Commission on Accreditation of Allied Health Education Programs

Standards and Guidelines

for the Accreditation of Educational Programs in Diagnostic Medical Sonography

Essentials/Standards initially adopted in 1979; revised in 1987, 1996, 2007, and 2011 by the:

American College of Cardiology Foundation
American College of Radiology
American Institute of Ultrasound in Medicine
American Society of Echocardiography
American Society of Radiologic Technologists
Society of Diagnostic Medical Sonography
Society for Vascular Surgery
Society for Vascular Ultrasound
Joint Review Committee on Education in Diagnostic Medical Sonography
and
Commission on Accreditation of Allied Health Education Programs

The Commission on Accreditation of Allied Health Education Programs (CAAHEP) accredits programs upon the recommendation of the Joint Review Committee on Education in Diagnostic Medical Sonography (JRC-DMS).

These accreditation **Standards and Guidelines** are the minimum standards of quality used in accrediting programs that prepare individuals to enter the Diagnostic Medical Sonography profession. Standards are the minimum requirements to which an accredited program is held accountable. Guidelines are descriptions, examples, or recommendations that elaborate on the Standards. Guidelines are not required, but can assist with interpretation of the Standards.

Standards are printed in regular typeface in outline form. *Guidelines* are printed in italic typeface in narrative form.

Preamble

The Commission on Accreditation of Allied Health Education Programs (CAAHEP), Joint Review Committee on Education in Diagnostic Medical Sonography (JRC-DMS), and the American College of Cardiology, American College of Radiology, American College of Obstetricians and Gynecologists, American Institute of Ultrasound in Medicine, American Society of Echocardiography, American Society of Radiologic Technologists, Society of Diagnostic Medical Sonography, Society for Vascular Surgery, and Society for Vascular Ultrasound cooperate to establish, maintain and promote appropriate standards of quality for educational programs in diagnostic medical sonography and to provide recognition for educational programs that meet or exceed the minimum standards outlined in these accreditation **Standards and Guidelines**. Lists of accredited programs are published for the information of students, employers, educational institutions and agencies, and the public.

These **Standards and Guidelines** are to be used for the development, evaluation, and self-analysis of diagnostic medical sonography programs. On-site review teams assist in the evaluation of a program's relative compliance with the accreditation Standards.

Description of Profession

The profession of diagnostic medical sonography includes general sonography, cardiac sonography, vascular technology, and various subspecialties. The profession requires judgment and the ability to provide appropriate health care services. General sonographers, adult cardiac sonographers, pediatric cardiac sonographers, and vascular technologists are highly skilled professionals qualified

by education to provide patient services using diagnostic techniques under the supervision of a licensed doctor of medicine or osteopathy. The general sonographer, adult cardiac sonographer, pediatric cardiac sonographer, and vascular technologist may provide this service in a variety of medical settings where the physician is responsible for the use and interpretation of appropriate procedures. General sonographers, adult cardiac sonographers, pediatric cardiac sonographers, and vascular technologists assist physicians in gathering data necessary to reach diagnostic decisions.

The general sonographer, adult cardiac sonographer, pediatric cardiac sonographer, and vascular technologist are able to perform the following:

- Obtain, review, and integrate pertinent patient history and supporting clinical data to facilitate optimum diagnostic results;
- Perform appropriate procedures and record anatomic, pathologic, and/or physiologic data for interpretation by a physician;
- Record, analyze, and process diagnostic data and other pertinent observations made during the procedure for presentation to the interpreting physician;
- Exercise discretion and judgment in the performance of sonographic and/or other diagnostic services;
- Demonstrate appropriate communication skills with patients and colleagues;
- Act in a professional and ethical manner;
- Provide patient education related to medical ultrasound and/or other diagnostic vascular techniques, and promote principles of good health.

The four learning concentrations are:
1. General (Defined as abdomen, obstetric, gynecologic, superficial parts, and other appropriate areas)
2. Adult Echocardiography (including adult congenital)
3. Pediatric Echocardiography (including adult congenital and fetal)
4. Vascular

I. Sponsorship

A. Sponsoring Institution

A sponsoring institution must be at least one of the following:

1. A post-secondary academic institution accredited by an institutional accrediting agency that is recognized by the U.S. Department of Education, and authorized under applicable law or other acceptable authority to provide a post-secondary program, which awards a minimum of a certificate at the completion of the program.
2. A hospital or medical center or other governmental medical service, which is accredited by a healthcare accrediting agency or equivalent that is recognized by the U.S. Department of Health and Human Services, and authorized under applicable law or other acceptable authority to provide healthcare, which awards a minimum of a certificate at the completion of the program.
3. A branch of the United States Armed Forces, which awards a minimum of a certificate at the completion of the program.

B. Consortium Sponsor

1. A consortium sponsor is an entity consisting of two or more members that exists for the purpose of operating an educational program. In such instances, at least one of the members of the consortium must meet the requirements of a sponsoring institution as described in I.A.
2. The responsibilities of each member of the consortium must be clearly documented as a formal affiliation agreement or memorandum of understanding, which includes governance and lines of authority.

C. Responsibilities of Sponsor

The Sponsor must assure that the provisions of these *Standards and Guidelines* are met.

II. Program Goals

A. Program Goals and Outcomes

There must be a written statement of the program's goals and learning domains consistent with and responsive to the demonstrated needs and expectations of the various communities of interest served by the educational program. The communities of interest that are served by the program must include, but are not limited to, students, graduates, faculty, sponsor administration, employers, physicians, and the public.

Program-specific statements of goals and learning domains provide the basis for program planning, implementation, and evaluation. Such goals and learning domains must be compatible with both the mission of the sponsoring institution(s), the expectations of the communities of interest, and nationally accepted standards of roles and functions. Goals and learning domains are based upon the substantiated needs of health care providers and employers, and the educational needs of the students served by the educational program.

B. Appropriateness of Goals and Learning Domains

The program must regularly assess its goals and learning domains. Program personnel must identify and respond to changes in the needs and/or expectations of its communities of interest.

An advisory committee, which is representative of at least each of the communities of interest named in these **Standards***,* must be designated and charged with the responsibility of meeting at least annually, to assist program and sponsor personnel in formulating and periodically revising appropriate goals and learning domains, monitoring needs and expectations, and ensuring program responsiveness to change.

C. Minimum Expectations

The program must have the following goal(s) defining minimum expectations:

- "To prepare competent entry-level general sonographers in the cognitive (knowledge), psychomotor (skills), and affective (behavior) learning domains" and/or
- "To prepare competent entry-level adult cardiac sonographers in the cognitive (knowledge), psychomotor (skills), and affective (behavior) learning domains" and/or
- "To prepare competent entry-level pediatric cardiac sonographers in the cognitive (knowledge), psychomotor (skills), and affective (behavior) learning domains" and/or
- "To prepare competent entry-level vascular technologists in the cognitive (knowledge), psychomotor (skills), and affective (behavior) learning domains."

Programs adopting educational goals beyond entry-level competence must clearly delineate this intent and provide evidence that all students have achieved the basic competencies prior to entry into the field.

Nothing in this Standard restricts programs from formulating goals beyond entry-level competence.

III. Resources

A. Type and Amount

Program resources must be sufficient to ensure the achievement of the program's goals and outcomes. Resources must include, but are not limited to: faculty, clerical and support staff; curriculum; finances; offices; classroom, laboratory, and ancillary student facilities; clinical affiliates; equipment; supplies; computer resources, instructional reference materials, and faculty/staff continuing education.

1. *Support Staff*
   a. *Support staff should be available to provide counseling or referral for problems that may interfere with the student's progress through the program. Guidance should be available to assist students in understanding course content and in observing program policies, and practices.*

2. *Clinical Resources*
   a. *Maximum student enrollment should be commensurate with the volume and variety of sonographic procedures, equipment, and personnel available for educational purposes. The number of students assigned to the clinical affiliate/clinical education center should be determined by a student/clinical staff ratio not greater than one-to-one, and a student/work station ratio of not greater than one-to-one.*

   b. *Programs should provide students with a variety of care settings in which sonographic and/or other diagnostic vascular procedures are performed on in-patients and outpatients. These settings may include the following: Ambulatory care facilities, Emergency/trauma, Intensive/critical/coronary care, Surgery, Angiography/cardiac catheterization*

      (1) Each general learning concentration affiliate or clinical education center should perform approximately 1500 completed patient examinations, including production of permanent records and reports, per year, per student equivalent. The overall volume of procedures in which students participate in throughout the program should include a minimum of 30% ob/gyn procedures and a minimum of 30% abdominal procedures.

      (2) Each cardiac learning concentration affiliate or clinical education center should perform approximately 800 completed patient examinations, including permanent records and reports, per year, per student equivalent. The overall volume of procedures in which students participate in throughout the program should be representative of the range of cardiac procedures.

      (3) Each pediatric cardiac learning concentration affiliate or clinical education center should perform approximately150 completed transthoracic echocardiograms (at least 50 in infants age ≤ 1year), including permanent records and reports, per year, per student equivalent. In addition, each pediatric cardiac learning concentration should perform approximately 50 adult echocardiograms and 25 fetal echocardiograms.

      (4) Each vascular learning concentration affiliate or clinical education center should perform approximately 1000 completed patient examinations, representative of the range of vascular procedures, including permanent records and reports, per year, per student equivalent. The overall volume of procedures in which students participate in throughout the program should be representative of the range of non-invasive vascular procedures.

   A student equivalent is defined as equal to one full-time student for one year.

B. Personnel

The sponsor must appoint sufficient faculty and staff with the necessary qualifications to perform the functions identified in documented job descriptions and to achieve the program's stated goals and outcomes.

1. Program Director

a. Responsibilities

The program director must be responsible for the structure as well as the daily operation of the program, including organization, administration, periodic review and evaluation, continued development, and general effectiveness of program curricula. The program director must ensure that the effectiveness of all clinical affiliates/clinical education centers is maintained. The responsibilities of the program director must not be adversely affected by educationally unrelated functions.

b. Qualifications

The program director must;

1) be an appointed faculty member or institutional equivalent
2) possess a minimum of a Bachelor's Degree

3) have course work in instructional methodologies, evaluation and assessment
4) possess the appropriate credential(s) specific to one or more of the concentration(s) offered.
5) have proficiency in curriculum development;
6) possess a minimum of two years of full-time experience as a registered sonographer in the professional sonography field. Full-time is defined as 35 hours per week.

As of January 1, 2012, program directors at CAAHEP-accredited Diagnostic Medical Sonography programs will be grandfathered for the Bachelor's degree requirement in their current positions at their current institutions. Upon leaving the grandfathered position the individual will be required to meet all of the qualification standards in order to qualify as a Program Director at another institution.

2. Concentration Coordinator(s)

a. Responsibilities

Concentration coordinator(s) report(s) to the Program Director, and must be designated and responsible for the coordination of concentration(s) for which the Program Director does not possess the appropriate credential.

b. Qualifications

Concentration coordinator(s) must:
1) be an appointed faculty member or institutional equivalent;
2) possess an academic degree at least equivalent to the degree that is offered in the concentration(s) that s/he is designated to coordinate;
3) possess the appropriate credential(s) specific to the concentration(s) that s/he is designated to coordinate;
4) have proficiency in curriculum development;
5) possess a minimum of two years of full time experience as a registered sonographer in the professional sonography field. Full-time is defined as 35 hours per week.

3. Clinical Coordinator(s)

Programs with eight or more clinical affiliates / clinical education centers must have an additional faculty member designated as the clinical coordinator. For programs with fewer than eight clinical affiliates/clinical education centers that do not have an additional faculty member designated as the clinical coordinator, the Program Director must have the qualifications and fulfill the responsibilities of the Clinical Coordinator.

a. Responsibilities

The clinical coordinator(s) must be responsible for coordinating clinical education with didactic education as assigned by the program director. The clinical coordinator must evaluate and ensure the effectiveness of the clinical affiliate/clinical education centers. The clinical coordinator's responsibilities must include coordination, instruction, and evaluation. The responsibilities of the clinical coordinator must not be adversely affected by educationally unrelated functions.

b. Qualifications

The clinical coordinator(s) must possess, at a minimum, the following:
1) proficiency in teaching methodology, supervision, instruction, evaluation, and guidance;
2) appropriate credential(s) specific to the concentrations offered;
3) the equivalent of two years full-time professional experience as a general sonographer, cardiac sonographer, pediatric cardiac sonographer and/or vascular technologist. Full-time is defined as 35 hours per week; and
4) an academic degree no lower than an associate's degree and at least equal to that for which the graduates are being prepared.

The clinical coordinator should document experience as a clinical or didactic instructor in a general sonography, cardiac sonography, pediatric sonography and/or vascular technology program. The instructor experience may have been attained concurrently with the professional experience requirement.

4. Medical Advisor

a. Responsibilities

The medical advisor must provide guidance that the medical components of the didactic and clinical curriculum meet current acceptable performance standards.

b. Qualifications

The medical advisor must be a United States licensed physician, Board certified in a medical specialty related to at least one of the cardiac, vascular or general learning concentrations as applicable to the program's design.

The medical advisor should participate in goal determination, curriculum development and outcomes assessment. The medical director/advisor should participate in instruction.

5. Faculty and Instructional Staff

If the key personnel do not have all of the appropriate credentials for the learning concentrations offered, then there must be another faculty member with the appropriate credentials who will assume the didactic instruction and clinical evaluation responsibilities specific to that concentration.

All faculty must be familiar with program goals, be able to demonstrate the ability to develop an organized plan of instruction and evaluation, and have appropriate credentials for the learning areas they teach.

a. Didactic Instructor(s)

1) Responsibilities

The instructional staff must be responsible for providing didactic content, evaluating students, reporting progress, and for the periodic review and updating of course material.

2) Qualifications

The instructors must be individually credentialed if a credentialing examination is offered in the concentration that the instructor is teaching and the program is seeking initial or continuing accreditation in the concentration. They must also be qualified by education and experience, and be effective in teaching the subjects assigned.

b. Clinical Instructor(s)

A clinical instructor must be identified for each clinical affiliate/clinical education center.

1) Responsibilities

A clinical instructor must be available to students whenever he or she is assigned to a clinical setting, provide appropriate clinical supervision, and be responsible for student clinical evaluation. The program must provide a position description for a clinical instructor to carry out educational responsibilities.

2) Qualifications

Clinical instructors must have the appropriate credential for the concentration they are teaching.

C. Curriculum

The curriculum must ensure the achievement of program goals and learning domains. Instruction must be an appropriate sequence of classroom, laboratory, and clinical activities. Instruction must be based on clearly written course syllabi that include course description, course objectives, methods of evaluation, topic outline, and competencies required for graduation.

A desirable program-length goal for the core curriculum and one learning concentration, excluding requisites, is 18 months. Each additional learning concentration should encompass an additional six months of education.

1. **Curriculum Requisites**
   The following curriculum requisites must be met prior to the beginning of the core curriculum of the diagnostic medical sonography education program; they must be included in college level courses:

   a. Algebra, statistics, or higher mathematics course
   b. General college-level physics and/or radiographic physics
   c. Communication skills and
   d. Human anatomy and physiology

   The communication skills requisite may be met by a variety of courses including English, speech, or composition.

   The following curriculum requisites must either be met prior to the diagnostic medical sonography education program or be presented within the program at the college level and must include the following:

   e. Patient care
   f. Medical ethics and law
   g. Medical terminology and
   h. Pathophysiology

2. **Master Plan**
   The master plan of education must be sufficiently detailed to provide for continuity, delivery, and ongoing evaluation of the program in the event of staff changes. The master plan of education must be available for review.

   Documentation of the program master plan of education should include the following:

   Philosophies and goals of the program and institution
   Curriculum sequence with rationale
   Course outlines, course descriptions, and performance (behavioral) objectives
   Clinical education plan demonstrating correlation with the didactic curriculum
   List of clinical affiliates and contact person for each site
   Performance objectives for clinical education
   Evaluation tools of learning concentration competencies
   Grading policy
   Objectives, evaluation tools, and grading criteria for each course
   Description of evaluation methods for each course
   Program policies
   Internal and external mechanisms for evaluating program effectiveness

3. **Learning Competencies Common to Each Concentration**
   The minimum competency offered by the program must include the following:

   a. Utilize oral and written communication.
   1) Maintain clinical records;
   2) Interact with the interpreting physician or other designated physicians with oral or written summary of findings as permitted by employer policy and procedure
   3) Recognize significant clinical information and historical facts from the patient and the medical records, which may impact the diagnostic examination;
   4) Comprehend and employ appropriate medical terminology, abbreviations, symbols, terms, and phrases; and
   5) Educate other health care providers and the public in the appropriate applications of ultrasound and other diagnostic vascular evaluation, including the following:
      Medical terminology
      Sonographic/other vascular terminology
      Pertinent clinical signs, symptoms, and laboratory tests

Pertinent legal principles

b. Provide basic patient care and comfort.

1) Maintain infection control and utilize standard precautions;
2) Anticipate and be able to respond to the needs of the patient;
Demonstrate age related competency (i.e., neonates, pediatric patients, adolescents, adults, and Obstetric patients)
Respond appropriately to parental needs
Recognize when sedation may be appropriate
Demonstrate appropriate care in nursery and intensive care environments (ancillary equipment, thermal, central venous lines, ET tubes, respiratory needs)
3) Identify life-threatening situations and implement emergency care as permitted by employer procedure, including the following:
- Pertinent patient care procedures
- Principles of psychological support
- Emergency conditions and procedures
- First aid and resuscitation techniques

4) Proper patient positioning

c. Demonstrate knowledge and understanding of human gross anatomy and sectional anatomy.

1) Evaluate anatomic structures in the region of interest; and
2) Recognize the sonographic appearance of normal tissue structures, including the following:
- Sectional anatomy
- Embryology
- Normal sonographic patterns

d. Demonstrate knowledge and understanding of physiology, pathology, and pathophysiology.

1) Obtain and evaluate pertinent patient history and physical findings;
2) Extend standard diagnostic testing protocol as required by patient history or initial findings;
3) Review data from current and previous examinations to produce a written/oral summary of technical findings, including relevant interval changes, for the interpreting physician's reference and
4) Recognize examination findings that require immediate clinical response and notify the interpreting physician of such findings, including the following:
- Patient interview and examination techniques
- Chart and referral evaluation
- Diagnostic testing protocols related to specific disease conditions
- Physiology including blood flow dynamics
- Pertinent pathology and pathophysiology
- Pertinent legal issues

e. Demonstrate knowledge and understanding of acoustic physics, Doppler ultrasound principles, and ultrasound instrumentation.

1) Select the appropriate technique(s) for examination(s) being performed;
2) Adjust instrument controls to optimize image quality;
3) Perform linear, area, circumference, and other related measurements from sonographic images or data;
4) Recognize and compensate for acoustical artifacts
5) Utilize appropriate devices to obtain pertinent documentation
6) Minimize patient exposure to acoustic energy
7) Apply basic concepts of acoustic physics which include the following:
- Sound production and propagation
- Interaction of sound and matter
- Instrument options and transducer selection
- Principles of ultrasound instruments and modes of operation

Operator control options
Physics of Doppler
Principles of Doppler techniques
Methods of Doppler flow analysis
Recording techniques
Acoustic artifacts

8) Emerging Technologies

f. Demonstrate knowledge and understanding of the interaction between ultrasound and tissue and the probability of biological effects in clinical examinations, including the following:

Biologic effects
Pertinent in-vitro and in-vivo studies
Exposure display indices
Generally accepted maximum safe exposure levels
ALARA principle

g. Employ professional judgment and discretion.

1) Protect the patient's right to privacy based on current federal standards and regulations;
2) Maintain confidentiality; and
3) Adhere to the professional codes of conduct/ethics through the following:
Medical ethics
Pertinent legal principles
Professional interaction skills
Professional scopes of practice

h. Understand the fundamental elements for implementing a quality assurance and improvement program, and the policies, protocols, and procedures for the general function of the ultrasound laboratory, including the following:

Administrative procedures
Quality control procedures
Elements of quality assurance program
Records maintenance
Personnel and fiscal management
Trends in health care systems

i. Recognize the importance of continuing education, through the following:

Professional journals
Conferences
Lectures
In-house educational offerings
Professional organizations and resources
Recent developments in sonography
Research statistics and design

j. Recognize the importance of, and employ, ergonomically correct scanning techniques:

Personal fitness
Supports, tools, and devices
Equipment adjustments
Patient positioning

4. The General Learning Concentration must include the following:

a. Demonstrate the ability to perform sonographic examinations of the abdomen, superficial structures, non-cardiac chest, and the gravid and nongravid pelvis according to protocol guidelines established by national professional organizations and the protocol of the employing institution utilizing real-time equipment with both transabdominal and endocavitary transducers, and Doppler display modes.

b. Recognize and identify the sonographic appearance of normal anatomic structures, including anatomic variants and normal Doppler patterns:

- Liver
- Biliary system
- Pancreas
- Urinary tract
- Adrenal glands
- Spleen
- Prevertebral vessels
- Peritoneal cavity, including potential spaces
- Gastrointestinal tract
- Noncardiac chest
- Neck
- Breast
- Scrotum
- Prostate
- Anterior abdominal wall
- Extremities
- Brain and spinal cord
- Musculoskeletal

c. Recognize, identify, and appropriately document the abnormal sonographic and Doppler patterns of disease processes, pathology, and pathophysiology of the structures listed in III.C.4.b. Modify the scanning protocol based on the sonographic findings and the differential diagnosis:

- History and physical examination
- Related imaging, laboratory, and functional testing procedures
- Clinical differential diagnosis
- Role of ultrasound in patient management

Sonographic and Doppler patterns in clinical diseases that may occur in the following categories:

- Iatrogenic
- Degenerative
- Inflammatory
- Traumatic
- Neoplastic
- Infectious
- Obstructive
- Congenital
- Metabolic
- Immunologic

d. Recognize and identify the sonographic appearance of normal anatomic structures of the female pelvis, including anatomic variants and normal Doppler patterns:

- Reproductive system
- Pelvic muscles
- Suspensory ligaments
- Peritoneal spaces
- Pelvic vasculature

e. Recognize and identify the sonographic appearance of normal maternal, embryonic, and fetal anatomic structures during the first, second, and third trimesters:

- Sectional anatomy
- Pertinent measurement techniques
- Doppler applications

f. Recognize, identify, and appropriately document the sonographic appearance of gynecologic disease processes, pathology, and pathophysiology:
- History and physical examination
- Related imaging, laboratory, and functional testing procedures
- Differential diagnosis
- Role of ultrasound in patient management

Abnormal sonographic patterns:
- Iatrogenic
- Degenerative
- Inflammatory
- Traumatic
- Neoplastic
- Infectious
- Obstructive
- Congenital
- Metabolic
- Immunologic
- Contraceptive devices
- Infertility procedures
- Doppler applications

g. Recognize, identify, and appropriately document the sonographic appearance of obstetric abnormalities, disease, pathology, and pathophysiology:
- History and physical examination
- Related imaging, laboratory, and functional testing procedures
- Differential diagnosis
- Role of ultrasound in patient management
- Use of three-dimensional obstetric sonography
- Abnormal sonographic characteristics in pregnancy:
  - Placenta
  - Congenital/genetic anomalies
  - Growth abnormalities
  - Amniotic fluid
  - Viability
  - Multiple gestation
  - Fetal monitoring
  - Maternal factors
  - Postpartum
  - Fetal therapy

h. Demonstrate knowledge and understanding of the role of the sonographer in performing interventional/invasive procedures.

5. The Cardiac Learning Concentration must include the following:

a. Demonstrate knowledge of normal and abnormal cardiac anatomy:
- Embryology and fetal cardiac development
- Cardiac chambers and septation
- Valve anatomy and dynamics
- Coronary artery anatomy
- Relationships of cardiac chambers and great vessels

b. Demonstrate knowledge of normal cardiovascular physiology:
- Hemodynamics
- Ventricular function, including influence of loading conditions and measurement of cardiac output
- Exercise physiology
- Electrophysiology and conduction system
- Pulmonary vascular disease

c. Demonstrate knowledge and understanding of cardiac pathology, pathophysiology, and hemodynamics in different types of cardiac disease:

Valvular heart disease
Ischemic cardiac disease
Cardiomyopathy
Pericardial disease
Congenital heart disease
Cardiac neoplasms and masses
Cardiac trauma
Pulmonary vascular disease
Diseases of the aorta and great vessels

d. Demonstrate knowledge and understanding of clinical cardiology:

Relationship of echocardiography to history and physical examination (including indications for echocardiography)
Differential diagnosis as it relates to the echocardiographic examination
Cardiovascular surgery and interventional cardiology
Effect of systemic diseases on cardiovascular anatomy and physiology

e. Demonstrate knowledge of other cardiac procedures emphasizing indications, utility, and limitations of these procedures:

Angiography and cardiac catheterization
Electrocardiography, electrophysiologic studies, Holter monitoring
Stress testing
Radionuclide studies
Other tomographic imaging procedures
Phonocardiography and external pulse recording

f. Demonstrate proficiency in the performance of M-mode, two-dimensional, and Doppler (pulsed wave, continuous wave, color flow and power) echocardiographic studies.

g. Recognize, identify, and appropriately document the abnormal echocardiographic and Doppler patterns of disease, pathology, and pathophysiology for the disease categories listed

h. Demonstrate knowledge and understanding of the indications, utility, limitations, and technical procedures for related echocardiographic studies:

Stress echocardiography
Transesophageal echocardiography
Intraoperative echocardiography
Contrast echocardiography
Three-dimensional echocardiography
Echo-guided procedures

i. Demonstrate knowledge and understanding of clinical pharmacology as it relates to echocardiography and provocative maneuvers:

Cardiovascular pharmacology
Theory and use of provocative stress agents
Non-pharmacologic stress
Potential effects of cardiac medications on echocardiographic findings

j. Demonstrate knowledge, understanding, and proficiency in the use of quantitation principles applied to echocardiographic images and flow data:

Standard M-mode, two-dimensional, and Doppler measurements and calculations
Knowledge and understanding of normal and abnormal values for M-mode, two-dimensional and Doppler echocardiography
Evaluation of normal and abnormal ventricular function

Evaluation of the severity of valve stenosis and regurgitation
Knowledge of normal and abnormal cardiovascular hemodynamics and flow patterns

6. **The Pediatric Cardiac Learning Concentration must include the following:**
a. Demonstrate knowledge of normal and abnormal cardiac anatomy (adult, pediatric, and fetal):
Embryology and fetal cardiac development
Segmental approach
Cardiac chambers and septation
Valve anatomy and dynamics
Coronary artery anatomy
Relationships of cardiac chambers and great vessels
Mediastinal structures
Arch anatomy
Pulmonary artery and venous anatomy
Systemic venous return

b. Demonstrate knowledge of normal cardiovascular physiology as appropriate to the patient or fetus with congenital heart disease:
Hemodynamics
Ventricular function, including influence of loading conditions and measurement of cardiac output
Exercise physiology
Electrophysiology and conduction system
Pulmonary vascular disease
Fetal physiology
Transitional Neonatal physiology

c. Demonstrate knowledge and understanding of cardiac pathology, pathophysiology, and hemodynamics in different types of cardiac disease as appropriate in the fetus or patient with congenital heart disease:
Valvular heart disease
Ischemic cardiac disease
Cardiomyopathy
Pericardial disease
Congenital heart disease
Situs abnormalities
Defects in cardiac septation
Abnormalities in atrial-ventricular connections
Ventricular hypoplasia
Ventricular Inflow anomalies
Abnormalities in ventriculoarterial connection
Ventricular outflow anomalies
Abnormal vascular (arterial and venous) connections
Abnormalities within cardiac chambers, vessels and thorax
Post operative repair
Cardiac neoplasms and masses
Cardiac trauma
Pulmonary vascular disease
Diseases of the aorta and great vessels

d. Demonstrate knowledge and understanding of clinical cardiology as appropriate to the fetus and patient with congenital heart disease:
Relationship of echocardiography to history and physical examination (including indications for echocardiography) - diagnostic approach to congenital heart disease
Acquired heart disease and noncardiac disease and effects of systemic diseases on cardiovascular anatomy and physiology
Differential diagnosis as it relates to the echocardiographic examination
Arrhythmias

Genetic syndromes and chromosomal anomalies associated with congenital heart disease (CHD)
Cardiovascular surgery and interventional cardiology
Post-operative repair evaluation
Current and future approaches to caring for the fetus identified with CHD
Current and future approaches to caring for the pediatric patient with CHD
Current and future approaches to caring for the adult patient with CHD

e. Demonstrate knowledge of other cardiac procedures emphasizing indications, utility, and limitations of these procedures:

Chest X-ray
Angiography and cardiac catheterization
Electrocardiography, electrophysiologic studies, Holter monitoring
Stress testing
Radionuclide studies
Tomographic imaging procedures (CT, MRI)
Fetal interventions for congenital heart disease

f. Demonstrate proficiency in the performance of M-mode, two-dimensional, and Doppler (pulsed wave, continuous wave, color flow) echocardiographic studies.

g. Recognize, identify, and appropriately document the abnormal echocardiographic and Doppler patterns of disease, pathology, and pathophysiology for the disease categories (knowledge of additional views to obtain based on patient history).

h. Demonstrate knowledge and understanding of the indications, utility, limitations, and technical procedures for related echocardiographic studies:

Stress echocardiography
Transesophageal echocardiography
Intraoperative echocardiography
Contrast echocardiography
Three-dimensional echocardiography
Echo-guided procedures
Strain echocardiography
Targeted obstetric exam

i. Demonstrate knowledge and understanding of clinical pharmacology as it relates to echocardiography and provocative maneuvers:

Cardiovascular pharmacology
Theory and use of provocative stress agents
Non-pharmacologic stress
Potential effects of cardiac medications on echocardiographic findings

j. Demonstrate knowledge, understanding, and proficiency in the use of quantitation principles applied to echocardiographic images and flow data:

Standard M-mode, two-dimensional, and Doppler measurements and calculations (which should be normalized based on body surface area, and/or other biometric measurements for the fetus)
Knowledge and understanding of normal and abnormal values for M-mode, two-dimensional and Doppler echocardiography
Evaluation of normal and abnormal ventricular function
Evaluation of the severity of valve stenosis and regurgitation
Knowledge of normal and abnormal cardiovascular hemodynamics and flow patterns
Knowledge of normal and abnormal sonographic appearances of peripheral vascular anatomy (i.e., branches of pulmonary artery, branches of aortic arch)
Miscellaneous measurements specific to patient history

7. The Vascular Learning Concentration must include the following:
a. Demonstrate knowledge of normal and abnormal vascular anatomy:

Extremity Arterial (upper and lower)
Extremity Venous (upper and lower)
Cerebrovascular: extracranial and intracranial
Abdominal Vasculature: arterial and venous
Special circulations: arterial and venous

b. Demonstrate knowledge of normal and abnormal vascular physiology;
Normal and Abnormal Arterial and Venous Hemodynamics: Flow physics
Exercise physiology
Effects of collateralization on Hemodynamics

c. Demonstrate knowledge and understanding of vascular physiology, pathophysiology, and hemodynamics in the different types of vascular disease/dysfunction:
Iatrogenic
Degenerative
Inflammatory
Traumatic
Neoplastic
Infectious
Obstructive
Congenital
Metabolic
Immunologic
Flow changes secondary to other states, e.g., cardiac diseases, pulmonary diseases, pregnancy, inflammatory diseases, intracranial and extracranial disease, anemia
Pharmacology

d. Demonstrate knowledge and understanding of clinical vascular diagnostic procedures:
Relationship of vascular diagnostic techniques to patient history and physical examination
Knowledge of appropriate indications for vascular examination
Differential diagnosis as it relates to vascular testing and examination
Vascular surgery and interventional vascular procedures including intravascular ultrasound, angioscopy, transluminal angioplasty with and without stenting, atherectomy, endarterectomy, patch graft endarterectomy, vein and synthetic vascular bypass procedures as well as embolectomy and thrombectomy, radio-frequency and laser vein ablation, endovascular repair

e. Demonstrate knowledge of other vascular procedures emphasizing indications, utility, and limitations of these procedures:
Angiography
Venography
Magnetic resonance angiogram
Magnetic resonance flow meters
Computed tomography
Nuclear medicine vascular procedures

f. Knowledge of importance and impact of other laboratory values and invasive and non-invasive testing/imaging modalities.

g. Demonstrate proficiency in the performance of physiologic testing (including volume pulse recording, pressure measurements, plethysmography, and stress testing), real-time ultrasound imaging, and Doppler evaluation (pulsed and continuous wave, color and power flow) as relates to the vasculature. Vascular testing proficiency must be demonstrated in the following areas:
Extracranial Cerebrovascular
Intracranial Cerebrovascular (transcranial Doppler)

Extremity Arterial (upper and lower)
Extremity Venous (upper and lower)
Visceral Vascular (renal artery, mesenteric/splanchnic, hepatoportal)

h. Demonstrate knowledge and understanding of clinical pharmacology as it relates to vascular evaluation and stress testing:

Vasoactive relationships
Potential effects of medications on vascular diagnostic findings

i. Demonstrate knowledge, understanding, and proficiency in the use of quantitative principles applied to vascular testing:

Ankle/brachial pressure ratios
Segmental pressures
Aorta/renal ratios
Resistive index
Pulsatility index
Internal carotid artery to common carotid artery ratio
Percentage velocity change across stenosis for grading arterial lesions
Area and diameter reduction measurements
Knowledge of normal and abnormal vascular flow patterns and waveform morphology

D. Resource Assessment

The program must, at least annually, assess the appropriateness and effectiveness of the resources described in these **Standards.** The results of resource assessment must be the basis for ongoing planning and appropriate change. An action plan must be developed when deficiencies are identified in the program resources. Implementation of the action plan must be documented and results measured by ongoing resource assessment.

IV. Student and Graduate (Outcomes) Evaluation/Assessment

A. Student Evaluation

1. Frequency and purpose

Evaluation of students must be conducted on a recurrent basis and with sufficient frequency to provide both the students and program faculty with valid and timely indications of the students' progress toward and achievement of the competencies and learning domains stated in the curriculum.

The supervising sonographer/vascular technologist should be identified on all student clinical education records.

2. Documentation

Records of student evaluations must be maintained in sufficient detail to document learning progress and achievements.

Records indicating the number and type of procedures performed by the student, the examination findings, the extent of student supervision, and the level of involvement of the student in scanning/performance must be maintained and must document that all students meet the minimum numbers of procedures and types of procedures established by the program.

B. Outcomes

1. Outcomes Assessment

The program must periodically assess its effectiveness in achieving its stated goals and learning domains. The results of this evaluation must be reflected in the review and timely revision of the program.

Outcomes assessments include, but are not limited to: national credentialing examination performance, programmatic retention/attrition, graduate satisfaction, employer satisfaction, and job (positive) placement. The program must meet the outcomes assessment thresholds.

"Positive Placement" means that the graduate is employed full or part-time in a related field; and/or continuing his/her education, and/or serving in the military.

"National credentialing examinations" are those accredited by the National Commission for Certifying Agencies (NCCA) or American National Standards Institute (ANSI). Participation and pass rates on national credentialing examination(s) performance may be considered in determining whether or not a program meets the designated threshold, provided the credentialing examination(s), or alternative examination(s) offered by the same credentialing organization, is/are available to be administered prior to graduation from the program. Results from said alternative examination(s) may be accepted, if designated as equivalent by the same organization whose credentialing examination(s) is/are so accredited.

2. Outcomes Reporting

The program must periodically submit to the JRC-DMS its goal(s), learning domains, evaluation systems (including type, cut score, and appropriateness), outcomes, its analysis of the outcomes and an appropriate action plan based on the analysis.

Programs not meeting the established thresholds must begin a dialogue with the JRC-DMS to develop an appropriate plan of action to respond to the identified shortcomings.

V. Fair Practices

A. Publications and Disclosure

1. Announcements, catalogs, publications, and advertising must accurately reflect the program offered

2. At least the following must be made known to all applicants and students: the sponsor's institutional and programmatic accreditation status as well as the name, mailing address, web site address, and phone number of the accrediting agencies; admissions policies and practices, including technical standards (when used); policies on advanced placement, transfer of credits, and credits for experiential learning; number of credits required for completion of the program; tuition/fees and other costs required to complete the program; policies and processes for withdrawal and for refunds of tuition/fees.

3. At least the following must be made known to all students: academic calendar, student grievance procedure, criteria for successful completion of each segment of the curriculum and graduation, policies for student leave of absence, exposure to blood borne pathogens, communicable diseases, and pregnancy, and policies and processes by which students may perform clinical work while enrolled in the program.

4. The sponsor must maintain, and make available to the public, current and consistent summary information about student/graduate achievement that includes the results of one or more of the outcomes assessments required in these Standards.

The sponsor should develop a suitable means of communicating to the communities of interest the achievement of students/graduates (e.g. through a website or electronic or printed documents).

B. Lawful and Non-discriminatory Practices

All activities associated with the program, including student and faculty recruitment, student admission, and faculty employment practices, must be non-discriminatory and in accordance with federal and state statutes, rules, and regulations. There must be a faculty grievance procedure made known to all paid faculty.

A procedure should be established for determining that a student's health will permit him or her to meet the documented technical standards of the program.

C. Safeguards
The health and safety of patients, students, and faculty associated with the educational activities of the students must be adequately safeguarded.

All activities required in the program must be educational and students must not be substituted for staff.

The program must ensure voluntary and prudent use of students or other human subjects for non-clinical scanning. Students' grades and evaluations must not be affected by participation or non-participation.

The combined total didactic/clinical involvement of the student in the program must not exceed 40 hours per week.

Students should be informed of and have access to the health care services provided to all other students of the institution.

D. Student Records
Satisfactory records must be maintained for student admission, advisement, counseling, and evaluation. Grades and credits for courses must be recorded on the student transcript and permanently maintained by the sponsor in a safe and accessible location.

E. Substantive Change
The sponsor must report substantive change(s) as described in Appendix A to CAAHEP/JRC-DMS in a timely manner. Other substantive change(s) to be reported to JRC-DMS within the time limits prescribed include:

1. Changes in affiliates
2. Added or deleted learning concentrations
3. Institution's mission or objectives if these will affect the program
4. Addition of courses that represent a significant departure in content or in method of delivery
5. Degree or credential level
6. Substantial change in clock or credit hours for successful completion of a program or in the length of a program.

F. Agreements
There must be a formal affiliation agreement or memorandum of understanding between the sponsor and all other entities that participate in the education of the students describing the relationship, role, and responsibilities between the sponsor and that entity.

The delineation of responsibilities should include student supervision, benefits, liability and financial arrangements, if any. The agreement should include a clause to protect students and to ensure due process.

An affiliate is an institution having adequate resources to provide a broad range of appropriate clinical education opportunities for students.

A clinical education center is a department, division, or other designated part of a clinical affiliate having adequate resources to provide clinical education opportunities for students. Multiple clinical education centers may be identified within a clinical affiliate.

APPENDIX A

Application, Maintenance and Administration of Accreditation

A. Program and Sponsor Responsibilities

1. Applying for Initial Accreditation

a. The chief executive officer or an officially designated representative of the sponsor completes a "Request for Accreditation Services" form The "Request for Accreditation Services" form can be found online via the CAAHEP website at https://www.cognitoforms.com/CAAHEP2/RequestForAccreditationServices. The form can be completed on-line and submitted directly to the JRC-DMS via the CAAHEP website (preferred); completed on-line, printed, signed and mailed to the JRC-DMS; or it can be printed as a blank form, completed, signed and mailed to:

JRC-DMS
6021 University Blvd. Suite 500
Ellicott City, MD 21043

Note: There is **no** CAAHEP fee when applying for accreditation services; however, individual committees on accreditation may have an application fee.

b. The program undergoes a comprehensive review, which includes a written self-study report and an on-site review.

The self-study instructions and report form are available from the JRC-DMS. The on-site review will be scheduled in cooperation with the program and JRC-DMS once the self-study report has been completed, submitted, and accepted by the JRC-DMS.

2. Applying for Continuing Accreditation

a. Upon written notice from the JRC-DMS, the chief executive officer or an officially designated representative of the sponsor completes a "Request for Accreditation Services" form.

The "Request for Accreditation Services" form can be found online via the CAAHEP website at https://www.cognitoforms.com/CAAHEP2/RequestForAccreditationServices. The form can be completed on-line and submitted directly to the JRC-DMS via the CAAHEP website (preferred); completed on-line, printed, signed and mailed to the JRC-DMS; or it can be printed as a blank form, completed, signed and mailed to:

JRC-DMS
6021 University Blvd. Suite 500
Ellicott City, MD 21043

b. The program may undergo a comprehensive review in accordance with the policies and procedures of the JRC-DMS.

If it is determined that there were significant concerns with the on-site review, the sponsor may request a second site visit with a different team.

After the on-site review team submits a report of its findings, the sponsor is provided the opportunity to comment in writing and to correct factual errors prior to the JRC-DMS forwarding a recommendation to CAAHEP.

3. Administrative Requirements for Maintaining Accreditation

a. The program must inform the JRC-DMS and CAAHEP within a reasonable period of time (as defined by JRC-DMS and CAAHEP policies) of changes in chief executive officer, dean of health professions or equivalent position, and required program personnel.

b. The sponsor must inform CAAHEP and the JRC-DMS of its intent to transfer program sponsorship. To begin the process for a Transfer of Sponsorship, the current sponsor must submit a letter (signed by the CEO or designated individual) to CAAHEP and the JRC-DMS that it is relinquishing its sponsorship of the program. Additionally, the new sponsor must submit a "Request for Transfer of Sponsorship Services" form. The JRC-DMS has the discretion of requesting a new self-study report with or without an on-site review. Applying for a transfer of sponsorship does not guarantee that the transfer will be granted.

c. The sponsor must promptly inform CAAHEP and the JRC-DMS of any adverse decision affecting its accreditation by recognized institutional accrediting agencies and/or state agencies (or their equivalent).

d. Comprehensive reviews are scheduled by the JRC-DMS in accordance with its policies and procedures. The time between comprehensive reviews is determined by the JRC-DMS and based on the program's on-going compliance with the Standards, however, all programs must undergo a comprehensive review at least once every ten years.

e. The program and the sponsor must pay JRC-DMS and CAAHEP fees within a reasonable period of time, as determined by the JRC-DMS and CAAHEP respectively.

f. The sponsor must file all reports in a timely manner (self-study report, progress reports, annual reports, etc.) in accordance with JRC-DMS policy.

g. The sponsor must agree to a reasonable on-site review date that provides sufficient time for CAAHEP to act on a JRC-DMS accreditation recommendation prior to the "next comprehensive review" period, which was designated by CAAHEP at the time of its last accreditation action, or a reasonable date otherwise designated by the JRC-DMS.

Failure to meet any of the aforementioned administrative requirements may lead to administrative probation and ultimately to the withdrawal of accreditation. CAAHEP will immediately rescind administrative probation once all administrative deficiencies have been rectified.

4. Voluntary Withdrawal of a CAAHEP- Accredited Program

Voluntary withdrawal of accreditation from CAAHEP may be requested at any time by the Chief Executive Officer or an officially designated representative of the sponsor writing to CAAHEP indicating: the desired effective date of the voluntary withdrawal, and the location where all records will be kept for students who have completed the program.

5. Requesting Inactive Status of a CAAHEP- Accredited Program

Inactive status may be requested from CAAHEP at any time by the Chief Executive Officer or an officially designated representative of the sponsor writing to CAAHEP indicating the desired date to become inactive. No students can be enrolled or matriculated in the program at any time during the time period in which the program is on inactive status. The maximum period for inactive status is two years. The sponsor must continue to pay all required fees to the JRC-DMS and CAAHEP to maintain its accreditation status.

To reactivate the program the Chief Executive Officer or an officially designated representative of the sponsor must notify CAAHEP of its intent to do so in writing to both CAAHEP and the JRC-DMS. The sponsor will be notified by the JRC-DMS of additional requirements, if any, that must be met to restore active status.

If the sponsor has not notified CAAHEP of its intent to re-activate a program by the end of the two-year period, CAAHEP will consider this a "Voluntary Withdrawal of Accreditation."

B. CAAHEP and Committee on Accreditation Responsibilities – Accreditation Recommendation Process

1. After a program has had the opportunity to comment in writing and to correct factual errors on the on-site review report, the JRC-DMS forwards a status of public recognition recommendation to the
CAAHEP Board of Directors. The recommendation may be for any of the following statuses: initial accreditation, continuing accreditation, transfer of sponsorship, probationary accreditation, withhold accreditation, or withdraw accreditation.

The decision of the CAAHEP Board of Directors is provided in writing to the sponsor immediately following the CAAHEP meeting at which the program was reviewed and voted upon.

2. Before the JRC-DMS forwards a recommendation to CAAHEP that a program be placed on probationary accreditation, the sponsor must have the opportunity to request reconsideration of that recommendation or to request voluntary withdrawal of accreditation. The JRC-DMS reconsideration of a recommendation for probationary accreditation must be based on conditions existing both when the committee arrived at its recommendation as well as on subsequent documented evidence of corrected deficiencies provided by the sponsor.

The CAAHEP Board of Directors' decision to confer probationary accreditation is not subject to appeal.

3. Before the JRC-DMS forwards a recommendation to CAAHEP that a program's accreditation be withdrawn or that accreditation be withheld, the sponsor must have the opportunity to request reconsideration of the recommendation, or to request voluntary withdrawal of accreditation or withdrawal of the accreditation application, whichever is applicable. The JRC-DMS reconsideration of a recommendation of withdraw or withhold accreditation must be based on conditions existing both when the JRC-DMS arrived at its recommendation as well as on subsequent documented evidence of corrected deficiencies provided by the sponsor.

The CAAHEP Board of Directors' decision to withdraw or withhold accreditation may be appealed. A copy of the CAAHEP "Appeal of Adverse Accreditation Actions" is enclosed with the CAAHEP letter notifying the sponsor of either of these actions.

At the completion of due process, when accreditation is withheld or withdrawn, the sponsor's Chief Executive Officer is provided with a statement of each deficiency. Programs are eligible to re-apply for accreditation once the sponsor believes that the program is in compliance with the accreditation *Standards*.

Any student who completes a program that was accredited by CAAHEP at any time during his/her matriculation is deemed by CAAHEP to be a graduate of a CAAHEP-accredited program.