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Clinician–Researcher in Pediatric Cardiology: An Exploration of Domain-Specific Expertise—An Interview With Adam Dorfman

Interviewed by Don Ambrose

Adam Dorfman is a pediatric cardiologist, specializing in noninvasive imaging of the heart. He is an associate professor, clinical track, in the departments of Pediatrics and of Radiology and the co-director of the Pediatric and Congenital Cardiac Magnetic Resonance Imaging (MRI) Program at the University of Michigan. After obtaining his BA in biology from Yale University, Adam received his MD degree from the University of Michigan. He then moved to Boston, where he did his 3-year pediatric residency at the Boston Combined Residency Program in Pediatrics (at Boston Children’s Hospital and Boston Medical Center) followed by a 3-year fellowship in pediatric cardiology and additional year of fellowship in advanced cardiac imaging at Boston Children’s Hospital. He then stayed on for 2 years as an assistant in cardiology at Boston Children’s Hospital and instructor of pediatrics at Harvard Medical School. At that time, Adam was recruited to come back home to the University of Michigan as a clinical assistant professor, with a focus on building the Congenital Cardiac MRI Program as a collaborative effort between the departments of Pediatrics and Radiology. Adam has focused his research career on the clinical use of cardiac MRI and echocardiography in the diagnosis and management of congenital heart lesions, particularly including tetralogy of Fallot and single-ventricle heart disease. He is a Fellow of the American College of Cardiology and the American Society of Echocardiography and currently sits on the Executive Committee of the Pediatric and Congenital Interest Group of the Society for Cardiovascular Magnetic Resonance and the Pediatric and Congenital Heart Disease Board of the American Society of Echocardiography.

Ambrose: Please describe some of the work an expert typically does in your field.

Dorfman: As an academic physician, the three main areas of practice are clinical work, teaching, and research. Within pediatric cardiology, there are many subareas and options. I work in all three of these areas, as do all of my colleagues to varying degrees.

While no two people in my division have exactly the same job description, my own clinical work consists of a number of components. I have a half-day general outpatient pediatric cardiology clinic once a week, where I see a mix of new patients with typical referral complaints such as heart murmurs, chest pain, or syncope (fainting), as well as patients returning to clinic with any number of issues, including some who require or are following up after heart surgery. I also spend a few weeks per year as the attending physician on the inpatient ward service, taking care of hospitalized pediatric cardiology patients. The remainder of my clinical time is spent as a noninvasive imager of the heart, using both echocardiography, which is ultrasound of the heart, and cardiovascular MRI. Other physicians in my division specialize in cardiac catheterization, electrophysiology (abnormal heart rhythms), adult congenital heart disease, heart failure, or cardiac critical care. The clinical work that they do is reflective of their individual expertise after further subspecializing following training in general pediatric cardiology.

My teaching responsibilities dovetail with those clinical duties. Whether seeing patients in clinic, on the ward, or doing imaging work, I am nearly always doing those things with our cardiology fellows, who are physicians who have completed general pediatrics training and are working towards becoming pediatric cardiologists. Teaching can be practical at the patient’s bedside or imaging computer, as well as didactic or interactive. I will sometimes have pediatric residents or medical students with me as well, particularly when caring for medical inpatients. A significant part of teaching in this field is educating children and their families about their heart problems. Many of us also lecture at regional, national, and international meetings, educating our colleagues about our research and experience.

Research also is an important component of my career. A few of my clinical colleagues have labs and do basic science research, though this is difficult to combine with a full clinical workload. The rest of us do clinical research,
gathering data prospectively or retrospectively from the work we do in the hospital and clinics and publishing our results in peer-reviewed medical journals to advance knowledge in our field. This work may help those in our field to better understand various disease states, how to treat them, or how to use technological advances to better care for patients.

Finally, administrative responsibilities and service become an increasing part of the work that we do as we progress up the ladder in academic medicine. I serve on committees for national medical societies and within my own institution, codirect the pediatric cardiovascular MRI program at my institution, and spend time on peer review of manuscripts, reviewing abstracts for regional and national meetings, and planning parts of meetings as well.

Ambrose: What kind of knowledge, skills, and dispositions (attitudes, personality characteristics) are required for success in your field?

Dorfman: Pediatric cardiology is a heavily knowledge-based specialty. This begins with basic medicine, belying the common refrain heard in grade school of “When will I ever need this in the real world?” My everyday work requires knowledge of physics, biochemistry, sometimes cell biology and other basic sciences. A broad medical knowledge is important, particularly because children who are acutely ill with heart problems often develop problems with other organ systems. Finally, going through fellowship one develops a broad and deep understanding of cardiovascular anatomy and physiology, as well as the myriad of disease states and pathophysiology that will require management. That knowledge base continues to grow and be refined throughout a career; the learning in this field is never complete.

There are many different categories of skills that are important in this field. One type of skill is that directly needed in patient care. In noninvasive cardiac imaging, strong spatial ability is important to understand three-dimensional anatomy, particularly when putting those images together in one’s head based on a series of twodimensional images. This ability, honed with experience, enables understanding of complex situations. For those who perform procedures such as cardiac catheterization or electrophysiologic ablations, there is more of a physical skill level and coordination that is important; for example, to properly maneuver catheters and wires through challenging paths in the body. Another crucial skillset in this field involves interacting with people. This may be in the intensely emotional interactions with the family of a sick child, or in teaching trainees, or in various leadership roles. The role of the physician in this field in supporting a family, including a sick child, reassuring when appropriate, and being a source of emotional support when things are not going well is probably the most important and meaningful thing that we do. It is a skill that can be improved with experience and practice, but some people will always be better than others at doing this. Teaching skills are also crucial in the academic world. We traditionally do not get a lot of instruction in how to teach adults, though that is changing in some places. Developing a personal teaching style is important and can be honed, but I have some colleagues who seem naturally to be remarkably talented educators; it is a pleasure to watch them in action.

There are, of course, many different types of people who enter this field, with very different strengths and weaknesses. I do think there are certain personality characteristics that are helpful to success in this field. Some are essential and really are prerequisites, in a way. People in this field need to be bright, curious, and eager to learn. This is lifelong learning in its truest sense; whether reading new literature that changes approaches to disease or gaining experience in helping families or in teaching trainees, nearly everything we do represents new learning. I think it is crucial to embrace that in this field; we are clearly not perfect and have an awful lot to learn. This yearning to continue to acquire knowledge is the engine that pushes the field forward; it has progressed remarkably over a relatively short period of time.

Other types of individual dispositions are helpful in my eyes, if not essential. While this may be somewhat surprising, I think it is important to be thick-skinned. This can be a tough and stressful career. In emotional situations it is important to be able to set aside personal feelings and ego and to be able to take criticism in stride. I am fortunate to work in a place where people generally do treat each other well, but that is not the case everywhere. Related to this, I think it is extremely important to be able to accept responsibility when something does not go well despite one’s best efforts. Nobody in any field is right 100% of the time. But accepting that responsibility and learning from mistakes that are made is a key ingredient in making oneself a better physician, and eventually in improving outcomes in a field.

Ambrose: What kind of education/training is required for the development of the necessary credentials and expertise in your field (academic degrees or licenses or internships, etc.?)

Dorfman: The educational pathway to pediatric cardiology is fairly long. It shares the first steps in common with other medical fields; following a bachelor’s degree, one matriculates to a medical school to obtain an MD (or, alternatively, a DO from a school of osteopathic medicine.) The medical degree typically takes 4 years of study, but some people take extra time during this period to obtain other advanced degrees; relatively common choices would include a master’s in public health (MPH), or a joint MD/PhD degree, which is usually part of a specific health sciences program and is applied to jointly when considering medical school. Following medical school, if one is considering pediatric cardiology as a career, the next step is a residency program in pediatrics. The pediatric residency, including the year of
internship, takes 3 years to complete. The next stage is a 3-year pediatric cardiology fellowship, which is filled with intense clinical training. This includes training in all of the subspecialties within pediatric cardiology, such as noninvasive imaging, cardiac catheterization, electrophysiology, and cardiac critical care. Following this period of training, physicians interested in an academic career often spend an additional year training in one of those subspecialties.

This training includes step-by-step eligibility for a variety of certifications and licensures necessary to practice medicine in this field. The first set of board exams, the U.S. Medical Licensing Exam, comprises three steps. The first two are usually taken during medical school and the third during the first year of residency. This series of exams results in board certification as a physician. The more specific certifications are administered by the American Board of Pediatrics. Following residency, physicians are eligible to board certify in pediatrics, which requires a qualifying exam and career-long maintenance of certification. The same is true for the subboard of pediatric cardiology. Eligibility is established after 3 years of fellowship and similarly requires a qualifying exam, as well as various learning and quality improvement exercises for maintenance of certification; it currently requires a recertification exam every 10 years. Finally, the individual states regulate physicians with state licensure, which needs to be periodically renewed with documentation of continuing medical education credit.

Ambrose: Can you think of a teacher or mentor who helped you prepare for success in your field? How did this person help you develop the knowledge, skills, dispositions, or motivation that contributed to your success?

Dorfman: I think that for virtually everyone in this field, the answer to the first part of this question is “yes.” We all have a mentor; it is an essential ingredient for a successful career in academic medicine in general, and certainly in pediatric cardiology. I was and continue to be extremely fortunate in my mentor relationship with Tal Geva in Boston. Tal is an experienced physician, researcher, and educator, who has an international reputation as one of the leading experts in congenital cardiac noninvasive imaging. I think that first and foremost, he leads by example; he is one of the hardest workers that I have ever been around. When you see somebody so accomplished who never rests on his laurels and keeps a constant hunger to learn, teach, and discover, it is inspiring. Even after all this time, I feel like if I am not working as hard as I should, I am letting him down.

In terms of developing knowledge and skills, Tal is an excellent teacher. He pushes hard. I was expected to work very hard, to improve and to learn from my own and other people’s mistakes. I remember sitting at my desk as a Chief Fellow getting some administrative work done when my phone rang. When I asked what he needed, the response was “Oh, I just thought you might want to learn something.” There was no reason to take time out; there was more to pick up. And I knew I would be spending some time with him pushing me out of my comfort zone to keep my education progressing. Technically, he is quite good, and I learned a lot by watching and working directly with him. I think what was most striking was the diligence and doggedness with which he attacks a difficult clinical study. He wouldn’t give up when I thought as a trainee it was long past time.

A mentor is crucial in this field for getting one onto the national stage and beginning to develop a reputation as well. My experience was that when Tal thought I was ready he found a way to get me invited to give a talk at a national meeting (actually it was in Rome, at about 3:00 AM Eastern Time). Clearly there is a benefit here to having a mentor with enough connections and respect to be able to do that. There is some “sink or swim” mentality to this, except that I think he knew I would succeed.

You may be given the opportunity as a trainee or junior faculty member, but you have to prove yourself and stand on your own two feet at some point. After 2 years on faculty in Boston, I was recruited away. My wife and I decided that the best thing for our family was to move. It was particularly difficult leaving that mentor relationship. But 8 years later, I can continue to call him when I need help or have a question. When I left, he told me that he knew I would do fine clinically but that he would be happy when he reviewed one of my papers for a medical journal. I can’t describe my elation a few years later when he told me that he liked the first paper that I wrote as senior author.

Ambrose: Describe a typical work day for an expert in your field. If there isn’t such a thing as a “typical” workday, please explain why that’s the case.

Dorfman: There is not a “typical” workday in my field, because there are so many different things that we do. In my case, there are typically five different types of days that I may have. This reflects that my job includes seeing patients in clinic, doing cardiovascular magnetic resonance imaging, and doing different types of echocardiography. Plus, I have an occasional day without clinical responsibility, which I can dedicate to research and to administrative responsibilities.

On my clinic day, I see patients with a cardiology fellow, a nurse practitioner, and sometimes a pediatrics resident or medical student. I’m typically in clinic for around 5 hours, seeing around 10 patients. The remainder of those days I usually have time to tie up loose ends regarding my patients and to take care of administrative issues. On MRI days, I spend most of the day in the MRI suite; congenital cardiac MRI studies are quite hands-on and complex, demanding a lot of physician time. I am directly involved in performing, interpreting, and reporting the study, and usually talking to the patient and/or their parents about the results as well. On an echocardiography day, I may be assigned to transthoracic studies or transesophageal studies. On a transthoracic
both validate that the results “make sense” and help ask the relevant clinical questions that can be answered by this type of work.

This project has been fascinating materially but also in terms of process. Collaboration between physicians and engineers has a long and productive history and is probably growing in volume. However, it is not always easy. I think we learned as a group that we have different ways of thinking and of addressing problems, and we needed to bridge that gap to have a successful collaboration. Medicine is truly a mixture of science and art. We strive to do as much as we can based on hard evidence, but the reality, especially in a pediatric subspecialty in which the numbers of patients with certain diseases are limited, is that we often have to make decisions without comprehensive experimental data. In addition, we learn to be comfortable with a degree of uncertainty in clinical data. The reality is that no test is perfect, including that there is some amount of intra- and interobserver variability in most things that we do. We are cognizant of that uncertainty when we make clinical judgments.

While my knowledge of the engineering world is, of course, limited compared to medicine, a lot of the work they do is more exact. We had to work our way through this obstacle of different approaches and understanding, which I think we were able to do through time spent as a group with a lot of discussion. This is never an easy process and it took a lot of intellectual flexibility and understanding from all of the individuals involved, but in the end we have accomplished a lot, in terms of data and our original scientific goals but also in terms of mutual understanding and ability to work together. For me personally, this has also resulted in an improvement in my ability to communicate with parents of my patients who happen to be engineers.

Ambose: Think of a challenging initiative or project in which you were involved. What barriers and opportunities arose throughout the development of that project? How did you overcome the barriers and/or capitalize on the opportunities?

Dorfman: I have been fortunate to be involved in a research project funded by Fondation Leducq, a wonderful French foundation that provides grants specifically for trans-Atlantic collaborative cardiovascular research. This particular project is one that brought together pediatric cardiologists, surgeons, and engineers to collaborate on work creating multiscale models to describe the circulations of patients born with only a single ventricle in the heart (engineering work creating computational fluid dynamic models of the local circulation and coupling those with lumped parameter networks describing the other parts of the circulation in physics terms. I don’t claim to be expert in this work, or even to be able to adequately describe it.) Essentially, the process is for the clinicians to provide the data required for the engineers to create these models and then, on the back end, to provide both data for model validation and the clinical knowledge to
how we rely on one another, to help teach and motivate them to practice the same way in the future.

Teaching in general is more of a mix between individual work and teamwork. Individually, some of my colleagues are just terrific teachers, as I discussed earlier. There is teamwork inherent in teaching trainees as well. We set priorities as a program, including a curriculum for the fellows and goals within the various subspecialties. In addition, we have a group of physicians who trained in many different places and learned different approaches to clinical problems. This breadth of experience is educationally important, enabling the fellows to learn that there are different ways to accomplish the same goal and, I think, encouraging flexibility of thought.

Research, whether clinical or basic science, is most clearly a “team sport.” Physicians bring their different sets of knowledge and experience together to answer the research question. These questions are being attacked more and more through national consortia or other multicenter approaches. Particularly in our field when doing clinical research, a single center often doesn’t have enough patients with a specific problem to be able to achieve meaningful statistical findings. So research teams now are often composed of people all over the country, working together (which is made far easier with modern communication-related technology) to answer questions that are important to all involved.

**Ambrose:** What are some things about your work that you find most rewarding?

**Dorfman:** There are aspects of clinical work, teaching, and research that all are highly rewarding. But I went into medicine first and foremost to work hands-on with patients and families in the clinical realm, and that continues to be what gives me the most satisfaction. One of the great things about pediatric cardiology is that we, working together as a team with our surgeons, can make such an enormous difference in people’s lives. We work with diseases that can be disabling or fatal if not treated but that fortunately are often eminently treatable, with children going on to live long, productive lives. In fact, an emerging area in my field is adult congenital heart disease, because we have more and more children with congenital heart disease surviving and thriving into adulthood. For me, the most satisfying and rewarding times are the first postoperative clinic visits for kids who are doing well after surgery. The family, and sometimes the child, depending on age, have been so stressed and so anxious awaiting this ominous-seeming date of open heart surgery. Then they make it through and are usually amazed by how quickly their child returned to their usual self (or sometimes better, depending on what lesion and what type of surgery was performed). It is incredible to see how happy and relieved these families are, and how good the kids look, with this visit usually happening around 6 weeks after their operation. To be clear, I am not a surgeon, and that field is completely different from what I do. But we all do work very closely together to use our combined skills and knowledge to care for these kids.

As I said, there are a lot of rewarding things in this career. Teaching is certainly its own reward as well. The best moments in teaching are when you see the trainee put what was learned into action, showing tangible progress. Of course, having the chance to see the success of somebody who you have mentored is also a wonderful feeling. With clinical research, I think the two most exciting moments are getting a data set back (we have a biostatistician in my division who runs our statistical analyses) and seeing that an important finding has shown statistical significance, and then that first time that a new paper shows up on pubmed.gov as officially published. I think I’m quite fortunate to have a career in which there are so many rewarding times. There always is a new patient, a new trainee, a new research project. This keeps the time spent in this field fresh over the course of a long career.

**Ambrose:** What advice would you give to a gifted, talented young person who is interested in pursuing a career in your field?

**Dorfman:** The first thing I would say is “go for it!” There has been a lot made of the changes in medicine over the years, from HMOs to capitation to the Affordable Care Act. Some physicians make a point of talking about how medicine “isn’t what it used to be” and how they wouldn’t choose it again as a career path. While some would disagree, I think this is often more about making a political statement than actual career advice. I remember one of our more venerable medical school lecturers, who had already been teaching for decades when I was a first-year medical student (he just retired a couple of years ago!) telling us that when he was considering medicine, a friend of his father’s told him not to do it—as I remember it now: “They’ve ruined medicine; it’s not what it was.” That was probably 40 or more years ago. So some things don’t change.

In terms of readying oneself for this career path, I continue to believe very strongly in the importance of a liberal arts education; it may reflect an ivory tower mentality in part, but I really think that the pursuit of knowledge for its own sake is important. While I’ll admit to having my bachelor’s degree in biology, a significant percentage of matriculants to medical school have a nonscience major. And some of the classes I remember best from college are those like my art history survey class and a sociology class on inequality. I would like to think that having had a broad education makes me a better physician, by helping me to understand the world a little better and to relate to all kinds of people better. And I’m sure it makes me a better and more interesting person.

There are other traditional steps along the way that are important. I think during college, and potentially high school, it is important to both volunteer in a hospital or
other medical setting, which often offers an opportunity to see things from the patient’s point of view, and also to try some shadowing experiences with health care providers, to see what some of the work is like. The one thing that gives me pause when recommending medicine as a career is the average amount of student loan debt incurred by the average medical student by the time of graduation. It is a lot; it has grown significantly since I was in school, and it seemed pretty oppressive back then. One needs to be as sure as possible about this path before jumping into it, and all of those early experiences help.

The road to medicine in general, and particularly to subspecialties like what I do, is long. So planning ahead is a good thing. Understand the prerequisite coursework for medical school and be sure to find a counselor who you trust to help you along the way. Finally, while this is more difficult for some people than others, it helps to be proactive and take the initiative in finding mentors. Most of my colleagues and I love to be approached by an undergraduate or medical student who is looking for advice, shadowing experiences, or research mentorship. It is a competitive field, and a certain level of aggression and self-advocacy can be a good thing.

Ambrose: Is there anything else you would like to discuss that we haven’t yet covered?

Dorfman: The first step toward choosing a medical field is usually deciding between a surgical-based specialty and a medical-based specialty, although some fields like mine can include both. But the next step for many people is the decision of whether to work with children or adults (although people who want to do both can choose a specialty like family medicine or internal medicine/pediatrics.) For me, choosing to work with kids was the easiest part of the decision-making process. In part it is that sense that we can make a difference for somebody who has their whole life ahead of them to make their own impact on the world. The other part is just the fun of the everyday work. The kids are smart and funny and inspire me to look at the world through fresh eyes. Rounding on the inpatients can be emotionally challenging, but then the team will see a 2-year-old in an open-backed hospital gown teetering down the hallway with a smile on his or her face, and it changes everything. Plus, I can wear a Sesame Street tie to work, and nobody looks at me like I’m crazy. I really enjoy what I do; as I said, the chance to always have new fellows to teach, new research to do, and new clinical problems to treat keeps everything fresh and interesting. But it is working with the kids every day that really makes this a great field.