QIBA Lung Density Biomarker Committee (BC) Call in lieu of QIBA AM Breakout Session

Wednesday, July 22, 2020 from 2 – 4 PM (CT)

Call Summary

In attendance			**RSNA**
Sean Fain, PhD (Co-Chair)	Timothy Hall, PhD	Amin Motahari, PhD	Joe Koudelik
Charles Hatt, PhD (Co-Chair)	Bernice Hoppel, PhD	Nancy Obuchowski, PhD	Julie Lisiecki
Miranda Kirby, PhD (Co-Chair)	Steve Humphries, PhD	Kevin O'Donnell, MASc	
Raul San José Estepar, PhD	Philip Judy, PhD	Daniel Sullivan, MD	
Chase Hall, MD	Joe Mammarappallil, MD, PhD	Gonzalo Vegas-Sanchez-Ferrero, PhD, MSc	

Moderator: Drs. Fain and Hatt

Lung Density Profile's Advancement to Stage 2: Consensus (Dr. Fain):

- Dr. Fain discussed the public comments received from AAPM
- Several items needed additional discussion including:
  - P17 table re: the measured Hounsfield unit (HU) spec for air likely being too strict
  - GE scanner concern re: scattering for consistent measurement
    - COPDGene phantom groundwork was completed for GE HG 750, which proved feasibility
  - For the question "How is the 3 milligray (mGy) mean dose target defined?", it was suggested to consider water equivalent diameter
    - It is difficult to make this measurement quickly in practice, though the desire is to keep the dose low
  - Issue with reverse cupping material
  - Forward half max method (FWHM) requires more work and testing
    - The BC intends to test this in the feasibility phase and is in favor of using the ACR and CATPHAN phantoms if they are more available
    - Evaluation would be in-plane and through-plane spatial resolution
  - Dr. Fain to reach out to Mr. Avila regarding the measurement of MTF for the COPDGene phantom, as well as discuss the Accumetra phantom and online tool that performs fast performance assessment
  - In addition, a meeting with the CT Volumetry BC was suggested to discuss the "estimation of variability table" that the CT Volumetry BC created which lists expected variability when mixing and matching scanners, readers, software, etc.
  - Consensus was to follow local site recommendations regarding lowest dose scanning
  - Additional review may be needed to address bias amongst different scanner makes and models
    - Plan to move forward with a longitudinal claim; want to correct for biases with the aid of statistical models; will consider this an "open issue"
    - A flow chart created by Dr. Obuchowski which demonstrates how bias works was recommended as a reference
  - Is it sufficient to use the same scanner make and model or the same exact scanner? The latter may be difficult for realistic longitudinal multi-center design
  - Redundant language in section 3.10 (Image Interpretation Section)
    - Consensus was to keep the text and reference the original mention earlier in the Profile to avoid confusion
  - Regarding kernels, there was a question about what it means that a vendor shall specify that the kernel is "matched"
    - This was reworded to clarify, with examples, suggesting use of an appropriately smooth kernel
    - A concrete metric is desired for the goal we are trying to achieve; an overly smooth kernel can fail resolution

        - This should be specified in terms of the image characteristics and the assessor, not just the kernel; transition band and cutoff should also be considered
        - Use of the MTF metric and a specific target was recommended for resolution
- Mr. O'Donnell recommended that the comment resolution be posted to the wiki once agreed upon, and that the necessary updates to the Profile be made
    - Once ready, the resolution document will be attached with the revised Profile and provided for a Consensus e-ballot at the BC and CC levels
- A Google link for Public Comment Resolution has been created for ease of sharing updates with the group: https://docs.google.com/document/d/1uOzBaB_77vLSv8FKtQ59AxpfcAswtJ4t/edit?dls=true

Next Steps

- Once the BC completes the following tasks, it can declare its Profile as Stage 2: Consensus:
    - Consensus is reached on all public comments
    - The completed comment resolution sheet is submitted to staff to post on the Comment Resolutions page on the QIBA Wiki
    - Checklists to be updated and Conformance Procedures established
    - Successful BC and CC votes to publish on the Profiles Page on the QIBA Wiki

Next QIBA Profile: Proposal Ideas Under Consideration (Dr. Hatt)

- Dr. Hatt provided an overview of proposal ideas for a future Profile
- **Pi10** has been eliminated due to associated vendor proprietary issues
- **Deep learning-based classification of visual emphysema** is being considered if QIBA Leadership agree that this falls under the QIBA mission
- **Fissure completeness percentage**, which is being used to select patients for reduction of lung volume procedures
    - Positive and negative numbers are unknown in terms of how they might affect clinical care, which may make study of this metric very useful
- **Gas trapping** and Parametric Response Mapping (PRM) are complementary to current studies and could expand upon existing work
- **Vascular volume**
    - This would focus on segmenting vessels in the lung and would be complementary to current work for the small lung nodule efforts
    - A promising quantitative biomarker for multiple pulmonary diseases
- **Lung texture** and **techniques for diagnosis** (beyond biomarkers) were suggested
- Dr. Hatt intends to share a Google document with the group with these topics and ask BC members to edit and provide feedback, expanding on these topics and providing their expertise, along with any pros and cons for each topic
    - This information will then be used to create a poll for the BC to vote on future directions for exploration

For Follow Up on Suggested Topics

- Dr. Estepar mentioned that a histological clinical index is also needed
    - Dr. Hatt asked Dr. Estepar to expand upon the vascular volume topic, as he is doing research in this area with his team
- Dr. Fain reminded the group that any topics under consideration had to have a viable claim
    - Without a claim in mind, a Profile cannot be pursued
    - New Profiles proposed should have a significant clinical impact for consideration
- Dr. Fain expressed an interest in gas-trapping and plans to follow up with Dr. Lynch for input
- Dr. Hatt volunteered to provide more details on fissure completeness

- Dr. Humphries was suggested for deep learning details
- Dr. Kirby was suggested to provide more details for airways, as this is her area of research
- Comments are open to everyone, though 2-3 person teams were recommended to better distribute the research details needed
- Repeatability data would be necessary to support a new biomarker
- A white paper on measures derived from CT was suggested
- The QIBA Multi-parametric Metrology Task Force (TF) is trying to generate consensus regarding work with multiple quantitative imaging biomarkers (QIBs) and multiple parameters
    - Suggestion to look to this group for guidance regarding lack of direct measurement and ground truth, i.e., is AI applicable to QIBA?

Action items:

- Complete resolution of public comments and distribute to BC for review, via shared Google doc or attachment

Next meetings: 8/26, 9/23