QIBA SPECT BIOMARKER COMMITTEE: Literature Review Task Force

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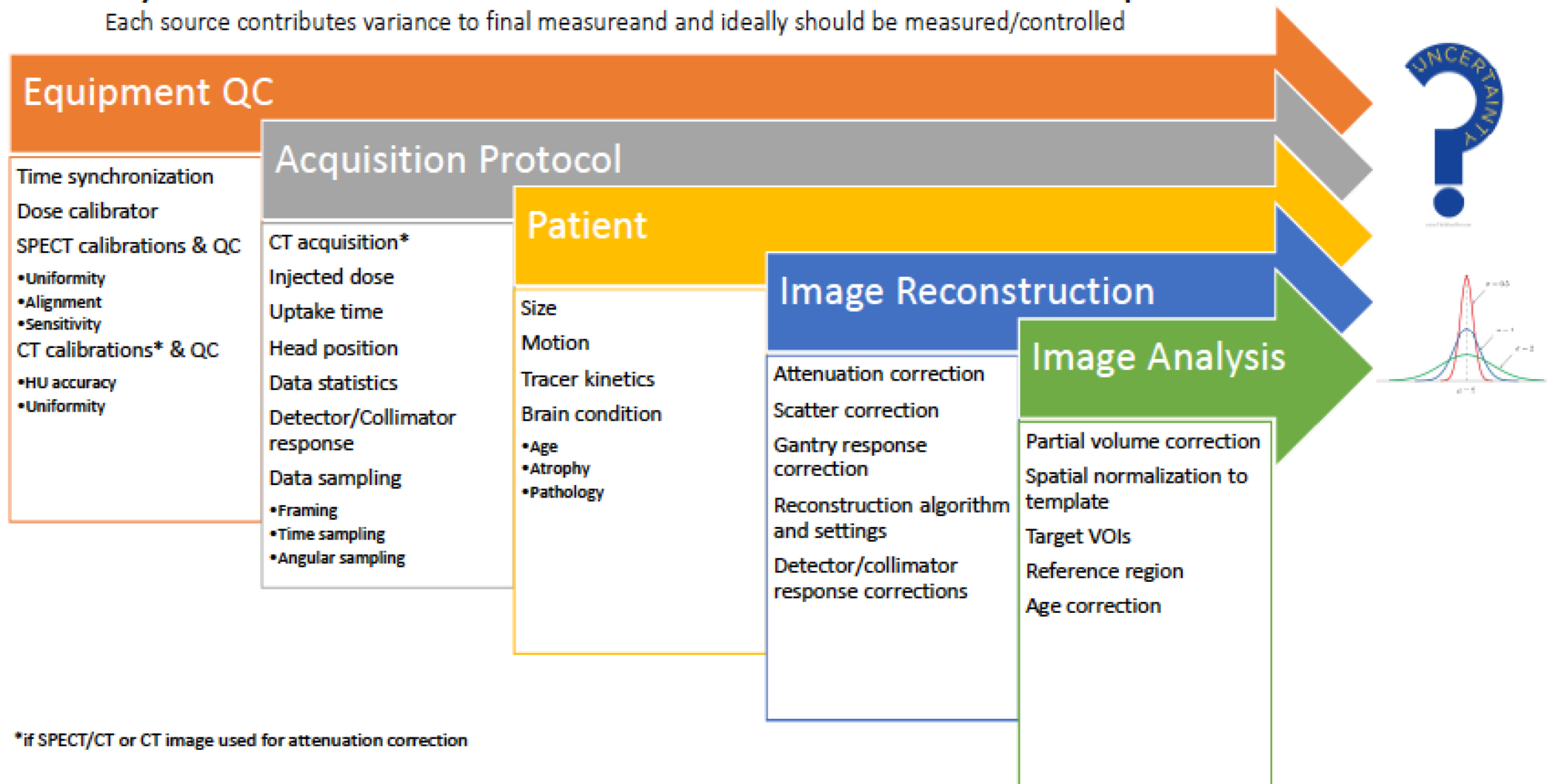
Quantitative Imaging Biomarkers Alliance

RSNA

Agenda

- Progress report on literature review
- Integration with Profile
- Action items and timelines
- AOB

How can the literature support these efforts?

How can the literature support these efforts?

- Reported Experience with measurands
  - Accuracy and precision
  - Validation- pk modeling for bias estimates of SBR
  - Test-retest studies

- General quantitative SPECT issues
  - Standardization with phantoms, normative data, image VOIs
  - Reconstruction and filtration
  - Attenuation correction, scatter correction
  - Spatial normalization
  - VOI strategy
  - Parametric and voxel-wise approaches

DOPAMINE TRANSPORTER SPECT KEY PUBLICATIONS 1995-2016

- Clinical: vis and quantitation   60
- Clinical: visual interpretation only   23
- Image analysis   11
- Acquisition and image recon   7
- Software   4

Review performed 3/2016

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Image Acquisition and Technical Considerations

1. Rajeevan, N., I. G. Zubal, S. Q. Ramsby, S. S. Zoghbi, J. Seibyl and R. B. Innis (1998). "Significance of nonuniform attenuation correction in quantitative brain SPECT imaging." J Nucl Med **39**(10): 1719-1726.
2. Zaknun, J. J., H. Schucktanz and F. Aichner (2007). "Impact of instrumentation on DaTSCAN imaging: how feasible is the concept of cross-systems correction factor?" Q J Nucl Med Mol Imaging **51**(2): 194-203.
3. Bienkiewicz, M., M. Gorska-Chrzastek, J. Siennicki, A. Gajos, A. Bogucki, A. Mochecka-Thoelke, A. Plachcinska and J. Kusmierek (2008). "Impact of CT based attenuation correction on quantitative assessment of DaTSCAN ((123)I-ioflupane) imaging in diagnosis of extrapyramidal diseases." Nucl Med Rev Cent East Eur **11**(2): 53-58.
4. Seibyl, J., K. Marek and I. G. Zubal (2010). "The role of the core imaging laboratory in multicenter trials." Semin Nucl Med **40**(5): 338-346.
5. Seibyl, J., I. G. Zubal, D. Jennings, K. Marek and P. M. Doraiswamy (2011). "Molecular PET imaging in multicenter Alzheimer's therapeutic trials: current trends and implementation strategies." Expert Rev Neurother **11**(12): 1783-1793.
6. Lange, C., A. Seese, S. Schwarzenbock, K. Steinhoff, B. Umland-Seidler, B. J. Krause, W. Brenner, O. Sabri, J. Kurth, S. Hesse and R. Buchert (2014). "CT-based attenuation correction in I-123-ioflupane SPECT." PLoS One **9**(9): e108328.
7. Lange, C., J. Kurth, A. Seese, S. Schwarzenbock, K. Steinhoff, B. Umland-Seidler, B. J. Krause, W. Brenner, O. Sabri, S. Hesse and R. Buchert (2015). "Robust, fully automatic delineation of the head contour by stereotactical normalization for attenuation correction according to Chang in dopamine transporter scintigraphy." Eur Radiol **25**(9): 2709-2717.

Next Steps

- Upload the reference file to be available for everyone's use

- Merge with other references from other Task Force group

- Populate Profile with appropriate references

- What are the gaps in the literature vis a vis validation as a quantitative biomarker of DAT?

- What studies are suggested to fill in these gaps?

Where does the literature fall short?

- Different DAT tracers are used
  - The great majority of longitudinal data is with b-CIT, not FP-CIT (ioflupane)
  - There are differences in rates of longitudinal change which is tracer specific
  - Limited with-in subject studies with different tracers
- Validation of DAT measurands is incomplete
  - Validation- pk modeling for bias estimates of SBR exist b-CIT, not FP-CIT
  - Limited test-retest data
- Many key studies are ongoing with some data presented but not formally published
  - PPMI- Scintigraphic biomarker study of disease progression in de novo PD is largest longitudinal dataset with ioflupane
  - At risk studies may be most relevant for quantitation

Extra

Scope of the Quantitative DAT SPECT Literature

Topic	Sub-topic	Notes
Studies with DAT reporting Quantitation	Single Center Studies	Many studies
	Multicenter studies	PPMI,PRECEPT, PARS, others
		EANM NL DAT DB Consortium
	Screening algorithms- visual vs quant	
Technical Reports Acquisition, Recon, Standardization across Cameras	Phantom Standardization	
	AC methods	
	Reconstruction algorithms	
	Scatter correction	
	Standardizing imaging processing	
Image Processing Methods	Voxel-wise	Threshold and cluster cut-offs
	VOI sampling	SBR- target density
		% ID- target number
		Volume
		Comparison w age matched normal data
Outcome Measure Validation	PK modeling	
	Bias assessment of simple ratio methods	
	Test-retest	
Software	HERMES Brass	Issues- normative data characterization,
	GE DATQuant	VOI templating, spatial normalization, validation procedures
	SEGAMI- DATScan	
	OSA	
	MIM	
	Others	

Scope of the Quantitative DAT SPECT Literature

Topic	Sub-topic	Notes
Applications of Quantitative DAT SPECT	Longitudinal Assessments of DAT in PD	ELL DOPA, CALM PD,PRECEPT, PRIDE PPMI, OTHERS
	Eligibility criteria for screening	PPMI
	Screening algorithms- visual vs quant	P-PPMI
	Imaging at-risk populations	PPMI, OTHERS
	Receptor/transporter Occupancy Studies	DAT, SERT, NET
		nicotinic receptors- several subtypes
		adenosine 2a
	Evaluate non-PS pathophysiology	Cocaine addiction
		Depression
		ADHD
DAT Radiopharmaceuticals	ioflupane	Commercially available
	b-CIT	Most longitudinal data
	PE2I	
	altropane	
	others	