ASNC2017 General Education Information

Statement of Need

Radionuclide-based cardiac imaging studies, including myocardial perfusion imaging (MPI), play an important role in the diagnosis and management of patients with known or suspected heart disease. Today more than 5000 laboratories are performing an estimated 8 million myocardial perfusion studies of which 58% use pharmacological stress agents, either alone with exercise. [DAIC 2013] A large body of scientific evidence exists on the clinical value of MPI, based on studies performed on many thousands of patients. These studies are highly sensitive and specific for the diagnosis, prognosis, and treatment response of coronary artery disease, as well as for selection of patients who may benefit from other types of intervention, including revascularization and device therapy. The value and justification of MPI for risk assessment is based on large observational outcome studies. As a result of the recognized clinical value and cost-effectiveness of these studies, they have been incorporated into many ACC/American Heart Association (AHA)/ASNC clinical management guidelines.

Nuclear cardiology is an evolving field with continuing advances in software, instrumentation and radiopharmaceuticals to provide high quality clinically relevant information for patient care. These advances require those involved in the providing nuclear cardiology studies to be continuously updated to ensure that the procedures are used appropriately and safely and that recent clinical and technological advances are incorporated in a timely manner to continue to improve the image quality and interpretation to provide the best clinical care.

ASNC2017 is an educational activity designed to help imaging professionals obtain the latest information in clinical practice and review cutting-edge scientific advances in nuclear cardiology and cardiac imaging.

ASNC2017 Knowledge Gaps The four knowledge gaps identified for ASNC2017 are: **Reporting, AUC, Radiation Safety, and Clinical Protocols.** These gaps were shared with the tracks as part of the Program Committee Conference call and were to be thought of when developing their topic selections.

(1) **State the professional practice gap(s) of your learners on which this activity is based? (Max 100 words):**

1 a. **What "is" the current state of practice?**

2013 Certification –Gaps (Confidential Data from CBNC)

21% percent of applicants to the CBNC board certification failed the physics and instrumentation part of the exam

17% of applicants to the CBNC board exam failed the Radiopharmaceuticals section of the exam; 32% of applicants to the CBNC board Exam failed the radiation safety section of the exam; 24% of board exam registrants failed the NC Diagnostic test section of the exam; 22% of registrants failed the General Cardiology Imaging Interpretation section of the exam; 25% of CBNC certification exam takers failed the Risk Stratification part of the exam; 20% of CBNC certification registrants failed the MPI section of the exam; 22% of board exam registrants failed the VFI section of the exam; 23% of board exam takers failed the Myocardial Viability of the exam

2013 Recertification – Gaps (Confidential Data from CBNC)

22% of recertifiers failed the physics and instrumentation section of the exam; 15% of board exam recertifiers failed the radiopharmaceuticals part of the exam; 24% of recertifiers failed the radiation safety section of the exam

27% of recertifiers failed the nuclear cardiology diagnostics section of the exam; 18% of recertifiers failed the general cardiology in imaging section of the exam; 23% of board exam recertifiers failed the risk stratification section of the exam; 18% of CBNC recertification board exam takers failed the MPI interpretation section of the exam

19% of CBNC recertifiers failed the VFI part of the exam

28% of recertifiers failed the Myocardial Viability section of the exam

1b What "should be" the state of practice?

Physicians will gain knowledge and skills (**competence change**) to pass the board or recertification exam in nuclear cardiology and appropriately treat patients on their specific needs (**performance change**).

2a. **What "is" the current state of practice?**

1. Multimodality AUC have been published describing the use of seven tests for detection and risk assessment of stable ischemic

heart disease. Source: Wolk M, Bailey SR, Doherty JU, et al. ACCF/AHA/ASE/ASNC/HFSA/HRS/SCAI/SCCT/SCMR/STS 2013 multimodality appropriate use criteria for the detection and risk assessment of stable ischemic heart disease. *J Am Coll Cardiol.* 2014;63:380-406.

The new AUC document reviews the use of exercise ECG, stress radionuclide imaging, stress echo, stress cardiac magnetic resonance imaging (CMR), calcium scoring, coronary computed tomography angiography (CCTA), and invasive coronary angiography, side by side, across different clinical indications. These include patients with signs and/or symptoms and/or various levels of risk for coronary disease; patients undergoing follow-up for prior test results or coronary revascularization; patients scheduled for noncardiac surgery, and patients with an exercise prescription or referral to cardiac rehabilitation. Each test, in each indication, is ranked as "appropriate," "may be appropriate," or "rarely appropriate." Understanding the appropriate use of the multiple imaging tests available is critical to providing optimized patient-centered care and reduced radiation exposure. Source: Depuey EG, Mahmarian JJ, Miller TD, et al. Patient-centered imaging. *J Nucl Cardiol.* 2012;19:185-215; Einstein A, Berman DS, Min JK, et al. Patient-centered imaging. Shared decision making for cardiac imaging procedures with exposure to ionizing radiation. *J Am Coll Cardiol.* 2014;63:1480-1489.

2. In a recent publication, results from FOCUS (Formation of Optimal Cardiovascular Utilization Strategies), a Web-based community quality improvement instrument, developed to increase the feasibility of measuring and improving practice patterns based on the appropriate use criteria were published. [Saifi 2013] Between April 2010 and December 2011, 55 centers voluntarily collected data through the FOCUS radionuclide imaging performance improvement module (PIM). Over this period, the proportion of inappropriate cases decreased from 10% to 5% ($p < 0.0001$) demonstrating the value of educational intervention for improving the use of appropriate testing. Rare appropriate testing usually occurs in patient being evaluated for non-cardiac surgery and for risk assessment in asymptomatic patients (or patients with stable symptoms) with a prior history of known coronary disease or prior abnormal stress imaging. Source: Singh M, Babayan Z, Harjai KJ, Dedhia P, Sattur S, Jagasia DH. Utilization patterns of single-photon emission cardiac tomography myocardial perfusion imaging studies in a rural tertiary care setting. *Clin Cardiol.* 2014;37:67–72.

3. Results from case-based polling at ASNC meetings continue to demonstrate the need for ongoing education on Appropriate Use Criteria. At the ASNC 2014 meeting in Boston, a satellite symposium was held on Appropriate Use Criteria two questions were posed to the participants prior to the presentations and these same questions were asked after the presentations. One question addressed the appropriateness of a myocardial perfusion study in a female patient with a history of hypertension, diabetes, prior cerebrovascular accident, and stage 4 CKD and poor functional capacity. Clearly this is an appropriate study but **only 75%** of the program participants answered this question correctly at the beginning of the program. When asked again, >**90%** were able to answer the question correctly. When asked to identify the most appropriate indication for a SPECT myocardial perfusion study from a list of 4 patients typically seen in routine clinical practice, 50% identified the appropriate indication at the beginning and only 60% after the program. These data indicate an ongoing need for education on the appropriate use of myocardial perfusion imaging. By education nuclear cardiology healthcare professionals on the appropriate use of cardiac imaging has the added benefit of resolving differences in professional opinions regarding the choice of test.

4. AUC will play an important role in controlling the growth of healthcare costs. The Protecting Access to Medicare Act of 2014. [H.R. 4302] makes permanent changes to how physicians who perform advanced imaging services are paid by connecting it to appropriate use criteria. By November 15, 2015, the Secretary of Health and Human Services, in consultation with stakeholders, will choose which AUCs will be included in the program with the goal to identify patients who will most appropriately benefit from a procedure, thus resulting in a more effective and equitable allocation of healthcare resources. AUCs, which must be created or endorsed by national medical specialty societies will be implemented in 2017. ASNC remains a leader in developing and updating the appropriate use of nuclear cardiology procedures.

2b What "should be" the state of practice?

Attendees will gain knowledge and skills ***(competence change)*** necessary to use the updated ACC/ASNC Appropriate Use Criteria for MPI to treat special populations and improve patient health ***(performance change)***.

Physicians should be implementing protocols that result in lower radiation doses.

Physicians should be able to operate with best practice protocols that would allow them to: 1) distinguish artifacts from true medical abnormalities, 2) best utilize software/hardware tools in cardiac imaging to improve image interpretation, 3) produce accurate reports with true positive and true false positives, 4) follow best treatment guidelines for asymptomatic and symptomatic patients.

The ASNC imaging guidelines include specific protocols that should be followed for nuclear cardiology procedures. Nuclear Cardiology Healthcare providers need to increase their competence in applying these protocols to every day practice

(competence change) in order to appropriately treat patients (**performance change**).

3a. **What "is" the current state of practice?**

1. Pharmacologic stress represents approximately 59% of all stress myocardial perfusion imaging (MPI) studies. A recent ASNC survey indicates that 83% of these studies are performed with regadenoson. [Nuclear Cardiology 2013] Currently there are 3 agents approved but ease of administration, safety profile, agent half-life and dosing regimen can impact on the choice of agent. Intravenous dipyridamole, adenosine and regadenoson have shown similar diagnostic and prognostic data. [Iqbal 2012; Iskandrian 2007] A recent publication indicates that regadenoson induces similar and possibly larger perfusion defects than observed with adenosine in a quantitative analysis of the ADVANCE MPI trials in a heterogeneous patient population. Source: *Mahmarian JJ, Peterson LE, Xu J, et al. Regadenoson provides perfusion results comparable to adenosine in heterogeneous patient populations: A quantitative analysis from the ADVANCE MPI trials.* J Nucl Cardiol*. 2014. ePub October 2014.*
Understanding the appropriate use and potential risks of these agents is an important component of a high quality nuclear cardiology laboratory.
2. There is a large body of clinical data supporting the use of adenosine and dipyridamole in a variety of different clinical scenarios and the undesirable side effects are well documented. [Miyamoto 2007] Regadenoson, an A2A adenosine receptor selective pharmacologic stress agent was approved in 2008 and is widely used instead of adenosine and dipyridamole. Source: Al Jaroudi W, Iskandrian AE. Regadenoson: A new myocardial stress agent. *J Am Coll Cardiol.* 2009;54:1123-30. Al Jaroudi W, Hermann D, Hage F, Heo J, Iskandrian AE. Safety of regadenoson in patients with end-stage renal disease. *Am J Cardiol*. 2010;105:133–135.
However, despite wide scale use, at the 2014 NC Today meeting, only 70% of meeting participants identified the lower incidence of AV block as a significant advantage of regadenoson over adenosine.
3. Data on the use of regadenoson in a variety of patient types, with various protocols including with exercise and prognostic markers continue to emerge. Combining exercise and pharmacologic stress can provide challenges in the nuclear cardiology laboratory. Incorporating best practices will ensure the safe and effective use of radiopharmacologic agents in cardiac imaging studies.
Submaximal heart rate response to exercise treadmill testing is common and can lead to reduced diagnostic accuracy by reducing the size and severity of the ischemic area. Source: Hage FG, Dean P, Bhatia V, Iqbal F, Heo J, Iskandrian AE. The prognostic value of the heart rate response to adenosine in relation to diabetes mellitus and chronic kidney disease. *Am Heart J.* 2011a;162:356-362. Hage FG, Dean P, Iqbal F, Heo J, Iskandrian AE. A blunted heart rate response to regadenoson is an independent predictor in patients undergoing myocardial perfusion imaging. *J. Nucl Cardiol.* 2011b;18:1086-1094. Heller GV, Ahmed I, Tilkemeier PL, Barbour MM, Garber CE. Influence of exercise intensity on the presence, distribution, and size of thallium-201 defects. *Am Heart J.* 1992;123:909-16.
4, Best practices for the use of pharmacologic stress agents include a thorough understanding of the safety profile. The FDA issued a Drug Safety Communication warning to healthcare professionals concerning the rare but serious risk of heart attack and death with use of either regadenoson or adenosine. Source: FDA 2014. FDA warns of rare but serious risk of heart attack and death with cardiac nuclear stress test drugs Lexiscan (regadenoson) and Adenoscan (adenosine) http://www.fda.gov/drugs/drugsafety/ucm375654.htm. Agarwal V, DePuey EG. Regadenoson and seizures: A real clinical concern. *J Nucl Cardiol.* 2014;21:869-870. Bokhari S, Shahzad R, Castano A, Maurer MS. Nuclear imaging modalities for cardiac amyloidosis. *J Nucl Cardiol*. 26 October 2013. [E-pub ahead of print]
As new data become available, healthcare providers need to be updated to ensure their laboratories are providing the best clinical practice when performing pharmacologic stress.

3b What "should be" the state of practice?

Understanding the clinical benefits, logistical concerns and safety profile of pharmacologic stress agents so that they are used properly in clinical practice is critical providing the best clinical practice as well as appropriate and effective patient-centered imaging. (**competence change**)

Nuclear cardiologists, nuclear medicine physicians, radiologists and nuclear imaging technologists need to understand the best practices for performing SPECT or PET pharmacologic stress tests. (**performance change**)

4a What is the current state of practice?

Positron emission tomography enables imaging and evaluation of the cardiovascular system at multiple levels. In addition, PET in combination with other imaging modalities including contrast tomography, may enhance clinical decision making. Today, almost 80% of nuclear cardiology laboratories do not have cardiac PET capabilities. Complex and not well understood protocols methodological complexity, high operating costs and lack of widespread availability limit the use of PET.

1. Incorporating PET into clinical practice can be challenging. Physicians have been cited for errors in PET imaging protocols and procedures including laboratory accreditation standards. Source: Intersocietal Accreditation Commission. The IAC Standards and Guidelines for Nuclear/PET Accreditation/ Nuclear PET/ICANL. Updated 8/2012. Available at: http://www.intersocietal.org/nuclear/main/nuclear_standards.htm. Accessed January 1, 2015.
2. With improvements in instrumentation, software, tracer availability and new tracers in development, PET is becoming a more important part of cardiovascular imaging in the nuclear cardiology practice. Source: Heller GV. Nuclear cardiology in the present and beyond: Can we meet the challenges? *J Nucl Cardiol.* 2013;20:510–518. Ohira H, Mc Ardle B, Cocker MS, deKemp RA, Dasilva JN, Beanlands RS. Current and future clinical applications of cardiac positron emission tomography. *Circ J.* 2013;77:836-848.
3. PET has been shown to have superior diagnostic accuracy for the diagnosis of coronary artery disease in comparison with SPECT and provides important prognostic value. The addition of absolute myocardial blood flow quantification increases sensitivity for 3-vessel disease and provides incremental functional and prognostic information. Metabolic imaging using ^{18}F-fluorodeoxyglucose can be used to guide revascularization in the setting of heart failure and also to detect active inflammation in conditions such as cardiac sarcoidosis and within atherosclerotic plaque. Source: *McArdle B, Dowsley TF, Cocker MS, et al. Cardiac PET: metabolic and functional imaging of the myocardium.* Semin Nucl Med. *2013;43:434-448.*
4. A recent summit on PET imaging, sponsored by ASNC, identified a number of important benefits and explored critical issues limiting widespread acceptance of this technique. There is a need to clearly and effectively demonstrate the VALUE of PET and the importance of myocardial blood flow measurements, the high diagnostic accuracy, low radiation dose, and efficiency and minimization of downstream costs. The experts highlighted the need to dispel the myths about PET (cost, availability, etc.) in the medical community and to make available the necessary training and educational materials as well as guidelines and protocols. In addition, there is a need to establish best practices for those laboratories already performing cardiac PET imaging. [ASNC PET Summit notes]

4b What "should be" the state of practice?

Nuclear cardiologists, nuclear medicine physicians, radiologists and imaging technologists need to understand PET protocols and procedures and to understand and incorporate PET technology and tracers into their laboratory to provide the best state-of-the-art patient care. (**competence change**)

5a. **What "is" the current state of practice?**

Recent article published on JAMA has demonstrated underutilization of current and standard practices that reduce radiation exposure in patients as well as gaps in radiation safety knowledge among practicing NC physicians.
Source: Radiation Safety in Nuclear Cardiology: Current Knowledge and Practice—Results from the 2011 American Society of Nuclear Cardiology (ASNC) Member Survey. JAMA Internal Medicine June 10, 2013, Vol 173, No. 11

5b What "should be" the state of practice?

Physicians should know standard protocols and procedures to reduce radiation exposure on patients (**competence change**).