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Subject: Advanced Imaging of the Heart: Echocardiography

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DESCRIPTION:

Tests addressed in this guideline include stress echocardiography, transesophageal echocardiography, and resting transthoracic echocardiography.

Stress Echocardiography (SE)

Uses of SE:

- The primary use of SE is in the diagnosis or exclusion of obstructive coronary artery disease (CAD).
- SE is also used for management of established coronary artery disease.
- SE may be used for assessment of myocardial viability in patients who have had myocardial infarction.
- SE is occasionally used in the evaluation of valvular heart disease, and for the detection and management of occult pulmonary hypertension.

Imaging Considerations:

- A recent EKG is strongly recommended, preferably within 7 days of request for stress echocardiogram. The findings on the resting EKG may help to determine the need for imaging and may also show evidence of ischemia at rest or interval myocardial infarction.
- Unlike MPI, stress echocardiography does not expose the patient to ionizing radiation.
- Age, gender and the character of the chest pain provide useful predictors of CAD, as stratified in Table 1 below.

Table 1: Pre-Test Probability of Coronary Artery Disease by Age, Gender and Symptoms

Very Low < 5% Low Probability < 10%			Intermediate probability 10-90% High Probability > 90%		
Age (yr)	Gender	Typical/Definite Angina Pectoris	Atypical/Probable Angina Pectoris	Non-Anginal Chest Pain	Asymptomatic
30-39	Men	Intermediate	Intermediate	Low	Very Low
	Women	Intermediate	Very Low	Very Low	Very Low
40-49	Men	High	Intermediate	Intermediate	Low
	Women	Intermediate	Low	Very Low	Very Low
50-59	Men	High	Intermediate	Intermediate	Low
	Women	Intermediate	Intermediate	Low	Very Low
60-69	Men	High	Intermediate	Intermediate	Low
	Women	High	Intermediate	Intermediate	Low

(Gibbons RJ, Balady GJ, Beasley JW, et al. ACC/AHA Guidelines for Exercise Testing: Executive Summary. Circulation.1997;96:345-354.)

Myocardial Perfusion Imaging and Stress Echocardiography may provide useful information on Coronary Heart Disease.Comparison data on Sensitivity and Specificity are provided in Table 2 below. Due to regional variation in technical expertise and interpretive proficiency, the clinician should use the diagnostic imaging modality that has been proven most accurate in his/her practices.

Table 2: Comparison of Non-Invasive Diagnostic Imaging

	Nuclear Imaging Sensitivity(%)	Stress Echo Sensitivity (%)	Nuclear Imaging Sensitivity (%)	Stress Echo Sensitivity (%)
Exercise (7 studies)	83%	78%	83%	91%
Dobutamine (8 studies)	86%	80%	73%	86%
Adenosine (3 studies)	89%	63%	73%	86%
Dipyridamole (4 studies)	83%	68%	88%	89%

(Zaret BL, Bellar GA. Clinical Nuclear Cardiology. 3rd Edition. Philadelphia: Elsevier Mosby Publishers; 2005, page 539.)

Several clinical indications listed for Myocardial Perfusion Imaging include standard methods of risk assessment, such as the SCORE (Systematic Coronary Risk Evaluation) or the Framingham risk score calculation. These risk calculation systemsinclude consideration of the following factors:

Age	Sex
Abnormal Lipid Profile	Hypertension
Diabetes Melitus (always=high risk)	Cigarette Smoking

Other coronary risk factors such as family history of premature CAD, coronary artery calcification, C reactive protein levels, obesity etc. are not included in the standard methods of risk assessment but are thought to contribute to coronary artery disease risk.

- Selection of the optimal diagnostic work-up for evaluation or exclusion of coronary artery disease should be made within the context of available studies (which include treadmill stress test, stress myocardial perfusion imaging, stress echocardiography, cardiac PET imaging and invasive cardiac/coronary angiography), so that the resulting information facilitates patient management decisions and does not merely add a new layer of testing.
- Occasionally it may be appropriate to do a second non-invasive test for diagnosis or exclusion of CAD when the initially selected test is technically suboptimal and the diagnosis of CAD cannot be established or excluded.
- SE may be performed using either physical or pharmacologic stress. If physical stress is used, the choice rests between treadmill exercise test and bicycle exercise test. While it is possible to acquire images during exercise in patients undergoing bicycle exercise testing, image quality during treadmill exercise is suboptimal. In this situation, the “stress” images are actually acquired immediately following peak exercise. Thus, the laboratory must be set up in a manner that allows imaging to be completed within 45 to 60 seconds after peak exercise.
- Some patients may not be suitable candidates for SE. Image quality is frequently suboptimal in morbidly obese patients and in those with advanced lung disease. If image quality at rest is inadequate, the test should be canceled and consideration given to an alternative imaging modality.
- For patients who are unable to walk on a treadmill for non-cardiac reasons (orthopedic limitations, claudication, neurological conditions, advanced lung disease, etc. exercise stress testing is not an option. These patients will require pharmacological testing with echo or nuclear imaging.
- It is anticipated that the evaluation of patients with acute chest pain will occur in the emergency room or in an inpatient setting and stress echo performed in these locations is not included in the AIM preauthorization program.

Transesophageal Echocardiography (TEE)

Standard Anatomic Coverage

- Heart, proximal great vessels, pericardium

Imaging Considerations

- In general, it is assumed that TEE is appropriately used as an adjunct or subsequent test to transthoracic echocardiography (TTE) when suboptimal TTE images preclude obtaining a diagnostic study.

- There are some clinical situations for which TEE is a more appropriate initial imaging test than TTE. These situations are outlined below under Common Diagnostic Indications for TEE.
- Since TEE requires conscious sedation, it should only be performed at locations where cardiac monitoring and appropriate equipment for cardiopulmonary resuscitation are readily available.
- Patients with oropharyngeal or esophageal pathology which contraindicates intubation of the esophagus are not suitable candidates for TEE.
- Intraoperative TEE (93318) is beyond the scope of AIMs diagnostic imaging management program and will not be addressed in this document.

Resting Transthoracic Echocardiography (TTE)

Standard Anatomic Coverage

- Heart, proximal great vessels, pericardium

Imaging Considerations

Advantages of transthoracic echocardiography:

- No risk to the patient
- Minimal patient discomfort
- Widely available
- Extremely portable
- No exposure to ionizing radiation.

Disadvantages of transthoracic echocardiography:

- Image quality suboptimal in some patients
- Less sensitive than transesophageal echocardiography in some clinical situations.

Ordering Issues:

- Transthoracic echocardiography should only be acquired on equipment which has the capability to perform Doppler echocardiography (pulsed-wave and continuous wave with spectral display) and color flow velocity mapping.
- In interpretation of this document, the term “clinically stable” is taken to mean that the patient has no new or worsening cardiac symptoms and there are no changes on cardiovascular examination.

POSITION STATEMENT:

Stress Echocardiography (SE)

Stress echocardiography **meets the definition of medical necessity** for members whomeet **ONE** of the following indications:

Suspected coronary artery disease in asymptomatic members

- Members with high-risk of CAD (SCORE) who have not had evaluation of coronary artery disease (MPI, stress echo, cardiac PET, coronary CTA or cardiac catheterization) within the preceding three (3) years; **OR**

- Members with moderate or high risk of CAD (SCORE) who have a high risk occupation that would endanger others in the event of a myocardial infarction (for example: airline pilot, law-enforcement officer, firefighter, mass transit operator, bus driver) who have not had evaluation of coronary artery disease (MPI, stress echo, cardiac PET, coronary CTA or cardiac catheterization) within the preceding three (3) years; **OR**
- Members with diseases/conditions with which coronary artery disease commonly coexists and who have not had evaluation of coronary artery disease (MPI, stress echo, cardiac PET, coronary CTA or cardiac catheterization) within the preceding three (3) years:
    - Diabetes mellitus; **OR**
    - Abdominal aortic aneurysm; **OR**
    - Established and symptomatic peripheral vascular disease; **OR**
    - Prior history of cerebrovascular accident (CVA), transient ischemic attack (TIA) or carotid endarterectomy (CEA) or high grade carotid stenosis (>70%); **OR**
    - Chronic renal insufficiency; **OR**
- Members who have undergone cardiac transplantation and have had no evaluation for coronary artery disease within the preceding one (1) year; **OR**
- Members in whom a decision has been made to treat with Interleukin 2; **OR**
- Members awaiting solid organ transplantation who have not undergone evaluation for coronary artery disease within the preceding one (1) year.

Suspected coronary artery disease in symptomatic members who have not had evaluation of coronary artery disease (MPI, stress echo, cardiac PET, coronary CTA or cardiac catheterization) within the preceding sixty (60) days

- Chest pain
    - With intermediate or high pretest probability of CAD (Table 1); **OR**
    - With low or very low pretest probability of CAD (Table 1) and high risk of CAD (SCORE)
- Atypical symptoms: shortness of breath (dyspnea), neck, jaw, arm, epigastric or back pain, sweating (diaphoresis), or exercise-induced syncope
    - With moderate or high risk of CAD (SCORE)
- Other symptoms: palpitation, nausea, vomiting, anxiety, weakness, fatigue, or any of the following symptoms when induced by exercise dizziness, lightheadedness, or near syncope.
    - With high risk of CAD (SCORE)
- Members with any cardiac symptom who have diseases/conditions with which coronary artery disease commonly coexists such as:
    - Diabetes mellitus; **OR**
    - Abdominal aortic aneurysm; **OR**
    - Established and symptomatic peripheral vascular disease; **OR**
    - Prior history of cerebrovascular accident (CVA), transient ischemic attack (TIA) or carotid endarterectomy (CEA) or high grade carotid stenosis (>70%); **OR**
    - Chronic renal insufficiency or renal failure; **OR**
- Memberts who have undergone cardiac transplantation; **OR**
- Members in whom a decision has been made to treat with Interleukin 2; **OR**

- Members awaiting solid organ transplantation.

Established flow-limiting coronary artery disease in asymptomatic members

- Members awaiting solid organ transplantation who have not undergone evaluation for coronary artery disease within the preceding one (1) year; **OR**
- Members who have undergone cardiac transplantation and have had no evaluation for coronary artery disease within the preceding one (1) year.

Established flow-limiting coronary artery disease* in members who have new or worsening symptoms

*diagnosed by MPI, cardiac PET, stress echo, or coronary angiography (CCTA or invasive) demonstrating coronary stenosis greater than 70% or FFR less than or equal to 0.8.

Note: If symptoms are typical of myocardial ischemia cardiac catheterization may be more appropriate than SE.

Established coronary artery disease* in members who have not undergone revascularization and have no symptoms or stable symptoms

*diagnosed by MPI, cardiac PET, stress echo, or coronary angiography (CCTA or invasive) demonstrating coronary stenosis greater than 70% or FFR less than or equal to 0.8.

- No evaluation of CAD (MPI, stress echo, cardiac PET, coronary CTA or cardiac catheterization) within the preceding three (3) years
- No evaluation of CAD (MPI, cardiac PET, stress echo, coronary CTA or cardiac catheterization) within the preceding one (1) year in a member who has undergone cardiac transplantation and has been found to have CAD since transplantation.

Established coronary artery disease in members who have undergone revascularization

- For evaluation of new or worsening cardiac symptoms
    - If symptoms are typical of myocardial ischemia cardiac catheterization may be more appropriate than SE; **OR**
- For evaluation of stable members who have undergone coronary artery bypass grafting more than five (5) years previously and who have not had an evaluation for coronary artery disease (MPI, stress echo, cardiac PET, coronary CTA or cardiac catheterization) within the past two (2) years
    - Stable members whose revascularization has been incomplete may undergo SE three (3) years following the procedure and every three (3) years thereafter; **OR**
- For evaluation of stable members who have undergone percutaneous coronary intervention(PCI) more than three (3) years previously and who have not had an evaluation for coronary artery disease (MPI, stress echo, cardiac PET, coronary CTA or cardiac catheterization) within the past three (3) years when any of the following applies
    - The member has undergone PCI of the left main (LM) coronary artery or the proximal left anterior descending (LAD) coronary artery
    - The member has undergone PCI of more than one coronary artery

- The member has chronic total occlusion of a coronary artery and the vessel on which PCI was performed is supplying collateral flow to the occluded vessel
- The member is known to have only one patent coronary artery.
- Left ventricular ejection fraction LVEF is <35%.

Established coronary artery disease in members who have had myocardial infarction (ST elevation or non-ST elevation) or unstable angina within the preceding ninety (90) days provided that

- The member did not undergo coronary angiography at the time of the acute event; **AND**
- The member is currently clinically stable.

Established Kawasaki disease with coronary artery involvement

- Every two year evaluation for confirmed small to medium coronary artery aneurysm
- Annual evaluation for confirmed large (giant) coronary artery aneurysm, multiple or complex aneurysms or coronary artery obstruction confirmed by angiography.

Members with new onset arrhythmias (member can be symptomatic or asymptomatic)

This guideline applies to members with suspected or established CAD

- Members with sustained (lasting more than 30 seconds) or non-sustained (more than 3 beats but terminating within 30 seconds) ventricular tachycardia; **OR**
- Members with atrial fibrillation or flutter and high or moderate risk of CAD (SCORE); **OR**
- Members with atrial fibrillation or flutter and established CAD; **OR**
- Members who have frequent premature ventricular contractions (PVC) defined as more than thirty (30) PVCs per hour on ambulatory EKG (Holter) monitoring
    - It is not appropriate to perform stress echocardiography for evaluation of infrequent premature atrial or ventricular depolarizations.

Members with new onset congestive heart failure or recently recognized left ventricular systolic dysfunction (member can be symptomatic or asymptomatic)

This guideline applies to members with suspected or established CAD

For members in this category whose CAD risk (SCORE) is high, cardiac catheterization may be more appropriate than non-invasive evaluation.

- Provided that new or worsening CAD has not been excluded as the cause of LV dysfunction/ CHF by any of the following tests: MPI, stress echo, cardiac PET, coronary CTA or cardiac catheterization .

Members with abnormal exercise treadmill test (performed without imaging)

This guideline applies to members with suspected or established CAD

- Abnormal findings on an exercise treadmill test include (chest pain, ST segment change, abnormal BP response or complex ventricular arrhythmias) .

Members who have undergone recent (within the past 60 days) myocardial perfusion imaging (MPI)

- When the MPI is technically suboptimal, technically limited, inconclusive, indeterminate, or equivocal, such that myocardial ischemia cannot be adequately excluded
    - It is not appropriate to perform SE on members who have had a recent normal or abnormal MPI
    - An MPI is deemed to be abnormal when there are abnormalities on the nuclear imaging portion of the test. Electrocardiographic abnormalities without evidence of ischemia on the nuclear imaging portion of the test are considered to be normal studies .

Members with abnormal findings on cardiac CT / coronary CTA

Symptomatic members:

- With coronary artery calcium score > 400 Agatston units; **OR**
- Intermediate severity coronary stenosis on coronary CTA.

Note: If symptoms are typical of myocardial ischemia, cardiac catheterization may be more appropriate than stress echo

Asymptomatic members who have not had MPI, stress echo, cardiac PET or cardiac catheterization within the preceding three (3) years:

- With coronary artery calcium score > 400 Agatston units; **OR**
- Intermediate severity coronary stenosis coronary CTA.

Members with abnormal findings on cardiac catheterization

- To determine flow limiting significance of intermediate coronary stenosis.

Myocardial viability evaluation

Stress Echo may be used to evaluate myocardial viability in members who

- Have established coronary artery disease; **AND**
- Have left ventricular systolic dysfunction (Left Ventricular Ejection Fraction <55%); **AND**
- Are candidates for revascularization.

Note: Pharmacologic stress echocardiography with a drug such as dobutamine that increases myocardial contractility is the preferred protocol.

Preoperative cardiac evaluation of members undergoing non-cardiac surgery

This guideline applies to members undergoing non-emergency surgery

It is assumed that those who require emergency surgery will undergo inpatient preoperative evaluation

- Members with active cardiac conditions such as unstable coronary syndromes (unstable angina), decompensated heart failure (NYHA function of class IV, worsening or new onset heart failure), significant arrhythmias (third degree AV block Mobitz II AV block, uncontrolled supraventricular arrhythmia, symptomatic ventricular arrhythmias, ventricular tachycardia), symptomatic bradycardia or severe stenotic valvular lesions. It is recommended that these conditions be

evaluated and managed per ACC/AHA guidelines prior to considering elective surgery. That evaluation may include Stress Echo.

Low-risk surgery (endoscopic procedures, superficial procedures, cataract surgery, breast surgery, ambulatory surgery)

- Provided that there are no active cardiac conditions (as outlined above) Stress Echo prior to low-risk surgery does not meet the definition of medical necessity.

Intermediate-risk surgery (including but not limited to intraperitoneal and intrathoracic surgery, carotid endarterectomy, head and neck surgery, orthopedic surgery, prostate surgery, gastric bypass surgery) or High-risk surgery (including but not limited to aortic and other major vascular surgery, peripheral vascular surgery) when

- The member has not had a normal coronary angiogram, SE, MPI, CCTA, Cardiac PET perfusion study or revascularization procedure within the previous one (1) year; **AND**
- At least one of the following applies:
  - Member has established CAD (prior MI, prior PTCA, stent, or CABG) or presumed CAD (Q waves on EKG, abnormal MPI, SE or cardiac PET); **OR**
  - Member has compensated heart failure or prior history of heart failure (CHF); **OR**
  - Member has diabetes mellitus; **OR**
  - Member has chronic renal insufficiency or renal failure; **OR**
  - Member has a history of cerebrovascular disease (TIA, CVA or documented carotid stenosis requiring carotid endarterectomy); **OR**
  - Member is unable to walk on a treadmill for reasons other than obesity.

Valvular heart disease

- Stress echocardiography may be used in evaluation of asymptomatic members with any of the following valvular lesions
  - Severe aortic stenosis
  - Severe aortic regurgitation with normal left ventricular size and function
  - Severe mitral stenosis
  - Severe mitral regurgitation with normal left ventricular size and function; **OR**
- Stress echocardiography may be used in evaluation of symptomatic members with any of the following valvular lesions
  - Aortic stenosis of uncertain degree (due to the presence of co-existent severe left ventricular systolic dysfunction). Pharmacologic stress echocardiography with a drug such as dobutamine that increases myocardial contractility is the preferred protocol
  - Moderate mitral stenosis
  - Moderate mitral regurgitation .

Pulmonary hypertension

- For evaluation of members with suspected pulmonary hypertension whose resting echocardiogram fails to confirm that diagnosis, such that exercise induced pulmonary hypertension needs to be excluded; **OR**

- For evaluation of right and/or left ventricular function during exercise in members with established exercise-induced pulmonary hypertension.

Hypertrophic obstructive cardiomyopathy

- For the evaluation of dynamic changes during exercise in members with an established diagnosis of hypertrophic obstructive cardiomyopathy who do not have a resting outflow tract gradient of 50 mm Hg or more.

Abnormal EKG findings

Some members have resting EKG findings which would render the interpretation of an exercise EKG test difficult or impossible. In these situations members who, in the absence of the EKG abnormality, would not meet approval criteria for SE, may be approved for SE because exercise EKG testing without imaging would provide little clinically useful data. Members with the following resting EKG abnormalities are included in this category:

- Left bundle branch block; **OR**
- Ventricular paced rhythm; **OR**
- Left ventricular hypertrophy with repolarization abnormality; **OR**
- Digoxin effect; **OR**
- 1 mm ST depression or more on a recent EKG (within the past 30 days); **OR**
- Pre-excitation syndromes (e.g. WPW syndrome).

Members who are unable to walk on a treadmill for reasons other than obesity.

Transesophageal Echocardiography (TEE)

Transesophageal echocardiography **meets the definition of medical necessity** for **ONE** of the following indications (1 or 2):

1. In members who have had, or are likely to have suboptimal transthoracic imaging

- When image quality is suboptimal such that the clinical question(s) prompting the TEE has/have not been adequately answered; **OR**
- When it is likely that transthoracic imaging will be suboptimal in the following situations:
  - Previous transthoracic echocardiograms were of suboptimal quality
  - In members with severe abnormalities of thoracic contour (pectus deformities, severe kyphoscoliosis)
  - In members who have recently had thoracic surgery where post-operative tenderness or the location of dressings or incisions would preclude imaging from the usual transthoracic locations
  - Following severe chest trauma
  - Following extensive burns to the thorax
  - In members with a cardiac diagnosis made by TEE who require reevaluation, the results of which would lead to a change in therapy (e.g. resolution of an intracardiac thrombus following anticoagulation).

2. In members whose clinical situation suggests that TEE may be preferable to transthoracic echocardiography

- In evaluation of suspected acute aortic pathology; **OR**
- In evaluation of valvular structure and function to assess suitability for and assist in planning of surgical or catheter based valvular intervention; **OR**
- To diagnose/manage endocarditis with a moderate or high pretest probability (e.g. bacteremia, especially staph bacteremia or fungemia); **OR**
- To diagnose/manage endocarditis involving prosthetic heart valves; **OR**
- In evaluation of persistent fever in a member with an intracardiac device to exclude endocarditis; **OR**
- In evaluation of a member with atrial fibrillation/flutter to facilitate clinical decision-making with regards to anticoagulation and/or cardioversion and/or ablation
    - TEE is not required when the decision has been made to anticoagulate the member and not perform cardioversion; **OR**
- In evaluation of a member who has undergone surgical correction of complex congenital heart disease for the exclusion of intracardiac thrombus; **OR**
- In evaluation for cardiovascular source of embolic event when no non-cardiac source has been identified.

Resting Transthoracic Echocardiography (TTE)

Resting transthoracic echocardiography **meets the definition of medical necessity** for **ONE** of the following indications:

Suspected valvular heart disease

- Evaluation of cardiac murmurs when the diagnosis of valvular heart disease has not been established
    - After the diagnosis of valvular heart disease has been established, follow the guidelines for the specific valvular lesion (eg, established aortic stenosis)
- Initial evaluation for mitral valve prolapse when signs or symptoms of mitral valve prolapse are present
- Initial evaluation for bicuspid aortic valve when there is a family history (established diagnosis in a first-degree relative).

Established native valvular stenosis (does not apply to congenital valvular stenosis)

- Changing signs or symptoms; **OR**
- Reevaluation of clinically stable members with moderate or severe stenosis annually; **OR**
- Reevaluation of clinically stable members with mild stenosis every three (3) years; **OR**
- Assessment of changes in hemodynamic severity and left ventricular function in members with known aortic stenosis during pregnancy.

Established native valvular regurgitation

- Changing signs or symptoms; **OR**
- Reevaluation of clinically stable members with moderate or severe regurgitation annually; **OR**
- Reevaluation of clinically stable members with mild regurgitation every three (3) years.

Established bicuspid aortic valve

- Changing signs or symptoms suggesting the development of aortic valve dysfunction; **OR**
- Bicuspid aortic valve and dilated aortic root on prior echo (annual echocardiography is indicated); **OR**
- Bicuspid aortic valve and normal aortic root on prior echo [echo at three (3) yearly intervals is indicated].

Established mitral valve prolapse

- Changing signs or symptoms.

Prosthetic cardiac valves (mechanical or bioprosthetic) and members who have undergone valve repair

This guideline does not apply to valve replacement or repair for correction of congenital heart disease in childhood- see indication Evaluation of members with congenital heart disease.

- Initial post-operative evaluation of valve function (baseline study); **OR**
- Signs and/or symptoms suggesting dysfunction of a repaired or replaced valve; **OR**
- Annual reevaluation of a member with a prosthetic or repaired heart valve noted on prior imaging study to have moderate or severe dysfunction (stenosis or regurgitation); **OR**
- Evaluation at three (3) yearly intervals of a member with a prosthetic or repaired heart valve noted on prior imaging study to have mild dysfunction (stenosis or regurgitation); **OR**
- Annual reevaluation of clinically stable adults (age 19 years or older) who have undergone valve repair or implantation of a bioprosthetic valve more than seven (7) years previously
    - This guideline does not apply to members with a mechanical valve prosthesis; **OR**
- Following transcatheter aortic valve implantation/replacement (TAVI or TAVR), TTE is appropriate in clinically stable members on one (1) occasion within the first three (3) months, at one (1) year, and annually thereafter
- Following transcatheter mitral valve repair, TTE is appropriate on one occasion within the first three (3) months, at one (1) year and annually thereafter for members with moderate or severe residual mitral regurgitation.

Evaluation of members with congenital heart disease

- Evaluation of members in whom congenital heart disease is suspected based on signs and symptoms (including murmur, cyanosis, unexplained arterial desaturation, abnormal arterial pulses) abnormal EKG, abnormal chest x-ray; **OR**
- Members with chromosomal abnormalities or major extra cardiac abnormality associated with a high incidence of coexisting cardiac abnormality; **OR**

- Members with established congenital heart disease (repaired or unrepaired) in whom there is a change in clinical status; **OR**
- Adult members with a childhood history of congenital heart disease (with or without prior surgical repair) in whom the original diagnosis is uncertain or when the precise nature of the structural abnormalities or hemodynamics is unclear; **OR**
- Annual echocardiography is appropriate in clinically stable members age six (6) years or older with established complex congenital heart disease (with or without prior surgical repair) in whom surveillance for ventricular function, valvular function or pulmonary artery pressure is important in clinical decision-making
    - This does not include members with successfully repaired patent ductus arteriosus, small atrial or ventricular septal defects, bicuspid aortic valve or mitral valve prolapse; **OR**
- Echocardiography is appropriate in clinically stable members age five (5) years or younger with established congenital heart disease (with or without prior surgical repair) in whom surveillance for ventricular function, AV valvular regurgitation or pulmonary artery pressure is important in clinical decision-making; **OR**
- Initial outpatient post-operative evaluation of members who have undergone surgical or catheter-based procedures to correct congenital heart disease (within 60 days of the procedure); **OR**
- TTE is appropriate every three (3) years in the follow up of members who have undergone catheter-based closure of atrial or ventricular septal defects; **OR**
- Non adult members (less than or equal to 18 years old) who are undergoing staged surgical correction of congenital heart disease; **OR**
- Members in whom a decision to perform surgical or catheter based repair of congenital heart disease has been made and in whom echocardiography will be used to assist with procedural planning.

Evaluation of ventricular function

Note: It is assumed that left ventricular function will be evaluated using a single imaging modality. Thus, if left ventricular function has been evaluated recently by blood pool imaging reevaluation using echocardiography is not necessary.

Abnormalities on other testing

- Evaluation of members with resting EKG abnormalities (LBBB, RBBB with left anterior or posterior hemiblock, LVH, RVH, Q waves suggestive of prior infarction); **OR**
- When left ventricular dysfunction is suggested by other testing (chest imaging, elevated BNP) and LV function has not been evaluated by another modality since that testing was performed; **OR**
- Where a significant discrepancy (more than would be expected for the range of error of the methods) exists in the evaluation of left ventricular dysfunction by two other imaging modalities, echocardiography can be used as an arbiter.

Hypertension

- Initial evaluation of members with an established diagnosis of hypertension; **OR**
- Annual evaluation of non-adult members (less than or equal to 18 years old) with an established diagnosis of hypertension.

Heart Failure / Cardiomyopathy / Left Ventricular Dysfunction

- Initial evaluation of known or suspected heart failure; **OR**
- Reevaluation of members with known heart failure (systolic or diastolic) in a member with a deterioration in clinical status; **OR**
- Reevaluation of members with known LV dysfunction (systolic or diastolic) in a member with a deterioration in clinical status; **OR**
- Reevaluation of clinically stable non-adult (age 18 years or younger) memberts with left ventricular systolic dysfunction (Left Ventricular ejection fraction <60%) at six (6) monthly intervals; **OR**
- Screening study every two (2) years in clinically stable first-degree relatives of members with inherited cardiomyopathy {see specific indications for hypertrophic obstructive cardiomyopathy (HOCM) below}; **OR**
- Evaluation of suspected restrictive, infiltrative or genetic cardiomyopathy; **OR**
- Initial evaluation of suspected hypertrophic obstructive cardiomyopathy (HOCM) ; **OR**
- Reevaluation of known hypertrophic obstructive cardiomyopathy (HOCM) in a member with a change in clinical status to guide or evaluate therapy; **OR**
- Annual reevaluation non-adult (age 18 years or younger) first-degree relatives of members with established hypertrophic obstructive cardiomyopathy (HOCM); **OR**
- Evaluation every five (5) years of adult (age 19 years or older) first-degree relatives of members with established hypertrophic obstructive cardiomyopathy (HOCM); **OR**
- Annual reevaluation of asymptomatic adult (age 19 years or older) members with known hypertrophic obstructive cardiomyopathy (HOCM); **OR**
- Reevaluation of asymptomatic non-adult (age 18 years or younger) members with known hypertrophic obstructive cardiomyopathy (HOCM) at six (6) monthly intervals.

Implantable devices

- Evaluation of LV function in a member with known cardiomyopathy being considered for cardiac resynchronization therapy (CRT), implantable defibrillator (AICD) or ventricular assist device (VAD); **OR**
- Initial evaluation for cardiac resynchronization therapy (CRT) device optimization following implantation; **OR**
- Evaluation of a member being treated with cardiac resynchronization therapy (CRT) with new or persistent signs or symptoms of heart failure for device optimization; **OR**
- Echocardiography is indicated for optimization of device settings in members with ventricular assist device (VAD); **OR**
- Echocardiography is indicated for evaluation of signs and/or symptoms suggestive of device related complications in members with ventricular assist device (VAD).

Other

- Precardiac transplant evaluation; **OR**
- Post cardiac transplant evaluation when any of the following (a-d) applies

A. Evaluation of new or worsening cardiac signs, symptoms or new EKG abnormalities

B. Surveillance of a stable member (no new or worsening cardiac signs or symptoms) within the first 6 months of transplant

C. Surveillance of a stable member (no new or worsening cardiac signs or symptoms) at 3 month intervals at 6 to 24 months post-transplant

D. Annual surveillance of a stable member (no new or worsening cardiac signs or symptoms) more than 24 months post-transplant

- Evaluation of known or suspected myocarditis; **OR**
- Echocardiography to evaluate right ventricular function in members with disease likely to affect right ventricular function including but not limited to chronic lung diseases and sleep apnea syndrome; **OR**
- Evaluation of ventricular function prompted by treatment with cardiotoxic agents (examples include but are not limited to some chemotherapeutic agents for cancer, Novantrone [mitoxantrone] for multiple sclerosis, etc.)
    - Baseline evaluation prior to starting treatment
    - Serial evaluation during or within 6 months of completion of treatment
    - Surveillance annually thereafter.

Evaluation of members with cardiac arrhythmias

- In members who have sustained (lasting more than 30 seconds) or nonsustained (more than 3 beats but terminating within 30 seconds) ventricular tachycardia
- In members who have sustained (lasting more than 30 seconds) or non-sustained (more than 3 beats but terminating within 30 seconds) supraventricular tachycardia (including but not limited to atrial fibrillation, atrial flutter, atrial tachycardia, AV node reentrant tachycardia, etc.
- In members who have frequent premature ventricular contractions (PVC) defined as more than thirty (30) PVCs per hour on ambulatory EKG (Holter) monitoring
    - It is not clinically indicated to perform echocardiography for evaluation of infrequent premature atrial or ventricular depolarizations.

Evaluation of infective endocarditis (native or prosthetic valves)

- Members with suspected endocarditis (positive blood cultures and/or a new murmur on physical examination)
- Reevaluation of members with established endocarditis who have any of the following:
    - Virulent organism; **OR**
    - Severe hemodynamic lesion; **OR**
    - Aortic involvement; **OR**
    - Persistent bacteremia; **OR**
    - Clinical deterioration.

Evaluation of members with suspected coronary artery disease

- Chest pain

- Resting echocardiography may suggest a cause for the chest pain other than myocardial ischemia (mitral valve prolapse) and is therefore a reasonable imaging procedure in members with chest pain
- If coronary artery disease is a likely diagnosis and if a resting echocardiogram cannot be performed while the member is experiencing the pain, a provocative test (exercise or pharmacological stress test with or without imaging as appropriate) is preferable
- Resting echocardiography has no role in screening for coronary artery disease in asymptomatic members; **OR**

- Echocardiography is appropriate in the evaluation of members with suspected aberrant or anomalous coronary origins or coronary artery fistula.

Evaluation of members with known coronary artery disease

- Recent (< 3 weeks) acute coronary syndrome (myocardial infarction or unstable angina) and hemodynamic instability or signs or symptoms suggesting a complication of myocardial infarction including but not limited to acute mitral regurgitation, hypoxemia, abnormal chest x-ray, acute ventricular septal rupture, free wall rupture / tamponade, shock, right ventricular involvement, heart failure, or thrombus (This study is usually requested on an inpatient); **OR**
- Recent (< 3 weeks) acute coronary syndrome (myocardial infarction or unstable angina) for initial assessment of LV function (This study is usually done prior to discharge)
  - Not required if left ventricular function has been assessed using a different imaging modality; **OR**
- Prior acute coronary syndrome (myocardial infarction or unstable angina) for reevaluation of ventricular function during recovery phase {up to six (6) months following acute coronary syndrome}; **OR**
- Prior acute coronary syndrome (myocardial infarction or unstable angina) for reevaluation of ventricular function after the recovery phase {more than six (6) months} in members who develop new symptoms or signs suggestive of heart failure; **OR**
- Prior myocardial infarction for reevaluation of LV function in members being considered for AICD or cardiac resynchronization therapy (CRT); **OR**
- Annual echocardiography is appropriate in non-adult members (less than or equal to 18 years old) with an established diagnosis of aberrant or anomalous coronary origins or coronary artery fistula if the findings on echocardiography will impact clinical decision making.

Evaluation of Kawasaki disease

- Echocardiography is appropriate in the evaluation of members with suspected Kawasaki disease; **OR**
- Echocardiography is appropriate in members with an established diagnosis of Kawasaki disease at 2–4 weeks and again at 6-8 weeks following diagnosis whether or not there was coronary artery involvement; **OR**
- Echocardiography is appropriate for periodic surveillance up to one year following diagnosis of Kawasaki disease in members with persistent fever; **OR**
- Echocardiography is appropriate for periodic surveillance up to one year following diagnosis of Kawasaki disease when previous echocardiograms reveal any of the following:
  - Coronary abnormalities
  - Left ventricular dysfunction

- Pericardial effusion
- Valvular regurgitation (other than trace or trivial regurgitation)
- Aortic dilation; **OR**

- Annual echocardiography is appropriate in members with an established diagnosis of Kawasaki disease who have small or medium sized coronary artery aneurysms; **OR**
- Semiannual (every six months) echocardiography is appropriate in members with an established diagnosis of Kawasaki disease who have large or giant coronary artery aneurysms or coronary artery obstruction.

Evaluation of signs, symptoms or abnormal testing

- Echocardiography is appropriate in the evaluation of the following newly recognized symptoms {dyspnea, lightheadedness, syncope, palpitations, reduced functional capacity, orthopnea, paroxysmal nocturnal dyspnea, transient ischemic attack (TIA) or cerebrovascular attack (CVA)}; **OR**
- Echocardiography is appropriate in the evaluation of chest pain not thought to be due to myocardial ischemia or infarction. If myocardial ischemia or infarction is thought to be the cause, resting outpatient echocardiography is not appropriate; **OR**
- Echocardiography is appropriate in the evaluation of the following newly recognized signs suggesting structural heart disease (murmur, cyanosis, ankle edema, ascites, elevation of jugular venous pressure, unexplained weight gain, tachycardia, tachypnea, audible third heart sound, lung crackles suggestive of pulmonary edema); **OR**
- Echocardiography is appropriate in the evaluation of members who are hemodynamically unstable or hypotensive for unknown reasons; **OR**
- Echocardiography is appropriate in further evaluation of abnormal results from other testing which suggests underlying cardiac disease {abnormal chest imaging suggesting cardiac chamber enlargement, valvular or congenital heart disease or congestive heart failure, abnormal EKG suggesting chamber hypertrophy, valvular or congenital heart disease (LBBB, RBBB with anterior or posterior hemiblock, left or right ventricular hypertrophy or Q waves suggestive of prior infarction) or abnormal laboratory results suggesting congestive heart failure such as elevated B-type natriuretic peptide (BNP)}
    - When other cardiac testing raises concerns of underlying coronary artery disease, provocative testing is recommended over resting echocardiography; **OR**
- Echocardiography is appropriate in the evaluation of respiratory failure of unknown cause; **OR**
- Echocardiography is appropriate annually in the evaluation of members with syndromes which place them at increased risk for the development of acquired myocardial or aortic diseases (for example, Marfan Syndrome, Ehlers-Danlos Syndrome, Turner Syndrome, etc.); **OR**
- Echocardiography is appropriate in the evaluation of suspected acute rheumatic fever.

Evaluation of members with pulmonary embolus

- In members with known acute pulmonary embolus, echocardiography may be performed as it is useful in guiding initial decision making (thrombectomy, thrombolysis)
    - Echocardiography is not indicated in the initial evaluation of a member with suspected pulmonary embolism in order to establish the diagnosis; **OR**

- In members who have had a pulmonary embolus, echocardiography may be performed to evaluate right ventricular function and pulmonary artery pressure. If right ventricular function and pulmonary artery pressure are normal, repeated studies are not necessary.

Evaluation of members with pulmonary hypertension

- Echocardiography is indicated for evaluation of suspected pulmonary hypertension; **OR**
- Echocardiography is indicated in follow-up of pulmonary arterial pressures in members with pulmonary hypertension to evaluate response to treatment; **OR**
- Echocardiography may be performed annually in clinically stable members with an established diagnosis of pulmonary hypertension; **OR**
- Echocardiography may be performed to evaluate signs or symptoms which may be attributable to worsened pulmonary hypertension.

Evaluation of aortic disease

- Echocardiography is appropriate on one occasion when ascending aortic aneurysm / dilation or dissection is suspected based on symptoms of chest pain or shortness of breath or abnormal physical findings suggesting these diagnoses
    - Although some providers will use transthoracic echocardiography in evaluation of diseases of the thoracic aorta, transesophageal echocardiography (TEE) is often preferable in this situation
- Echocardiography is indicated annually when pathology of the ascending aorta (aneurysm / dilation or dissection) is suspected because the member has an established diagnosis of a connective tissue disease or genetic condition which predisposes to ascending aortic pathology including but not limited to Marfan syndrome, Ehlers-Danlos syndrome and familial aortic dilation (this guideline does not apply to surveillance of members with bicuspid aortic valve)
- Echocardiography is appropriate for evaluation of the ascending aorta in members with a suspected connective tissue disease or genetic condition which predisposes to ascending aortic pathology including but not limited to Marfan syndrome, Ehlers-Danlos syndrome and familial aortic dilation
- Annual echocardiography is appropriate in members with an established diagnosis of ascending aortic aneurysm or dissection
    - Annual echocardiographic evaluation is usually sufficient in clinically stable members but more frequent testing may be appropriate in some situations (e.g. in longitudinal follow-up of large or enlarging thoracic aneurysms, in follow-up of recently diagnosed thoracic aneurysms until stability is established)
- Echocardiography is appropriate in members with an established diagnosis of ascending aortic aneurysm or dissection who develop new symptoms or signs of aortic aneurysm or dissection.

Evaluation of pericardial diseases

- Echocardiography is indicated in the evaluation of suspected pericardial conditions including but not limited to pericardial effusion, pericardial mass, constrictive pericarditis, effusive-constrictive conditions, members post cardiac surgery or suspected pericardial tamponade
- Echocardiography is indicated in the evaluation of established pericardial conditions including but not limited to moderate and large pericardial effusion, pericardial mass, constrictive pericarditis,

effusive-constrictive conditions, members post cardiac surgery or suspected pericardial tamponade

- Routine surveillance of known small pericardial effusions with no change in clinical status is not appropriate.

Evaluation of cardiac masses or cardiac source of embolus

- Echocardiography is indicated in the diagnosis or exclusion of a cardiac source of embolus in a member who has had or appears to have had a systemic embolic event (although transesophageal echocardiography (TEE) is often preferable in this situation)
- Echocardiography is indicated in the pre- and post-treatment evaluation of cardiac masses (tumor or thrombus)
  - Annual echocardiographic evaluation is usually sufficient in clinically stable members with cardiac masses (tumors or thrombus) but more frequent testing may be appropriate in some situations (e.g. in longitudinal follow-up of enlarging masses or in follow-up of recently diagnosed masses until stability is established).

BILLING/CODING INFORMATION:

CPT Coding:

93303	Transthoracic echocardiography for congenital cardiac anomalies; complete
93304	Transthoracic echocardiography for congenital cardiac anomalies; follow-up or limited study
93306	Echocardiography, transthoracic, real-time with image documentation (2D), includes M-mode recording, when performed, complete, with spectral Doppler echocardiography, and with color flow Doppler echocardiography
93307	Echocardiography, transthoracic, real-time with image documentation (2D), includes M-mode recording, when performed, complete, without spectral or color Doppler echocardiography
93308	Echocardiography, transthoracic, real-time with image documentation (2D), includes M-mode recording, when performed, follow-up or limited study
93312	Echocardiography, transesophageal, real-time with image documentation (2D) (with or without M-mode recording); including probe placement, image acquisition, interpretation and report
93313	Echocardiography, transesophageal, real-time with image documentation (2D) (with or without M-mode recording); placement of transesophageal probe only
93314	Echocardiography, transesophageal, real-time with image documentation (2D) (with or without M-mode recording); image acquisition, interpretation and report only
93315	Transesophageal echocardiography for congenital cardiac anomalies; including probe placement, image acquisition, interpretation and report
93316	Transesophageal echocardiography for congenital cardiac anomalies; placement of transesophageal probe only

93317	Transesophageal echocardiography for congenital cardiac anomalies; image acquisition, interpretation and report only
93320	Doppler echocardiography, pulsed wave and/or continuous wave with spectral display (List separately in addition to codes for echocardiographic imaging); complete
93321	Doppler echocardiography, pulsed wave and/or continuous wave with spectral display (List separately in addition to codes for echocardiographic imaging); follow-up or limited study (List separately in addition to codes for echocardiographic imaging)
93325	Doppler echocardiography color flow velocity mapping (List separately in addition to codes for echocardiography)
93350	Echocardiography, transthoracic, real-time with image documentation (2D), includes M-mode recording, when performed, during rest and cardiovascular stress test using treadmill, bicycle exercise and/or pharmacologically induced stress, with interpretation and report;
93351	Echocardiography, transthoracic, real-time with image documentation (2D), includes M-mode recording, when performed, during rest and cardiovascular stress test using treadmill, bicycle exercise and/or pharmacologically induced stress, with interpretation and report; including performance of continuous electrocardiographic monitoring, with supervision by a physician or other qualified health care professional
93352	Use of echocardiographic contrast agent during stress echocardiography (List separately in addition to code for primary procedure)

REIMBURSEMENT INFORMATION:

Refer to section entitled **POSITION STATEMENT**.

PROGRAM EXCEPTIONS:

Federal Employee Program (FEP): Follow FEP guidelines.**State Account Organization (SAO):** Follow SAO guidelines.

Medicare Advantage products:

The following Local Coverage Determinations (LCDs) were reviewed on the last guideline reviewed date located at fcso.com: Transesophageal Echocardiogram (L33756), Transthoracic Echocardiography (TTE) (L33768), Cardiology- non-emergent outpatient testing: exercise stress test, stress echo, MPI SPECT, and cardiac PET (L36209).

DEFINITIONS:

Bicuspid aortic valve: Inherited form of heart disease in which two of the leaflets of the aortic valve fuse during development resulting in a bicuspid valve instead of the normal tricuspid.

BNP: A blood test that measures levels of a protein called brain natriuretic peptide (BPN) that is made by the heart and blood vessels.

chamber hypertrophy

Ehlers-Danlos syndrome: A group of disorders that affect connective tissues supporting the skin, bones, blood vessels, and many other organs and tissues.

Framingham Risk Score: A gender-specific system used to predict 10-year risk of cardiovascular mortality; low risk- 10% or less coronary artery disease (CHD) risk at 10 years, intermediate risk 10-20%, and high risk 20% or more.

Hypertrophic obstructive cardiomyopathy: A genetic disorder characterized by marked hypertrophy (thickening) of the myocardium.

Kawasaki disease: Blood vessels throughout the body become inflamed.

Marfan syndrome: A genetic disorder that affects the connective tissue in many parts of the body

Pericardial diseases: Pericardial disease affects the pericardium and can present clinically as pericarditis, cardiac tamponade, and pericardial effusion.

SCORE (systematic coronary risk evaluation): A model that predicts the ten-year risk of cardiovascular mortality; high and low cardiovascular risk charts based on age, gender, systolic blood pressure, cholesterol, smoking status, with relative risk chart and qualifiers (<1% lowest to 15% and over).

Turner Syndrome: A chromosomal disorder that affects females; it is characterized by partial or complete loss of one of the X chromosomes.

Valvular heart disease: Any disease characterized by damage to or a defect in one of the four valves of the heart (aortic, mitral, pulmonary, tricuspid).

RELATED GUIDELINES:

Arterial Ultrasound (Duplex Ultrasounds and Physiologic Testing), 06-0000-01
Diagnostic Coronary Angiography, 02-0000-03
Elective Percutaneous Coronary Intervention, 06-0000-04

OTHER:

None applicable.

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COMMITTEE APPROVAL:

This Medical Coverage Guideline (MCG) was approved by the Florida Blue Medical Policy & Coverage Committee on 05/23/19.

GUIDELINE UPDATE INFORMATION:

06/15/18	New Medical Coverage Guideline.
03/15/19	Revision; description, position statements, program exception, and references updated.
06/29/19	Revision; SE & TTE position statements and references updated.