

FELLOWS-IN-TRAINING & EARLY CAREER PAGE

# Building Bridges in Cardiology and Radiology

## Why Collaboration Is the Future of Cardiovascular Imaging



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In 1976, an unknown early-career 37-year-old Swiss cardiologist submitted a research poster to the American Heart Association Scientific Sessions. The poster was rejected in the cardiology section, but found a welcome home in the radiology portion of the meeting (1). This initial seminal work of Dr. Andreas Gruentzig, demonstrating the first coronary angioplasty in dogs, was later translated to humans. In 1977, Dr. Gruentzig presented his first 4 human angioplasty cases to astonishment and a standing ovation and revolutionized the treatment of coronary artery disease. Thus, one might say that this bedrock of modern cardiology and interventional cardiology arose out of an important collaboration with radiologists and was led by an early-career cardiologist.

Moving to the present day, Narula et al. (2) note in COCATS 4 Task Force 4: Training in Multimodality Imaging that “the future of cardiac imaging will include enhanced integration across modalities...to provide high quality, efficient, cost-effective care.” Achieving this “triple-aim” will require further enhanced collegiality between radiologists and cardiologists to redefine the training paradigm for both radiology residents and cardiology fellows in training (FITs). In this paper, we aim to define the challenges, opportunities, and future directions for imaging collaboration across cardiology and radiology for residents, FITs, and early-career professionals (ECPs) (3).

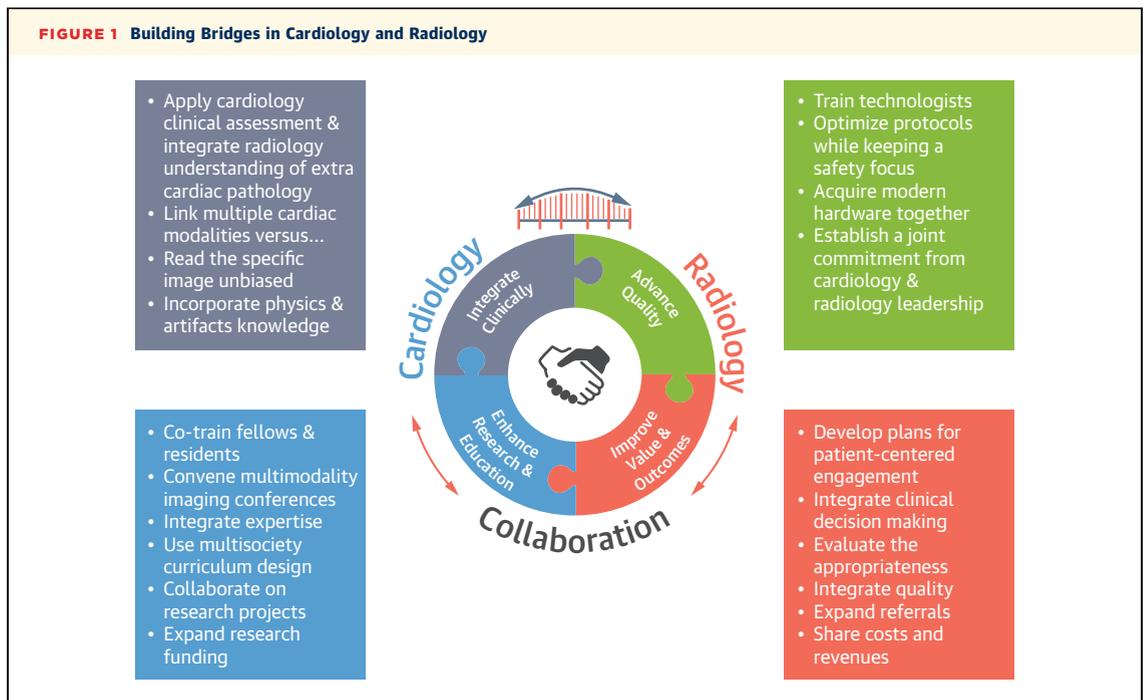
### CHALLENGES

The American College of Cardiology’s (ACC’s) Fellow-in-Training Leadership Council recently recognized a potential shortage in the cardiovascular workforce to meet the demands of patients with cardiovascular disease (4). Within cardiac imaging, the scope of training has evolved tremendously over the last few decades with multimodality advancements in the diagnosis of coronary artery disease, rebirth in the field of valvular and structural heart disease, and novel insights into the diagnosis of cardiomyopathies (5,6). As a result, there is increased demand for highly qualified multimodality imagers within cardiology and radiology with specialized expertise in cardiac computed tomography (CT), cardiac magnetic resonance imaging (CMR), and also positron emission tomography/CT (7).

In fact, the publication of the 2016 National Institute for Health and Care Excellence (NICE) clinical guidelines recommended making cardiac CT a first-line diagnostic modality in the evaluation of chest pain (8). Subsequent analysis of this guideline by Dreisbach et al. (9) found that only 10% of the needed practitioners and 2% that are Level III qualified (advanced level of training) are available to fully implement this clinical guideline in the United Kingdom (9). Parallel to the Dreisbach et al. (9) analysis, early evidence in the State of Massachusetts by Spilberg et al. (10) note that only 23% and 7% of American College of Radiology (ACR) accredited sites have further accreditation in cardiac CT and CMR, respectively (10). Although American guidelines do not recommend cardiac CT as a first-line diagnostic test, Shaw and Chandrashekhar (11) recently editorialized that data from the PROMISE and SCOT-HEART trials, “may be foundational for future guidance documents developing accurate evaluation

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This Page is also publishing in the November 13/20 issue of the *Journal of the American College of Cardiology*.



algorithms for ischemic heart disease” (11-14). A potential evolution in guidelines would provide further rationale to increase the number of fully trained imaging specialists (9).

Opportunities for training in cardiac imaging are steadily increasing, although challenges remain (15). There is no Accreditation Council for Graduate Medical Education-accredited pathway for cardiac imaging, in part due to differing training requirements for cardiologists and radiologists (6,16). The ACC—along with other subspecialty societies—has defined the curricular requirements for competency within cardiology (2). In contrast, the ACR has defined competency requirements within radiology (17,18). The ACR, subspecialty societies, and Intersocietal Accreditation Commission all define distinct hospital accreditation pathways.

Although some institutions have invested in CT, CMR, and positron emission tomography scanners with cardiac capabilities, high cost remains a limitation. The size and structure of the cardiovascular program within the hospital will determine the priority of hardware acquisition. A few high-volume centers have dedicated scanners for cardiovascular testing, although many scanners require mixed-use (e.g., neurology, orthopedic, trauma imaging, and so on) and are solely administered within radiology. Many smaller cardiology practices may find it impractical to acquire a scanner. There are also

statewide restrictions to hardware acquisition through “certificate of need” (CON) programs in 36 states and Washington, DC, that require the state’s medical governing body to approve new hardware acquisition (19). Originally intended in the 1960s to control health care costs tied to Medicare, the CON is often applied to advanced technology at a set cost threshold, which may limit access to care by preventing organizations from obtaining the newest grade equipment. Obtaining a CON is a time-consuming process that may also factor in local concerns. Although there is a need for trained specialists, a lack of uniform training pathways and difficulty gaining access to appropriate scanning technology contribute to the challenges of FIT/early-career cardiologists collaborating with cardiac radiologists.

## COLLABORATION OPPORTUNITIES

Multiple avenues exist for FITs/ECPs and radiologists to overcome these challenges through collaborative solutions described within several domains (Figure 1): 1) integrate clinically; 2) advance quality; 3) improve value and outcomes; and 4) enhance research and education.

To provide clinical integration, radiology and cardiology trainees gain tremendously by reviewing complex studies together. In such joint sessions, a

cardiologist and/or radiologist faculty member moderates a small group reading session in which the cardiology fellows provide the relevant history, results of other cardiac tests, and clinical integration of multimodality imaging findings. The radiology residents integrate understanding of complex cardiothoracic and extracardiac pathology while incorporating the physics and technical aspects of the imaging equipment and scanning methods (20). Cardiologists also gain perspective in applying novel techniques in the noncardiac realm (e.g., dual-energy abdominal CT imaging) to cardiac diagnoses. There is often overlap in expertise in these domains among trainees. Regular, joint reading sessions enable relationship building that fosters ongoing partnership at multiple levels (trainee to attending to department leadership).

Thus, many U.S. programs are now offering multimodality imaging fellowships that represent joint efforts of cardiology and radiology (15), enabling an integrated approach to multisociety cardiac imaging curricula. Multimodality imaging conferences organized by cardiac imaging residents and fellows from both departments have been part of didactics across many academic centers in recent years. Such conferences allow multimodality integration, including nuclear cardiology and echocardiography to solve a diagnostic dilemma. This interaction allows all trainees to discuss the latest technical advances in cardiac imaging, appropriate use criteria, and novel investigations. If departments are limited by geographic constraints, web-based teleconferences are an avenue to maintain collaborative discussions. Social media also is an emerging forum for discussions (21). Last, these joint interactions will also allow opportunities for enhanced research collaborations that may increase impactful publications and potentially expand grant opportunities.

Some approaches can advance quality—as recently defined by the American Heart Association—via a cardiology-radiology collaboration, including excellence in technical standards, consistent interpretive acumen, and a patient-centered approach (22). First, cardiologists and radiologists may approach hardware acquisition jointly through decision-making that enables all stakeholders meet mutual priorities as outlined previously. Consistent application of ACC/multisociety appropriateness criteria may enhance appropriate referrals and improve effectiveness (22). From a practical perspective, most radiologists interpret and provide coverage for other radiologic services, while cardiologists have inpatient and outpatient clinic responsibilities. Developing a collaborative plan for engagement between patients and the cardiac imaging team can enhance productivity and improve

overall patient care (22). Routinely reviewing imaging protocols allows the team to ensure that the protocol sufficiently addresses the specific clinical concern while ensuring safety (e.g., low radiation). Importantly, the ideal collaborative program establishes a clear, joint commitment from both cardiology and radiology leadership and seeks to share in the expenses, profits, and resources between departments while maintaining efficiency (22).

Last, to provide further practical examples of collaboration, the authors' institutions (J.L.M., A.D.C.) grant cardiologists a joint appointment in radiology, and radiologists are highly engaged with cardiology initiatives (e.g., structural heart team). In addition, in 1 author's institution (A.D.C.), the radiologist serves as the formal billing physician, and the cardiologist and radiologist evenly split the physician component of the clinical revenues of CT and CMR; through this approach, the program has grown significantly.

## FUTURE DIRECTIONS

As Dr. Gruentzig and colleagues showed us, a collaborative approach unbound by subspecialization can be transformative for the medical field. As health care moves away from volume-based imaging to integration and value-based imaging, initiating these collaborations from the FIT/ECP level will become increasingly vital. We hope that this paper will help trainees and ECPs foster conversations regarding joint training, advocacy, and collaborations at their local institutions, at the medical society level (e.g., between the ACC and ACR) and through social media (using hashtags #ACCImaging and #CardsRads). We also hope that this evolving paradigm will lead to further cross-pollination between fields and create cohesiveness in practice between both parties (23). The future of cardiovascular imaging is bright as cardiac imagers and academic and practice clinicians become stakeholders in building stronger bridges that will support making these modalities widely available for optimal patient care.

**ACKNOWLEDGMENTS** The authors thank Dr. Robert K. Zeman, Chairman of Radiology at The George Washington University, and Dr. Jadranka Stojanovska, Assistant Professor of Radiology and Director of Cardiovascular MR at Michigan Medicine, for their review of this paper.

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## **RESPONSE:** Collaboration and Collegiality

### The Dual Pillars of Cardiovascular Imaging Now and in the Future

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Dr. Parwani and colleagues have laid out an important vision of the future of cardiovascular imaging, especially for fellows-in-training and early career cardiologists. The future of cardiovascular care is an emphasis on value of care rather than volume, and it is in this light that collaboration and collegiality between cardiologists and radiologists is essential. Gone are the days when cardiologists and radiologists can compete over who performs cardiac imaging. It is a must that clinicians choose the right imaging test for the right patient, and the ACC has taken the lead in that direction by creating appropriate use criteria that began as single imaging modality criteria but have

since evolved into multimodality criteria (1). These criteria will form the basis for payment decisions for imaging services in the not-so-distant future.

FITs and ECs have been trained in the era of growing clinical utility of advanced cardiovascular imaging with cardiac magnetic resonance, coronary computed tomography angiography, and positron emission tomography. It is their cohort that can truly understand which is the right test in a given clinical scenario in the present era. They have also been trained during an era of revolutionary changes in structural heart interventions that are guided by imaging technology. Cardiologists are well-situated to

be the gatekeepers for choosing the correct test for each patient.

As clearly delineated by Dr. Parwani and colleagues, cardiologists and radiologists bring different backgrounds and expertise to the table. Cardiologists will be referring their patients for imaging procedures and understand the underlying clinical scenarios and pathophysiology. Radiologists are well trained in imaging physics and instrumentation and are highly skilled in diagnosing critical noncardiac

findings. Thus, joint involvement is important to building a robust cardiovascular imaging service. Indeed, this is how it is approached at our institution (2), where there is a cardiology fellow and radiology resident at every reading session with an attending (cardiologist or radiologist) in a larger reading room with consultation available as needed. It is this kind of collaboration and collegiality that is essential to the future of our profession and is best for our patients.

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