	Encouraged, not required, but needed for academic promotion	Encouraged, not required, but needed for academic promotion	Yes	Academic productivity part of annual evaluations, needed for academic promotion, but not going to get fired for not
Do MP staff receive protected time for these activities?	No	Technically, we get time for "academic" work. This encompasses anything not clinical - research, teaching, volunteer work, etc	No	Yes, not formalized, but we are encouraged to engage in these activities

Big Picture

What Works Well With Your Practice Model?

- Good communication & everyone on the same page
- Group works well collaboratively & willing to step in if someone needs additional help
- Each member has leadership responsibilities, either within a modality or at a specific site
- Low turnover rate in the group
- Close integration with informatics

What Challenges Do you Face?

- System size growing faster than physics group size
- Geographical expansion
- Non-centralized hospital management
- Bandwidth for new projects
- Changing bandwidth per modality as regulatory/accreditation requirements change


MetroHealth