trainee to be qualified to perform any type of cardiac catheterization procedure at the completion of a general training program.

While advanced training in interventional cardiac catheterization is available in many institutions around the world, there are substantial variations in the total experience, educational structure, and scope of practice. Various societies and regulatory authorities have recognized the importance of such advanced training and have put forth consensus guidelines and assessment tools for such training.[6,8,9-13] It is important for pediatric cardiologists who wish to perform cardiac catheterizations to prove proficiency through a minimum of 1 (or more) additional postcore year(s) of dedicated interventional training. During this advanced training under the supervision of an experienced interventional cardiologist, it is expected that with increasing case complexity, the trainee will achieve competency as a sole or primary operator. Trainees would then be able to advance their skills independently and progressively with varying and increasing case complexity through a lifetime learning model. Most trainees will maintain mentorship links far beyond their training years (see Section 6.2.1).

6.2.2. Prerequisites for training. The prerequisites for procedural training for the core trainee in pediatric cardiology are admission to a pediatric cardiology training program, the exact details of which may vary between different jurisdictions. Admission requirements to general pediatric cardiology training are therefore not discussed in this section.

Instead, this section will focus on those interested in pursuing a career in congenital interventional cardiology including both pediatrics and/or ACHD.

Trainees will come from diverse backgrounds. Most trainees will have completed a general pediatrics and pediatric cardiology training program as specified by the country in which they practice. Prior to entering an advanced interventional training program, trainees should have acquired a thorough understanding of cardiac anatomy, pathophysiology, and various treatment strategies including an understanding of the natural and unnatural (modified) history of all congenital heart defects.

During their core training (and preceding the advanced interventional training), trainees should have acquired introductory experience in the basic principles of cardiac catheterization. This should include an understanding of the basic procedures involved in catheterization: indications for the procedure, basic acquisition and interpretation of hemodynamic and angiographic data, and the overall place of interventional catheterization in the treatment algorithm. The early catheterization experience should have focused on acquisition and interpretation of hemodynamic and angiographic data while minimizing use of radiation. It is expected that trainees pursuing an advanced interventional fellowship will have acquired an introduction to basic technical skills (vascular access, catheter manipulation, and limited exposure to device use), enabling the trainee and mentor to assess whether a trainee may have the necessary skills to pursue a career in advanced interventional cardiac catheterization.

It is important that a thorough assessment and selection process should be put into place prior to offering an opportunity for an advanced interventional fellowship. Completing such training does not equate to competency, and it will need to be emphasized to trainees upfront that starting an interventional fellowship does not guarantee a successful sign-off at the end of the training year. The selection process should be structured to limit the possibility that trainees who are selected do not have the skills to succeed as interventional cardiologists, an outcome that would be devastating to the professional career of a trainee.

The duration of advanced training may vary but should ideally be a minimum of 1 year, with each program having the infrastructure and volume to provide trainees exposure to and experience with a wide variety of representative techniques and procedures, to achieve the competencies listed below. While recommendations for total case numbers have their limitations (Section 6.1), any program that wishes to offer an interventional training program should include a minimum of 200 congenital catheterizations per year (per advanced fellow being trained) to be drawn upon (with at least 150 interventional cases). However, this must be taken in the context of regional training requirements and center-specific volumes. A minimum of 200 cases may be difficult to achieve in some countries where there are a limited number of very large volume centers. At the opposite end of the spectrum, in larger programs where a fellow may be exposed to a very large procedural volume, a training period of just 6 months may be adequate, if the fellow meets all volume and other requirements that are expected from a 1-year training program.

Programs offering interventional training should be committed to mentoring and supporting junior cardiologists and should have the ability to measure the outcome of their training efforts. Competence assessment schemes are presented below as a guide for trainers and assessment committees to consider.

6.2.3. Assessment of training progress and competency. The following comments apply to in-training core and interventional fellows whether following a pediatric-focused pathway, an ACHD pathway, or both. It is the training programs' responsibility to monitor core and dedicated interventional fellows in all aspects of their training, using clinical competency committees to review performance and provide feedback on the achieved milestones. The curricular competencies that require mastery include systems-based practice, practice-based learning and improvement, professionalism, and interpersonal and communication skills.

Several assessment methods have been utilized over the years to determine training progress and competency. The traditional framework emphasized a time or case-number-based approach (Section 6.1). However, this has been replaced by an educational and assessment framework focused on processes and (more importantly) outcomes, with specified levels of achievement. All trainees must have a named training supervisor appropriate to their training aims and environment. The trainee's supervisor should set and review the learning objectives for each training level.

A similar format that has become central in medical education is the shift to what is called "*competency-based training or competence by design.*" This construct requires the trainee to achieve an expected level of competency in predefined clinical and academic tasks rather than simply spending a defined amount of time in the subspecialty service or performing a certain number of procedures to be considered fully "trained."[14,15]

6.2.3.1. Entrustable professional activities. Several methods exist to assess competency, including case-based assessments, structured observation, and assessment of practical skills. On a global scale, several licensing boards and licensing authorities[16-18] have required training programs to utilize these "entrustable professional activities" (EPA) as the framework to evaluate a trainee's ability to practice. EPA are observable and measurable, and map the competencies and milestones of trainees as they move through the stages of acquiring fundamental interventional skills. Using this assessment format, the trainee is "entrusted" to move through levels of learning, demonstrating competencies in both the technical and academic components of congenital interventional cardiac catheterization. Achievement of competency as entrustable activities should be measured, monitored, and documented throughout the entire training curriculum (logbooks may complement this process).

Requirements and demands from the core fellow rotating through the cath lab should be viewed to establish the critical base of information required by the general cardiologist in assessing the diagnostic and interventional modalities of the cath lab. As such, their assessment as learners will be different from the dedicated interventional fellow. A