THE ACER CONNECTION

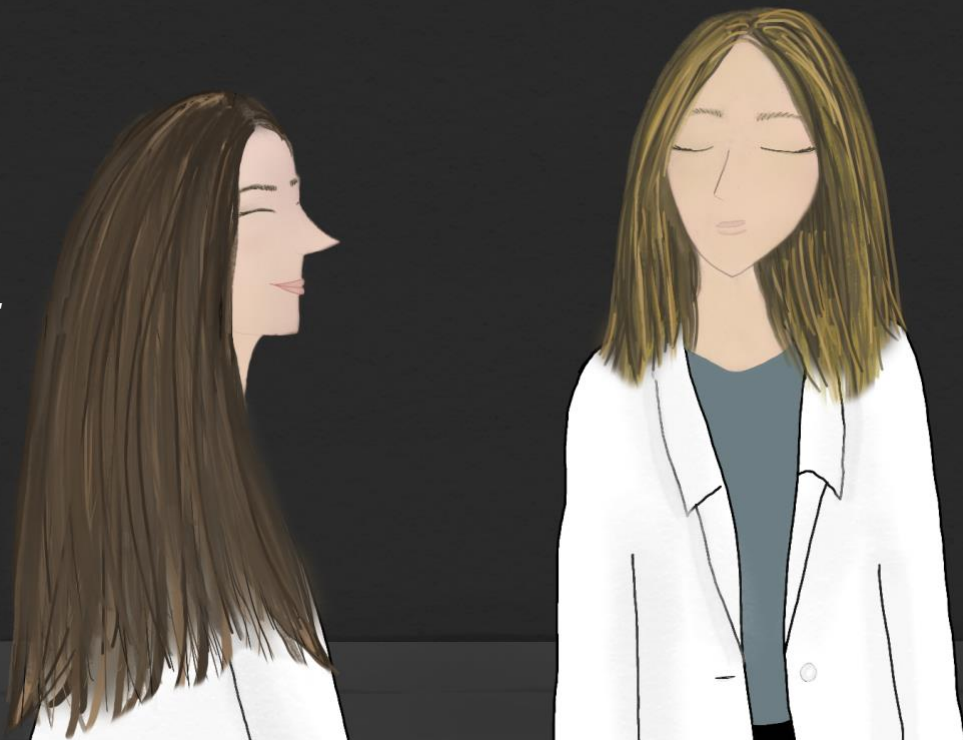What type of music you like?

Ultrasound

Featured inside:

President's Message

Cecilia L. Mercado, MD, FACR
ACER President

*G*reetings to the ACER membership:

Welcome to the 2024 Spring ACER newsletter, *The ACER Connection*. I would like to take this opportunity to share with you some exciting and new ACER developments as well as provide you with the details of the program that we have planned for the upcoming 2024 AUR 72nd Annual meeting.

The Alliance of Clinician-Educators in Radiology (ACER) has a long-standing tradition of honoring leaders in radiology education with its ACER Achievement Award and this year is no exception. Building on this tradition, the affinity group will also celebrate and recognize the achievements of early-career educators with the introduction of the ACER Emerging Educator Award. The first recipient of this annual award will be announced at this year's AUR Annual Meeting. Among other initiatives, the ACER Executive Board will introduce a new position for Chair of Finance Committee, a 3-year term which has been created to ensure continuity of ACER finances.

We have an exciting upcoming program at the 2024 AUR Annual Meeting, put together by our planning program committee led by Dr. Tara Catanzano. The theme of the meeting is the "The Learning Healthcare System". There will be several ACER sessions on exploring the growth mindset in education, creating the next generation of leaders, the role of culture in the learning environment, and workshops addressing giving feedback, the effective use of PowerPoint, strategies to approach medical errors, and optimization of workstation teaching. In addition, ACER has introduced a Teaching Certificate Program for clinician educators interested in advancing their knowledge in medical education. The half day course will be held on the last day of the AUR annual meeting with topics that will include designing, validating, implementing, and interpreting education surveys, mastery of PowerPoint presentations, negotiation skills for clinical educators, teaching for the old/new Oral and Certifying exams, learning about the various types of educational research, how to publish your scholarship, and which topics editors seek.

I would like to encourage all members to attend the annual meeting. It is a wonderful opportunity to network with colleagues and the perfect venue for the exchange of ideas on how to be a great educator.

Lastly, I would like to give thanks to the current officers, committee chairs and ACER members for their hard work and volunteering efforts!

We hope to see you at the meeting!

Best wishes,

Cecilia L. Mercado

Cecilia L. Mercado, MD, FACR
ACER President

Contents

Contents

ACER will once again provide both structured and unstructured programming at the AUR annual meeting, with a mix of roundtable discussion sessions and more formal programming during focused themed sessions. A sample roundtable will include career development topics for clinician educators.

There are three core sessions which align with the AUR theme of the Learning Healthsystem. These sessions include: The Growth Mindset, Creating the Next Generation of Leaders, and The Role of Culture in the Learning Environment. An outstanding speaker lineup had been secured to take participants through these important topics during the live meeting. You won't want to miss any of these sessions!

ACER is also proud to announce the return of a Certificate Program designed for clinician educators seeking to hone their skills, or newcomers interested in developing their teaching expertise. The four hour session will occur on the last day of the meeting (Friday), and will cover topics such as designing and implementing education surveys, effective PowerPoint presentations for brain friendly teaching, and publishing educational scholarship. There are eight total topics which will be covered in this must-see event. Make sure to pencil this program into your AUR event calendar!

Round Robin Committee Updates 📢

Awards Committee – Ryan Peterson, MD

This year, the executive committee approved a new award focused on celebrating the future junior teachers in radiology. We reviewed multiple outstanding nominations in the new Emerging Educator Award. We also reviewed nominations for the ACER Achievement Award, which recognizes key leaders in radiology education with significant contributions to ACER, education, and academic radiology. This year's recipients will be announced during the annual AUR meeting in April.

If there are junior faculty members within your practice who are passionate about radiology education, we encourage you to recommend their participation in AUR/ACER. Joining this community will not only foster the growth of their skills but also provide valuable connections with other educators.

Finance Committee – Chloe Chhor, MD

I am excited to serve in the inaugural 3-year position of ACER Finance Chair and work closely with our Treasurer, Dr. Jamal Bokhari. The Finance Committee oversees and monitors ACER's financial operations, including annual and operational budget reviews. As of the latest financial statement ending 6/30/2023, we are in the positive. Our biggest expense last year was for the annual AUR meeting. The same is expected for 2024. Currently, we are actively seeking strategic ways to allocate funds to advance our mission.

Round Robin Committee Updates

In-Training Committee – Eric Dietsche, MD & Sherley Demetrius, MD

This is the second year of the ACER In-Training Committee, which has diligently continued working on our needs assessment/ research survey, which was finalized and distributed in late 2023. We will be actively collecting responses through the end of the AUR annual meeting, after which we will start analyzing our results with the intent of a group publication. The responses to the survey will help to guide future directions of the committee overall. We will also shortly be starting an advice column of sorts for those at almost every stage of training, spanning from medical students to early career faculty. These entries will feature personal experiences from our own committee members and will be published on X (formerly Twitter) through ACER with the hashtag **#ACERITC**. Keep an eye out for our posts and let us know if there are any specific questions that you'd like us to answer!
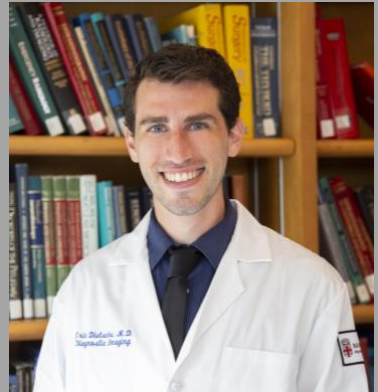
Publications Committee – Biren A. Shah, MD

The Publications Committee worked on the spring issue of *The ACER Connection* that would encompass the spirit of the 2024 meeting theme of "The Learning Healthcare System". I would like to thank all the members of the ACER Publications Committee for their dedication and contributions in making the spring issue of *The ACER Connection*. The ACER Publications Committee welcomes anyone interested in joining this active Committee!

Beyond Medical Knowledge: Other Important Skills to Learn OnCall
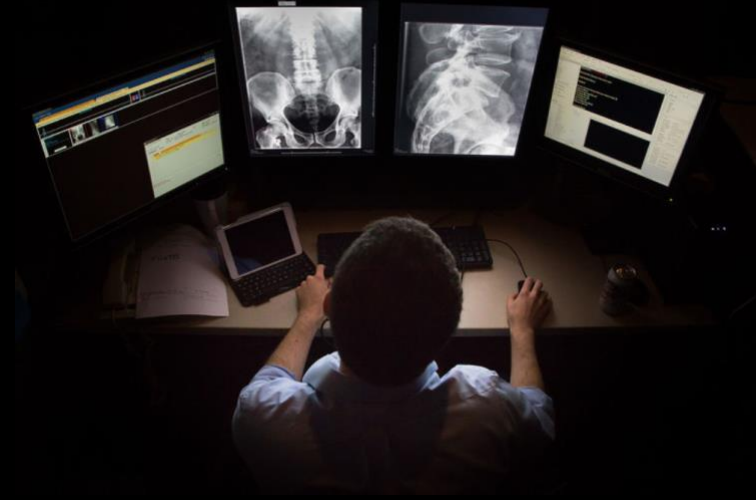
Many residents first experience working after hours, aka being 'OnCall,' as medical students, usually in their third year of medical school. The OnCall experience is often most rigorous during intern year but becomes more familiar and less intense as they progress through their residency. However, not all call is created equal. Radiology afterhours call is quite unique, as new residents usually have limited or no true experience of the nature of call or duties that it entails. In fact, while other medical specialty residents get to build on their internship experience, Radiology residents start anew and are not even allowed to take independent call, until they have completed their first year of residency. A robust well rounded medical knowledge base and its integration into the services provided by Radiology, is key to becoming a competent Radiologist, and the fundamental purpose of OnCall responsibilities for residents providing afterhours service. But as in life, the key to transforming a resident from a learner to a proficient professional is more complicated and requires mastering of additional crucial OnCall skills.

Five of these important skills to learn include:

1. Triage: To perform preliminary assessment to determine the nature and degree of urgency of treatment is essential. For Radiology, OnCall triage is developing a skill to effectively assess and maximize throughput of radiology studies and manage the workload accurately and in the shortest time possible.

All afterhours work is by virtue urgent or emergent, as said patients cannot wait for the 'regular office,' hours to see their personal clinician. However, when inundated with a large volume of studies at the same time, there is need to triage even emergent studies. This can be difficult, because it is a fine juggling act and a gamble, that certain conditions will remain stable as predicted. It involves, not just knowledge on severity and stability of medical conditions, but also the ability to decisively rank almost equally emergent conditions and get through them efficiently, while constantly re-evaluating prior 'lower ranked' studies, as well as consulting with ordering providers regarding any interim change that may require re-prioritization of resources. When practiced expertly, effective triage helps maximize the throughput, in the safest manner possible, especially during busy surges that happen quite often afterhours. Learning what types of clinical indications need immediate full review, a preliminary quick review or could wait for a little while, is one component. Another is learning to perform quick succinct medical review of the patient indication, symptoms, prior history and other preliminary results from their electronic record, and from clear communication with the ordering provider to gain any additional insight on acuity of illness or patient stability.

2. Efficiency: Fitness or power to accomplish, or success in

accomplishing, the purpose intended; adequate power, effectiveness, efficacy. Learning and refining the ability to achieve an end goal, which in Radiology after hours, means getting through a radiology study worklist, with little to no wasted effort or energy. Efficiency is a dynamic skill that constantly changes with time and situation, and certainly something that is necessary to continue to perfect throughout our careers. Learning to delegate, when and where appropriate, as well as incorporating supportive resources such as AI software can help us become more efficient if we understand the limitations of any aids used, as well as how and when to use them effectively. Triage, when effectively implemented, becomes a tool to maximize efficiency, and in turn creates more opportunities for case review, which then increases our knowledge base. As a result, we become more proficient with a wide variety of cases, further translating to increased speed with which we can accurately diagnose cases, which eventually results in an improved efficiency, overall.

3. Adaptability: Ability to adjust to new conditions or situations; or to

changes in one's environment. For radiology, this is particularly a useful skill to acquire, and applies to many facets of our OnCall work. With a mixed set of radiology cases and tasks that require access to different areas of expertise, we have to be able to adapt to virtually any type of case that comes through in any modality as well as manage various consults to the service from the emergency room, urgent, care, clinics, inpatient care, teams, and sometimes even outreach/additional remote contract sites. In addition, we need to be able to adjust to the case volume; working efficiently through routine "bread and butter" cases, while slowing down appropriately for complex cases as needed. Some afterhours shifts can be slow, and during those shifts, adaptability allows us to take advantage of extra time awarded. For example, review results of prior shift cases and show/share interesting cases. On busier nights when we cannot take time away, we should develop an easily accessible way to add interesting cases to a curated folder for future review on slower shifts.

4. Resilience: Capacity to withstand or to recover quickly from

difficulties; toughness. The quality or fact of being able to recover quickly or easily from, or resist from being affected by a fortune, shock, illness, etc.; robustness. For a Radiologist, missing a finding or failing to make the right diagnosis, even for a student in a learning environment, can be difficult to accept, and if not handled appropriately, could even result in additional mistakes. This is often more evident OnCall, given the challenges of high-volume and time pressures that are inherent in the emergent/urgent cases that make up afterhours work. While most accept call as important resident learning experience, where the hope is to be able to integrate in practice what they have learned from other rotations, somehow it may still seem like "failure" and "criticism" when one falls short of perfection. As a result, we need to develop resiliency so that we can objectively evaluate and learn from our mistakes in a timely manner and move on. Similarly, often the bottleneck in an ever-growing healthcare system we need to be able to handle being on the receiving end of clinical frustrations about study interpretation delays or patient's complaints of prolonged radiology study results. While diplomacy will help us deal with the situation, resilience will not only help us acknowledge our part in it and where we can improve, it will also help us recognize the systemic component of the problem that may need more complex problem solving to resolve. In doing so, one can deal with difficult situations in a manner that allows us to learn, as well as enables us to continue seamless management of the constant workflow.

5. Self-care: Cares for oneself to ensure that both physical and emotional needs are met. Taking care of ourselves, for many, is at the bottom of a long list of priorities. Because that list is often long and never ending, this often means that we never carve out time to take care of ourselves. No time is this lack of self-care more evident than when OnCall. The duties of the resident, calls to the service and pressures of a never ending work list, makes many postpone much needed breaks or skip meals. Ironically, taking a short break to stretch or nourish ourselves, makes us more alert and efficient, than when we try to plough through and ignore our physiological needs. Similarly, some may view OnCall hours as an opportunity to catch up with their other day-time obligations, neglecting to dedicate enough time to rest and sleep, in preparation for the afterhours work. While this may at first feel great, given accomplishing many obligations while working, the lack of adequate rest and/or sleep becomes cumulative and may manifests itself in many negative ways, including fatigue, irritability, and poor concentration, that can lead to errors, poor communication, and inability to learn.

When OnCall, we should learn to, "put our oxygen masks on first", and by so doing, we will be in a better state of health and mind to provide service to others. We can start to do this by teaching our residents to make sure that they have protected rest/sleep time during the day, and practice the same good sleep hygiene techniques recommended at night, such as; turning off pagers, phones and media feeds, to allow for uninterrupted sleep. Because Radiology Call is almost always busy, advance meal planning is essential. Take time to shop for nutritious meals to bring with you and/or familiarize yourself with cafeteria hours and offerings, to allow for optimal use of often very short breaks. Incorporating exercise and mindfulness into our daily lives, further contributes to our overall well-being, and provides the energy and clarity required for self-actualization and eventual self-growth.

These are just a sample of important skills that we should learn and practice perfecting during challenging OnCall shifts. While not comprehensive, or in any rank order, triage, efficiency, adaptability, resilience and self-care are five skills that can start the process. Additional skills such as diplomacy, advocacy and becoming good consultants, can be pursued and could help augment the other skills. When mastered and used appropriately, all these skills will not only help us manage our afterhours OnCall duties effectively but will build upon our medical knowledge and clinical practice, help transform us into consummate professionals, and also even apply to and improve our own personal lives as well.

References:

Oxford English Dictionary. (2023) Oxford: Oxford University. [Online] www.oed.com

Soukup, Ruth. "48 Essential Life Skills Everyone Should Learn." Living Well Spending Less.

www.livingwellspendingless.com/48-life-skills-everyone-learn

by Ruth Magera, MD, MBA

"In the Spotlight" is a summary of a book recommended by an ACER member
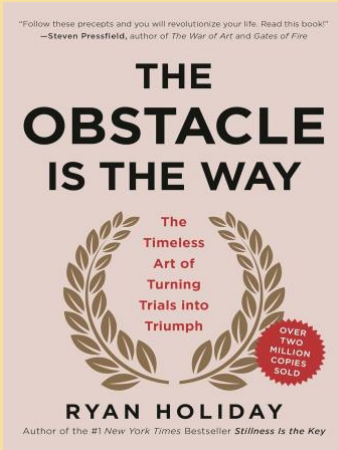
The Obstacle Is The Way is a book written by Ryan Holiday. It is a modern take on the ancient philosophy of Stoicism, a philosophy that teaches individuals to focus on what they can control, accept what they cannot, and find opportunity in adversity.

The book is divided into three main sections, each focusing on a different aspect of the Stoic approach to overcoming obstacles.

1. Perception: Instead of seeing challenges as insurmountable roadblocks, Stoicism teaches us to view them as opportunities for growth and learning. By changing our perspective, we can transform obstacles into advantages.

2. Action: Stoicism emphasizes taking deliberate and decisive action in the face of adversity. Rather than passively accepting our circumstances, we should actively seek solutions and opportunities for improvement. Holiday provides examples of individuals who have embodied this principle, such as Thomas Edison and Abraham Lincoln, who turned setbacks into triumphs through persistence and resilience.

3. Will: The final section of the book focuses on the power of will and determination in overcoming obstacles. Holiday argues that we must cultivate inner strength and discipline to persevere in the face of adversity. By developing a strong will, we can endure hardships and emerge stronger on the other side.

Overall, *The Obstacle is The Way* offers practice advice and timeless wisdom for navigating life's challenges with courage and resilience. Drawing on the timeless teachings of Stoicism, Holiday shows readers how to embrace obstacles as opportunities for growth and ultimately achieve success and fulfillment.

by Biren A. Shah, MD

C THE ACER ONNECTION

FUN FACTS ABOUT BOSTON

ACROSS

1. The first American lighthouse.
5. The official dessert of the state of Massachusetts that was invented at the Omni Parker House.
6. The deepest tunnel in America that is 90 feet underground.
7. The first college in North America.
11. The city of Newton, Massachusetts was the inspiration for the name of this popular cookie.
12. The oldest public park in the United States.
13. The United States first public beach that was established in 1896.

DOWN

2. The name of the first U.S. subway that was built in Boston.
3. The renowned Christmas carol that was written by Phillip Brooks, the 9th rector of Trinity Church in Boston, in 1868 after visiting the Holy Land.
4. The only place in the world where a boat can sail under a train going under a vehicle driving under a plane.
8. A variation of bowling that was invented in BostonThe city of Newton, Massachusetts was the
9. This name came as a result of a love among the city's earliest settlers for baked beans in molasses.
10. The oldest original major league baseball stadium still in use.

Groupthink: Consensus Feedback in a Radiology Residency Program

by George (Chip) J. Watts V, MD

Introduction

As an educational tool, feedback is of paramount importance to the growth and development of radiology residents throughout their training. Effective feedback entails a bi-directional exchange of information between teacher and learner, aimed at closing gaps in knowledge and optimizing performance. Providing this type of thoughtful feedback in a radiology residency is the goal of all program directors, but there are many challenges in this effort. Recent interest in the topic has resulted in numerous contributions to the radiology literature that identify barriers and inefficiencies in the provision of feedback to radiology residents. Some of the more commonly listed examples include cognitive biases, time pressures, clinical demand, and emotional/interpersonal tensions (1,2). While these are certainly to be countermanded whenever possible, our program has identified other nuanced factors that may inhibit effective feedback. These include lack of timeliness, limited interactions between residents and individual faculty members, and a lack of agreement among evaluators on resident performance during a particular rotation.   In response to these issues, our program has recently introduced consensus faculty evaluations of residents at the conclusion of each clinical rotation, in an effort to provide timely feedback with clear expectations and unambiguous directives.

Formative and Summative Feedback

In accordance with Core Program Requirements set forth by the Accreditation Council for Graduate Medical Education (ACGME), our program provides both *formative* and *summative* feedback to our residents throughout their training. The traditional model of radiology residents and faculty reviewing imaging studies or performing procedures together is conducive to daily face-to-face feedback encounters during routine clinical work (3). This type of

formative feedback represents a low-stakes environment for information sharing focused on individual skills and occurs at frequent intervals in our program. By contrast, *summative* feedback is provided less-frequently, in the form of end-of-rotation faculty evaluations, standardized exams (ACR DXIT, ABR Core), and semi-annual performance reviews with the program director (3). Historically, our program has delivered end-of-rotation evaluation forms via an online platform (MedHub) to those faculty who read the highest number of studies with the resident on their service. These evaluation forms were distributed after the conclusion of a given rotation, typically the following week.

Systematic Feedback Limitations

Through anonymous internal and external surveys related to resident feedback, including the ACGME Annual Resident and Faculty Survey, it was identified that our traditional method of eliciting summative feedback via end-of-rotation evaluations was prone to inefficiency, ineffectiveness, and could at times be confounding. Because resident scheduling is impacted by intermittent elective rotations, vacations, and one-week call rotations, there are instances where a resident may spend only one or two weeks on a given clinical service (rather than a more traditional 4-week block). This resulted in frequent comments from faculty that there was "insufficient time to properly evaluate" resident performance given "limited interaction." The dispersion of evaluations to multiple faculty members could at times lead to delays in feedback completion for a given rotation, often returning to the learner several weeks after the rotation concluded. This was met with understandable frustration on the part of our residents, noting the inability to adapt behavior or adjust study habits and depriving them of the ability to incorporate new/more effective methods on subsequent rotations. Perhaps most troubling were cases in which individual faculty evaluations

seemed to drastically disagree with one another. In one such case, a resident was lauded for their skills and proficiency by one faculty member, while another held serious reservations as to their competency and readiness for independent practice. This situation may lead to confusion on the part of the resident, and unclear messaging to the residency program as to how best to proceed with that resident's training.

Consensus Feedback

In response to the aforementioned limitations, our program engaged faculty, residents, and members of our education committee to arrive at an alternative strategy to improve resident feedback. Prior to the start of the 2023-2024 academic year, we nominated an "educational liaison" for each clinical division in the department to serve as a point of contact for program leadership and foster communication among faculty within their respective divisions. The liaison holds the responsibility for collecting feedback and commentary from all faculty members who worked with the resident, facilitate discussion related to individual resident performance, and submit a single consensus evaluation on behalf of the division. All faculty members participating in the evaluation are named, and specific comments are attributed to individual evaluators where appropriate. These consensus end-of-rotation summative feedback evaluation forms are made available to the resident as soon as they are completed, typically within days of concluding their rotations.

Overall, this approach has been warmly received by faculty evaluators at our program. There has been a welcome reduction in "email traffic" related to evaluation reminders and late notices, a common complaint in the prior system. Many faculty members have also commented on the benefits of discussing resident performance as a group, particularly when there are differing opinions. Often these conversations reveal important and

nuanced aspects of resident performance that may have been otherwise unwitnessed or underappreciated. By compiling multiple viewpoints through collective discussion, faculty are encouraged to contribute even when their interactions with a particular resident may have been limited in scope. This has dramatically reduced the occurrence of comments like "insufficient time to properly evaluate," even in the case of one or two-week rotations.

Importantly, our residents have also been ardent supporters of the consensus feedback model since it's introduction. By streamlining the evaluation process, residents now receive summative feedback in a timely, organized fashion. This new system allows residents to respond to both positive and constructive feedback more efficiently and with specific purpose, an outcome that has garnered widespread praise. The potential for drastically divergent performance evaluations by faculty members has been effectively eliminated, thus avoiding resident confusion, and providing a more cohesive assessment to program leadership.

Considerations

Although the institution of consensus feedback has a been a popular at our program, there are several considerations worth examining when implementing such a change. The consensus feedback model may permit the comments of other faculty to influence an individual evaluator. This "halo effect" is described as a cognitive tendency to over-ascribe positive tendencies to people who are otherwise favorably perceived (2). Additionally, the size of a residency program may limit the effectiveness or practicality of a consensus feedback model. While a medium sized program such as ours (24 residents) is conducive to such feedback at regular intervals, the burden on divisional liaisons in much larger programs may be too much to tolerate. Conversely, very small programs may depend on fully independent evaluations in

resident assessment. As a neurosurgery program director recently divulged in conversation, "*I only have 1 resident a year, so I need as many data points as I can get when it comes to faculty evaluations.*"

Conclusions

Implementation of a consensus feedback model in our radiology residency program has been an effective and popular method of resident assessment. Consensus feedback is still a relatively new concept in our program, having only been in place for 7 months. It will be necessary to re-examine the utility and practicality of this method in the coming months and years to ensure it merits permanent usage. Some residency programs, particularly those with very large or very small resident cohorts, may find consensus feedback too onerous or impractical. For us, the consensus model has resulted in improved feedback timeliness, effectiveness, and clarity.

REFERENCES:

1. Stewart M, Yang N, Lim R. Provision of feedback to radiology trainees: Barriers and inefficiencies, why it matters and a potential solution. *J Med Imag Rad Onc*. 2023; 67(1):77-80.
2. Burns J, Chelten A, Morgan D, et al. Affecting change: Enhancing feedback interactions with radiology trainees. *Acad Radiol*. 2022; 29:S11-S117
3. Sarkany D, Deitte L. Providing feedback: Practical skills and strategies. Acad Radiol. 2017; 24:740-746.

ACER Publications Committee
Artistic or humorous radiology contest

The ACER Publications Committee invited ACER and AUR Members to submit their best winning artistic or humorous radiology image to be considered for the front cover of the spring 2024 issue of *The ACER Connection*.

Types of artistic image that were considered were:

1. Painting (oils, acrylics, tempera, pastels, or watercolors)
2. Drawing (colored pencil, graphite pencil, charcoal pencil, pen and ink)
3. Photography
4. Radiographic image

ACER and AUR Members could submit up to 3 image entries. Selection of the best image was made by the ACER Publications Committee with the names of the ACER and AUR Members anonymized.

There was a total of 3 artistic or humorous radiology submissions. The following pages show the winning submission, that is on the cover of spring issue of *The ACER Connection,* along with the other great submissions.

Thank you everyone who participated!
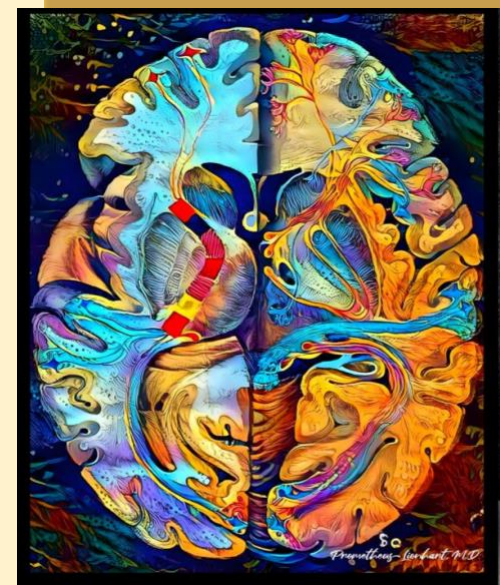
ACER Artistic or Humorous Radiology Image Contest Winner

Ultrasound

Painting submitted by: Justina Kasteri, 3rd year medical student at
Lake Erie College of Osteopathic Medicine
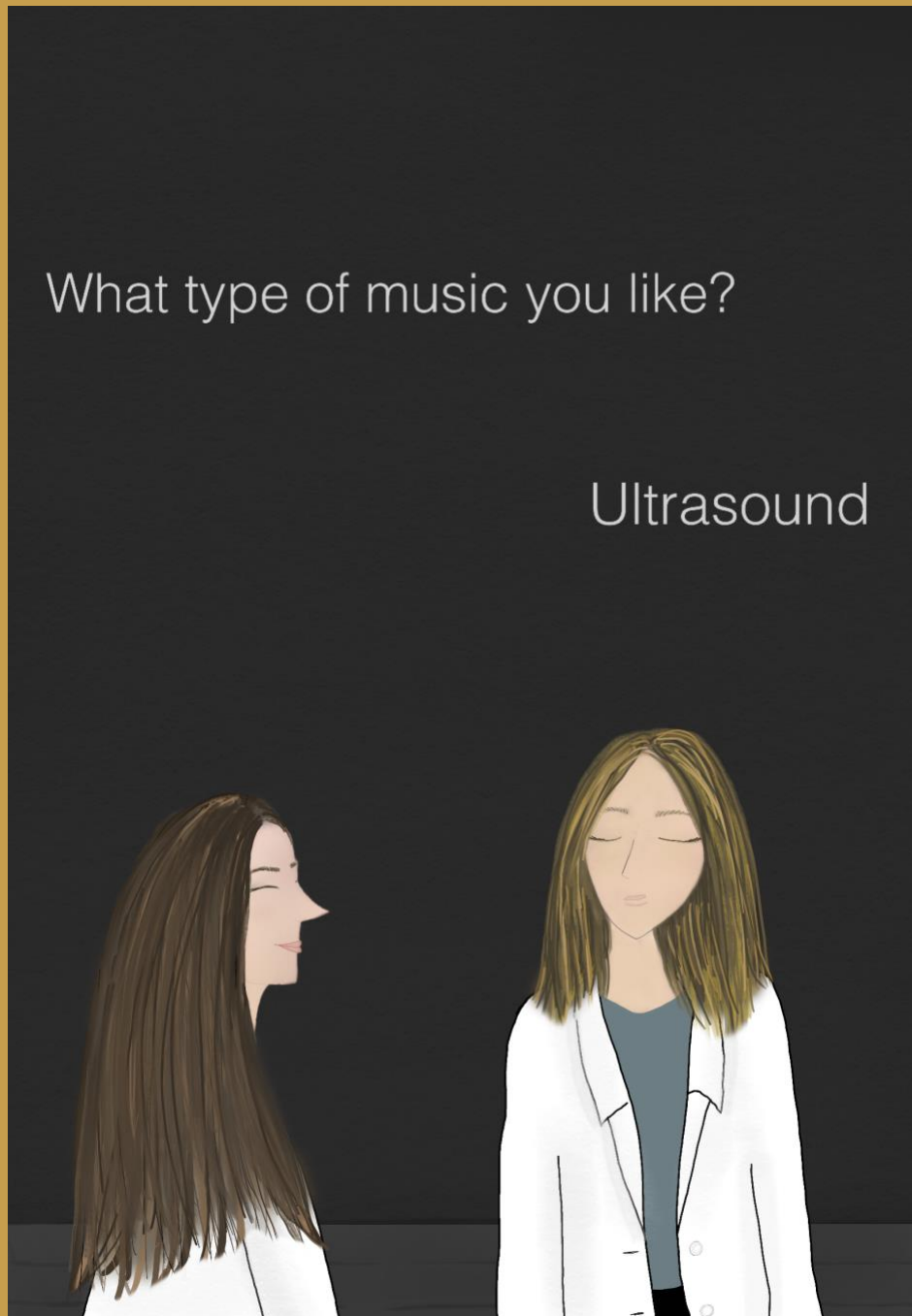
Other Artistic or Humorous Radiology Image Submissions

Cat Scan Appointment
Painting submitted by Justina Kasteri, 3rd year medical student at Lake Erie College of Osteopathic Medicine

…next appointment is a cat scan.
I am sorry but you need to see the doctor.
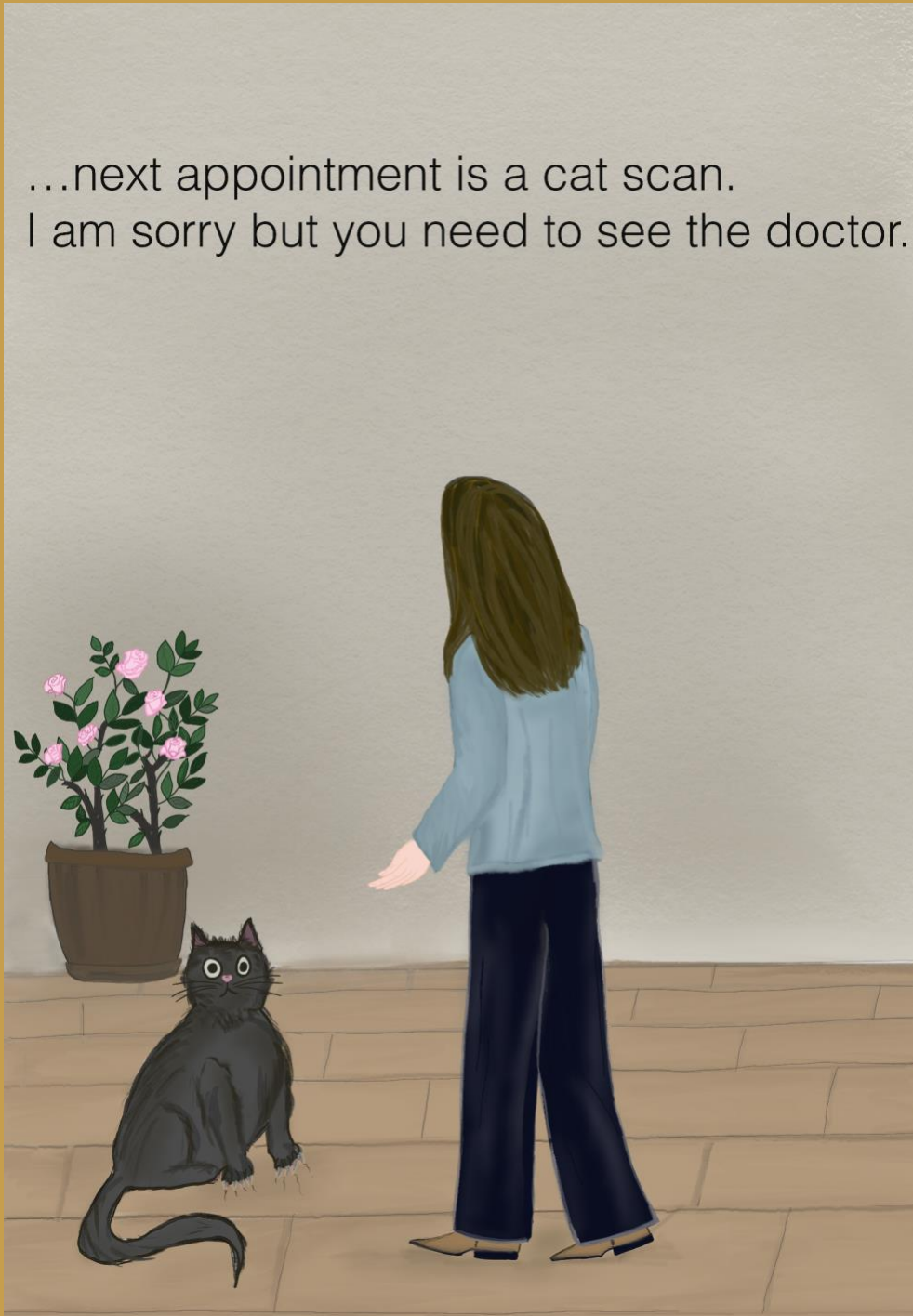
Busy? – Try CT on the Go!
Photo submitted by Ruth W. Magera, MD, MBA,
Dartmouth Hitchcock Medical Center

The buzz of the 'growth mindset'

By
Juan D Guerrero-Calderon, MD

Our mindset is the lens through which we see our reality or the vantage point that provides our perspective. "Our mindset has behavioral and physiological repercussions". (1) Stanford psychologist Dr. Carol Dweck has distinguished between a fixed mindset and a growth mindset. Her research has become widespread among individuals and organizations given its relevant personal and professional applications.

People with a fixed mindset believe their talents are innate and static. For example, a bad experience in one area is taken as a definitive conclusion that they lack ability in that area and they stop trying to improve. In reverse, when they accomplish high marks, they consider that is an innate talent and, therefore, will always perform well in that area. They think learning new things is useless. They are more prone to cheating in order to achieve success. They focus on looking smart and seek constant confirmation of their intelligence or character.

On the contrary, embracing a growth mindset means believing that your talents can be developed through hard work, perseverance, and input from others. People with a growth mindset are intentional in learning. They don't have a perspective of success vs. failure, but rather seek to learn and develop abilities. They are more empowered and committed, not hindered by self-doubt, or limiting beliefs. Therefore, they are more likely to receive more organizational support and to achieve success.

People with a growth mindset consider that a challenge is an opportunity for improvement and effort to achieve mastery. People with a fixed mindset fear failure and consider effort as pointless, which results in avoidance of challenges and and

surrender in the face of difficulties. Those with a growth mindset receive feedback as constructive criticism, to move forward in their path of progress. However, those with a fixed mindset ignore negative feedback. Accordingly, a growth mindset would be beneficial in our personal and professional lives. It would make us more adaptable and innovative in the face of obstacles, seeing problems as opportunities to improve rather than reasons to quit.

Nevertheless, like in most aspects of life, we don't exactly fit into one category. A pure growth mindset is not achievable. We are all a combination of fixed and growth mindsets and the ratios of the combined mindsets change as we go through life.

At an institutional level, fostering a growth mindset requires practical strategies, not just mission statements. It values learning and the efforts that lead to progress, such as accepting our limitations and seeking help..., trying new strategies, and capitalizing on setbacks to move forward effectively. Institutional policies should make a growth mindset attainable by providing development and advancement opportunities that encourage appropriate risk-taking, knowing that some risks won't work out. Institutions should also reward employees for important lessons learned even if the projected outcomes are not achieved. Rewards incentivize effort and encourage persistence.

It's not easy to attain a growth mindset. We all have fixed-mindset triggers that inhibit our growth. For example, challenges, criticism, and/or poor outcomes may trigger insecurities and defensiveness. Nevertheless, a lot is gained by deepening our understanding of growth-mindset concepts.

Radiologists that pursue a growth mindset are more willing to adapt a new PACS or to learn a new procedure, and less likely to be dominated by a fear of failure. This will foster creativity and allow the development of new skills. To promote a growth

mindset, radiologists' assessments of performance should make improvement feel within reach. Dweck argues that the addition of the simple word "yet" will promote a growth mindset regarding a goal that hasn't been achieved. The statement "I am not fast enough" obtains a new lens when we say, "I am not yet fast enough". The effect can be greater if the assessment includes specific advice on how to improve.

A work environment that promotes more of a growth than a fixed mindset is one where we want to show up to work the next day. The aim of our daily work should be to learn as much as possible, rather than merely getting the work done and avoiding mistakes." (2) We should focus on learning rather than just practicing. This will make work more engaging and fulfilling, as we play a part in improving it. In turn, this will reduce the feelings of burnout.

Furthermore, we can apply the concepts of the growth mindset in order to become better radiology educators. When communicating a miss or misinterpretation to a trainee, we could simply point out the mistake. This may leave the learner feeling that they are not "meant" to become a radiologist. To promote a growth mindset, we could add to our communication that everyone has made such mistakes and we could suggest learning resources and even ask the trainee to prepare a brief presentation on the topic. A strong way to instill a growth mindset in our trainees or mentees is to be vulnerable and share past experiences when we made a similar mistake or went through similar hardships. By telling them how we faced these, we promote the trainee/mentee to become open to new strategies and to seek innovative ways to address the challenge. "Often those who struggle along the way become the best educators, because they understand what a focus on improvement looks like." (2)

A growth mindset fosters continual improvement and engagement, promoting communication and synergistic collaboration that will benefit everyone in both our personal and professional spheres. Let's reflect on our perspectives and attitudes. Let's be intentional in how we respond to challenges to promote a growth over a fixed mindset.

References:

1. Crum A, Zuckerman B. Changing Mindsets to Enhance Treatment Effectiveness. JAMA. 2017 May 23;317(20):2063-2064. doi: 10.1001/jama.2017.4545. PMID: 28418538; PMCID: PMC7608684.
2. Mukhtar M, Gunderman RB. Instilling a Growth Mindset in Resident Orientation. Acad Radiol. 2022 No; 29 (11): 1763-1764. doi: 10.1016/j.acra.2022.07.009. Epub 2022 Aug 31. PMID 36055882.
3. Dweck C. What Having a "Growth Mindset" Actually Means. Harvard Business Review. 2016 Jan 13. Retrieved from https://hbr.org/2016/01/what-having-a-growth-mindset-actually-means
4. Jain, Y. The Ultimate Guide for Developing a Growth Mindset: 6 Tips for Success. Emeritus. 2023 June 14. Retrieved from https://emeritus.org/in/learn/online-learning-growth-mindset
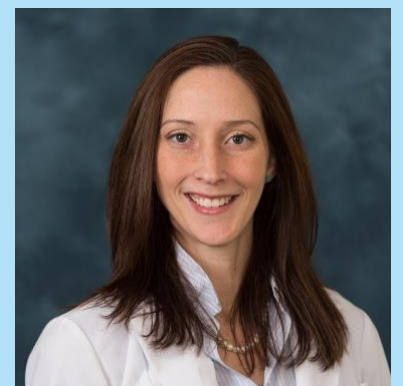
Planetary Health and Graduate Medical Education:

An opportunity for Radiology

By

Jessica R Leschied, MD

Planetary Health is a growing area of research focused on understanding the relationship between human health and how it is affected by our changing environment. It has arisen largely in response to the changing climate and the extreme weather events and environmental disruptions that appear to directly affect human physical and mental health. The World Health Organization has declared climate change the greatest threat to human health of our lifetime and predicts that in less than a decade, climate change will result in an additional 250,000 deaths per year globally, and 2-4 billion dollars of direct public health related costs in the US alone[1].

Many medical schools have started incorporating planetary health into their longitudinal curriculum. According to data from the Association of American Medical Colleges, more than 50% of the 150 medical schools surveyed each year now offer required or elective courses in climate change and human health[2]. This number of schools doubled from 2019-2020 to 2021-2022, indicating a rapid uptake in interest in making this part of medical school training. Graduate medical education has been slower to incorporate planetary health in structured curricula though recently a handful of academic institutions have called on resident training programs to include climate change in formal education specifically addressing trainees in Emergency Medicine, Internal Medicine, Pediatrics and Family Medicine[3].

Why not Radiologists? Our daily practice certainly contributes its share of emissions and waste to the overall emissions of health care delivery. One hospital in Switzerland determined that running their 3 CT scanners and 4 MRI machines utilized 4% of the hospital's energy usage[4]. Additionally, as climate change related illnesses continue to increase in prevalence, we need to be aware of how these illnesses may manifest on imaging. Consider a review article recently published by Kim HR, et al. describing diseases by system that are a result of climate change and imaging manifestations of those diseases in children (ie. Heat-related illness,

vector-borne disease, polytrauma related to extreme weather events, etc.) (Figure 1)[5].

A planetary health curriculum for radiology residents could include no more than 3 lectures: a) a review of climate change related illness and their appearances on imaging, b) raising awareness of radiology operations impact on hospital waste and emissions, c) a discussion of ways in which a radiology department can cut down on energy use and emissions.

All of us are in a race against time to reverse the effects of climate change and mitigate its effects on planetary and human health. As leaders in medical innovation and medical education, radiologists are well positioned to accept this challenge and incorporate teaching of planetary health into our practice and graduate medical education.

References:

1. World Health Organization. Climate change and health. Available at: https://www.who.int/news-room/fact-sheets/detail/climate-change-and-health. Accessed March 3, 2024.
2. Mallon WT, Cox N. Climate Action in Academic Medicine: An Overview of How Medical Schools and Teaching Hospitals and Health Systems Are Responding to Climate Change. Washington, DC: AAMC; 2022.
3. Phillpsborn RP, Sheffield P, White A, Osta A, Anderson MS, Bernstein A. Climate Change and the Practice of Medicine: Essentials for Resident Education. Acad Med. 2021 Mar 1;96(3):355-367.
4. Heye T, Meyer MT, Merkle EM, Vosshenrich J. Turn It Off! A Simple Method to Save Energy and CO2 Emissions in a Hospital Setting with Focus on Radiology by Monitoring Nonproductive Energy-consuming Devices, Radiology 2023 307:4.
5. Kim HHR, Leschied JR, Noda SM, Sarma A, Pruthi S, Iyer RS. Planetary health: an imperative for pediatric radiology. Pediatr Radiol. 2024 Jan;54(1):20-26
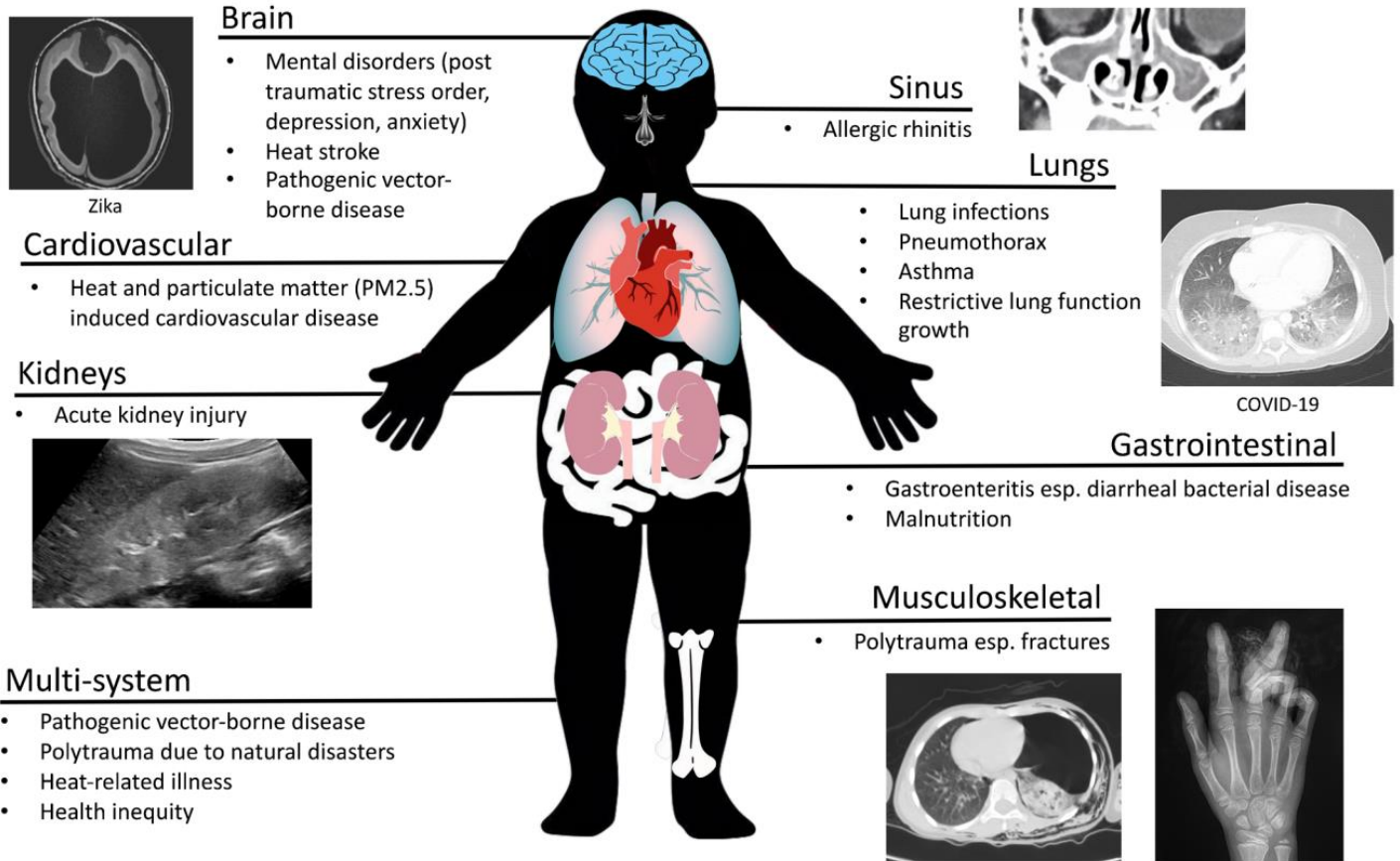
Fig. 1 Illustration shows a variety of pathologies secondary to extreme weather events and environmental exposures intricately tied to climate change on a child. The health effects are grouped according to the organ system. Created with DALL-E 2

Figure 1. Above is borrowed from Kim HHR et al. with permission from authors.

The Benefits of Radiologists Studying Art

By Eric Dietsche, MD
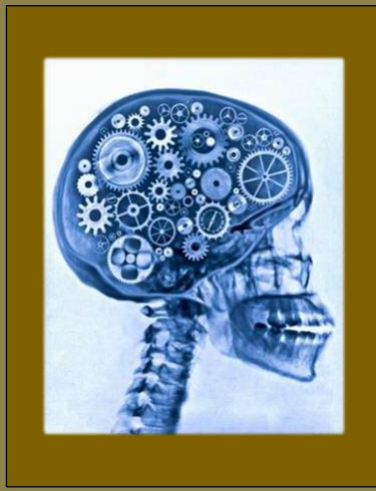
We, as radiologists, spend our days interpreting countless images to diagnose and treat assorted conditions. Art education has increasingly been incorporated into a variety of training programs in medicine including radiology, dermatology, emergency medicine, and internal medicine (among others) as a method of providing a framework for discussing difficult topics. There are a number of ways that art enriches radiology education specifically, as outlined below:

1. Enhancing Observation Skills

- Art education hones the ability to observe minute details, colors, shapes, and textures, which translates directly to the interpretation of radiographic images. By studying art, radiologists can refine their visual acuity and attention to detail, enabling them to identify subtle abnormalities in medical images that may have otherwise gone unnoticed.

2. Developing Empathy and Communication

- Art has the power to evoke emotions and cultivate empathy. Radiologists who engage with art can gain a deeper understanding of human experiences and emotions, which can be invaluable when interacting with patients. This enhanced empathy can lead to improved patient communication and a more compassionate approach to healthcare delivery. Radiologists must also work to dissect artistic images to understand the emotions being conveyed,

which will invariably help them in identifying and appropriately responding to their patient's reactions that may or may not be explicitly expressed.

3. Encouraging Critical Thinking

- Art challenges individuals to think critically and interpret visual information in a nuanced manner. Radiologists who study art can develop enhanced critical thinking skills, allowing them to approach diagnostic challenges with a more analytical and open-minded perspective. Art is also highly subjective, with the same piece potentially meaning something very different to two individuals simultaneously observing it. This is similar to how the same set of radiologic images can mean something very different in various clinical contexts and can also help drive home that point to trainees.

4. Fostering Creativity and Innovation

- Art education nurtures creativity and innovation, qualities that are increasingly valued in the medical field. Radiologists who immerse themselves in art may discover new ways to approach diagnostic imaging, leading to innovative techniques and solutions in the interpretation of complex medical images.

5. Promoting Well-Rounded Professional Development

- Embracing art as part of their education can contribute to the well-rounded development of radiologists. It also offers a refreshing break from the rigors of medical training while providing a creative outlet that can ultimately enhance their overall professional fulfillment and satisfaction.

6. Understanding Cultural Context

- Art reflects cultural, historical, and societal contexts. By studying art, radiologists can gain a deeper understanding of diverse cultural perspectives and historical contexts, which can be invaluable in providing patient-centered care to individuals from various backgrounds. There have been numerous instances in which I personally have learned important information from either fellow trainees or friends that are outside of medicine just from discussing pieces of art together at a museum. Much of the time, those surrounding us can serve as our greatest educators especially given our diversity of backgrounds and experiences, however, none of these conversations would have happened without dedicated time and a piece of art serving as the catalyst. On a more objective note, studies have shown that art education can improve ethical competency, identity formation, and team building for both students and physicians (Dalia et al, 2020).

Conclusion

While I was in my fellowship, I had the pleasure of participating in the Seeing Art in Medical Imaging (SAMI) curriculum headed by Hyewon Hyun, MD (my fellowship program director); Jen Thum, PhD (one of the curators at Harvard Art Museums); and David Odo, PhD (one of the former curators at Harvard Art Muscums, now at the Georgia Museum of Art). This experience was truly a highlight of the year, since it provided a framework in which to interact with some of my co-fellows in conversations that never would have occurred otherwise. I learned a great deal about the variability in cultural and societal norms from both my international and domestic colleagues and thankfully was able to expand my worldview as a result.

I truly believe that there is a potential benefit to all that are involved in and participate in these types of programs, especially

when they are run by an experienced moderator at an art museum that has worked with medical professionals in the past. The popularity of art education in medicine has been increasing over the last decade, with multiple articles recently being published, including two in the Journal of the American College of Radiology (JACR) alone within the last 4 months (Cooke et al, 2023; Park and Cooke, 2024). Based on my personal experiences as well as the above-mentioned research and perspectives outlining all of the possible benefits, I am working to bring a similar program to residents at my program by interfacing with curators at the Rhode Island School of Design (RISD) Art Museum. I hope that this type of curriculum will continue to become more widespread in the future so that we can all continue to educate and learn from each other and become more empathic and culturally aware radiologists.

References:

Cooke EA, Sheth MM, Shah AA, Jbara M. Art in Radiology: Enhancing Patient- and Family-Centered Care Through Visual Engagement. J Am Coll Radiol. 2024 Jan;21(1):27-30. doi: 10.1016/j.jacr.2023.11.004. Epub 2023 Nov 7. PMID: 37939811.

Yoseph Dalia, Emily C. Milam, Evan A. Rieder; Art in Medical Education: A Review. *J Grad Med Educ* 1 December 2020; 12 (6): 686–695. doi: https://doi.org/10.4300/JGME-D-20-00093.1

Park B, Cooke E. Artificial Intelligence-Generated Imagery: A New Approach to Art in Medicine. J Am Coll Radiol. 2024 Jan;21(1):31-33. doi: 10.1016/j.jacr.2023.10.011. Epub 2023 Oct 18. PMID: 37863154.

BACK TO THE FUTURE

Oral Boards are Back – how do we Prepare?

by

Jessica G. Fried, MD & Erica B. Stein, MD

The American Board of Radiology (ABR) announced in April of 2023 that the certifying exam for diagnostic radiology will become an oral exam beginning in the calendar year 2028. This means that diagnostic radiology residents who entered their R1 year in July 2023 will sit for the "new" DR Oral exam to complete their initial certification. The content, format, and timing of the DR qualifying exam, known as the "Core" exam, will remain unchanged, per the ABR. While many details remain to be worked out, the ABR has elected to allow the new oral exam to be taken online in a location of the examiner's choosing, citing technological advancement necessitated by the novel coronavirus-19 pandemic. The change is reportedly motivated by the desire to better test the general knowledge of candidates with an instrument that allows examinees to demonstrate nuance in observation, synthesis, and management in radiologic findings, ability to communicate effectively, and practice with sound judgement. A candidate's first opportunity to take the oral exam will be in the calendar year following completion of residency training, with the plan to offer two examination opportunities in the winter/spring and fall of the calendar year.

For clinician educators, this change poses an interesting challenge—how will we best prepare our residents for both the multiple-choice question (MCQ) Core exam and the oral certifying exam during their residency? If most candidates choose to sit for the examination in the calendar year after graduation from residency, this will occur during their fellowship year or while in independent practice. It is unlikely that subspecialty fellowships will be able to take on the responsibility of preparing candidates for the examination, and even if they were to do so, this would

leave candidates who go straight into practice at a disadvantage. As a community, we will have to take on the mantle and strive to "teach new dogs old tricks," so to speak.

The ABR promises to regularly release information and communicate openly with the medical education community in the coming years as the new oral exam takes shape. As we await more guidance, clinician educators can still take proactive steps to begin to prepare our current R1s and future subsequent classes for this inevitable transition. Here are a few suggestions to jumpstart your action plan:

- *Warm up the hotseat*: It will be in the best interest of our trainees to re-invigorate case-based 'hot seat' learning, balanced with the MCQ exposure that our trainees need to help prepare for the Core examination. Of course, 'hot-seat' type education and learning is an artform with many potential pitfalls. It would benefit our community for future AUR meeting sessions, workshops, and webinars to focus on this format of training. If you are an expert in this area, consider this a call to arms!
- *See one, do one*: Residents currently in training are less likely to have benefitted from robust professional modeling of oral exam gamesmanship from their senior residents and it may be helpful for faculty to host "imaging Olympics" or "stump the expert" sessions where residents can learn how to best approach a case in this format directly from the faculty.
- *Cultivate the pasture*: Consider steps to re-establish the R4 year as a valuable part of the general diagnostic radiology training experience. The new oral exam promises to test nuanced observation, judgement, synthesis, and

management. Arguably, our residents are most primed to grow and solidify these advanced skillsets in their final year of training, after amassing basic knowledge in all specialties in preparation for the Core exam. Spending the majority of the fourth year in "mini-fellowships" may not be an optimal training pattern for the new examination era. Exploring new models of the fourth year learning experience ahead of "go time" will be critical.

We look forward to hearing more from our membership on innovative approaches you are taking at your home institution!

Balanced Accountability for Just Culture

by Chloe Chhor, M.D.

Physicians inevitably make mistakes; it's probable that we've made them before and will again. The way we and our organizations handle these errors dictates whether we foster a culture of blame or one of learning. In a blame culture, individuals or teams are often targeted and criticized for mistakes, cultivating a reluctance to take responsibility due to fear of reprimand. This atmosphere discourages open communication, leading to a tendency to conceal errors rather than learn from them. In contrast, a just culture, or a culture of learning, establishes a safe and transparent environment, encourages the reporting of risks and hazards, and ultimately leads to improvement in patient care. While a just culture recognizes shared accountability between systems and individuals, it does not completely eliminate the concept of blame. It emphasizes a balanced approach between holding both the system and individuals accountable, where individual responsibility depends on the quality of their choices and behavior.

An individual's behavior can be categorized as one of three types. The first is human error. This type of behavior is characterized as an

inadvertent action, one that is unintentional or accidental, often occurring without planning or awareness. The second type of behavior is at risk-behavior. An at-risk behavior can be characterized as knowingly engaging in noncompliant actions, resulting in a differing viewpoint between the observer and the observed concerning the balance between risk and reward. The third is reckless behavior, where individuals consciously choose to ignore a significant and unjustifiable risk. In a just culture framework, policies, principles, practices, and processes are implemented to handle the various types of behavior. Irrespective of the outcome, the usual response includes providing support for human error, coaching for at-risk behavior, and administering consequences for reckless behavior.[1,2]

As clinical-educators, our crucial responsibility is to ensure that our trainees understand the principles of a just culture and are acquainted with the guidelines that endorse fairness, learning, and improvement. We want them to feel at ease when voicing concerns about anything jeopardizing patient safety, without the fear of being blamed in the event of errors. This promotes a culture of psychological safety and thereby contributes to overall well-being, which is particularly important in this era where physician burnout is a pressing concern.

The idea of a just culture aligns well with this year's AUR meeting theme of "The Learning Healthcare System." This system aims to integrate internal data and experiences with external evidence for practical knowledge application. In this context, the just culture concept establishes an environment that harmonizes learning and accountability.

References:

1. Marx D. How building a 'just culture' helps an organization learn from errors. OR Manager. 2003 May;19(5):1, 14-5, 20. PMID: 12762162.

2. Marx D. Patient Safety and the Just Culture. Obstet Gynecol Clin North Am. 2019 Jun;46(2):239-245. doi: 10.1016/j.ogc.2019.01.003. PMID: 31056126.

Inclusion of faculty and trainees with disabilities

By Juan D. Guerrero-Calderon, MD

Medical literature agrees that we best serve our diverse patient population when physician practices reflect the diversity of patients. Therefore, many institutions have implemented strong programs to foster Diversity, Equity, and Inclusion (DEI). Medical schools are now calling for trainee diversity in several capacities. Nevertheless, many underrepresented minorities are significantly underrepresented in the radiology physician workforce despite an available medical student pipeline. (1)

In addition to improving patient care, the respect of human dignity is the gas that keeps the DEI engine running. Although significant advances have been made, much work remains. Characters with disabilities in TV shows and movies have advanced representation and equity in mainstream culture. However, beyond Grey's Anatomy and Star Trek, do our reading rooms reflect neurodiversity and disability inclusion?

Despite existing challenges, people with disabilities are succeeding and actively changing the face of healthcare. Years of work have led to marked improvement in diversity among medical students, including diversity of abilities. In 2019, 4.6% (2,600) of students from MD programs in the United States self-reported a disability to their institutions (2). There is no data on the prevalence of disability in residents and practicing physicians, but we should be making changes to welcome residents and radiologists with disabilities into our hospitals, clinics, reading rooms, and procedure rooms.

Disability is broad, including physical, sensory, learning, psychological, and chronic health conditions that substantially limit one or more major life activities. (2) Some disabilities are present since birth (i.e. color-blindness) and others are acquired from motor vehicle accidents or chronic illness. Nearly everyone

will develop a temporary or permanent disability at some point in life. Disability is part of the human condition.

Once we understand that disability is an important dimension of diversity, we should integrate disability into diversity initiatives, efforts, and language We should look at available materials that we can use for guidance. The AAMC Accessibility, Inclusion, and Action in Medical Education is a very rich manual with valuable recommendations that can be extrapolated from medical school, to residency, fellowship, and beyond. It recommends beginning with an assessment of services by an outside expert and through soliciting feedback from existing community members with disabilities. Trainees should be included in this process but should not be required to lead it. It is important to make sure that trainees are not overburdened.

A safe place where people are open to disclose their disability is an organization where disability has been normalized. Normalization of disability is promoted with awareness training that highlights radiologists with disabilities, such as twentieth century neuroradiologist Giovanni DiChiro or Instagram's @doc.on.wheels. We should also offer training about the principles of disability and accommodations from a social-model perspective.,

Additional efforts include professional development training our faculty, trainees, and staff to communicate effectively with people with disabilities. This includes the use of inclusive language such as "person with a disability" or "person who uses a wheelchair" and to discard words that judge the recipient, such as "victim", "handicapped", "afflicted by a disability", or "wheelchair-bound". Also, captions should be provided for all video conferences.

Finally, culturally appropriate content about disability should be integrated into curricula, standardized-patient scenarios, and case

studies. The AAMC recommends evaluation of curricula and pedagogy to assess whether language and content reflect best practices in disability, are accessible, and are respectful to persons with disabilities.

We should be intentional in recruiting and retaining faculty, administrators, and clinicians with disabilities. People with disabilities with established roles in our institutions will contribute to a better understanding of disability and positively affect the culture toward disability. They may be willing to serve as skilled mentors for trainees or junior faculty with or without disabilities.

When inviting candidates for interviews, the policy for requesting and accessing accommodations should be clear and easily accessible in the invitation. A simple line that allows an applicant to request an accommodation demonstrates that disability inclusion is not an afterthought, but a valuable pursuit. When applicants with disabilities have matched in your residency program or you have hired a radiologist, consider discussing accommodations immediately after the match or after the job offer has been accepted to allow time for the program to effectively implement scheduling changes or accommodations. Furthermore, planned accommodations for orientation activities, retreats, and courses should be clearly stated, as well as the information for the contact person for additional accommodation requests.

The request for accommodations may be the moment of 'coming out' as a person with a disability for those whose disabilities are not evident. This disclosure has traditionally been associated with numerous stigmas and condescending preconceptions. However, trainee interviewees with disabilities noted the importance of being open about their disability during the admissions process to gauge the knowledge base of the school and share a critical part of themselves. We should be thankful for the trust given to our institution when accommodations are requested and we should

have a plan to address and provide the accommodations in a timely manner.

Clear roles should be delineated in the onboarding process of residents and faculty. Admission officers should not make program accommodation determinations. The designated point person handling accommodations should be a person with training in disability services and disability law, who also understands the specific skills and minutia of our job.

Diversity initiatives must explicitly include disability as an aspect of diversity valued in our institutions. Disability should be intrinsically integrated into diversity trainings. The number of trainees and staff with disabilities should be monitored to assess progress in inclusion of persons with disabilities. These metrics will serve as an indication of the effectiveness of our efforts and should guide future endeavors.

Additional practical actions to include and support trainees, radiologists, and other physicians with disabilities are:
1. Normalize help-seeking behavior. Make sure these are confidential and that medical health services have locations convenient to the clinical sites.
2. Facilitate the leave request process. An attestation from the supporting physician is all that should be required.
2. Spend time shadowing in the clinic to better understand the environment, in advance of the needs to determine accommodations for a new hire
3. Work with medical school administration to develop effective and reasonable accommodations for learners
4. Offer support to trainees who request examinations for licensing exams
5. Maintain privacy and maintain trust with physicians to support disclosure
6. Exchange ideas and knowledge with peer institutions.

References:

1. Allen BJ, Garg K. Diversity Matters in Academic Radiology: Acknowledging and Addressing Unconscious Bias. J Am Coll Radiol. 2016 Dec;13(12 Pt A):1426-1432. doi: 10.1016/j.jacr.2016.08.016. PMID: 27916109.
2. Guerrero-Calderon JD, Lozano K, DeBenedectis CM, Shannon L, Viswanathan C, Kagetsu NJ. Disability: An Important Dimension of Diversity. J Am Coll Radiol. 2021 Nov;18(11):1585-1587 doi: 10.1016/j.jacr.2021.07.013. Epub 2021 Aug 12. PMID: 34390679.
3. Swenor B, Meeks LM. Disability Inclusion - Moving Beyond Mission Statements. N Engl J Med. 2019;380(22):2089-2091. doi:10.1056/NEJMp1900348
4. Meeks LM, Jain NR. Accessibility, inclusion, and action in medical education: Lived experiences of learners and physicians with disabilities. Washington, DC: AAMC. 2018 March 13.

The Future is Now - AI Image Generation in Radiology Education

By
Joseph S. Fotos, MD

"So, yes, this mass in the dependent lower lobe here is concerning for a malignancy." The faculty turns to the resident. "But what if it was more rounded, swirly, and there was a pleural effusion here - what else could it be?"

"Hm, I don't know." the resident states nervously.

"That would be more suggestive of something called Round Atelectasis, which is generally benign. Let's look at an example, shall we?" The attending turns back to the computer terminal. "Hey, RadTeach, generate an axial CT image set of the classic appearance of round atelectasis in the right lower lobe, and then give me a few variants and atypical appearances."

"Certainly," the terminal hums to life, "generating now." The images appear on the screen next to the patient images on the PACS monitor that faces them both.

"Excellent." The attending turns back to the resident. "So, as you can see here..."

One might imagine this scenario to be decades into the future, perhaps even in a Star Trek era of technological advancement; however, with the rapid development of AI tools in text and image generation, it is much closer than you think.

Much has been written about, both in the general media and the radiology literature, regarding the potential uses of AI text generation using Large Language Model (LLM) tools such as ChatGPT. Indeed, the rapid improvement in these models and tools has warranted genuine interest and practical implementation.[1,2]

On the other hand, AI image generation has been discussed in the public eye mainly regarding AI art generation and its potential to put real human artists out of work.[3] The art that AI can

currently generate is quite remarkable even in its current state and can easily be generated today using commercially available text-to-image products, such as DALL-E (*Open AI*, San Francisco, CA) and MidJourney (*MidJourney Inc*, San Francisco, CA). "Text-to-Image" in this context means that one simply types in some descriptive words, and the tool will use that as a prompt to generate an image.

What may be less well known generally is the remarkable capability of Generative Adversarial Networks (GANs), and their ability to generate realistic, not artistic, images based on large training datasets. These tools require advanced hardware in the form of one or more graphics processing units (GPUs) to first train the networks on datasets before giving them a generative task. GANs have many applications in radiology and have been shown to generate accurate medical images even in their current state. Often, the most discussed use of these generated images is to create datasets that can be used to train other AI models without the risk of accidental transmission of protected health information (PHI).[4]

GANs use two artificial neural networks with different goals, a generator, and a discriminator, that work against each other towards an output. Wolterink et al. describe this process in detail in their 2021 Radiographics article "Generative Adversarial Networks: A Primer for Radiologists" and discuss the potential applications in great detail. Included in that discussion is the possibility of generating medical images for training future radiologists.[5] Indeed, this is a tangible goal that could be implemented sooner than you might think.

This is also touched on by Tejani et al. in their 2022 article "*Artificial Intelligence and Radiology Education*" in Radiology: Artificial Intelligence, suggesting that not only could this benefit the general training of residents overall, but it could be of particular use for training in areas that lack diverse case volume

and available case examples, as well as in global health applications, where access to case sets may be minimal.[6]

But without the fancy hardware or know-how to train neural networks, how can an interested radiology educator use the current state of off-the-shelf image generators? The text-to-image generators mentioned above can generate images to make lectures more engaging or aesthetically pleasing. These can be used for free or with a monthly subscription and are as easy to use as simply typing a brief description of what you want. Within seconds, one can have something ready to paste into a lecture. Also, you will likely have immediate rights to the image to use how you please (though it is recommended to look carefully at each service and how its rights are structured). These tools use Natural Language Processing (NLP) to interpret the text and thus can take a prompt and connect it to related concepts to output an image that indicates a deeper interpretation of the text provided. [7]

For example, if I am giving a lecture on theragnostics (also spelled theranostics) in nuclear medicine, I might input a prompt of "radiation theragnostics." When I submit this prompt to an image generator available on ChatGPT that uses DALL-E, I get the image seen in Fig 1 and the text output seen in the figure legend. Although the text generation within the image is a little off, the image quality and the complex concepts illustrated remain very impressive.

Fig 1

"Here is an illustration representing radiation theragnostics, which combines elements of radiation therapy and diagnostics. The image blends aspects like radiation waves and therapy machines with diagnostic tools such as PET scans and gamma cameras, symbolizing the integration of radiation-based therapy and diagnostics in medicine. If you require any adjustments or a different focus, please let me know!" [8]

Conclusion:
As AI grows in capability and complexity at an incredible speed, new opportunities to leverage these technologies are continually emerging. Even ideas that seemed like science fiction a few years ago may be within our reach soon - or even now. AI image generators are but one example of exciting new technologies that

we can use to teach and engage the next generation of radiology learners.

Note: The cover image of this article was generated also using ChatGPT, with the prompt "cover image for an article about AI image generators for use in radiology education" and the following description:

"Here's the cover image for your article on AI image generators in radiology education. It features a close-up of a radiology image with AI-generated annotations and educational symbols, set against a dark background with futuristic elements. If there's anything else you'd like to adjust or add, just let me know!" [9]

REFERENCES:

1.   What is ChatGPT and why does it matter? Here's what you need to know [Internet]. ZDNET. [cited 2024 Feb 2]. Available from: https://www.zdnet.com/article/what-is-chatgpt-and-why-does-it-matter-heres-everything-you-need-to-know/

2.   What Is ChatGPT Doing … and Why Does It Work? [Internet]. 2023 [cited 2023 Mar 1]. Available from: https://writings.stephenwolfram.com/2023/02/what-is-chatgpt-doing-and-why-does-it-work/

3.   Ofgang E. What Happens to Illustrators When Robots Can Draw Robots? The New York Times [Internet]. 2023 Nov 4 [cited 2024 Feb 2]; Available from: https://www.nytimes.com/2023/11/04/books/booksupdate/ai-books-illustration.html

4.   Generative AI with MONAI [Internet]. 2023 [cited 2024 Feb 2]. Available from: https://www.youtube.com/watch?v=EQ-o60Ijrmg

5.   Wolterink JM, Mukhopadhyay A, Leiner T, Vogl TJ, Bucher AM, Išgum I. Generative Adversarial Networks: A Primer for Radiologists. RadioGraphics. 2021 May;41(3):840–57.

6.   Artificial Intelligence and Radiology Education [Internet]. [cited 2024 Feb 2]. Available from: https://pubs.rsna.org/doi/epdf/10.1148/ryai.220084

7.   Betker J, Goh G, Jing L, Brooks T, Wang J, Li L, Ouyang L, Zhuang J, Lee J, Guo Y, Manassra W, Dhariwal P, Chu C, Jiao Y, Ramesh A. Improving Image Generation with Better Captions.

8.   "radiation theragnostics" prompt [Internet]. ChatGPT, OpenAI. [cited 2024 Feb 1]. Available from: https://chat.openai.com/g/g-pmuQfob8d-image-generator

9.   "cover image for an article about AI image generators for use in radiology education" prompt [Internet]. ChatGPT, OpenAI. [cited 2024 Feb 1]. Available from: https://chat.openai.com/g/g-pmuQfob8d-image-generator

On Track to Success – How Optional Radiology Residency Tracks Provide Leadership Opportunities and Enhance Non-Interpretative Education
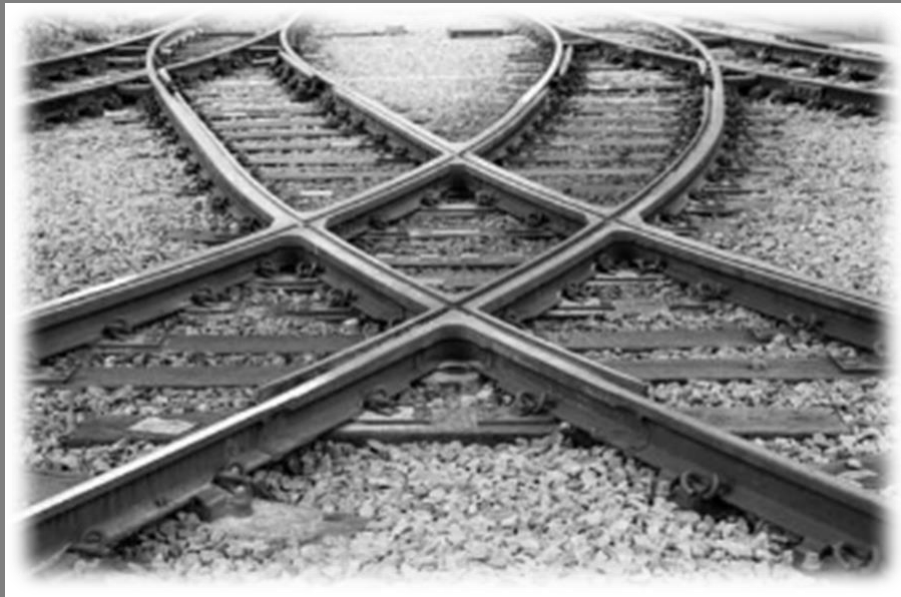
By Hernán Bello, MD

Introduction

Allowing residents the opportunity to explore their interests beyond clinical radiology is a fantastic way to introduce our future colleagues to the multifaceted nature of academic radiology and cultivate leadership. Emory Radiology has embraced these tracks, and I believe that this system can be adapted and replicated in a way that is synergistic with the trainees' clinical education and career goals.

Alternative pathways have existed in residency training for many decades. Some entail altering the typical length or structure of clinical training such as part-time residency in internal medicine[1] or accelerated training programs in family medicine[2]. Others have catered to specific societal needs, for example rural or community-focused training in surgery[3] and psychiatry[4]. Special pathways in wilderness medicine or toxicology prepare trainees for future subspecialized clinical practice in emergency medicine[5].

In radiology, dedicated research training during residency has existed since at least the 1980's[6]. Meanwhile, scholarship in radiology has grown ever more diverse and academic institutions are slowly becoming supportive of alternative routes to faculty success apart from the focus on basic science and clinical research. This has led to the organic development of niche areas of scholarly interest shared by both faculty members and, naturally, trainees. It is in this context where optional radiology residency tracks can serve as the perfect avenue for exploration, collaboration, mentorship, and growth. These predominantly non-clinical residency tracks have focused on research, education, administration, leadership, quality improvement, simulation, global and public health, and informatics, among others.

The benefits of residency tracks

Tracks allow residents to explore areas of expertise and advance their professional education in ways that support their career goals without committing to additional years of training. They are a way to offer a more holistic approach to training, going beyond the requirements set by the Accreditation Council for Graduate Medical Education (ACGME). The primary goal of residency is to learn clinical radiology. However, our residents are incredibly smart and naturally curious people that often come to our programs with preexisting and diverse academic interests. This predisposition for innovation should be promoted and not put on hold until after training. Residency tracks represent a positive structure by which to carefully balance learning clinical radiology and pursuing a passion area within medicine.

Setting aside a small amount of time (in our experience usually one day a month) for residents and their advisors to get together and discuss their shared interests serves as a catalyst for relationship-building, peer-to-peer learning, and organic mentorship. These kinds of relationships can otherwise take years to form, if they do at all in a large and busy academic medical center. Potentially counterintuitive, appropriately balancing clinical responsibilities with cultivating an area of personal passion surrounded by a community of peers and mentors invested in your success may be a recipe for combating burnout by gains in sense of belonging and personal accomplishment.

Finally, allowing trainees to cultivate additional areas of interest within academic medicine offers a powerful contrast with the prospect of exclusive clinical practice and has been shown to attract trainees not only into radiology residency but academic medicine more broadly.

Residency tracks offered exclusively to diagnostic and integrated interventional radiology residents at Emory University

There are two residency tracks that medical students can apply to through the Match, Research and Molecular Imaging in Medicine (MIM). MIM is a dual certification clinical pathway that combines training in diagnostic radiology and nuclear medicine. All others are officially presented every year during R1 orientation, when track leaders make a pitch to the group of new residents who then have the option to apply through an internal selection process.

Because of the way residency positions are funded by the Centers for Medicare and Medicaid Services (CMS) if the residents are engaged in patient care activities in U.S. patients, institutional support is mandatory for the success and sustainability of our residency tracks. When residents are on a research elective or outside the country during an international global health rotation, CMS stops providing funding for the resident's salary and benefits. One of the reasons we have been able to provide these tracks is because our department self-funds some of our radiology residency positions, allowing our program the flexibility to have a predetermined number of residents off clinical service at any given time. None of these tracks would be able to function without the continuous support from our department's chairs and educational leadership.

Research

The research track started in 2010 as an adaptation of the Holman Pathway to address the shortage of physician investigators in radiology and to ensure radiology maintains a central role in imaging research[7]. The track provides residents with formal instructional time, a dedicated research course,

space, and equipment, as well as protected academic time spread throughout the 4 years of residency. The program is individualized to each resident who is carefully paired with mentors.

The research track director, Dr. Brent Weinberg, is primarily in charge of the day-to-day operations of the program. This involves the selection of applicants, coordinating resident interviews, ranking candidates, meeting with track residents, coordinating with the residency education team, and ensuring residents make suitable progress. The director is aided by the research track steering committee of 6-8 faculty who assist in the mentorship of track residents.

In brief, successful residents find a lab and mentors, identify a project within the first year, submit research abstracts and attend national meetings, publish articles in relevant journals, apply for research grants, and finally obtain a faculty position at an academic institution where they will continue to grow their research career.

Residents in the research track have consistently obtained Radiological Society of North American and other society grants. They have a higher publication record than non-research track residents (based on unpublished internal data) and tend to continue a successful academic career where graduates often are awarded AUR GE Radiology Research Academic Fellowship (GERRAF) grants as junior faculty. Significantly, many research track graduates are successfully recruited to remain at or return to our institution after fellowship.

Research: Group of research track residents at the Holiday dinner with Dr. Brent Weinberg

Clinical Education

The Clinical Educator Track (CET) was started in 2015 with the objective to provide radiology residents with structured opportunities to practice and home in their teaching skills, to cultivate and develop abilities that will lead to a successful career in academic radiology that includes a focus on teaching[8]. CET's 4-year longitudinal program includes a structured curriculum consisting of three main components: small group series, teaching practicum, and a capstone project.

Residents get together once a month to share ideas, practice teaching skills, and learn from local and external lecturers. While dedicated mentorship and access to teaching different groups of learners are vital components of the track, the impact of the small group series cannot be overstated. The concept of providing a group of like-minded individuals with a full day each month protected from clinical duties to learn and practice education techniques, discuss projects, and share in the excitement of improving their teaching skills was groundbreaking.

CET members achieve success by implementing a capstone project based on their educational research interest or teaching activities. For example, trainees may provide lectures to and facilitate small groups with medical students, radiology technologists, midlevel providers, radiology residents, and residents from other specialties. All activities undergo peer and CET Committee review, currently led by Drs. Smyrna Tuburan and Jesse Conyers. The CET Committee also conducts an annual review with each trainee to provide feedback and to ensure appropriate progression through the program. Past CET capstone projects include the creation of an R1 lecture series and bootcamp, publication of education-related book chapters, RSNA education grant awards, and high viewership of radiology education items on social media.

CET was funded by an intramural grant awarded to Dr. Dexter Mendoza, Emory Radiology's Adopt-a-Resident Award. This started a trend that has proven successful at our institution: Innovative programs conceived by residents and their faculty advisors and brought to fruition through internal funding. CET's leadership structure also proved to be an effective combination of alternating resident leadership and consistent faculty oversight. Other tracks have since followed this blueprint including Imaging Informatics and Global Health.

Clinical Educator Track: Dr. Carolyn Meltzer discussing academic advancement with a group of CET residents

Imaging Informatics

Radiologists are some of the most tech-savvy of medical specialists and are expected to take the lead in the management of imaging information systems. Radiologist can pursue formal training in imaging informatics through a fellowship program, and at Emory, with our Integrated Imaging Informatics track or "I^{3}T", residence can obtain longitude instruction throughout the 4 years of residency[9]. The informatics track was started in 2017 by a resident-driven initiative funded by an intramural grant following the footsteps of the CET.

The I^{3}T supports further education for residents interested in the field of clinical informatics, which deals with the management of

information during all steps of the imaging chain – from ordering an imaging test to the communication of findings –using technology such as Electronic Health Records (EHRs), picture archiving and communication systems (PACS), radiology information systems (RIS), hospital information systems (HIS), and many other information technology (IT) tools.

Residents on the I^{3}T track learn skills needed to improve the quality and efficiency of imaging services while supporting clinical, educational, and research efforts. Many of the track member's capstone projects are designed to improve the residency training experience using innovative IT solutions while gaining hands-on experience in the field through a combination of early exposure to the National Imaging Informatics Course (NIIC), recommended readings and modules, small group discussions and activities, lectures, and organized leadership, operational, and research opportunities.

Leadership and scholarship are embedded in the track, which is led by track members with close mentorship and guidance from the track directors, Drs. Patricia Balthazar and Peter Harri. I^{3}T members' projects have already changed the residency program for the better, and many past and current members have received prestigious national awards including from the RSNA and SIR.

Informatics Track: Dr. Patricia Balthazar with track member Dr. Hanssen Li at RSNA. Dr Li received the 2023 GE Healthcare/RSNA Research Resident Grant for his project titled "Patient-Centered, AI-Synthesized Video Explanation of Radiology Reports Generated with NLP"

Global Health

The gap in access to radiology is astonishing: two thirds of the world's population have no access to medical imaging[12]. Despite such harrowing statistics, radiology remains a relatively new player in the global health arena. Recruiting and educating new generations of radiologists whose skillset, including cultural and

clinical competency, allows them to design and successfully implement sustainable solutions is key to overcoming these challenges.

Emory University has one the top Public Health Schools in the country and a considerable global footprint. Emory University School of Medicine's (EUSOM) Global Health Residency Scholars Program (GHRSP), a year-long curriculum including a month-long international rotation, has aimed at enhancing and expanding ongoing collaborations between Emory and Ethiopian institutions, particularly Addis Ababa University and Black Lion Hospital, since 2012. It was after my own GHRSP experience as a resident that the need for a radiology-specific global health track became clear. With the help of track co-director Dr. Jay Shah and passionate resident leaders Drs. Zofia Lasiecka and Fiza Khan, the Global Health Track (GHT) recruited its first cohort in July 2021.

The track's global health and policy curriculum aspires to equip residents with the tools to plan sustainable initiatives in resource-limited settings around the world as well as in the United States, while considering specific health care systems, disease patterns, political environments, and cultures. The program consists of monthly small group sessions where residents learn from interactive discussions with local and external radiologists with global health experience, invited speakers from relevant institutions such as the U.S. State Department's President's Emergency Plan for AIDS Relief (PEPFAR), Radiology in Global Health textbook discussions, and journal clubs. GHT residents are also enrolled in the EUSOM-wide GLOBE course, which provides general instruction in public health policy and awards them a Certificate of Distinction in Global Health upon graduation.

Given ultrasound's prominence as a diagnostic tool in resource-limited settings and the longstanding trend in the United States of relying on sonographers for imaging acquisition, the GHT has a

robust hands-on ultrasound curriculum with monthly workshops and simulation labs. Residents are also encouraged to participate in our volunteer-run and resident-driven free ultrasound clinic in Clarkston Georgia, an incredibly diverse city just outside of Atlanta which is also a refugee resettlement site, where they not only gain ultrasound scanning experience but continually develop cultural competency.

Track members are paired with mentors, typically members of the Department of Radiology Global Health Committee, who help guide them as they start to develop their capstone projects. Some of the current projects include performing a radiology needs assessment for Black Lion Hospital in Addis Ababa, Ethiopia after a few years of pandemic-induced travel hiatus; exploring an exchange program between Emory and the residency program in 37 Military Hospital in Accra, Ghana; deploying a breast-imaging specific needs assessment in Clarkston, GA to determine the feasibility of expanding our clinic's services; and contributing with the development of a women's health fellowship in Tanzania. Upon graduation, track members should feel capable of advocating for and working in a team implementing solutions to address access to health care and radiology medical education in a variety of settings.

Global Health Track: Drs. Bello and Shah with a strong representation of Emory GHT residents at the 2022 RAD AID meeting in Washington, DC

Quality Improvement

Radiologists lead quality improvement and patient safety initiatives in both academic medicine and private practice settings alike, not only within the radiology department, but increasingly serving on, and leading multidisciplinary teams.

The radiology residency Quality Improvement and Innovations Track (QI^2) consists of a longitudinal curriculum across the four years of residency with three main components: A radiology-specific QI curriculum organized and administered by the radiology department's quality team, participation in the EUSOM quality improvement and patient safety GME course, and successful completion of a capstone project to deeply explore and

address a quality improvement or patient safety issue with the guidance of a faculty mentor.

The QI^2 track builds essential skills through real-world experience with quality improvement activities, including the resident's capstone project, as well as through structured study and scholarship. Residents in the track can expect a graduate with both a GME Certificate of Distinction in Quality Improvement & Patient Safety with the RNA Advanced Certificate for Quality and Safety.

Additional tracks

There are several 12 to 24-month long residency tracks offered by EUSOM to all GME programs with a more general approach. These include: Medical Innovation, Medical Education, Simulation, Healthcare Management, Ethics, and Health Equity, Advocacy & Policy, in addition to the QI & Patient Safety and Global Health (GLOBE) courses previously mentioned.

The Medical Innovation track is led by Dr. Zach Bercu from Interventional Radiology and Dr. Jeremy Ackerman from Emergency Medicine and Georgia Tech's Biomedical Engineering, with funding from the Georgia Clinical and Translational Science Alliance (CTSA). Guided by their mentors and with the help of a textbook on biodesign, residents receive the foundation to pursue their own innovation projects. Ideally, residents will develop the skills to know how to identify problem, think innovatively about a solution, understand what might be needed next and where to go for support, how to develop and rely upon a team of experts, and how to seek similar resources elsewhere. Residents participate in monthly group sessions where they get to meet honored guest speakers including engineers, regulatory experts, entrepreneurs, and investors.

While not a substitute for a master's level degree, residents should come away from the tract with a sense of, "I can do this!".

Conclusions

Optional residency tracks in radiology offer trainees the opportunity to explore their academic interests without committing to additional years of training. When balanced appropriately, a residency track can complement the primary focus of learning clinical radiology and enhance the trainee's experience of academic medicine, potentially awakening an area of personal and professional passion that may otherwise have gone unexplored. Tracks are an excellent way of forming community and building relationships around a common goal, serving as a catalyst for collaboration between peers and for organic mentorship to develop, which can be otherwise challenging in a large academic medical center.

Institutional backing is key for the success of residency tracks, not only because of funding needs, but because a culture of support for the holistic development of residents should permeate the organization. Providing residents with a nurturing environment dedicated to pursuing their passions in academic medicine may provide a way to combat burnout and boost recruitment into academic radiology.
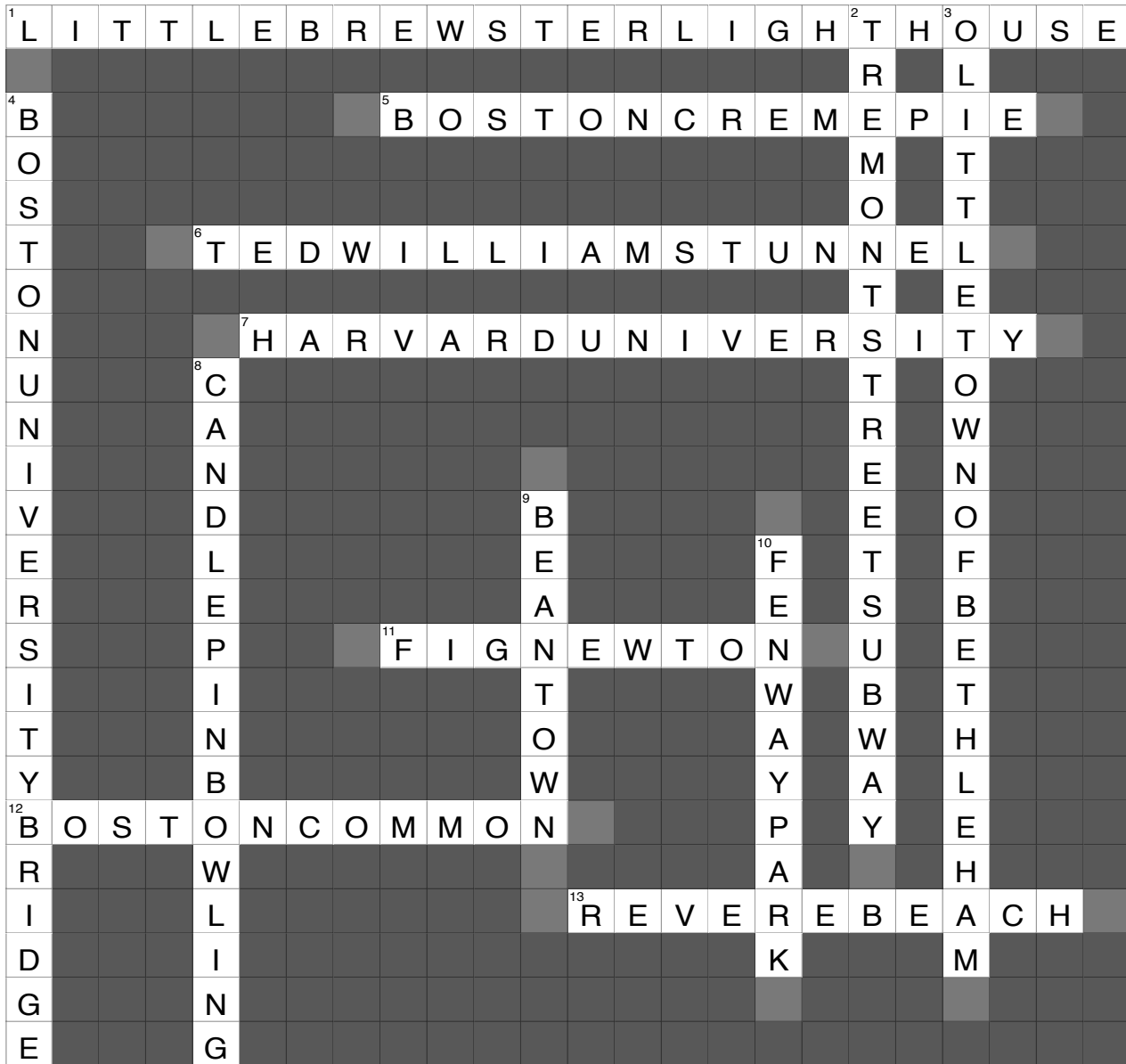
References:

1. Hillman BJ, Witzke DB, Fajardo LL, Fulginiti JV. Research and research training in academic radiology departments. A survey of department chairmen. Invest Radiol. 1990 May;25(5):587-90.
2. Costello JR, Mullins ME, Votaw JR, Karolyi DR, Kalb B, Gonzales P, Fornwalt B, Meltzer CC. Establishing a new radiology residency research track. Acad Radiol. 2013 Feb; 20(2): 243-8. Doi: 10.1016/j.acra.2012.08.011.Epub 2012 Oct 22. PMID: 23085410.
3. Mendoza D, Peterson R, Ho C, Harri P, Baumgarten D, Mullins ME. Cultivating Future Radiology Educators: Development and Implementation of a Clinician-Educator Track for Residents. Acad Radiol. 2018 Sep:25(9):1227-1231. doi:10.1016/j.acra.2018.03.032. Epub 2018 May 3. PMID: 297231418.
4. Balthazar P, Harri, Prater A, Heilbrun ME, Mullins ME, Safdar N. Development and Implementation of an Integrated Imaging Informatics Track for Radiology Residents: Our 3-Year Experience. Acad Radiol. 2022 May;29 Suppl 5:S58-S64. doi: 10.1016/j.acra.2020.11.015. Epub 2020 Dec 7. PMID: 33303347.

Further reading:
- Emory Radiology Residency Tracks Website: https://med.emory.edu/departments/radiology/education/diagnostic-radiology-residency/residency-tracks/index.html
- Emory University School of Medicine GME Residency Tracks Website: https://med.emory.edu/education/gme/housestaff/residency-tracks/index.html

Residents from multiple tracks collaborate in the Clarkston Imaging Clinic, our volunteer-run free ultrasound clinic in Clarkston Georgia, where they get hands-on practice with ultrasound, teach volunteer medical students, and help set up and maintain imaging informatics solutions.

Fun Facts about Boston

ACROSS

1 The first American lighthouse.

5 The official dessert of the state of Massachusetts that was invented at the Omni Parker House.

6 The deepest tunnel in America that is 90 feet underground.

7 The first college in North America.

11 The city of Newton, Massachusetts was the inspiration for the name of this popular cookie.

12 The oldest public park in the United States.

13 The United States first public beach that was established in 1896.

DOWN

2 The name of the first U.S. subway that was built in Boston.

3 The renowned Christmas carol that was written by Phillip Brooks, the 9th rector of Trinity Church in Boston, in 1868 after visiting the Holy Land.

4 The only place in the world where a boat can sail under a train going under a vehicle driving under a plane.

8 A variation of bowling that was invented in BostonThe city of Newton, Massachusetts was the

9 This name came as a result of a love among the city's earliest settlers for baked beans in molasses.

Cthe acer Connection

Want to contribute to the next issue of The ACER Connection?

Send your article to:

Biren A. Shah, MD

bshah@dmc.org