HHSN268201300071C
Quantitative Imaging Biomarkers Alliance (QIBA)

PROGRESS REPORT: OCTOBER 2014 THROUGH MARCH 2015

This progress report is stated in terms given in the accepted Work Plan. This progress report is organized in the same subsections as used in the approved work plan:

A. Review of activities responsive to each objective.

B. Status for each groundwork project approved by steering committee with respect to funding approval and start.

C. Additional descriptions of general committee progress.

A. REVIEW OF ACTIVITIES RESPONSIVE TO EACH OBJECTIVE

An update on Objectives 1-6 is given below.

OBJECTIVE 1. DEVELOP AT LEAST 2 NEW PROTOCOLS AND QIBA PROFILES PER YEAR THAT ADDRESS DISEASES OF SIGNIFICANT BURDEN TO THE US POPULATION.

Selected specifics:

PDF MRI: The PDF-MRI Biomarker Committee is finalizing v1.0 of the isotropic diffusion-weighted imaging (DWI) QIBA Profile, which incorporates results from two Round 3-funded (2013-2014) projects (isotropic diffusion phantom, PI Michael Boss, and software for analysis of data collected using the isotropic diffusion phantom, PI Tom Chenevert). Task forces have been formalized for the DWI activities, as well as for DCE-MRI, v2.0. Additional task forces have been formed for a diffusion tensor imaging (DTI) QIBA Profile, and for a dynamic susceptibility contrast (DSC) MRI QIBA Profile.

CT VOLUMETRY: The QIBA Profile describing measurements of change in tumor volume for advanced disease (the "CTV" profile) has been updated to align with metrology group definitions. Over the past 18 months, significant discussion has accumulated around points in the QIBA Profile, and much of it has now been incorporated into the text, with a plan and timeline for incorporating the remainder. The requirements for compliance have been revised, incorporating considerations previously not included in the QIBA Profile (for example, regarding the proper use of contrast). The committee has also focused effort on designing a field test of the QIBA Profile. The first step will check whether sites can take the QIBA Profile and execute its requirements. The second step will be to collect data on the precision of clinical lesion measurements, so that the precision can be combined with prior information on bias to provide a more complete description of measurement variability. The protocol design for this field test is in active development. The Lung Nodule Assessment in CT Screening Task Force has been working to ensure that the small nodule claims, as stated in the "small nodule" QIBA Profile, are consistent with the established claims of the advanced disease QIBA Profile. Published results and unpublished data from members of the group have been used to inform development of claim details. The group is close to being able to finalize its "small nodule" QIBA Profile document.

COPD/Asthma: Lung Density Profile Status: Careful specification acquisition and reconstruction parameters are required to control measurement bias of lung density. A Task Force of CT vendor scientists has formed to develop a compliance checklist and to suggest changes to the acquisition and reconstruction parameter specification. The Task Force has decided to use measurements on the COPDGene Phantom for compliance. The Task Force has organized a project that involves scanning the same COPDGene Phantom using three radiation doses on two models of each vendor's CT scanners. The CT Vendor Task Force will complete it first round of scanning of the COPDGene Phantom in March. The Biomarker Committee has completed a meta-analysis of the CT lung density repeatability literature. As a consequence, the Biomarker Committee has finalized its repeatability claim. The meta-analysis may be the basis for a submission of a manuscript for publication in the peer-reviewed literature.

SWS US: A first draft of the QIBA Profile claims statement has been created in the proper format—although many of the details regarding performance are awaiting additional phantom and clinical testing. The standard QIBA Profile template has been taken and reduced to outline format for writers to better understand how the sections should be organized. The outline draft has undergone significant revisions and sections of the outline

have been assigned to various members of the profile drafting group for completion. Profile drafting is proceeding on schedule for a mid-May release of a first draft of the "SWS Estimation of Liver Fibrosis" QIBA Profile. A standardized shear wave speed data collection case report form has been developed for inclusion in the profile appendices. Also UPICT style step by step protocol(s) specific for each US system capable of making the needed measurements will be appended to the QIBA Profile.

Amyloid-PET: The QIBA Amyloid PET Biomarker Committee has made substantive progress in drafting a QIBA Profile whereby amyloid tracers may be used in clinical trials for Alzheimer's dementia. There has been excellent participation on the every other week teleconferences by members of all radiotracer manufacturers and equipment manufacturers as well as key subject matter experts from clinical, academic, medical physics and systems engineering backgrounds. The group has leveraged relevant work from the FDG-PET Biomarker Committee and work from the QIBA metrology group to assist in the current draft creation. Currently, there are subgroups which are working on specific sections of the Profile, notably for development of Claim language, and performance requirements for site qualification and image analysis. The group is targeting Q4 2015 for completion of the first version of this QIBA Profile.

Quantitative SPECT: A QIBA Nuclear Medicine exploratory group was initiated in Q4 2014 to assess both the practicality and feasibility of drafting a quantitative SPECT QIBA Profile driven by increased use of quantitation in SPECT, and the emergence of commercial quantitative SPECT hardware/software packages from major vendors. A large group of engaged industry and academic physicians and scientists are actively working towards identifying appropriate and achievable targets for a QIBA Profile in this currently exploratory effort. Should an appropriate target be defined by the group, the formal formation of a Biomarker Committee will follow.

fMRI: The fMRI Biomarker Committee continues work on v1.0 of its Profile for Pre-surgical Mapping of Eloquent Brain Tissue. The Biomarker Committee made refinements to section 2, clinical claims and contexts; to Section 3, particularly Acquisition guidelines; as well as accompanying Appendices with detailed specifications.

OBJECTIVE 2. PERFORM INDIVIDUAL GROUNDWORK DATA COLLECTION AND ANALYSIS PROJECTS TO FILL GAPS IDENTIFIED DURING WORK DEVELOPING AT LEAST 6 QIBA PROFILES.

Selected specifics:

PDF MRI: Significant progress was made in the four Round 3 (2013-2014) projects funded within the PDF-MRI Biomarker Committee, and these projects are deemed completed per the original aims of the proposals. Activities building off of these groundwork projects continues, as detailed below.

A production phantom for DWI was finalized, fabricated, and disseminated across 13 QIBA sites, surpassing the revised proposal's promise of 10 phantoms (PI Michael Boss). These phantoms are similar to the prototype phantoms previously used in the multi-site study to assess reproducibility of data collected with the phantoms over time and sites. Improvements were made to the material choices and manufacturing methods to enable cost-savings, and a larger number of phantoms. Data acquired using the phantom will be aggregated on the Quantitative Imaging Data Warehouse (QIDW). These data will be analyzed in a consistent fashion using the software also funded by Round 3 (2013-2014) (PI Tom Chenevert). Beta testing has been completed across several sites, and the analysis package is available for download on the QIDW. Data collection and analysis with these tools will continue past the end of the original proposal timelines.

A DCE-MRI phantom study (PI Thorsten Persigehl) was completed, investigating the effects of parallel imaging (SENSE) and B_1 inhomogeneity at 1.0, 1.5, and 3.0 tesla, across 2 vendors (Siemens and Philips) with the DCE-MRI phantom previously developed with Round 1 funding (2011-2012). MR data were uploaded to the QIDW for public access. The conclusion of this study is that the use of SENSE does not adversely affect results (measurement of $1/T_1$), but that the benefit of B_1 correction remains unknown; however, good reproducibility of results was seen across field strengths.

Our final Round 3 (2013-2014) project (PI Hendrik Laue) was to develop an open-source software

package to facilitate comparison of parametric images generated by different DCE-MRI analysis packages when utilizing the digital reference object (DRO) created as part of a previous Round 1-funded project. This software is capable of importing 2D and 3D DICOM images or binary data formats, as well as imaging formats such as TIFF and PNG. It generates difference and ratio maps (exportable as PNG), scatter diagrams and box-plots, and ANOVA statistics to more easily compare analysis packages. The summary results are exported to a .pdf file. This software is available for Mac, Windows, and Linux operating systems, and further development continues past the original project timeline.

FDG-PET/CT: The FDG-PET/CT Profile Field Test was performed at Duke University, Johns Hopkins University, and VU University Amsterdam. This field test consisted of a thorough examination of the feasibility and practicality of the QIBA Profile in the specific context of three academic PET imaging centers using imaging equipment from three different manufacturers. In addition, each specification was evaluated for its relevance to quantitative PET. The primary results/deliverables of the field test were:

Profile revisions: Nineteen changes to the original QIBA Profile were identified and proposed. One important result of this "Field Test" process was that not only did it identify impractical or ambiguous specifications, but it initiated discussion regarding how to best formalize this QIBA workflow procedure.

Checklist: A reduced list of 36 specifications was produced that can serve as a simple checklist for imaging sites to determine their QIBA compliance. This distillation from the much longer set of QIBA Profile specifications was based on feasibility and relevance to quantitation. The list will likely be further reduced in phase II of the field test.

Amyloid-PET: Amyloid Digital and Physical Phantom Development: Currently available brain phantoms are inadequate for quantitative assessment of amyloid tracers. Amyloid imaging, in particular, and the field of neuro-PET imaging in general, would significantly benefit from a well-designed quantitative brain phantom. This project, begun in Q4 2014, is working towards the co-development of (1) a PET Brain Digital Reference Object (DRO) with separate gray and white matter anatomies plus CSF, with well-defined reference regions for SUVr (the amyloid metric identified for the Profile) calculations and (2) a precision physical brain phantom with anatomies identical to the DRO. In Q4 2014 and Q1 2015 progress has been made in several areas. Candidate high-resolution MRI scans of Alzheimer's patients with isotropic resolution of $1mm^3$ have been identified, and automated segmentation of relevant anatomies has begun. Methods to perform segmentation of gray matter from white matter and CSF, as well as cerebellum are well-underway. Concomitantly, testing of porous plastic sheets made by PorexTM as the material of choice for phantom construction is underway. CO_2 laser and high-pressure-water-cutting machining techniques are currently being tested to determine optimal strategies for creating the individual physical phantom slices.

fMRI: Year 1 (2013-2014) testing was completed at 8 sites, all analyzing the same bilateral hand motion DRO but with each site employing its own standard fMRI processing and analysis workflow. The activation map results accompanied by Data Analysis forms describing workflow were collected from each site.

OBJECTIVE 3. DEVELOP PROCEDURES AND PROCESSES FOR HARDWARE AND SOFTWARE MANUFACTURERS AND USERS TO DEMONSTRATE COMPLIANCE WITH QIBA PROFILES.

Selected specifics:

PDF MRI: The v1.0 DCE-MRI QIBA Profile lead editor, Dr. Alex Guimaraes, generated a compliance document for DCE-MRI. This document underwent extensive review by the wider PDF-MRI Biomarker Committee, and has informed the compliance section for the DWI Profile as well.

FDG-PET/CT: Profile Implementation Data Collection Part II: This project is an extension of the current field test of the FDG-PET/CT QIBA Profile and is commencing in Q1 2015. The checklists being generated by the current field test project will be evaluated by a number of different PET/CT imaging sites with variable level of technical expertise (academic sites to outpatient imaging centers), with Duke University being the coordinating site. This project will use physical and digital phantoms to provide data that can be analyzed to determine Profile feasibility. Patient scan data will be used within the validation workflow as much as feasible.

Measurement of SUVmax in tumor is the primary metric in the FDG-PET/CT QIBA Profile v1.0. While this parameter is highly informative, other parameters such as SUVpeak, MTV, and TLG may provide complementary and in some cases, unique data on tumor biology. We propose, in a limited set of DRO, physical phantom, and patient data, to compare the preceding parameters across the performance sites. The primary goal of this project is to determine the feasibility of the step-by-step list of compliance tests that are being generated by the current field test of the FDG-PET/CT QIBA Profile. In addition, the results will be used to define performance targets for compliance testing for PET/CT scanners from each of the major manufacturers. Areas in which compliance cannot be achieved will be identified and documented. Where possible, compliance tests performed by manufacturers will be identified and evaluated.

fMRI: Year 1 (2013-2014) testing of the first motor fMRI DRO resulted in generally similar maps but with considerable variability in quantitative results. (Results were reported in the Biomarker Committee's QIBA poster at RSNA 2014.) Differences in anatomical-functional registration, and/or motion correction methods, are the likely cause of variability. The variability and relationship to workflow will be further investigated in subsequent test rounds.

OBJECTIVE 4. DETERMINE FROM EXPERT CONSENSUS THE DESIGN REQUIREMENTS FOR PHYSICAL AND VIRTUAL (DIGITAL) REFERENCE OBJECTS NEEDED FOR DETERMINATION OF IMAGING BIOMARKER VARIABILITY OR TO DEMONSTRATE COMPLIANCE.

Selected specifics:

PDF MRI: See above (Objective 2).

FDG-PET/CT: DRO extension: The purpose of this QIBA/NIBIB funded project was to add functionality to the current PET-CT Digital Reference Object (DRO). Added features to the DRO include tests for (1) PET/CT display alignment (2) SUVpeak calculation and (3) Region of Interest (ROI) fidelity. The project was completed in Q3 2014. Final report submitted 9/29/2014. The project generated several findings. 1. The extended DRO (DROe) is a feasible test for (a) PET/CT display alignment (b) SUVpeak calculation and (c) Region of Interest (ROI) fidelity. 2. The testing procedure accompanying the DROe worked, although suggestions for improvement were provided by the test sites. 3. The PET/CT display systems that were tested (except one anomaly) correctly aligned the PET and CT in fusion mode and were able to compute the correct SUVpeak values. Manual placement of the SUVpeak ROI likely allowed for variations in the measurements. The ROI inclusion tests indicated that the viewers tested did not exhibit anomalous behavior and that voxels were included in an ROI equally, independent of the direction of approach of the ROI. Although the total of five PET/CT display systems tested performed properly, we hope to expand this study in the future to further sites to provide a validated DROe and testing procedure as a development and testing tool for medical imaging software.

fMRI: Participating DRO development sites are combining their expertise in year 2 (2014-2015) DROs incorporating task performance variability, motion, and neurovascular uncoupling (NVU). The framework is in place for selectively adding these effects, and work is proceeding on generation of a DRO family for testing later in 2015:

- Goal - isolate and characterize specific individual sources of variance by comparing reproducibility, sensitivity, bias, and linearity for DROs that vary systematically in signal and noise properties.
- Test site compatibility/qualification (10 sites)
- Designed, implemented, tested synthesis software
- Created a library of 20 DROs differing in signal/noise properties
- Test site QA – completed download and data processing for year 1 (2013-2014) DROs
- Datasets were uploaded to the QIDW
- At the 2014 RSNA meeting, we reported details regarding DRO design and construction methods, our simulation software and some preliminary results from analyses of our Phase 1 (2013-2014) DROs processed at multiple clinical fMRI sites across the country.

Going forward:

1. Create computational models of some of the most important sources of variance (SOV) not already addressed to be able to specify their "ground truth" quantitatively. Modeling variance in the DROs will also involve establishing QA metrics for quantifying each SOV.
2. Profile/Protocol Optimization - Influence of variance factors
    - Build on the results of the first year's round (2013-2014) of DROs to identify fMRI analysis methods that are optimal for reproducibility and sensitivity of task-related signal detection.
    - Systematic assessment of the components of the protocol using DROs with known variance properties in order to characterize the claims and qualifications of the fMRI Profile more fully.
    - Comparison of the standard algorithms commonly used for fMRI analysis and testing a novel algorithm developed during the 1st (2013-2014) and 2nd year (2014-2015) QIBA-funded projects to improve reproducibility. The DROs will allow us to evaluate these various approaches using realistic standards where ground-truth is known.

OBJECTIVE 5. COLLECT IMAGES AND ASSOCIATED CLINICAL DATA FOR THE RSNA-QIBA IMAGE WAREHOUSE OR OTHER LOCATIONS, AND PERFORM ANALYSES ON THE DATA TO SERVE QIBA COMMITTEES AND THE BROADER IMAGING COMMUNITY.

Note that in general the data from each of these efforts are available for uploading to the Quantitative Imaging Data Warehouse identified in the Methodology for Objective 5.

Selected specifics:

PDF MRI: Diffusion-weighted images of the isotropic diffusion phantom have been uploaded to the QIDW, which has served as a central repository for the phantom project. This process will greatly expand with the distribution of the phantoms to the 13 QIBA sites, and in conjunction with the associated analysis software (also uploaded to the QIDW), enable systematic and consistent comparison of results, better establishing the reproducibility of the ADC biomarker.

SWS US: A standardized plan for archiving clinical and phantom data into the QIBA data warehouse is being devised and will be included as an appendix to the QIBA Profile. Data sets are being developed by a group composed of researchers from Duke University, Mayo Clinic, Michigan Tech University and University of Rochester as part of a NIBIB funded project (Development and Validation of Simulations and Phantoms Mimicking the Visco-elastic Properties of Human Liver). These data sets are posted in the QIBA data warehouse for use by research groups and manufacturers. The goal being to find approaches that allow different ultrasound systems to achieve the same SWS results from data generated using appropriate simulated visco-elastic materials. A preliminary simulated data set has been released by Duke University for download by interested parties, and several manufacturers have agreed to look at the materials to determine if it is technically and economically feasible to analyze test data using their proprietary software. If this preliminary step is successful, then use of this "digital reference object" to analyze ways to achieve better agreement in SWS values becomes a real possibility.

fMRI: Year 1 (2013-2014) empirical DROs were uploaded to the QIDW database for DRO distribution to collaborating test sites. As the DRO production methods are completed, the foundational imaging and DRO programming will be separately archived in the QIDW.

OBJECTIVE 6. PROVIDE SUPPORT FOR QIBA STAFF, SCIENCE ADVISOR, SCIENTIFIC DIRECTOR, PROGRAM DIRECTOR, PROJECT MANAGEMENT, MEETINGS, TRAVEL, AND CONFERENCE CALLS.

Support for all of the above committee work, funded project management meetings, conference calls and travel continues to be administered and provided by the RSNA/QIBA staff, Science Advisor, Scientific Director, and Program Director.

B. QIBA/NIBIB ROUND-3 (2013-2014) FEDERALLY FUNDED PROJECT STATUS

Year-1 (2013-2014) Subcontracts Completed

No	Investigator	Not to exceed $Amt	Inst/Company	Project Title
B	CHENEVERT	47,960	Univ Mich	Software Development for Analysis of QIBA DW-MRI Phantom Data
C1	TURKINGTON	34,000	Duke Univ	FDG-PET/CT Profile Field Test
C2	BOELLAARD	28,000	VU Med Ctr	FDG-PET/CT Profile Field Test
C3	LODGE	28,000	JHMI	FDG-PET/CT Profile Field Test
D	HALL	20,460	Univ Wisc	Phase 2 Phantom Study with Inelastic, SWS-dispersive Media
E	KINAHAN	48,453	Univ Wash	FDG-PET/CT Digital Reference Object (DRO) Extension
F	BUCKLER	22,066	Elucid Biomed	Second 3A statistical and image processing analysis
G1	DEYOE	52,749	Med Col Wisc	fMRI Digital Reference Objects for Profile Development and Verification
G2	VOYVODIC	31,033	Duke Univ	fMRI Digital Reference Objects for Profile Development and Verification
H	PERSIGEHL	13,200	Univ Cologne	DCE-MRI Phantom Study to Evaluate the Impact of Parallel Imaging and B1 Inhomogeneities at Different MR Field Strengths of 1.0T, 1.5T, and 3.0T
I	SAMIR	78,700	Mass General	A Pilot Study of the Effect of Steatosis and Inflammation on Shear Wave Speed for the Estimation of Liver Fibrosis Stage in Patients with Diffuse Liver Disease
J	LAUE	24,657	Fraunhofer	Development of a Tool to Evaluate Software Using Artificial DCE-MRI Data and Statistical Analysis
K1	PALMERI	10,450	Duke Univ	Numerical Simulation of Shear Wave Speed Measurements in the Liver
K2	McALEAVEY	16,775	Univ Rochester	Numerical Simulation of Shear Wave Speed Measurements in the Liver
K3	JIANG	16,775	Mich Tech Univ	Numerical Simulation of Shear Wave Speed Measurements in the Liver
N	KITWARE	40,000	Kitware	Support and Development of the Quantitative Imaging Data Warehouse (RSNA-QIBA-QIDW)
O	OBUCHOWSKI	19,692	Cleveland Cl Foundation	Design and Statistical Analysis of Studies of Compliancy with QIBA Claims

Year-1 (2013-2014) Subcontracts Granted a No-cost Extension

No	Investigator	Not to exceed $Amt	Inst/Company	Project Title
L	ZHAO	53,500	Columbia Univ	Phantoms for CT Volumetry of Hepatic and Nodal Metastasis

Year-1 (2013-2014) Material Purchases by RSNA

No	Investigator	Not to exceed $Amt	Inst/Company	Project Title
A	BOSS	50,000		DW-MRI ADC Phantom

Year-2 (2014-2015) Subcontracts

No	Investigator	Not to exceed $Amt	Inst/Company	Project Title
P	OBUCHOWSKI	19,692	Cleveland Cl Foundation	Design and Statistical Analysis of Studies of Compliancy with QIBA Claims
Q	SAMEI	67,255	Duke Univ	Methodology and Reference Image Set for Volumetric Characterization and Compliance
R	TURKINGTON, et al.	30,500	Duke Univ	FDG-PET/CT Profile Multi-Center Field Test
S	ZHAO	33,000	Columbia Univ	Phantoms for CT Volumetry of Hepatic and Nodal Metastasis-Yr2
T	BARBORIAK	43,320	Duke Univ	Digital Reference Object for DCE-MRI analysis software verification 2
U	JACKSON	48,868	Univ Wisc	RSNA DCE-MRI Phantom Automated Analysis Software Package Development
V1	DEYOE	27,714	Med Col Wisc	Generation and Testing of Advanced Digital Reference Objects for fMRI
V2	VOYVODIC	23,277	Duke Univ	Generation and Testing of Advanced Digital Reference Objects for fMRI
V3	PILLAI	17,111	JHMI	Generation and Testing of Advanced Digital Reference Objects for fMRI
W*	SAMIR	53,570	Mass General	Beyond Confounders: Addressing Sources of Measurement Variability and Error in Shear Wave Elastography
X1	SUNDERLAND	37,400	Univ Iowa	Amyloid Profile Continued Support with Brain Phantom Development
X2	KINAHAN	25,300	Uni Wash	Amyloid Profile Continued Support with Brain Phantom Development
Y	FAIN	67,473	Univ Wisc	Low CT Dose Lung Protocols for Repeatable Quantitative Measures in Multi-center Studies
Z1	PALMERI	19,237	Duke Univ	Development and Validation of Simulations and Phantoms Mimicking the Viscoelastic Properties of Human Liver
Z2	McALEAVEY	8,427	Univ Rochester	Development and Validation of Simulations and Phantoms Mimicking the Viscoelastic Properties of Human Liver
Z3	JIANG	8,427	Mich Tech Univ	Development and Validation of Simulations and Phantoms Mimicking the Viscoelastic Properties of Human Liver
Z4	CHEN	19,237	Mayo Clinic	Development and Validation of Simulations and Phantoms Mimicking the Viscoelastic Properties of Human Liver
AA	OBUCHOWSKI	11,813	Cleveland Cl Foundation	Digital Reference Object for DCE-MRI analysis software verification 2

*Awaiting institutional signature

C. GENERAL PROGRESS ON ACTIVITIES BEYOND FUNDED PROJECTS (INCREMENTAL TO SPECIFICS LISTED UNDER OBJECTIVES ABOVE)

Additional updates from the committees are as follows.

CT VOLUMETRY: For the liver phantom imaging project, the liver phantom has been designed and the supplier selected. The phantom has been ordered, but its delivery has been delayed due to operational disruptions at the supplying company. The interval time has, however, been spent in designing the scanning protocols that will be used to image the phantom, and the process by which the data will be analyzed, once the scans are obtained. For the project on virtual lesions, a selection of lesion phantoms from the FDA was shipped to Duke. The phantoms were embedded within the chest phantom in the Duke lab, and were imaged under a multitude of protocols of varying dose, kV, and reconstruction. The data have been sorted. The lesions have been segmented and registered to their exact design mold as a way to create the form for their follow up virtual addition to the phantom images acquired without lesions. The clinical data challenge group (project 3A) has prepared a manuscript for publication, and secured permission to publish. A publication from the phantom data project is in the revision process after submission. The group dedicated to this project is now organizing to provide support for the upcoming "field test" of the CT volumetry biomarker profile.

COPD/Asthma: Radiation Dose – Automatic Exposure Control Project: The goal of this project is to use automatic exposure control acquisition (AEC) to achieve constant pixel noise across various scanners, subject size and reduce subject radiation dose. The project has identified the anthropomorphic phantom (CIRS dosimetry- model 700 series, adult male and female) we intend to use for the studies. The first scans are scheduled on the GE 750 HD CT system this week (Feb 2015). Once scans are completed on the GE 750 HD CT we will move to the Siemens Definition 64 system the first week of March. Upon analysis of these data and final definition of the protocol, the UW-Madison site will send the phantom to the University of Iowa where the protocol will be repeated on their Siemens Definition system. Once we have found a satisfactory protocol that matches sufficiently across the GE and Siemens systems, the project will then expand the phantom studies to test the protocol throughout the vendor network, including Philips and Toshiba systems. This network wide study will occur over the summer months.

fMRI: Biomarker Committee members are engaged in preparing an oral presentation for the 2015 meeting of the American Society of Functional Neuroradiology (ASFNR). This presentation will share the QIBA fMRI Biomarker Committee effort in DRO-based fMRI validation with a large audience invested in fMRI research and clinical use. Members of the Biomarker Committee contribute to the DICOM Working Group 16 fMRI sub-committee. The proposed DICOM work item will build on recent quantitative imaging support added to the standard, with new elements created as necessary to represent fMRI acquisition, activation maps, and task paradigms. The functional requirements incorporated by WG-16 fMRI were drawn from work done in the QIBA fMRI Biomarker Committee.

FDG-PET/CT: The QIBA Profile has undergone compliance 'Field Testing' from phase I (NIBIB [2013-2014]) at three academic centers in efforts to better understand real-world compliance procedures. Analysis of data is being finalized, while phase II, an expanded field test at additional sites (NIBIB [2014-2015]) is underway. The goal is to incorporate the phase I data acquired into the overall compliance procedures.

Profile revisions have been made in Q1 2015 regarding the control mechanism for lean body mass (LBM) based on public review comments and field-test findings. Future QIBA Profile updates being discussed include structured reporting inclusion/reference, clinical outcomes data, and biomarker qualification efforts.

Amyloid-PET: The new Biomarker Committee is drafting a Profile with an internal draft expected by Sept 2015. A deadline for public review/comment phase and finalization is slated for Dec 2015. Creation of matching reference Amyloid phantoms, both physical (NIBIB [2014-2015]) and synthetic, or DRO (NIBIB [2014-2015]), are underway.

SPECT/CT: Goals and timelines include evaluating a proposal to create a new QIBA Profile writing group, with coordinated teleconference discussions (Spring 2015), literature review to formulate a Claim, and resourcing volunteer interest and availability. Additional activates to follow based on group discussions, such as considering a DaTscan use-case in the future.

SWS US: The goal of the committee is to develop a QIBA Profile for a single biomarker: Ultrasound shear wave speed as a measure of liver stiffness which correlates with the degree of liver fibrosis/cirrhosis present. During this reporting period:

- Research the literature to find out how well the biomarker has done to date using a variety of different measurement devices. Compile literature search into usable database is done: Initial analysis was performed to identify major potential sources of variability and confounding factors.
- Visco-elastic Phantom study: Appropriate visco-elastic phantoms were not available commercially so had to be developed: this work was substantially complete as of 11-2014. Methods were developed for testing and characterizing the visco-elastic properties of very soft materials that are of critical importance for future phantom development and measurement bias estimation.
- Clinical SWS Performance Groundwork Studies to evaluate clinical sources of variability and possible confounding factors that might affect SWS correlation with fibrosis were undertaken at MGH as part of a funded NIBIB project “SWS Clinical Study 2013-2014”. Studies were based on the literature analysis of 1548 publications from which 102 SWS and ARFI papers that included a study of one or more confounding factors. Detailed summary of the findings in these 102 papers are compiled into an Excel spreadsheet. The confounders and sources of variation are ranked according to type and importance. A further analysis of the potential for steatosis and/or inflammation to affect the correlation of SWS with liver fibrosis was performed using results obtained for 242 clinical patients.