Quantitative Imaging Biomarkers Alliance RSNA

Application for QIBA Round-2 Project Funding

Title of Proposal: Extension of Assessing Measurement Variability of Lung Lesions in Patient Data Sets: Variability Under Clinical Workflow Conditions		
QIBA Committee/Subgroup: Volumetric CT Technical Committee		
NIBIB Task Number(s) which this project addresses: Task 7 – Determine the minimum change that can be measured for the proposed method		
Project Coordinator or Lead Investigator Information:		
Last Name: McNitt-Gray	First Name: Michael	Degree(s): PhD
e-mail:	Tel #:	
Institution/Company: UCLA Department of Radiological Sciences		
Amount Requested:		

Please check the primary category for this proposal from among the following:

- ☐ 1. Identification of Technical Characteristics and Standards
  - ☐ a. Creation and refinement of protocols for image acquisition, analysis, quality control, etc., for specific clinical utility
  - ☐ b. Phantom development and testing
  - ☐ c. Identification and assessment of intra-reader bias (1) and variance across scanners and centers
  - ☐ d. Identification and assessment of inter-reader bias and variance across scanners and centers
  - ☐ e. Other
- ☑ 2. Clinical Performance Groundwork
  - ☐ a. Assessment of intra-reader sensitivity and specificity
  - ☑ b. Assessment of inter-reader sensitivity and specificity
  - ☐ c. Other
- ☐ 3. Clinical Efficacy Groundwork
  - ☐ a. Assessment of correlation between new biomarker and 'accepted-as-standard' method
  - ☐ b. Characterization of value in clinical trials
  - ☐ c. Characterization of value in clinical practice
  - ☐ d. Development/merger of databases from trials in support of qualification
  - ☐ e. Other
- ☑ 4. Resources (money and/or people) committeed from other sources.

This project has already utilized tremendous resources committed free of cost from a variety of sources including:

(a) Project management resources from RadPharm (now CoreLabs)
(b) Extensive use of radiologist resources from CoreLabs (5 readers marking 32 lesions, imaged twice and measured using three different methods; additional reads were performed to assess intra-reader variability).
(c) Reading software was modified for image markup, annotation and recording of these markups into DICOM SR and other formats

The Image data used was from the NCI funded RIDER project, which sponsored the public release of the "Coffee Break" CT experiment data which was performed by Drs. Larry Schwartz and Binsheng Zhao (data was collected while they were at Memorial Sloan Kettering Cancer Center in NY; they are currently at Columbia University in New York

This proposal also describes methods that extend work previously funded by QIBA under round 1 of funding. That project, titled " Assessing Measurement Variability of Lung Lesions in Patient Data Sets" (PI: McNitt-Gray) has completed some interim analysis indicating significant measurement variation under an "independent and blinded read" paradigm. The purpose of this work is to extend that project to assess measurement variation under a reading workflow paradigm that more realistically reflects conditions encountered in clinical trials and clinical practice.

Please provide a one-page summary that includes the following information:

Project Description

The purpose of this project is to *extend* the data collection and statistical analysis of the QIBA Volumetric CT committee's 1B experiment, which is investigating the minimum detectable change in lesion size from patient datasets imaged on CT. That project used: (a) "Coffee Break" CT image datasets from 32 NSCLC patients who were imaged twice over a short (15 minute) interval on the same scanner using thin (1.25 mm) slices; (b) one lesion was identified for each patient, (c) Image data was marked up by five radiologists at RadPharm (now CoreLabs); (d) each reader marked the lesions on each of the repeat scans to obtain measures of volume, single longest diameter and bi-dimensional diameters. This data was previously collected and initial analyses have been performed.

In that previous project, each reader performed the image markup as an independent reading, with no access to the results or images of their markup of any previous session. This was done because the only data used in that study were limited to "Coffee Break" experiment cases. If readers were allowed to both: (a) know that these were cases with no change and (b) see their markings on one scan while making markings on the second scan, then those results would be considered very biased as readers would know what the answer should be (they would inherently know that the markings should match and that change should be zero). Using that independent reading paradigm, the initial results indicated that there were significant amounts of variation in measurement.

This project seeks to extend that previous effort by altering the reading paradigm to more realistically reflect conditions encountered in clinical trials and clinical practice. In the proposed project, readers would be allowed to read cases side by side and would be allowed access to both visual results of previous markings as well as the quantitative results of those measurements (diameter, volume, etc.). In order to reduce the potential of bias from reading repeat CT scans in a side by side paradigm, we propose to randomly introduce cases that do have some change in them; in this way, readers will not have the expectation that all cases will have "no change".

Primary goals and objectives

The primary goal of this project is to perform the analysis necessary to assess the minimum detectable change using reading conditions which are more realistic in clinical trials and clinical reading environments. The minimum change will be analyzed for each measurement method (volumetric and linear measurements). Inter- and intra-reader variability will be assessed.

Deliverables and Timetable [must include intermediate measureable milestones.]

1. Experimental design with side by side comparisons allowed, which will be presented to QIBA VolCT 1B group for approval. (2011 Q2; approximately May 31)
2. Data analysis plan presented to QIBA VolCT 1B group for approval (2011 Q2; Approx. May 31)
3. Completion of data analysis, including but not limited to:
    a. Investigation into minimum detectable change using revised reading paradigm (2011 Q3; Approx Sept 30)
    b. Inter- and intra-reader variability analysis (2011 Q3; Approx Sept 30)
4. Internal summary report of data analysis for QIBA members (2011 Q4; Approx RSNA)
5. Submission of results to conferences (e.g. RSNA, SPIE) for presentation (2012 Q1)
6. Submission of peer-reviewed publications based on results (2012 Q1)