

# The Society for Cardiovascular Angiography and Interventions Structural Heart Disease Early Career Task Force Survey Results: Endorsed by the Society for Cardiovascular Angiography and Interventions

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Over the last decade, structural heart disease interventions have emerged as a new field in interventional cardiology. Currently, the Accreditation Council for Graduate Medical Education accredited interventional cardiology fellowship programs in the United States provide high-quality and well established training curriculum in coronary and peripheral interventions, but training in structural interventions remains in its infancy. The current survey seeks to collect relevant information and assess the opinion of interventional cardiology program directors in ACGME-accredited institutions that are actively involved in structural interventional training. Our study describes the actual number of structural procedures performed by interventional cardiology fellows in ACGME-accredited programs, the form of the structural training today and the suggestions from program directors who are actively trying to integrate structural training in the interventional cardiology fellowship programs. © 2012 Wiley Periodicals, Inc.

**Key words:** congenital heart disease in adults; patent foramen ovale/atrial septal defect; paravalvular leaks

## BACKGROUND

Over the last decade, structural heart disease (SHD) interventions have emerged as a new field in interven-

tional cardiology. With an expanding adult congenital heart disease (ACHD) population [1] and recent advances in structural interventions especially the advent of transcatheter aortic valve replacement (TAVR),

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pulmonic valve implantation (TPVI), mitral valve repair (MitraClip), and shunt closure procedures, there is a growing need for highly specialized SHD interventional cardiologists to perform these complex transcatheter interventions.

Currently, Accreditation Council for Graduate Medical Education (ACGME) accredited interventional cardiology fellowship programs in the United States provide high-quality and well established training curriculum in coronary and peripheral interventions, but training in structural interventions remains in its infancy. The Society for Cardiovascular Angiography and Interventions (SCAI) has published an expert consensus statement to define the training needs and knowledge base for future structural interventional cardiologists in this rapidly developing field and also describe the difficulties in providing certification in this complex field [2].

Several accredited interventional cardiology fellowship programs integrate structural interventions training in their curriculum with some offering an additional advanced fellowship year. Major issues in the realization of dedicated structural fellowship programs include small number of centers experienced in transcatheter valve procedures and other technologies, constraints of trial enrollment, wide variation in which procedures are performed and the frequencies of each, the limited experience at the senior staff level itself and probably most importantly, the lack of funding for training [3]. Information regarding the number of structural fellowship programs, training curriculum, actual number of structural procedures and didactics, and conformation with the SCAI expert consensus statement remains scant.

## SCAI STRUCTURAL HEART DISEASE EARLY CAREER TASK FORCE

The SCAI Structural Heart Disease Early Career Task Force was formed in June 2011 as an effort to provide a forum for (a) interventional cardiologists seeking advanced training to network with physicians who have recently completed some form of SHD fellowship, (b) for interventional cardiologists involved in a SHD program and seek training not offered at their parent institution, and (c) for interventional cardiologists inclined toward sub-specialty SHD training but needing guidance.

After multiple meetings it became apparent that several important questions had to be addressed: (1) Evaluation of the current status of SHD training in the United States, (2) Enumerate the centers that have some form of training in SHD, and (3) types of procedures that are currently being performed. We decided to survey interventional cardiology program directors across the country about their ideas and suggestion

regarding an ideal SHD fellowship and other potential training pathways for gaining these skills without going through a dedicated training year. Furthermore, their views about the minimum number of procedures needed to be performed for someone to be “signed off” as being proficient at independently performing each of these complex procedures were surveyed.

A previously published survey was sent to all SCAI members of the Council on Structural Heart Disease, and to members of the Congenital Heart Disease Committee [4]. That survey evaluated the approximate number of structural interventions performed; the methods to obtain skills for future anticipated procedures and the factors believed to inhibit the more widespread growth of SHD interventions. The response of 107 US-based interventional cardiologists revealed that, although many procedures like transeptal puncture, patent foramen ovale (PFO), and atrial septal defect (ASD) closure are commonly performed by most interventionalists involved in structural interventions, others (e.g., alcohol septal ablation, transcatheter valve repair, and implantation) are limited to a significant minority. In addition, the number of procedures performed varied greatly. That SCAI survey highlighted insufficient patient volume, lack of funding, reimbursement issues, surgeon resistance, lack of transeptal skills, hybrid labs or adjunctive imaging, and inability to access new technology due to trial constraints as the main reasons inhibiting the widespread growth of SHD interventions [4]. The main limitations of that survey were the low response rate (3%) and the fact that it was not addressed particularly to program directors.

## SURVEY METHODOLOGY

A detailed evaluation of existing SHD programs and input from current program directors would allow a comprehensive evaluation of the current status of structural interventional cardiology training in the US and propose ways to provide additional structural training for new interventional cardiologists or experienced interventionalists who wish to get involved in this rapidly expanding field.

The current survey seeks to collect relevant information and assess the opinion of interventional cardiology program directors in ACGME-accredited institutions that are actively involved in structural interventional training.

During the regular SCAI SHD early career taskforce committee meetings, a survey including 16 questions was compiled and approved (Table I). We used Survey Monkey to compile and analyze our online web survey. The survey was distributed to all the 137 ACGME-

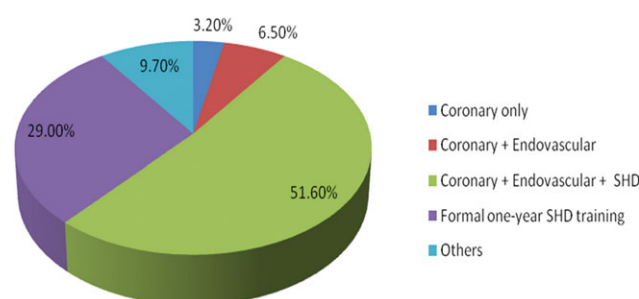
**TABLE I. Survey Questions**

1) Is your institution involved in the percutaneous treatment of structural heart diseases?
2) How is the interventional training program structured?
3) Is there dedicated time in the training program to address structural interventions?
4) In your opinion as Program Director, is this enough time?
5) In your opinion does a dedicated structural fellowship program detract from the overall interventional program fellowship training?
6) Would you consider having a dedicated year for structural interventional training?
7) Do you follow a didactic program (lectures) for structural training?
8) Are your fellows trained in interpreting the following: Cardiac CT scans, Cardiac MRIs, TTE, TEE, ICE?
9) Does your institution collaborate with a pediatric interventionalist for structural interventional work?
10) Of the following procedures, please estimate how many your fellows-in-training perform in 1 year. (ICE, BAV, BMV, BPV, Transeptal punctures, LAA occlusions, TAVR, TPVR, MitraClip, Perivalvular leak repair, ASD, PFO, VSD, Coronary fistula occlusions, PDA occlusions)
11) Of the following procedures, how many do you think should be performed by fellows-in-training in order to become proficient?
12) How do you think a position in structural interventional training should be funded?
13) How is your structural training program funded?
14) How do fellows submit their applications for the structural training program?
15) Is your application process internal or is it open to external applicants?
16) Who is the person to contact for information on training in structural interventional cardiology?

accredited interventional cardiology Program Directors (PD). An invitation letter was sent by email to complete the online survey.

The main objectives of the survey were:

1. To describe the state of the current structural interventional fellowship programs
2. To estimate the dedicated time by the current trainees to perform structural interventions
3. To evaluate the role of didactics, ancillary imaging training and collaboration with pediatric interventionalists in the structural fellowship training
4. To record the actual number of structural procedures performed by the interventional fellows and to determine the experience needed to achieve proficiency
5. To identify the funding sources of the current structural fellowship programs
6. To present the application process for the current structural fellowship positions
7. To assess the Program Directors' opinion about the minimum number of structural interventions needed to achieve proficiency
8. To publish recommendations for a nationwide collaboration in order to establish uniform training curriculum in SHDs.



**Fig. 1. SHD interventions in the current fellowship programs.** [Color figure can be viewed in the online issue, which is available at [wileyonlinelibrary.com](http://wileyonlinelibrary.com).]

## PRESENTATION OF SURVEY RESULTS

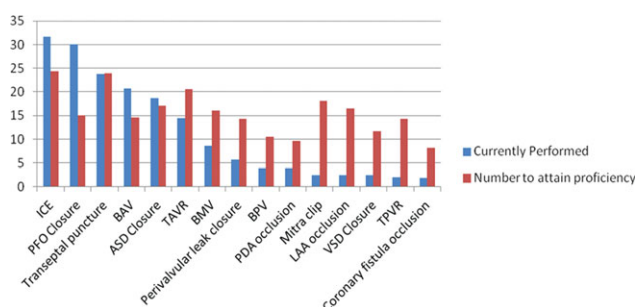
Surveys were sent to all the 137 ACGME-accredited interventional cardiology programs. Of those, 36.5% ( $n = 50$ ) of the current program directors completed our survey. From the responding institutions, 86% are involved in the percutaneous treatment of SHDs. Approximately 29% ( $n = 9$ ) offer a one-year training in structural interventions after the completion of interventional cardiology training, while the majority of them (51.6%,  $n = 16$ ) offer coronary and peripheral intervention training with structural heart interventions exposure integrated into the formal interventional fellowship (Fig. 1). The list of the responding institutions can be found in Table II.

Training in structural interventions is achieved by assigning structural cases throughout the year to the structural fellow (39.3%,  $n = 11$ ), by specialized conferences and courses (25%,  $n = 7$ ) and by dedicated months or rotations to adult congenital and structural interventions. Most of the fellowship programs follow a pre-specified didactic program for structural training, train their fellows in ancillary imaging studies, and collaborate with pediatric interventionalists to offer a global approach to the management of adult congenital and SHD.

Despite efforts to include structural training in the first year interventional cardiology training, approximately half of the program directors (58.6%) believe that this time is not enough. Our survey did not investigate the reasons for insufficient SHD training during the first year fellowship training or the program directors' opinion regarding suggested duration of the fellowship when SHD is integrated. However, about one-third of the program directors believe that a dedicated structural interventional fellowship program would detract from the overall interventional fellowship program. Most of the studied fellowship programs would consider having a dedicated year for structural intervention training ( $n = 21$ ). The majority of responding programs (73%,  $n =$

**TABLE II. List of Fellowship Programs**

Program Name	Program Director
Programs offering one year training in structural heart interventions after completion of interventional cardiology training	
Beth Israel Deaconess Medical Center, Boston, MA	Donald Cutlip, MD
Lenox Hill Heart and Vascular Institute, New York, NY	Carlos E. Ruiz, MD
Massachusetts General Hospital, Boston, MA	Igor Palacios, MD
Mayo Clinic, Rochester, MN	Paul Sorajja, MD
NorthShore University Health System, Evanston, IL	Ted Feldman, MD
Rush University Medical Center, Chicago, IL	Ziyad Hijazi, MD
Swedish Medical Center, Seattle, WA	Mark Reisman, MD
University of Kentucky College of Medicine, Lexington, KY	Khaled M. Ziada, MD
Vanderbilt University, Nashville, TN	David Zhao, MD
William Beaumont Hospital, Royal Oak, MI	Robert Safian, MD
Programs offering structural heart interventions training during the formal interventional cardiology fellowship	
Geisinger Health System, Danville, PA	James Blankenship, MD
Harbor-UCLA Medical Center, Torrance, CA	William French, MD
Temple University, Philadelphia, PA	Brian O'Murchu, MD
Tulane University School of Medicine, New Orleans, LA	Salman Arain, MD
UCLA Medical Center, Los Angeles, CA	Jonathan Tobis, MD and Daniel Levi, MD
University of Illinois - Chicago and Advocate Christ Medical Center, Chicago, IL	Adhir Shroff, MD
University of Iowa, Iowa City, IA	Phillip Horwitz, MD
University of Pennsylvania, Philadelphia, PA	Howard Herrmann, MD
University of Utah, Salt Lake City, UT	Anwar Tandar, MD
University of Washington, Seattle, WA	Steven Goldberg, MD
Winthrop University Hospital, Mineola, NY	Srihari Naidu, MD



**Fig. 2. Number of structural procedures/year currently performed versus the number recommended to attain proficiency.** [Color figure can be viewed in the online issue, which is available at [wileyonlinelibrary.com](http://wileyonlinelibrary.com).]

22) had some form of collaboration with a pediatric interventional cardiology program for SHD procedures.

In more than half of the current structural programs, applications for positions in the program are sent directly to the program director while in 24% ( $n = 5$ ) of the programs a website is used for applications. All those programs reported that they are open to external applicants.

Currently, half of the structural programs ( $n = 17$ ) are funded within the ACGME interventional program as structural training is integrated into the interventional cardiology fellowship program and half are funded by grants (private, institutional, SCAI or indus-

try). Sixty percent ( $n=17$ ) of the program directors believe that the government should fund the structural fellowship programs while 43% ( $n = 12$ ) believe that industry funds should also be included. Alternative proposed funding sources include Veterans Affairs Hospital or private hospital contributions, medical societies funding, and philanthropy.

The most commonly performed procedures are intracardiac echocardiography, percutaneous PFO and ASD closure, transcatheter aortic valve replacement (TAVR), and TAVR. For the remaining nine types of structural interventions we surveyed, the average volume of procedures is much lower with less than ten procedures per year (Fig. 2).

## INTERPRETATION OF RESULTS—DISCUSSION

From this survey it is apparent that training in structural interventions is in its infancy except in a few centers in the US. Most interventional cardiology training programs are involved in “some” sort of structural interventions but only few of them offer a dedicated SHD fellowship program.

The duration required for a structural interventional cardiology fellowship is unclear. Most of the program directors involved in the training of interventional cardiology fellows agree that an additional dedicated year



in structural interventions may be needed to achieve the required skills and competencies. Curriculum for that additional structural training remains ill-defined. Assignment of the structural procedures to a “structural” fellow for the whole year, structural or adult congenital months or rotations, specialized didactics or courses, use of ancillary transthoracic echocardiography (TTE), trans-esophageal echocardiography (TEE), intra-cardiac echocardiography (ICE), computed tomography (CT), and magnetic resonance imaging (MR) and rotations to the pediatric congenital catheterization labs have been used by different programs at different levels in an effort to offer a more comprehensive training in structural interventions.

Analysis of the number of procedures performed in each training institution shows that the average number of structural procedures performed per year in the studied institutions is small and may be inadequate to provide training even to dedicated structural fellows (Fig. 2). In only four out of the 15 types of procedures (ICE, BAV, PFO, and ASD closure) the average number of procedures performed is higher than what the program directors felt was the number necessary to achieve skill proficiency. It is also impressive that only five of the responding institutions perform enough number of cases for 10 out of the 15 types of advanced structural procedures. It is also important to notice that those institutions are different for each type of procedure, indicating that most institutions are “specialized” in only some structural interventions and that currently there is not a single center in the US to offer sufficient training in all advanced structural interventions.

Given the heterogeneity of experiences provided even in the busiest structural programs, it seems difficult to define a uniform training curriculum.

From this survey, it has become apparent that no single interventional cardiology fellowship program can offer sufficient training in all the 15 types of structural interventions in a single year. Combining rotations in different institutions and computer-based hands-on training simulators might be an approach to achieving training in all the required types of advanced structural interventions. Although many programs combine adult and pediatric interventions, several types of procedures are trial-restricted and inaccessible to the training fellows.

Funding for structural training is undefined. This survey did not ascertain mechanisms for funding in existing structural programs.

An initiative by SCAI in collaboration with other organizations to define a structured curriculum for SHD training address funding issues is timely.

## Limitations

Our study was limited by the small number of institutions involved in structural interventions and a limited response rate (36.5% of all the ACGME-accredited interventional cardiology programs). It is also important to realize that our data are compiled by subjective opinions of program directors and approximate estimate of their performed procedures. Accurate numbers of all the 15 types of advanced structural procedures in different centers in the United States are not currently available. The number of procedures in our study represents an approximate estimate that is performed by each fellow annually. It is necessary to assess the actual number of performed procedures in all the major teaching hospitals to allow us to define the number of structural fellows that can be trained in each one of them.

Inclusion of the programs in Table II may be incomplete as it only includes responding programs. Furthermore, it does not necessarily endorse the breadth, numbers, or quality of training and didactics of these programs which could not be independently assessed by this survey.

## CONCLUSIONS

The expanding field of adult congenital and structural interventional cardiology requires well-trained interventional cardiologists in advanced structural interventions. The SCAI Expert Consensus Statement has previously defined the training requirements for structural and ACHD interventions and it has suggested different “levels” of training [2]. Herrmann et al. have performed a survey to quantify the number of structural procedures performed by experienced operators and have successfully identified the factors that limit the more widespread growth of this field [4]. Our study describes the actual number of structural procedures performed by interventional cardiology fellows in ACGME-accredited programs, the form of the structural training today, and the suggestions from program directors who are actively trying to integrate structural training in the interventional cardiology fellowship programs.

Since the first use of percutaneous transluminal balloon angioplasty 30 years ago, interventional cardiology has undergone major improvements and development. Over those years training has evolved from “hands-on” experience to ACGME-accredited training programs, American Board of Internal Medicine (ABIM) certification and proposed Core Cardiology Training Statement (COCATS) guidelines to provide knowledge and training standards [5]. In an era of expanding use of structural procedures, we need to design US structural training programs with uniform requirements that will be able to train competent structural interventional cardiologists.

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