Cardiology in the Young

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Cross-continental guidelines for raising the next generation of paediatric electrophysiologists

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Editorial

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Thirty years ago, I began my paediatric residency at the Children's Hospital of Philadelphia. While the path from entering the clinical wards as a young bright-eyed intern to becoming a paediatric electrophysiologist is different for each individual, every path requires planning. Winston Churchill once said, "*he who fails to plan is planning to fail.*"

In the 1980s and 1990s, electrophysiology was considered by many to be an outlier in the field of paediatric cardiology, which at the time was focused on haemodynamics, circulatory physiology, and imaging. However, with technological advancements in catheter ablation, greater understanding of channelopathies and novel pacing strategies to improve cardiac function, paediatric electrophysiology has become a critical cornerstone in the field of paediatric cardiology. While curing a 14-year-old child with medically refractory supraventricular tachycardia with a few radiofrequency lesions may appear quite glamorous to the trainee, the skill set required to become a successful paediatric electrophysiologist extends far beyond knowing how to insert a catheter, orient it towards to the tricuspid valve, and apply energy. It is equally important to realise the complementary nature of electrophysiology in the bigger picture of congential heart disease (CHD) and heart failure. Management of the post-operative patient who has both arrhythmias and ventricular dysfunction, consideration of resynchronisation therapy for those with dyssynchrony, and which heart failure patients should receive a prophylactic implantable cardioverter defibrillator are requirements of the modern-day electrophysiology clinician. Additionally, the contemporary paediatric electrophysiologist should be adroit at caring for adults with CHD and arrhythmias and understand the risks of sudden cardiac death both from CHD as well as channelopathic and cardiomyopathic aetiologies. The roadmap to becoming a highly competent paediatric and congenital electrophysiologist requires gaining knowledge and skills through a well-designed series of building blocks that begins during general paediatric cardiology training.

In the decades prior to the 1990s, paediatric electrophysiology training began in a multitude of different ways. Paediatric cardiologists interested in arrhythmia management and electrophysiology testing may have been self-taught or worked with adult electrophysiologists to gain the requisite necessary skill sets. While certain basic electrophysiology tenets apply to patients regardless of age, paediatric patients are unique. For example, children with Wolff Parkinson White may be at risk for a sudden life-threatening event, while other children with frequent idiopathic premature ventricular contractions may outgrow the proclivity for such ectopy. As such, paediatric electrophysiologists must be knowledgeable in the care of arrhythmias from the foetus to the adult with congenital heart disease (CHD)(HRSS) understand arrhythmias in both the pre- and post-operative setting, be facile in complex arrhythmia ablations and device management and be up to date in the rapidly expanding field of cardiogenetics and sudden cardiac death.

The initial recommendations regarding clinical competency in invasive electrophysiology and pacemaker implantation were largely written by adult electrophysiologists.[1-9] The first recommendations for training in paediatric electrophysiology were published in 1988 by a group from Canada.[10] The first North American societal guidelines specific to paediatric electrophysiology were published in 2005 and endorsed by the Heart Rhythm Society (HRS).[11] Since that time, there have been a number of iterations to the training guidelines in paediatric electrophysiology studies, catheter ablation, and cardiovascular implantable electronic devices.[12-18] There have also been recommendations specific to the electrophysiology theatres itself and necessary equipment required in the catheterisation laboratories.[19] It is important that guidelines – whether for specific disease management, procedural recommendations, or as it relates to training – be reviewed every 3 to 5 years and updated accordingly based on either new scientific information, evolving technologies, or the changing landscape of training. Outdated guidelines provide little insight and can be harmful if one is not open-minded to a fresh perspective regardless of where one is practicing. It is important that competency in paediatric electrophysiology be assessed based on achievement of a fundamental knowledge base, technical proficiency, and a commitment to continued education. While the end result of training high-skilled paediatric electrophysiologists is the ultimate goal of every training programme, it is important to appreciate that there may be differences from region to region. Certainly, undergraduate college and university experiences differ vastly between the United States of America and Europe. However,

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what about subspecialised medical training? What are the differences regarding training in paediatric electrophysiology in the United States of America and in Europe?

Currently, there are two main societal bodies to which paediatric electrophysiologists are affiliated albeit with some overlap of physicians. The Pediatric and Congenital Electrophysiology Society is a largely North American society dedicated to improving the care of children and young adults with cardiac rhythm disturbances through high-quality collaborative research as well as the exchange of ideas on arrhythmia topics. In Europe, paediatric electrophysiology societal organisation is part of the construct of the Association for European Pediatric and Congenital Cardiology. Over the last decade, there has been tremendous integration and collaboration between the two societies with membership, shared symposiums, and guidelines. In this issue of "Cardiology in the Young," Kriebel and colleagues from the Working group for Cardiac Dysrhythmias and Electrophysiology of the Association for European Pediatric and Congenital Cardiology have put forth training recommendations for diagnostic and invasive electrophysiology in paediatric cardiology and adults with CHD in Europe. The authors are experienced paediatric electrophysiologists known internationally for their clinical and research expertise.

The United States of America has over 200 paediatric heart centres of varying size and complexity. Europe, representing 47 separate countries, has far fewer paediatric cardiology programmes which often are embedded within adult cardiology programmes. Additional training in the United States of America is typically conducted at a single institution, while it is not uncommon that trainees in Europe may require training at multiple institutions across different countries. The European task force guidelines acknowledge the vast differences in training across their continent as well as the differences between training in Europe and the United States of America.

In these new guidelines, the Task Force of the Association for European Pediatric and Congenital Cardiology Working Group for Cardiac Dysrhythmia and Electrophysiology developed three levels of expertise in the field of electrophysiology:

1. electrophysiology curriculum for fellowship in general paediatric cardiology – all paediatric cardiology trainees;
2. secondary training level focusing on non-invasive electrophysiological skills – basic-level paediatric and congenital electrophysiology specialist;
3. advanced training level including extensive knowledge and skills in non-invasive as well as invasive electrophysiology – advanced level paediatric and congenital electrophysiology specialist.

This European approach is somewhat different from the most recent North American recommendations from the training statement Task Force 4: Pediatric Cardiology Fellowship Training in Electrophysiology from the American College of Cardiology, American Board of Pediatrics American Heart Association and endorsed by the Pediatric and Congenital Electrophysiology Society.[14] In Task Force 4, there are two categories of training "Core" and "Advanced." The Core training recommendations are designed for the "traditional paediatric cardiology fellow" to ensure that the fellow acquires the base level of knowledge and skills necessary to become a paediatric cardiologist, and recognises when to refer his or her patient for more detailed and invasive rhythm investigation. Most paediatric electrophysiologists in North America complete an advanced electrophysiology curriculum in 1 year following their general paediatric cardiology fellowship. The American College of Cardiology (ACC) guidelines recommend certification by the International Board of Heart Rhythm Examiners examinations to assess for competency in both paediatric cardiac electrophysiology and cardiac rhythm device therapy. No distinct track for non-invasive electrophysiology training is described.

The uniqueness of having a "middle training tier" in non-invasive paediatric electrophysiology is somewhat prescient. With an increase in the number of children with cardiac implantable electronic devices, grown-ups with CHD and arrhythmias and those with heritable arrhythmias, the idea of a "middle" level of training to care for those patients serves as an interesting adjunct to most electrophysiology programs and should be welcomed. There are a few centres in the United States of America who have a specialist in non-invasive electrophysiology. These individuals may help run a pacemaker clinic or a heritable arrhythmia clinic. It is important as we continue to evolve as a sub-discipline within paediatric cardiology that we are open to fresh ideas. Not everyone who is interested in paediatric electrophysiology has to do catheter ablations. I applaud the authors of these guidelines for creating recommendations around training in non-invasive electrophysiology. Most adult invasive electrophysiology programs are two years, and it is likely that paediatric electrophysiology training centres, not just in Europe, but throughout the world need to consider either moving to a 2-year training time frame (for invasive electrophysiology) or assuring that following the current 1-year North American advanced training that ongoing mentoring and continual procedural and knowledge-based competency will continue as junior faculty.

These new guidelines address several important issues. While the North American guidelines recommended International Board of Heart Rhythm Examiners certification, the recently published European training guidelines require International Board of Heart Rhythm Examiners certification for advanced electrophysiology training until 2023 when a new examination presently being developed by Association for European Pediatric and Congenital Cardiology/European Heart Rhythm Association will be given. The European guidelines also require 2 years of advanced electrophysiology training following general cardiology training in a certified centre, and 30% of procedural recommendations must be in patients <30 kg. The document delves in to recommendations for the training centre – akin to a previously published document by HRS – but does not address the specifics of certification and how often that should occur and by whom.[19] The authors acknowledge the vast differences in centres across Europe and have allowed for 3 to 6 months of the training to take place in an adult laboratory. The specific procedural volume recommended between the North American and European guidelines are fairly similar, and it remains important for anyone considering a career in advanced electrophysiology training to have the courage and conviction to learn from both success and failure.

While these new guidelines have addressed multiple issues regarding fellow training and volume, they have not addressed the potential use of simulation laboratories, with both live and taped cases, for electrophysiology interventions. Our colleagues in interventional catheterisation have embraced such technology as a complement to hands-on learning. While simulation cases do not replace actual hands-on learning, they have the potential of enabling a greatly accelerated learning curve and overcoming some of the challenges that today's trainees face.

Over the last two decades as an electrophysiology attending, I have been quite fortunate to have had amazing role models

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and junior faculty who I have learned from and who I hope have learned from me. Regardless of which country you are practicing in as a paediatric electrophysiologist, it is of utmost importance that we should always remain patient centric not procedural centric.

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