Pediatric Cardiology Fellowship Standards for Training in Exercise Medicine and Curriculum Outline

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Abstract

Over the past 2 decades, fundamentals of exercise medicine, including clinical exercise testing, assessment and promotion of physical activity, exercise prescription, and supervised exercise training/rehabilitation programming have demonstrated considerable clinical value in the management of children and adolescents with congenital and acquired heart disease. Although the principles of exercise medicine have become an integral component in pediatric cardiology, there are no standardized training recommendations for exercise physiology during pediatric cardiology fellowship at this time. Thus, the Pediatric Cardiology Exercise Medicine Curriculum Committee (PCEMCC) was formed to establish core and advanced exercise physiology training recommendations for pediatric cardiology trainees. The PCEMCC includes a diverse group of pediatric cardiologists, exercise physiologists, and fellowship program directors. The expert consensus training recommendations are by no means a mandate and are summarized herein, including suggestions for achieving the minimum knowledge and training needed for general pediatric cardiology practice.

1. Introduction

There is a growing awareness of the importance of pediatric exercise testing with continued evolution of clinical applications, especially as they pertain to the management of congenital heart disease and other pediatric-onset heart disease. Exercise testing is increasingly available in pediatric institutions and has an established role in the practice of pediatric cardiology (1). Exercise testing is a valuable tool to assess exertional symptoms of unknown cause, diagnose cardiovascular disease, evaluate progression of disease, and evaluate response to treatment (1,2). Cardiopulmonary exercise testing (CPET) can identify primary physiologic or functional limitation, differentiating between cardiac, pulmonary, musculoskeletal, and metabolic mechanisms (2). Furthermore, CPET provides an objective

assessment of functional capacity, providing a framework for exercise prescriptions and identifying limits for safe participation in rehabilitative, recreational, competitive, and/or vocational activities (3). Additionally, CPET can be important for identifying patients at unappreciated risk. Exercise testing data from a single time point can be used to assess functional status and provide estimates about prognosis (1) while serial exercise testing is valuable in assessing the efficacy of interventions (pharmacologic, transcatheter, surgical, or cardiac rehabilitation), can identify asymptomatic or otherwise subclinical deterioration, and provides incremental prognostic information (4,5). Finally, CPET provides insights into normal physiology and disease-specific pathophysiology that may be applied by the pediatric cardiology or adult congenital cardiology trainee in other clinical settings including the intensive care unit, cardiac catheterization laboratory, operating room and outpatient clinic (1,2). Therefore, trainees in pediatric cardiology should understand the fundamental principles of exercise physiology, be capable of providing proficient interpretation of an exercise test, and be able to apply the findings to enhance patient care.

In 2015, pediatric cardiology fellowship guidelines were revised(6) with the goal of aligning training with core competencies and entrusted professional activities (EPAs) set forth by the American Board of Pediatrics (7) and Accreditation Council for Graduate Medical Education (ACGME)(8). These guidelines focused on 6 core areas of pediatric cardiology training (general cardiology, imaging, cardiac catheterization, electrophysiology, heart failure/pulmonary hypertension, and critical care) which became the basis of the EPAs. Curricula for these EPAs and standardized evaluation tools were developed (9). The 2015 guidelines did not adequately address training of pediatric cardiology fellows in exercise physiology to keep abreast with its evolution; exercise was minimally addressed in the sections of general cardiology (10) and electrophysiology (11), as shown in appendix 1. Thus, The Pediatric Cardiology Exercise Medicine Curriculum Committee (PCEMCC), a group of pediatric cardiologists, including fellowship directors, and exercise physiologists representing regionally diverse centers in United States virtually assembled to address this perceived gap in training (appendix 2).

Using the guidelines for the development of an educational curriculum published by Kern et al. (12), a needs assessment was conducted focusing on key stakeholders. In 2020, a survey was sent to all pediatric cardiology fellowship directors in the United States (n=63) to evaluate perceived exercise physiology training needs for fellows (13). The results revealed that all survey respondents (n=38) believed that explicit training recommendations would benefit fellow education (Figure 1). These expert consensus training recommendations are intended to address that unmet need.

Following this survey, and using the guidelines for the development of large educational curricula as outlined in appendix 3, the PCEMCC met several times over 14 months to discuss fellowship training and to develop a consensus of minimum expected goals to meet after the 3 years of categorical training in pediatric cardiology. Furthermore, the PCEMCC discussed, debated and developed a consensus for higher levels of competency in pediatric exercise cardiology for trainees expecting to supervise and interpret exercise testing and/or oversee an exercise training (e.g., cardiac rehabilitation) program during their career. The PCEMCC was mindful that all competencies may not be readily achieved in all training programs and may require transitioning and gradual restructuring of programs, especially those that may not have the necessary volume and diversity of clinical exercise encounters. The PCEMCC also acknowledged that the bar for expectations in pediatric exercise physiology may be lowered for categorical fellows, but with a higher expectation of mastery (13) and competence (including both theoretical and empirical knowledge) and skill competencies for those who wish to perform and interpret exercise testing within their institution. Guidelines for this degree of advanced

training have not adequately been addressed in the past though a recent American Heart Association Scientific Statement addresses the role of varying staff members including supervising physicians in performing and supervising exercise testing (14). Thus, it is anticipated hospital privileges granted for these skills may require a "grandfathered" policy for individuals who trained prior to these recommendations. As this is a guidelines document, and not a formal statement from a sub-board, it is not expected the above will be an issue at this time. Prior to implementation, these recommendations would need to be adopted by all program directors and governing/licensing organizations. However, it is also recognized that for the evolution of the field, the status quo in training should be challenged (15). In this case, setting parameters where none existed.

A model of stratification of core and advanced skills has precedent in pediatric cardiology. In past decades, graduates of training programs were deemed to have all skills necessary for the practice of all aspects of pediatric cardiology. However, it became evident cardiac catheterization and interventional cardiology as well as invasive electrophysiology required additional training beyond the 3 years of categorical training. Subsequently additional training requirements have been developed for critical care, imaging, heart failure, pulmonary hypertension, and adult congenital heart disease (10, 11, 16-21). It stands to reason mastery in pediatric exercise cardiology similarly requires additional training to achieve competencies and provide state-of-the-art care. Our proposal is perhaps most similar to training in cardiac imaging; where a categorical fellow may be able to engage in advanced training beyond the core training during the categorical fellowship with an appropriate individualized learning program (ILP). Examples are transesophageal echocardiography and fetal echocardiography (16).

The PCEMCC also discussed the value of specifying target numbers of observed or supervised exercise tests as present in former recommendations (10,16-21). It is understood target numbers of procedure observations/interpretations do not define competency, an issue compounded by the absence of empiric data on this particular topic and those included here are not a mandate. Rather, experiential volume provides a necessary measure of likely adequacy of exposure to avoid sampling bias and to satisfy credibility of the label "competent". Attaining a target number of procedures is increasingly feasible in the current era of asynchronous learning, in which online experiences may serve as a surrogate for real-time experience. Many aspects of pediatric cardiology exercise physiology training are well suited for online options. As such, while not all learners require the minimum procedural numbers and achieving those numbers does not guarantee competency, we have provided a recommendation for a target number of procedures that we expect will allow the majority of learners to achieve our listed competency.

Consideration of all of the above has resulted in the following recommendations for Core and Advanced levels of training in pediatric exercise medicine as detailed below. The format of the recommendations is similar to that used for the guidelines and EPAs (10,16-21).

2. Program Resources and Training Environment

Training in pediatric exercise physiology should be performed in a center with an ACGME accredited pediatric cardiology fellowship program. Basic exercise testing equipment incluing an integrated treadmill and/or cycle ergometer, ECG monitor, and tools appropriate for measuring blood pressure and pulse oximetry during exercise should be available. A breath-to-breath metabolic system

optimized for exercise, and capability to perform stress imaging utilizing echocardiography, nuclear medicine, or magnetic resonance imaging (MRI) are ideal additional resources. For institutions without a robust exercise laboratory, training can be offered physically at a partner institution, via a virtual experience, or a combination of these approaches. Indeed, it is a goal of the PCEMCC to create an online competency focused repository of exercise testing to supplement individual institutional resources to allow for the breadth and depth of training we recommend. The volume of exercise testing within a given center's exercise laboratory should be sufficient and diverse enough for each trainee to satisfy the competencies in combination with online resources. While exposure to a cardiac rehabilitation program is useful for comprehensive training in exercise cardiology, it is not a feasible requirement at this time due to a lack of widespread availability. However, the trainee should have the resources available to understand components of exercise prescription and principles of supervised exercise training. At least one board-certified pediatric cardiologist with expertise in exercise physiology should be identified as a point person for fellowship training. Third-tier board certification through the American Academy of Pediatrics is not available nor necessary at this time to supervise and interpret exercise testing.

3. Core Training: Goals and Methods

By the completion of the core training period, the trainee should achieve requisite competency in clinical aspects of exercise physiology. Table 1 lists the expected core curricular competencies for pediatric exercise physiology, along with corresponding evaluation tools. Specifically, trainees should be acquainted with a wide range of cardiovascular diseases encountered in youth and be able to independently evaluate young patients with congenital heart disease, acquired heart disease, and other pediatric diseases with exertional symptoms (e.g., pulmonary, oncologic, metabolic). The trainee should understand the indications for referral for basic exercise stress testing (i.e., ECG only) as well as CPET and the need for structured exercise prescription or supervised exercise training. The trainee should be exposed to a diverse spectrum of clinical material, such that patients having normal cardiac anatomy, pre- and postoperative congenital heart disease, and acquired heart disease are adequately represented.

The core curriculum includes a review of basic cellular metabolism, gas exchange, and the hemodynamic response to exercise. This knowledge should be acquired in the context of clinical care, didactic lectures, case review, and independent reading. Each trainee should gain experience in supervising basic and cardiopulmonary exercise tests in both cycle and treadmill ergometer modalities which can be augmented by training in sister institutions or virtually. Table 2 outlines the suggested target number of procedure observations/interpretations necessary to attain empirical knowledge and skills to understand the basics of exercise physiology and the utility of exercise testing. By the completion of core training in pediatric cardiology, fellows should understand the fundamentals of cellular energy metabolism, pulmonary function, and the role of the cardiovascular system in the delivery of oxygen and removal of carbon dioxide during exercise. Trainees should be able to select the appropriate testing modality, be familiar with the spectrum of exercise test abnormalities often encountered in patients with common congenital heart diseases and associated palliated states, heart failure from cardiomyopathy, pulmonary hypertension, and metabolic defects. Furthermore, the trainee should have the skills needed to understand exercise test interpretation and apply results to clinical decision-making.

4. Evaluation and Documentation of Competence

Pediatric cardiology training programs should provide written goals and objectives for fellows in exercise testing and clinical exercise physiology. A copy of these goals and objectives should be provided and reviewed with the fellows. Overall, our recommendations for pediatric cardiology fellows are not based on time of exposure, but rather knowledge based. Core pediatric cardiology fellows should be able to identify which patients should have exercise testing and indications for testing, which exercise testing modality is appropriate, identify target outcome variables that may provide insight for the patient's specific diagnosis, and how to optimally incorporate the results of exercise testing into the management of patients with cardiovascular and other diseases. Fellows who plan to perform and interpret exercise testing should display an advanced understanding of exercise physiology and demonstrate competencies in order to supervise testing. Expectations for this level of expertise are not described in detail in the current document.

5. Advanced training

Most pediatric cardiologists will not formally supervise, interpret, and report exercise tests or oversee rehabilitation programs. Those who will work in an exercise laboratory should have increased exposure and training. Ultimately these trainees should be able to interpret exercise tests and make appropriate patient management decisions or recommendations. Table 2 outlines the advanced competencies they should demonstrate in addition to the core competencies, and Table 3 gives recommended target number of procedural observations/interpretations to achieve competency.

This separate section on advanced training in this document is intended to provide an overarching framework where none existed, expecting this will evolve and a more specific curriculum and structure may be elaborated over time. It is also possible a trainee may need to achieve competency in more advanced areas as part of their career. Finally, there may be aspects in this advanced training that are pertinent to other advanced cardiology training (e.g., electrophysiology, heart failure, imaging/stress exercise, adult congenital heart disease, and pulmonary hypertension). Thus, these guidelines may be incorporated to define this training and be congruent within those advanced training curricula.

The timing of this additional training can be either during core fellowship, through an advanced fellowship or further training as a practicing cardiologist. Indeed, it should not be a requirement at this time to undergo an advanced fellowship in order to work in an exercise lab. Furthermore, we purposefully do not specify target procedural numbers in this document, but rather ascribe to competencies which we believe should be achievable through approximately 250-500 exercise electrocardiographic strips depending on the trainee as well as variation of indications, disease states, and findings experienced as per table 4. The availability of expert mentorship and other educational resources may also modify the experience needed to achieve this level of competence, but cannot substitute for real-world experience. It should be noted that the individual who will work in an exercise lab should have a broad sampling of experience with various exercise modalities, protocols, imaging strategies, disease states, and results.

The trainee should also understand the basic principles of exercise prescription and training. Trainees should understand the physiologic changes associated with exercise training as well as the indications for cardiac rehabilitation. As neither pediatric exercise prescription nor pediatric cardiac rehabilitation is widely available at this time, it is not an expectation that trainees would have experience with this training.

6. Future Directions

While the PCEMCC has formulated these recommendations with the goals of developing competency in exercise physiology, it will be important to create tools to measure outcome measures in competency. These should be developed with the aid of fellowship training directors. In addition, the PCEMCC recognizes there already exist many competing training requirements and it will be essential to evaluate how these competencies are achievable during the core pediatric cardiology fellowship. Creation of an online repository of competency-based curricula for exercise physiology would be necessary to allow implementation of these recommendations.

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Last update: August 10, 2021

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Figure 1.

Figure 1a.

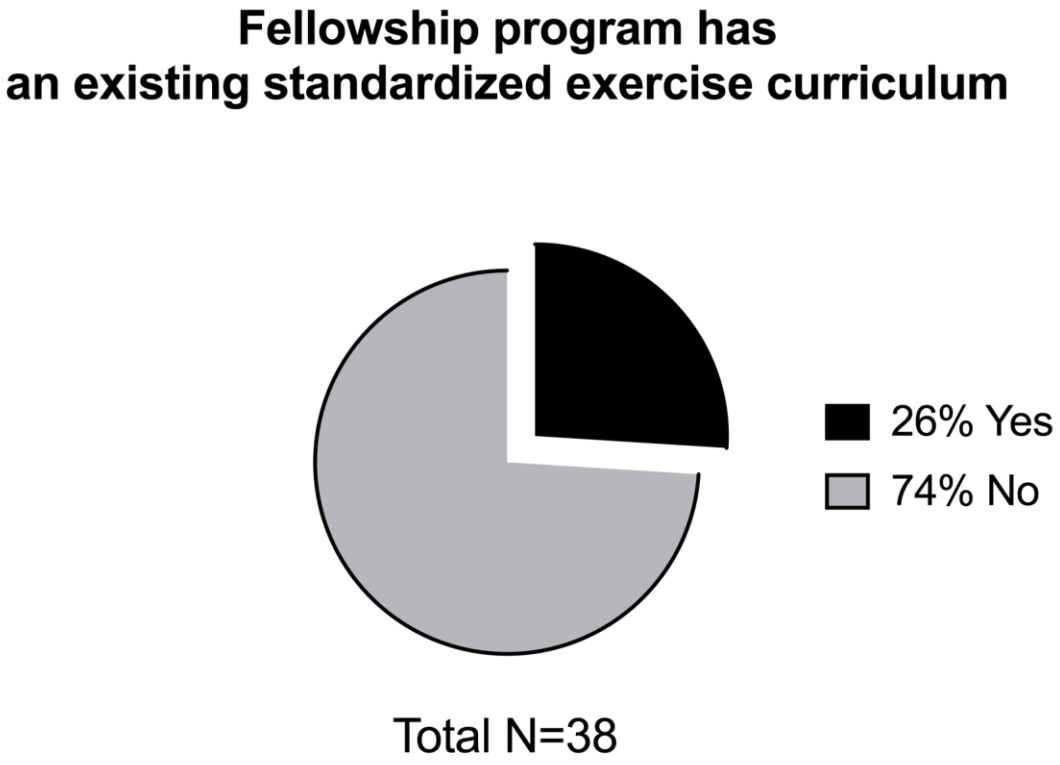

Figure 1b.

How important do you think it is to have a standardized exercise curriculum?

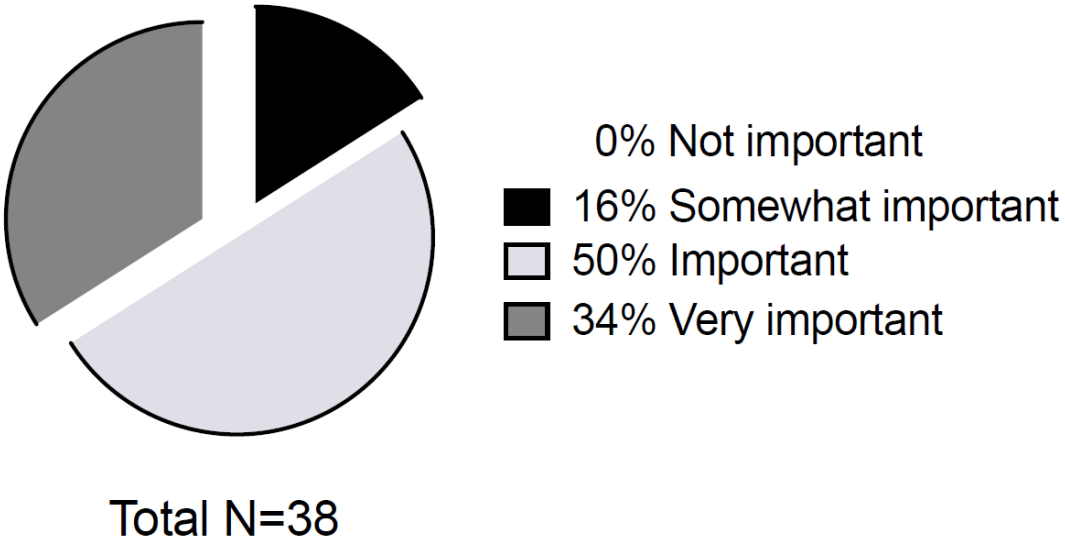

Table 1. Expected Core Curricular Competencies and Evaluation Tools for Pediatric Exercise Physiology

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Medical Knowledge: The graduating core fellowship trainee demonstrates:

- Knowledge of the basics of cellular energy metabolism including the importance of ATP and the energy systems to create it (aerobic and anaerobic).
- Knowledge of the role of cardiac and pulmonary function in oxygen delivery and carbon dioxide removal.
- Understanding of the normal and pathological ventilatory and hemodynamic responses to aerobic and anaerobic exercise commonly encountered in pediatric cardiology practice (see Appendix 1)
- Ability to recognize the primary limitation to further exercise.
- Recognition of normal and pathologic cardiac rhythms during exercise (e.g., premature atrial contractions, supraventricular tachycardia, complete heart block, premature ventricular contractions, ventricular tachycardia, torsade de pointes, pacemaker response) and their implications for clinical care.
- Recognition of normal and pathologic changes in electrocardiographic morphology (e.g., ST changes, T wave changes, etc.).
- Understanding of distinct cardiovascular effects of dynamic and static physical work.
- Knowledge of how cardiovascular drugs impact exercise performance, hemodynamics, and the electrocardiogram (e.g., beta blockers, digoxin, systemic and pulmonary vasodilator medications).
- Understanding the principles of ECG-focused, imaging-focused, and cardiopulmonary exercise testing.

- Understanding of the basic principles of exercise training and physical activity promotion, and the differences between these concepts.

Evaluation Tools: direct observation, conference participation, procedure logs, and in-training examination, written test: multiple choice question

Patient Care and Procedural Skills: The graduating core fellowship trainee demonstrates:

- Knowledge of indications for pediatric basic (ECG-only) testing.
- Knowledge of the indications for pediatric cardiopulmonary exercise testing (CPET).
- Knowledge of when the additional data from stress echocardiography, exercise flow volume loops, pre- and post-spirometry or other modalities may provide useful clinical information.
- Knowledge of the appropriate modality of basic exercise testing or CPET for specific pre-test diagnoses and cardiac conditions, and the appropriate testing options within each modality (cycle vs treadmill, incremental vs ramp protocol).
- Knowledge of the relative and absolute contraindications to maximal exercise testing.
- Knowledge of risk of serious events occurring during exercise (to obtain consent from patient and/or parents
- Knowledge of safety reasons for termination of exercise testing.
- Knowledge of treatments for complications of exercise testing including PALS/BLS based code-management.
- Knowledge of best practices for monitoring during a maximal exercise test (ECG, heart rate, blood pressure, pulse oximetry).
- Proper ECG lead placement, skin preparation and need for obtaining supine, seated, and hyperventilation ECG prior to testing.
- Skill of pediatric exercise testing interpretation, both ECG focused, imaging focused, and cardiopulmonary tests.
- Ability to apply standard testing and CPET results to patient management.
- Interpretation and understanding of sports classification systems and appreciation of the range of published exercise guidelines

Evaluation Tools: direct observation, conference participation, multiple choice questions, and procedure logs (Appendix 4)

Table 2. Minimal procedural experience in pediatric exercise testing, for general pediatric cardiology fellows (Online or In-Person)

Procedure	"Core" Suggested No. of Procedures

Exercise Electrocardiograms	**45**
Observed Treadmill or Cycle Ergometer Basic (ECG) Testing	3
Observed Stress Imaging (Echocardiography, Stress Magnetic Resonance Imaging, or Stress Nuclear Imaging)	2
Interpretation of Treadmill or Cycle Ergometer Basic ECG and imaging-based testing data	40
Cardiopulmonary Exercise Tests	**12**
Observed Treadmill or Cycle Ergometer Cardiopulmonary Exercise Test	2
Interpretation of Treadmill or Cycle Ergometer Cardiopulmonary Exercise Test Data	10

Table 3. Additional Curricular Components and Evaluation for pediatric cardiology fellows needing advanced in pediatric exercise physiology and testing

All competencies demonstrated in Table 1 with the addition of the following:

- List various exercise protocols (e.g., ramp vs incremental), modalities (cycle vs treadmill) and indications for each.
- Interpret and report pediatric exercise electrocardiogram testing.
- Interpret and report pediatric CPET.
- Understand distinctions in the interpretation of CPET responses and specific variables for different types of congenital heart disease and other pediatric heart disease.
- Demonstrates knowledge of the range of exercise test abnormalities that may be encountered in patients with common congenital and acquired heart defects, pulmonary hypertension, metabolic defects, electrophysiological diseases, etc.
- Demonstrates understanding of the cardiovascular adaptations to aerobic and anaerobic training (e.g., runners, weightlifters, sprinters, slow-twitch, fast-twitch muscles).
- Understand how to write an exercise prescription.
- Understand how to incorporate an exercise prescription into exercise training.

Table 4. Recommended Minimal Procedural Experience to Assess Competency in Pediatric Exercise Physiology for Providers Performing Exercise Testing (Online or In-Person)

Procedure	"Core" Suggested No. of Procedures

Observed or Interpreted Exercise Electrocardiograms	**200**
Treadmill or Cycle Standard (ECG only) Testing	150
Stress Imaging (Echo, MRI, or nuclear)	50
Observed or Interpreted Cardiopulmonary Exercise Tests	
Treadmill or Cycle Cardiopulmonary Exercise Test (CPET)	**100**

Appendix 1

Areas in which exercise was addressed in the 2015 training guidelines documents

1. From the "general cardiology training guidelines".

3.4. Evaluation and Management of Cardiomyopathies

MEDICAL KNOWLEDGE

- Know the appropriate limitations and restrictions to **physical activities and sports participation**.

SYSTEMS-BASED PRACTICE

- Order appropriate noninvasive and invasive diagnostic modalities in an efficient and cost-effective manner, and know how to interpret correctly: **treadmill stress testing**.

INTERPERSONAL AND COMMUNICATION SKILLS

-Communicate diagnosis, management plans, prognosis, and familial implications with patient, family, and primary care physician, and counsels child and family about **physical activity and sports participation.**

3.5. Evaluation and Management of Chest Pain in Children and Adolescents

MEDICAL KNOWLEDGE

- Know the costs and benefits relative to the likelihood of detecting abnormalities when obtaining an **exercise test**.

INTERPERSONAL COMMUNICATION AND SKILLS

- Summarize the findings with the patient and family with explanation of symptoms and reasons for any proposed **testing**.

Last update: August 10, 2021

- Review **results of tests** with patient and family. In the case of a cardiac etiology, discuss implications, plan for further work-up, and treatment/intervention as needed.

3.6. Evaluation and Management of Syncope

PATIENT CARE AND PROCEDURAL SKILLS

- Have the skills to order further cardiac testing as appropriate, including, **exercise**

Testing.

2. From the electrophysiology training guidelines.

Medical Knowledge:

- Know the specifics for clearance for **sports participation**.

Patient Care and Procedural Skills:

- Have the skills to utilize, **exercise testing** as a diagnostic tool.

Appendix 2: The Pediatric Cardiology Exercise Medicine Curriculum Committee Members

Name	Institution	Size of Institution (Cardiac Bypass Surgical Cases per Year)	Role
Jennifer Huang, MD, MCR	Oregon Health and Science University	Small (200)	Co-Director of Exercise Physiology and Cardiac Rehabilitation
Samuel Wittekind, MD	Cincinnati Children's Hospital Medical Center	Medium (370)	Co-Director of Cardiac Rehabilitation Program
Alexander Opotowsky, MD	Cincinnati Children's Hospital Medical Center	Medium (370)	Co-Director, Exercise Laboratory
Kendra Ward, MD	Ann & Robert H. Lurie Children's Hospital of Chicago	Medium (310)	Director, Cardiopulmonary Exercise Lab and Cardiac Rehabilitation Program
Alissa Lyman, PA-C	Oregon Health and Science University	Small (200)	Co-Director of Exercise Physiology and Cardiac Rehabilitation
Naomi Gauthier, MD	Boston Children's Hospital	Large (1100)	Director, Cardiac Fitness Program

Last update: August 10, 2021

Meg Vernon, MD	Seattle Children's Hospital	Medium (350)	Pediatric Cardiologist
Adam Powell, MD	Cincinnati Children's Hospital Medical Center	Medium (370)	Pediatric Cardiologist
David A. White, PhD	Children's Mercy Hospital	Small-medium (290)	Exercise Physiologist
Tracy Curran, PhD	Boston Children's Hospital	Large (1100)	Cardiac Exercise Program Development Manager
William Orr, MD	Washington University and St. Louis Children's Hospital	Small-Medium (275)	Director, Pediatric Exercise Physiology Lab and Cardiopulmonary Exercise Testing
Paul Stephens	Children's Hospital of Philadelphia	Large (800)	
Bradley Robinson	AI DuPont Hospital for Children	Small-Medium (250)	Fellowship Program Director Director, Cardiopulmonary Exercise Lab
Tam Dan "Tina" Pham	Texas Children's Hospital	Large (800)	Pediatric Cardiologist-Electrophysiology
Michael Carr	Ann & Robert H. Lurie Children's Hospital of Chicago	Medium (310)	Fellowship Program Director
Danielle Burstein	Children's Hospital of Philadelphia	Large (800)	Pediatric Cardiologist and Exercise Physiologist
Wayne Mays	Cincinnati Children's Hospital Medical Center	Medium (370)	Clinical Manager, Cardiopulmonary Exercise Physiology Lab
Stephen Paridon	Children's Hospital of Philadelphia	Large(800)	Director, Cardiopulmonary Exercise Lab and Cardiac Rehabilitation Program
Jonathan Rhodes	Boston Children's Hospital	Large (1100)	Co-Director, Exercise Physiology Service
Peter Koenig	Ann & Robert H. Lurie Children's Hospital of Chicago	Medium (310)	Pediatric cardiologists-exercise and echocardiography laboratories; former fellowship training director and guidelines committee member

Appendix 3

Applicable considerations for curricula development based (adapted from Kern et al).

1. Problem identification and general needs assessment: understanding societal needs, institutional mission and accreditation requirements (addressed with the initial survey).
2. Targeted needs assessment: selecting leaners and assessing the learners and learning environment (essentially already known).
3. Goals and objectives: prioritizing objectives, defining level of mastery, and ensuring congruence (the task for this committee).
4. Educational strategies: aligning and integrating content and choosing methods (another goal of the committee, to define and put forth educational content in a web-based platform along with a methods of evaluating competence).
5. Implementation: establishing governance, ensuring quality, and allocating resources (beyond the scope of the committee, but foundations in place for this to occur).
6. Evaluation and feedback: using learning analytics and dashboards (beyond the scope of the committed, but the foundations are in place for this to occur).

Appendix 4. Sample Procedural Checklist

Exercise Testing Training Checklist

Date:

Case:

Activity	**Pass/Fail**	**Comments**
Pre-procedure presentation of history		accurately describes patient history and indication(s)
Consent process		demonstrates ability to relay risks and benefits to patient/family
Pre-procedure patient assessment		assesses initial patient data to adjust plan accordingly
Planning of procedure		demonstrates understanding of how testing modality/protocol is chosen and identifies modifications appropriate for situation
Procedure termination		recognizes indications for test termination
Interpretation of data		demonstrates facility in the accurate interpretation of exercise testing data

Reporting of data		demonstrates ability to summarize data and recognizes normal vs pathology
Assessment of results in setting of patient care		able to apply results to develop a patient care plan
Overall performance		demonstrates capacity to choose appropriate testing modality to obtain goal results and interpret data appropriately