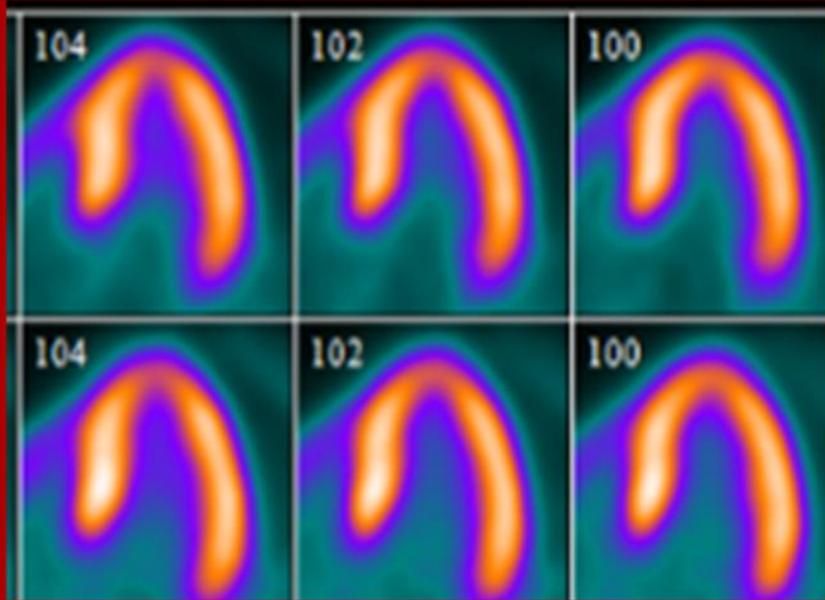


# SNMMI Mid-Eastern Chapter

## Cardiac PET/CT



- Superior Image Quality
- High Diagnostic Accuracy
- Short Imaging Time
- Safe
- Independent on Body size
- Quantification of MBF

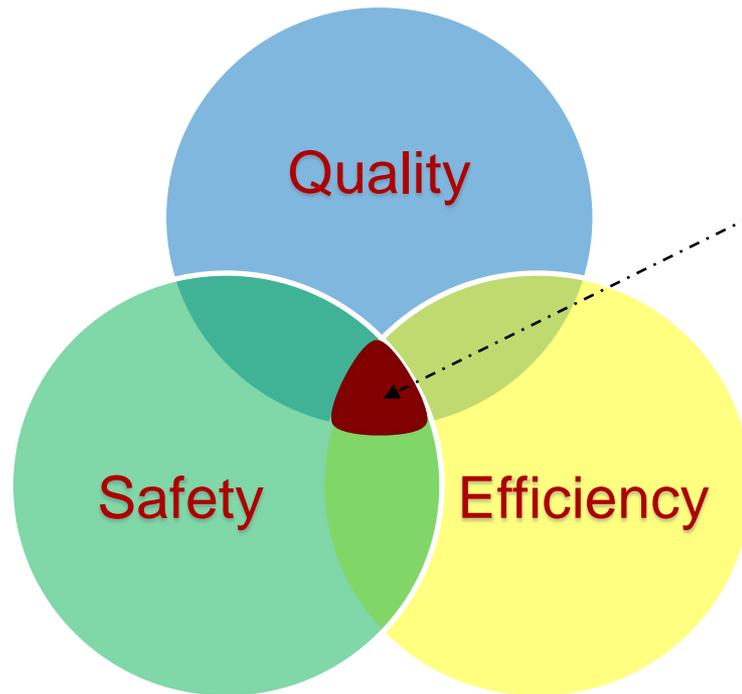
## Underutilization of Rb-82 PET Cardiac Imaging

Jason Jenkins BS CNMT PET CT(R)

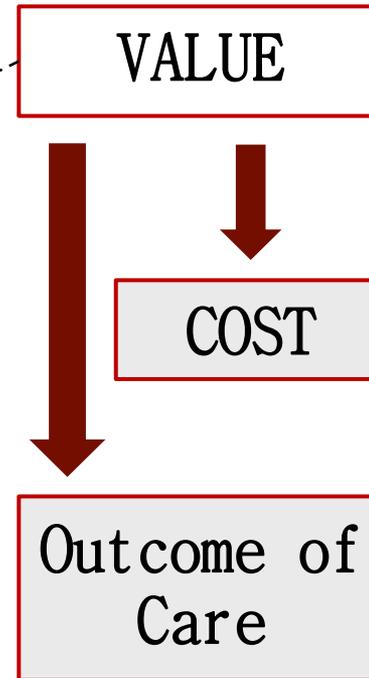
# Preview of Presentation

- Discuss Healthcare Environment
- Clinical Implementation of Technical Innovations
- SNMMI/ASNC Joint Statement on Rb-82 Cardiac PET
- Imaging Protocol
- Principles of Rb-82 Cardiac Imaging
- Technical Issues
- MBF Quantification
- Economic Analysis

# New Healthcare Landscape



Researchers: Medical errors now **third** leading cause of death in United States



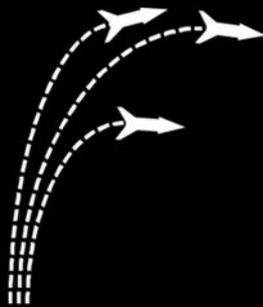
**Value-Based  
Healthcare Culture**

# New Care Delivery Models

- Evidence-Based Medicine *(Best Practice Standards)*
- Pay-4-Performance Model
- Cost and Waste Reduction
- High Value Care Delivery System



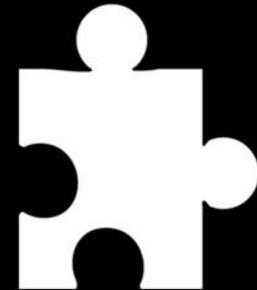
**APPROACH**



**DEPLOYMENT**



**LEARNING**



**INTEGRATION**

# Technical Innovation

- ❑ Where does [Diagnostic Imaging](#) fit in all this?
  - ❑ Continuous Quality Improvement (CQI)
  - ❑ Appropriate use Criteria
  - ❑ Promote Innovation
- ❑ PET/CT Cardiac Imaging Techniques
  - N-13 Ammonia
  -  ○ Rb-82 Chloride

# Joint Position Statement

Journal of Nuclear Medicine, published on August 25, 2016 as doi:10.2967/jnumed.116.180448  
SPECIAL CONTRIBUTION

## American Society of Nuclear Cardiology and Society of Nuclear Medicine and Molecular Imaging Joint Position Statement on the Clinical Indications for Myocardial Perfusion PET

### Writing Group:

Timothy M. Bateman MD (Co-Chair), Vasken Dilsizian MD (Co-Chair), Rob S. Beanlands MD, E. Gordon DePuey MD, Gary V. Heller MD, PhD, and David A. Wolinsky MD

- SNMMI
- American Society of Nuclear Cardiology
- Myocardial Perfusion PET
  - Preferred
  - Recommended

# Cardiac PET: Advantages

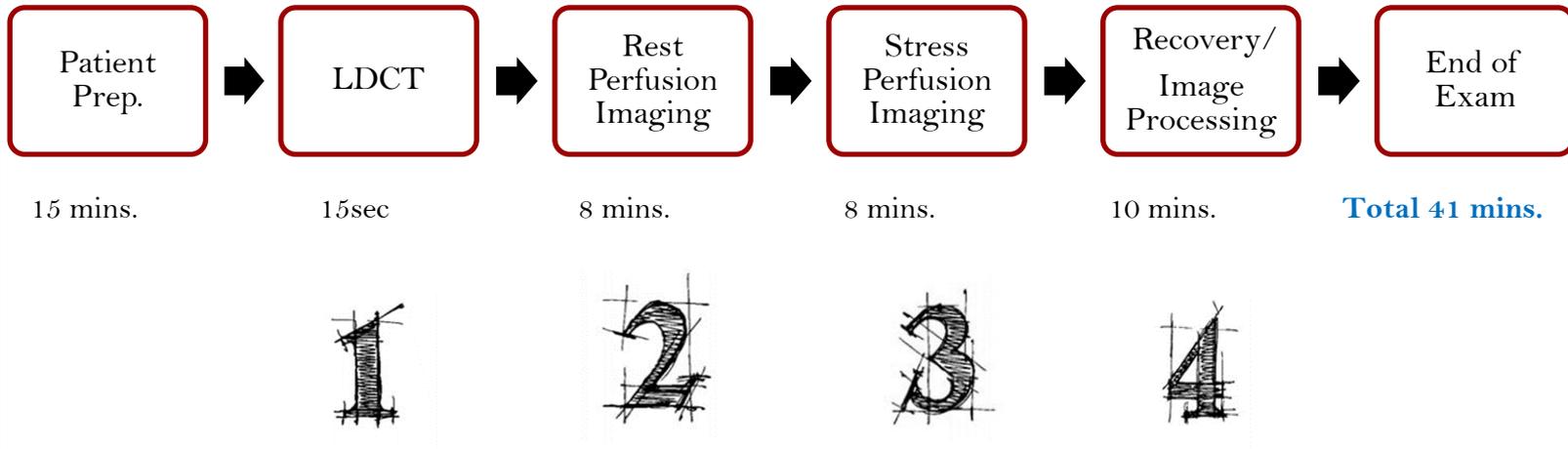
- ❑ **High Diagnostic Accuracy**
  - High Sensitivity/ Specificity
- ❑ **High Image Quality**
  - High Spatial Resolution
- ❑ **Low Radiation Exposure**
  - 2-3 mSv
- ❑ **Short Acquisition Protocols**
- ❑ **MBF Quantification**
- ❑ **Strong Prognostic Power (Risk Stratification)**



# Rb-82 MPI PET: Protocol

## Increase Patient Throughput

### Timeline Rb-82 PET/CT Cardiac Stress



❑ Tc-99m SPECT Technique: **3+ hours**

(Reduces patient throughput)



# LDCT Attenuation Profile

## ❑ Traditional MPI SPECT

- Non-uniform attenuation artifacts
- Breast/ Diaphragm artifacts
- Lower Specificity

**Patient Comfort**

## ❑ SPECT CT MPI

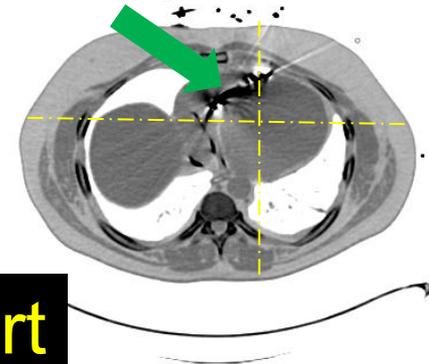
- CT attenuation correction
- Increase specificity

## ❑ PET/CT attenuation

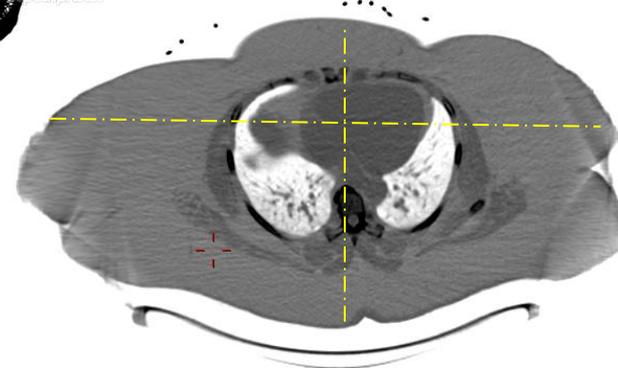
- CT vs. Radionuclide Attenuation



Average Size

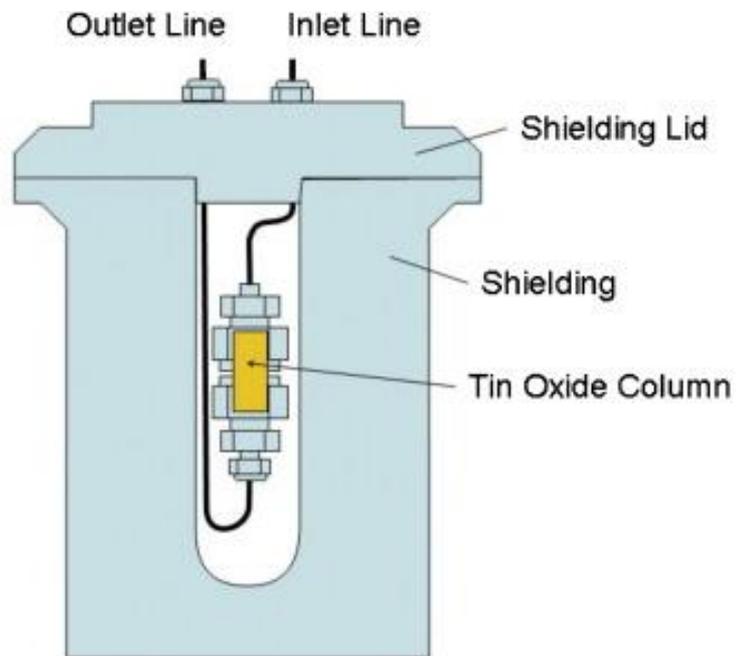


Large Patient



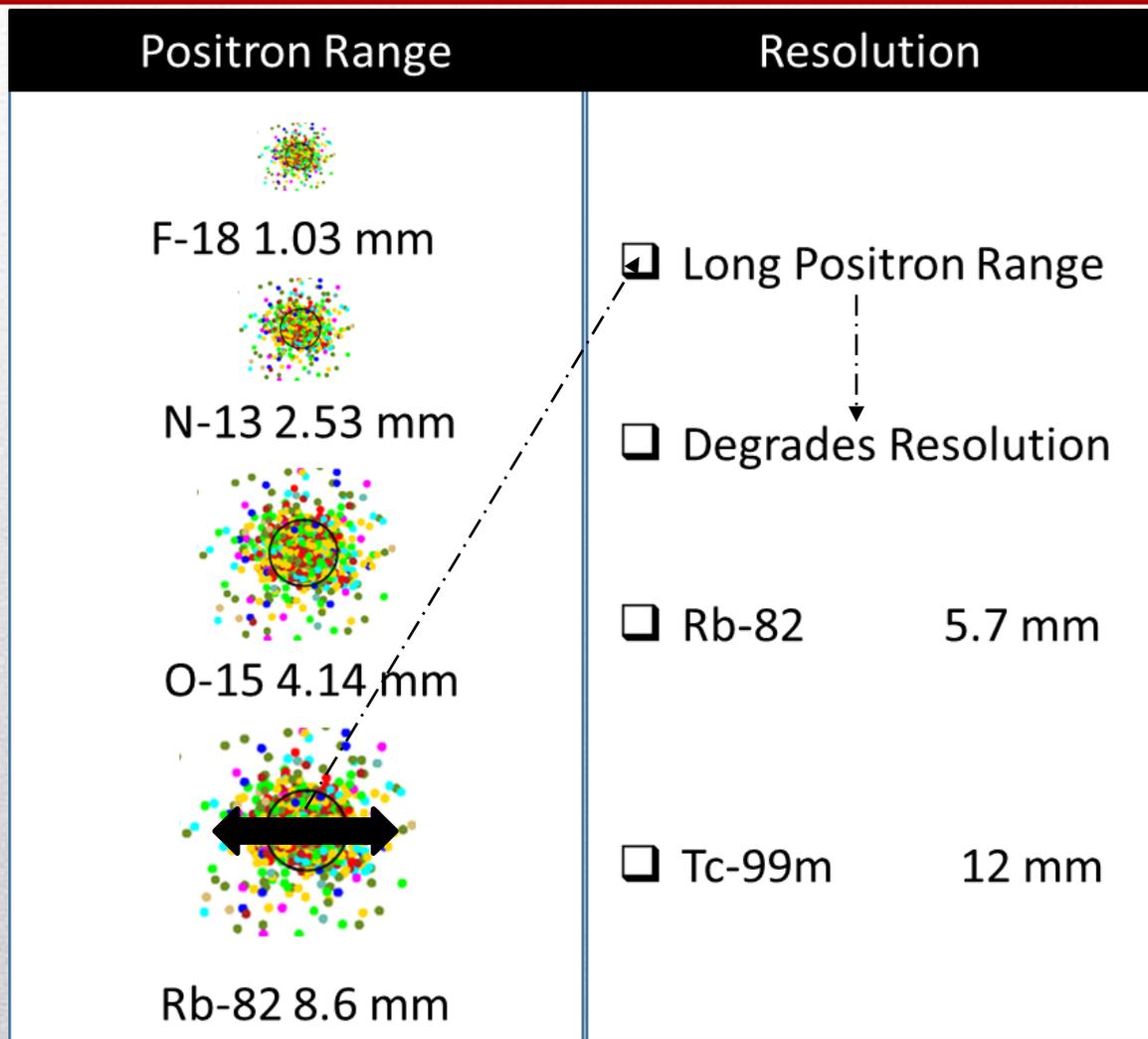
2

# Rb-82 Generator



- ❑ K<sup>+</sup> Analog
- ❑ Proportional to MBF
- ❑ Sr-82/Rb-82 (Parent/ Daughter)
- ❑ 0.9 Saline Elution: Rb-82
- ❑ Tin oxide binds Sr-82
- ❑ QC: Sr-82/ Sr-85 Ratio
- ❑ T<sub>1/2</sub>: 75s
- ❑ Repeat Elution: 10 min

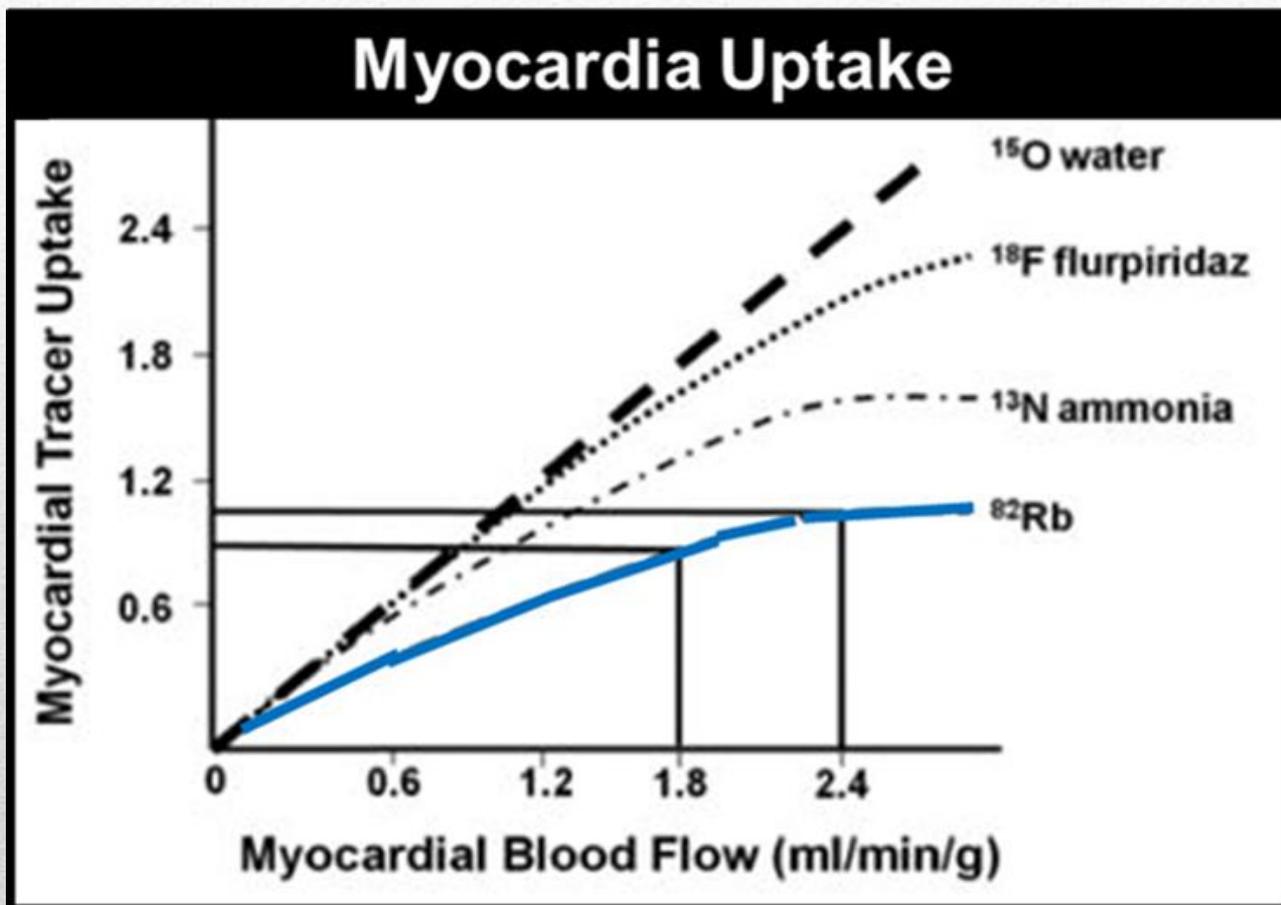
# Rb-82: Resolution



✓ High Spatial Resolution

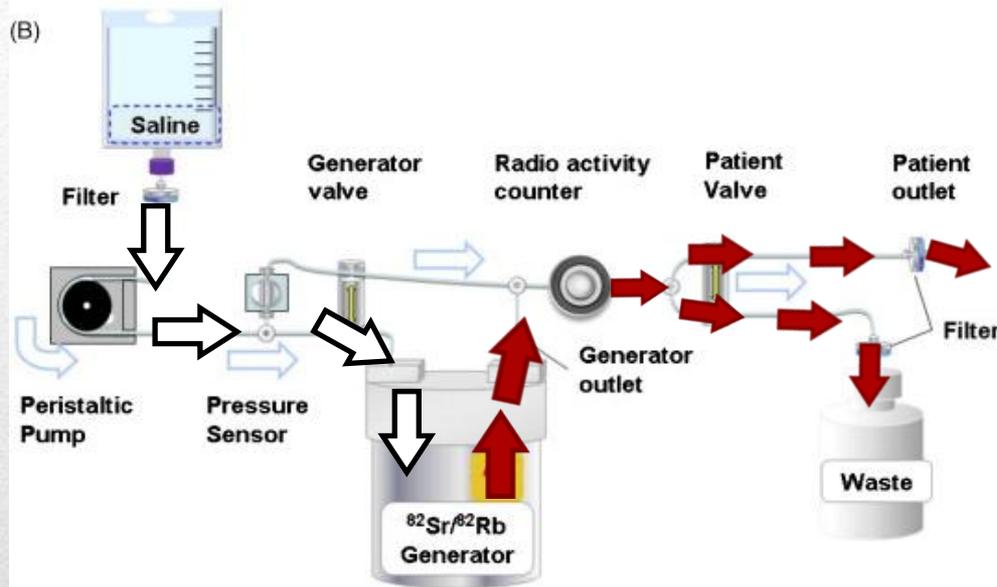
2

# Rb-82: Extraction Fraction



# 2

## Rest Perfusion: Imaging



### Dynamic Imaging

- 12 frames x 5s
- 6 Frames x 10s
- 4 frames x 20s
- 4 frames x 40s

## Acquisition Parameters

### Gated/ Static Imaging

- 1 bed position
- 90s delay
- 390s Imaging
- NAC Image Recon

# 2

## Rest Perfusion: Possible Errors

### Sources of Error

- Patient Anxiety (Motion)
- Arms get tired (Motion)
- High Pressure Error
- Clamped IV
- Dose Infiltration
- Positional IV
- Pump Limit Reached



- Time/ Motion Sensitive Procedure



# Stress Perfusion Imaging

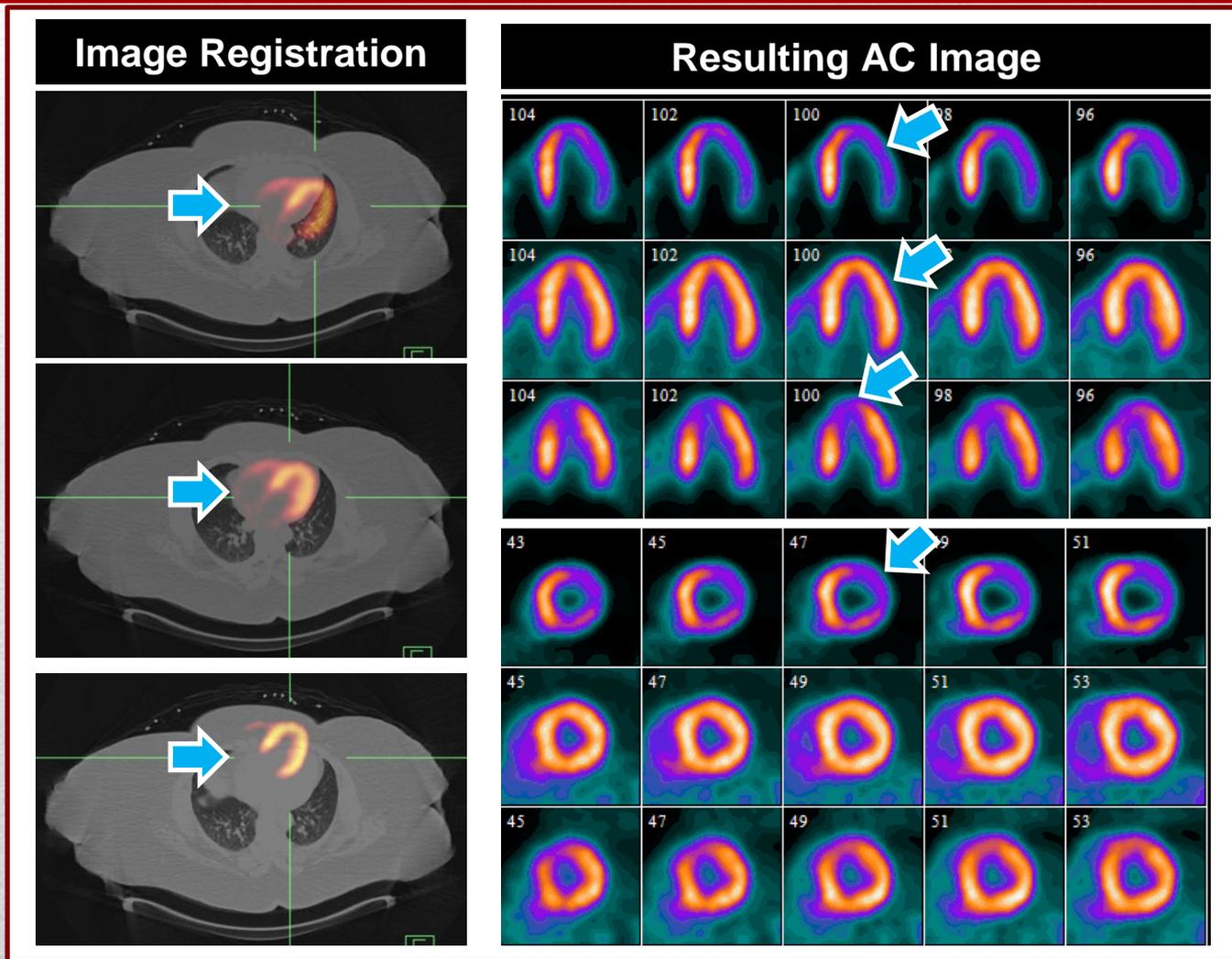
## Concern

- SOB
- Chest Discomfort
- Nausea
- Claustrophobia
- Patient Moves
- Mismatch PET-CT Profiles
- Attenuation Correction Error



- Heightened Patient Awareness

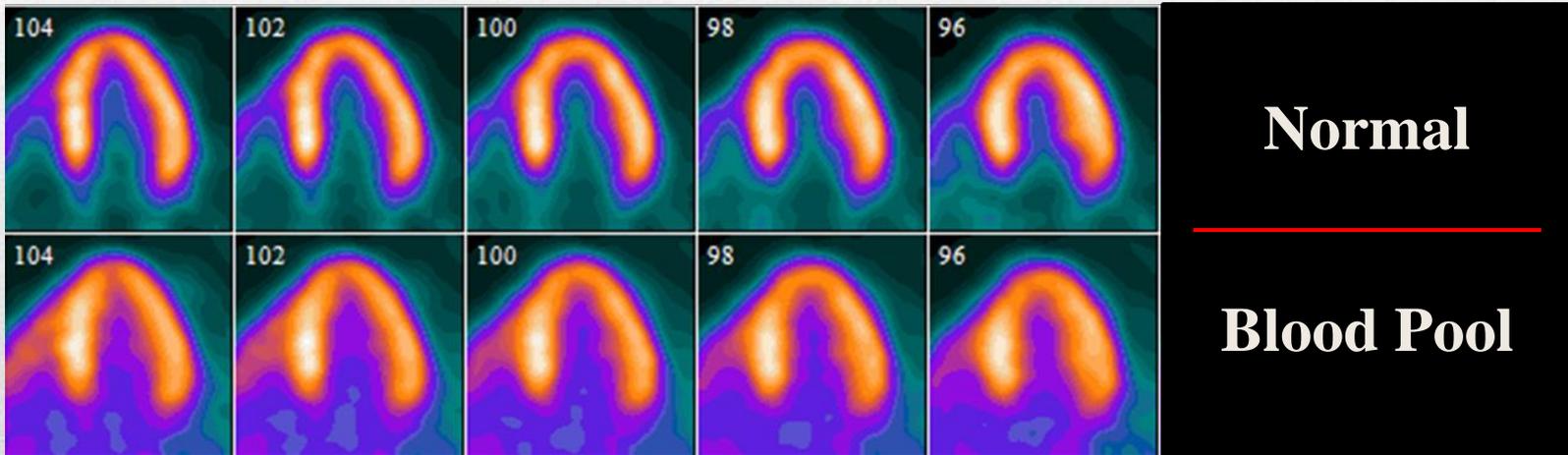
# Image Registration





# Image Blood Pool

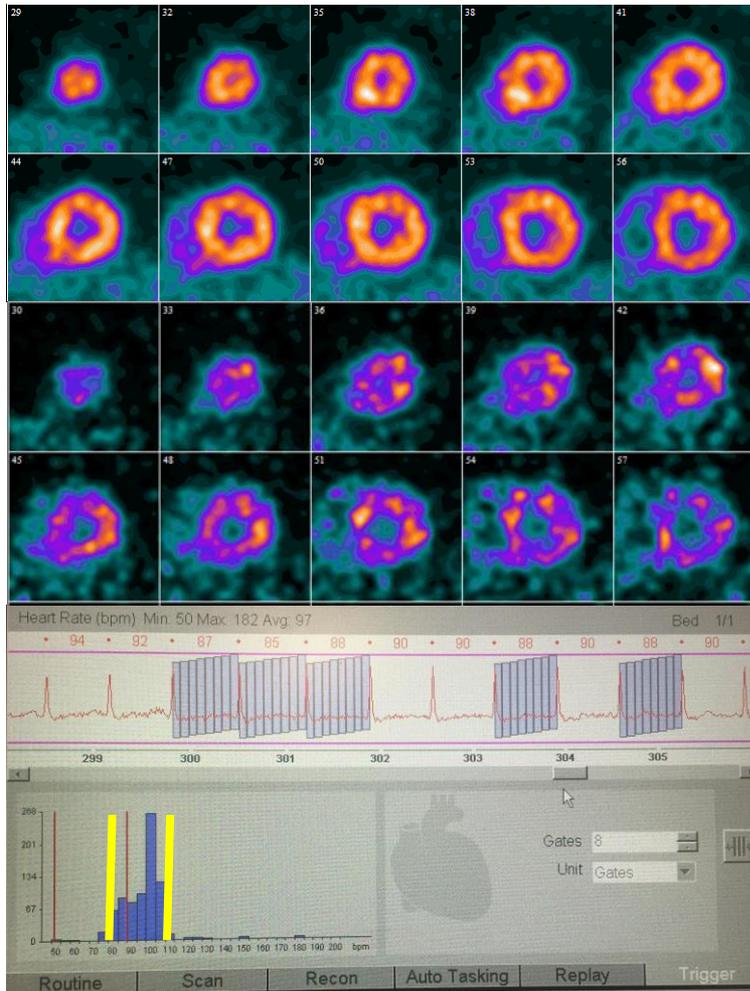
## Heart Failure Patients



Increase Delay time from 90s to  $\pm 120$ s



# Incorrect Window



## Gated Image

Normal

Low Count

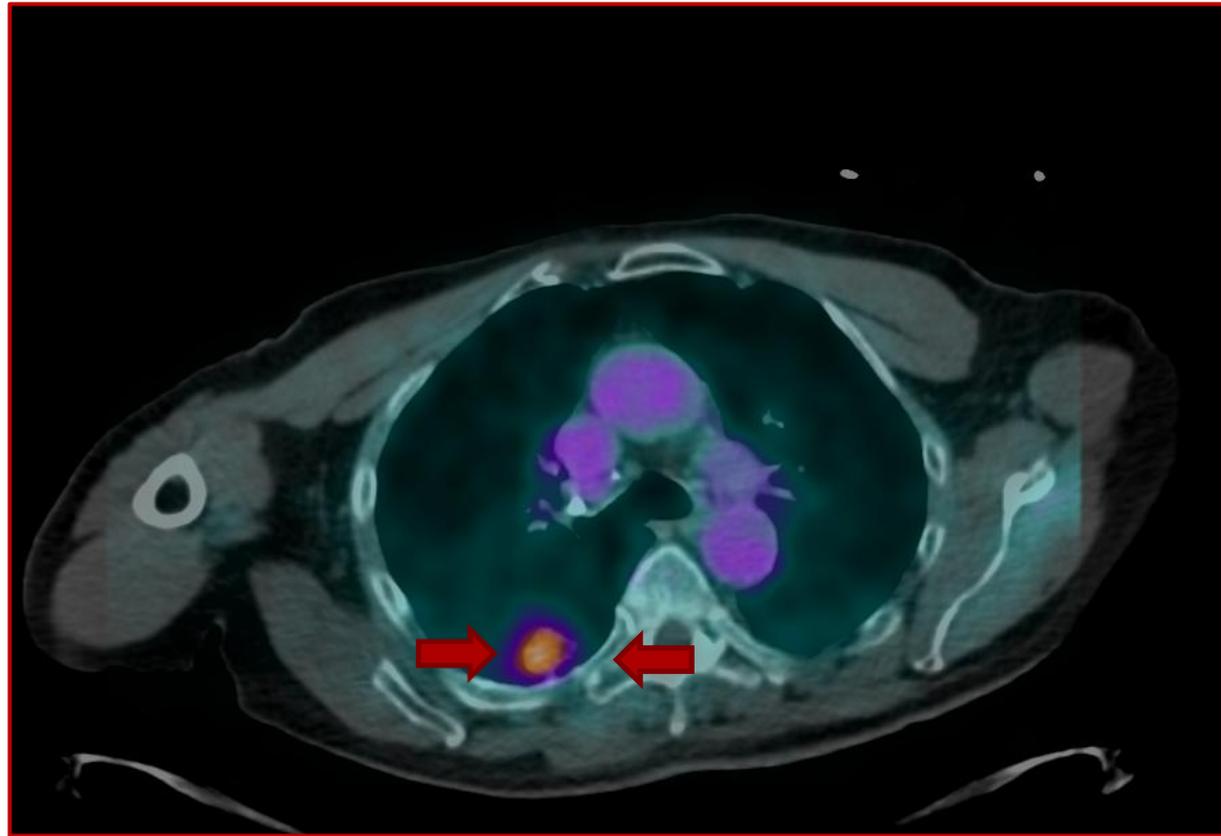
Incorrect Window

4

# Extra Cardiac Activity

Incidental Findings

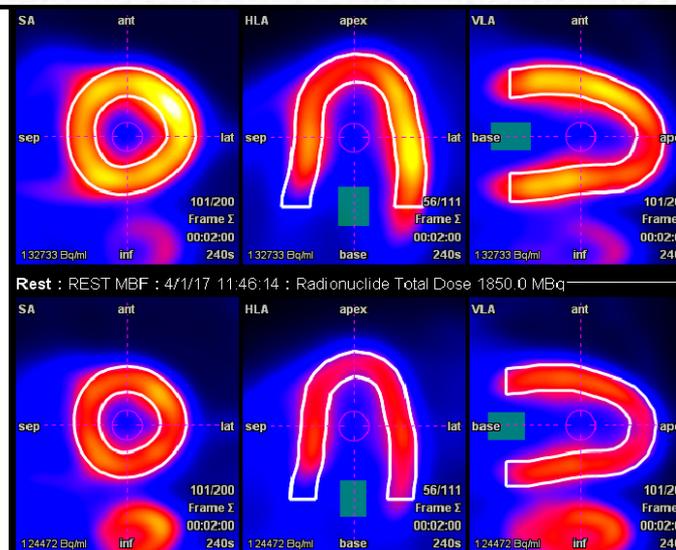
SPN



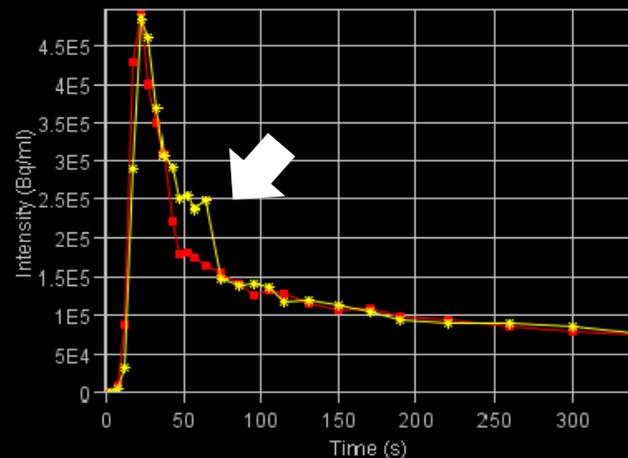


# MBF Quantification

- Absolute Flow Measurement (ml/g/min)
- Severity of CAD burden
- Compartment Model (Flow Kinetics)
- Vascular vs. Tissue Compartment
- Validation: Repeatability
- Normal Flow Reserve > 2



	Flow (ml/g/min)				Reserve	
	Stress		Rest		mean	std dev.
	mean	std dev.	mean	std dev.		
LAD	2.76	0.51	1.14	0.19	2.43	0.33
LCX	3.15	0.59	1.01	0.21	3.17	0.45
RCA	2.97	0.41	1.24	0.23	2.43	0.34
Global	2.91	0.54	1.13	0.22	2.63	0.50



4

# Anyone Still With Me?





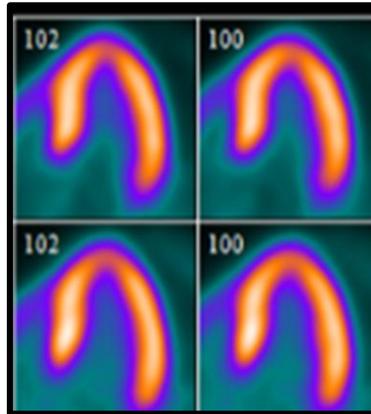
# Joint Statement Review

## High Diagnostic Accuracy

- Sensitivity/Specificity
- Image Quality
- Spatial Resolution

## MBF Quantification

- Rest/ Stress MBF
- Flow Reserve
- Pharmacologic



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Response

## Low Radiation Exposure

- Annual Natural Exposure
- Short Acquisition Time
- Increase Throughput

## Strong Prognostic Power

- Risk Stratification
- Risk Level
- Discrimination

# Economic Analysis: Procedure Cost

## Comparative Analysis

- Rb-82 PET Cardiac more expensive than Tc-99m Cardiac SPECT
- Does greater diagnostic yield compensate for high cost?
- Quite Possibly!
- As a General Principle: Diagnostic Accuracy and Value
- Sensitivity and Specificity
- Impact on Overall Cost of Medical Management

# Overall Economic Analysis

Sensitivity

True Positives

Specificity

True Negative



Diagnostic Accuracy

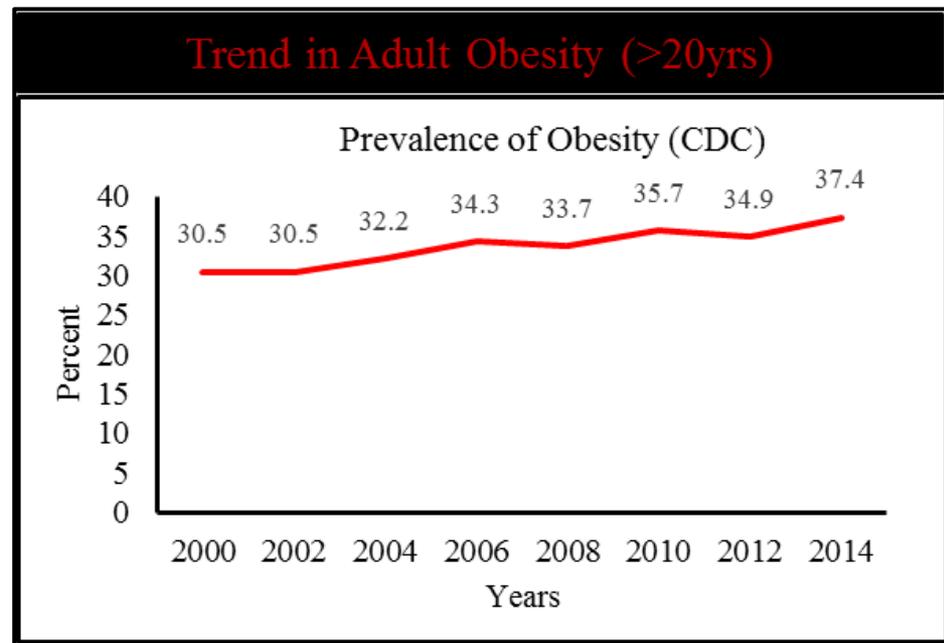
VALUE



Cost & Outcome of Care

# Conclusion

- ❑ SNMMI/ASNC Joint Statement: Cardiac PET Imaging
- ❑ Adequate Responds to Value-Based Healthcare Culture
- ❑ Will continue to meet the diagnostic imaging needs of our patients.



# Thanks for Listening!



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MEDICAL CENTER