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The Importance of the Clinical Internship for the Radiologist

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INTRODUCTION

In "The TechnoPhysics Year: Transformation of Diagnostic Radiology's Clinical Year as a Matter of Necessity," Wasserman et al argue that the current PGY-1 should be replaced by a year focusing primarily on physics, technology, and data science (1). We appreciate their thoughtful approach and innovative ideas and applaud the start of this conversation. However, their proposed PGY-1 would risk atrophy of core clinical knowledge and threaten the synergy that exists when physics/technology is taught alongside clinical radiology.

Much has changed since the reinstatement of the clinical internship year in 1997, including advances in artificial intelligence (AI), imaging technology, and data science. We will argue that these changes actually increase the importance of intensive clinical exposure. True, radiology resident education needs to be re-evaluated to ensure that we continue to be leaders during this technology boon. However, intensive clinical exposure remains necessary and if sacrificed would be detrimental to radiology as a field, to the individual radiologist, and ultimately to our patients. We also believe that the quality, durability, and practicality of physics/technology education is enhanced when it occurs alongside clinical radiology training.

Before starting, as Gunderman and Tobben rightly point out, the designation "clinical year" itself is problematic, as it implies that the subsequent four years of radiology are nonclinical, when of course they are highly clinical (2). We as radiology educators will utilize the term "clinical internship" simply as a convenient way to distinguish floor rotations from radiology rotations.

The clinical internship has been the subject of debate for years. A 2008 survey of American trainees in radiology found that 70% responded that the intern year was necessary for their development as a physician, while 49% responded that it was necessary for their development as a radiologist (3). A 2018 survey of Canadian radiologists and radiology trainees found that the majority (71%) were in favor of the basic clinical year (4). These statistics demonstrate some support of the clinical internship, but also raise important questions. In our experience advising medical students, we find that many consider the intern year just another obstacle to overcome before residency (2); this provides additional rationale to re-evaluate the intern year. While we are arguing for maintaining the clinical internship, we are not arguing for the status quo; the clinical internship can and must be improved.

The question for the clinical internship, as with any required step of radiologist training, should be: Does it provide opportunities to further a resident's ability to care for their future patients as a radiologist? We believe that it provides a decidedly unique opportunity to become a better clinician and radiologist. The supervised responsibility for direct patient care complements what is acquired in medical school and forms the foundational experiences that the radiologist will access throughout their career. This fosters what Ravin called "medical maturity" (5), allows for better understanding of and communication with the referring physician, and reinforces the perspective that each imaging study is of a patient. The radiologist becomes a more integrated member of the physician community, and the perception of the radiologist by other physicians, medical students, and the public is enhanced.

INCREASING PATIENT-CENTERED CARE AND PATIENT INTERACTION

Healthcare continues to move toward a value-based model and this includes ACR Imaging 3.0 and patient- and family-centered care (6–9). This patient-first model has been a radiology initiative for at least the past two decades with developments such as Radiologyinfo.org, patient-friendly ACR Appropriateness criteria, and ACR patient engagement case studies (7,10,11). This push to venture out of our dark rooms has been discussed throughout the radiology literature with broad support (12–14). The clinical internship aligns with the ACR Imaging 3.0 initiative. Furthermore, changes resulting from increased adoption of AI may open more opportunities for patient- and family-centered care and interprofessional/interdisciplinary work. While there is indeed wide variation between different clinical intern years (14), the key unifying factor is that they all consist of patient-facing clinical care that adds responsibility to the previous role of medical student.

Gunderman, in a 2004 article, "What we most need to see" (13), summarized the introspection needed for radiology as a field:

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"What are we, and what do we aspire to be? Are we merely what meets the eye when someone walks into a radiology department—namely, the place where all the x-ray machines happen to be located?"

"We need to look into the mirror from time to time, to catch a glimpse of the otherwise invisible image of radiology we are projecting in our communities"

"Tell a layperson that you are a radiologist, and he or she may ask, "Does that mean you're not a real doctor?"

"When opportunities for patient contact present themselves, we should seize them and polish radiology's image." (13)

Moehrle, in a 2018 article, ""Radiology" is going away-. . .and that's okay: Titles change, A profession evolves" (15) explains the opportunity that AI affords for radiology to pivot towards more patient interaction:

"Automation will offer radiologists the opportunity to reconnect with the greatest glories of the practice of medicine, to make a profound shift toward a more social and human-centered approach to their profession, a shift in which the bedside will no longer be an abstract."

". . .radiologists of the future. . . must be trained to become as sensitive to the psychology of communication as radiologists of the past were to the sight of a malignant abnormality, and they must learn to observe, listen, understand, and communicate results on a human level." (15)

IMPROVED CLINICAL SKILLS AND COMMUNICATION WITH REFERRING PHYSICIANS

One argument against the clinical internship is that fourth year of medical school offers students plenty of time to learn clinical skills, deal with challenging circumstances, and understand the perspective of their referring colleagues. Radiology would simply need to mandate that specific rotations occur before graduation (2). However, program directors and others could not adequately monitor these requirements (14). Additionally, those students who decide on radiology late in the match season would not have enough time to fulfill them.

Myriad tasks performed by the radiologist require a solid foundation of clinical skills. For example:

- Treating a patient with a contrast reaction
- Managing an acutely decompensating patient until help arrives
- Discussing risks and benefits of an image-guided procedure
- Supporting the anxious or upset patient
- Delivering the news of a new diagnosis of breast cancer

These are just to name a few. The response required by the COVID-19 pandemic also provides rationale for a solid clinical foundation (16,17). Here in New York City, radiology residents were redeployed to the frontlines during the peak of the COVID-19 pandemic. Having a larger group of residents who can respond during not just a pandemic, but a regional or national health crisis of any kind, is beneficial from a public health perspective. Clearly, there is room for discussion about the pros/cons of redeployment, but when radiology residents responded in such a positive way, helping their patients and colleagues, the added sense of teamwork, camaraderie, and selflessness was palpable. In fact, attendings were redeployed in some institutions as well. One of the authors personally experienced how rounding on the patients provided a better understanding of the clinical picture and thus, could result in a more useful radiology report.

We note that the Wasserman et al's TechnoPhysics Year does include some clinical exposure outside of radiology (surgery, ICU, and emergency medicine). However, their suggested schematic daily schedule of only having AM clinical responsibilities would preclude actual responsibilities on rotations. At a time when they have just obtained their MD degrees, they would take a step backward toward the shadowing completed in their preclinical years of medical school. Interns as future radiologists might be viewed as lazy, superfluous, and most insidiously, not as true members of the team. Changing to the TechnoPhysics Year would further silo us from other physicians. Some individual radiologists might prefer this. But as a field, do we want this? Does it further our goals as a specialty, or does it do the opposite?

THE SYNERGY OF LEARNING PHYSICS AND DATA SCIENCE ALONG WITH CLINICAL RADIOLOGY

We argue that one risk of the TechnoPhysics Year is that learning physics and data science before clinical radiology would undermine the synergy of learning the three together. Studying physics and technology in its own vacuum without "clinical correlation" would take us back to the physics education of years past. As Nickoloff et al described in their 2010 article "Physics Instruction for Radiology Residents in the Era of the New ABR Examination Process" (18):

"A more distributed teaching paradigm allows for learning physics at the appropriate time when questions are encountered during clinical training, instead of the concentrated "binge and purge" learning paradigm." (18)

When the physics boards existed, it was studied in a similar manner to the viewpoint of internship, a means to an end. Although the ABR Core Examination has garnered much debate, one definite benefit of the new exam is the incorporation of physics into the clinical setting. Learning the two together allows the trainee to focus on the most clinically relevant physics (18).

As Wasserman et al suggest, part of physics education for the radiologist should include "modality-immersion" (19).

This is best done when the resident is fully engaged in their clinical rotation. For example, monitoring a prostate or rectal MRI while on the Body rotation would be more meaningful than shadowing a technologist during a PGY-1 TechnoPhysics Year. In fact, most of us can envision a scenario of a technologist rotation without active clinical involvement leading to residents sitting around on their smartphones or "being in the way" and being told they can leave if they want.

Advances in AI have many implications for radiology training. Similar to physics, in order for education in AI to be successful, it should be embedded into the clinical milieu, occurring longitudinally throughout training. As described by Tajmir and Alkasab, this level of AI knowledge required by the individual radiologist will vary. The "AI tool creators" will be radiologist-scientists developing the world of AI—algorithms, software programs, workflow analysis, etc. Then, there will be the "AI tool deployers"; radiologists who will understand the science of AI enough to apply it to image/protocol optimization, the workflow within their institution, the ability to evaluate/reevaluate and peer-review the use of AI, etc. Finally, the average radiologists will need a basic skill set to utilize the AI appropriately in their daily clinical work. This is akin to the radiologist-scientists who helped develop MRI and its sequences, those radiologists able to enhance and develop protocols, and those radiologists needing to understand the basic differences between pulse sequences (20,21). Residents are likely to be supervising AI tools at some point in their radiology careers, and education on how to evaluate whether AI output is accurate is more likely to be effective when taught alongside clinical radiology, not months/years before. Furthermore, the rate of advance of AI means that there will be a non-trivial difference between what can/should be taught during PGY-1 and PGY-5. The resident whose AI curriculum occurs alongside clinical training will have more working AI knowledge that is more relevant to current practice when they complete training. Radiologists leading AI in medicine requires more, not less, clinical exposure. The successes and failures of AI tool creators and deployers will depend in large part on their understanding of what is clinically relevant.

IR became, as Wasserman et al state, an "almost autonomous clinical subspecialty" (1) by moving towards, not away from, patient interaction and patient-centered care. In order to "reclaim our identity", we need to more firmly establish our identity as physicians rather than data scientists.

AI education/training should also occur throughout radiology residency, perhaps with a dedicated rotation during PGY-5. Since many radiology programs would not have the breadth of faculty expertise to cover the important facets of this expansive topic, training within one's own program could be supplemented with the National Imaging Informatics Curriculum and Course, which is developed with support of the AUR and run by the RSNA and SIIM (22). Furthermore, a distinction should be made between the AI education that all radiologists need and the highly specialized education that radiologist leaders will need to innovate and drive the field forward (23).

MAKING IMPROVEMENTS TO THE CLINICAL INTERNSHIP

While we are arguing for continuation of intensive clinical patient care in PGY-1, we acknowledge the need to make it more relevant to a career in radiology and provide improved universal oversight. Proposals include:

- Implementation of a longitudinal introduction to radiology curriculum in the PGY-1 year (24)
- Implementation of a radiology "boot camp" to facilitate the transition to radiology residency (25)
- Shifting toward higher-yield clinical rotations during the year (4)
- Creating integrated clinical rotations with more radiology oversight (26,27)

Measures like implementing a longitudinal introduction to radiology curriculum in PGY-1 (24) are facilitated in categorical radiology residencies where residents are part of the same program in PGY-1 as PGY-2. Since the vast majority of radiology residency positions are advanced positions, there may be logistical barriers to implementation of targeted training for residents that are not yet officially part of one's own program. However, the increasing adoption of remote/virtual learning may make some of these initiatives feasible for advanced programs.

The concept of a categorical Diagnostic Radiology residency (spanning PGY-1 through PGY-5) (27) provides thought-provoking possibilities, as it would afford the following advantages:

- Ability to implement targeted educational initiatives aimed at improving radiology residency readiness during PGY-1
- Familiarity with non-radiology trainees/faculty and technical interfaces (e.g., the electronic medical record) used at the hospital(s) at the start of PGY-2
- Autonomy over the way that the clinical year is structured to meet specific goals and objectives
- Incorporating AI, data science, and continued radiology innovation in a longitudinal and immersive form

Making radiology residencies categorical "may be beneficial to reinforcing the role of radiologists as clinicians while decreasing the dependence on other clinical departments to train radiologists" (27). Furthermore, the radiology residency program would be empowered to reduce the variability of existing clinical internships. In 2017, Desouches and Andresen described their positive experience with the categorical radiology residency, which they call the integrated clinical year (26). The intern often served as a facilitator for increased communication between the team and the radiologists. Communication between radiology and other clinical departments improved, and residents learned "how to mold their interpretations and dictations to answer the clinical question at hand" (26).

Interestingly, there has been varied adoption of the categorical residency. Other specialties in similar positions have

shown a trend towards increasing adoption of the categorical residency since 2007 (e.g., anesthesiology, neurology, and to a lesser extent physical medicine and rehabilitation), some have remained stable (including diagnostic radiology, at 12%–14%), and some have moved towards decreasing adoption of the categorical residency (e.g., dermatology) (27).

We are not suggesting that a categorical residency represents a panacea for an improved clinical internship and better overall education including AI, data science, and physics. However, building on Cory M. Pfeifer's call for categorical programs (27), and similar to Wiest et al's 2002 description of their categorical experience (28), an updated frank discussion of key objectives, barriers, and recommendations for implementation of the categorical radiology residency would be useful in a more general effort to improve internship, incorporate technology and physics, and allow for continued flexibility as the field of radiology continues to grow.

CONCLUSIONS

We agree with the statement by Wasserman et al, "where there are alternate uses for limited resources, one must weigh the potential risks and benefits of such decisions" (1). However, we have come to a different conclusion after weighing the pros and cons. We are in favor of maintaining the clinical internship for the following reasons: direct patient interaction is in alignment with ACR 3.0, clinical skills and communication are enhanced, there is a unique synergy of physics and technology education when immersed in clinical radiology, and AI will potentially allow radiologists to increase face-to-face interactions. As Wasserman et al described, radiology education is at a crossroads. However, this is a great opportunity to join technology and patient-centered care, and reevaluation of radiologist training to better utilize clinical internship and better incorporate physics and AI education should continue. Perhaps a multiorganizational review involving such entities as the ABR, ACR, RSNA, ARRS, APDR, and AUR may be of future benefit.

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