QIBA fMRI Biomarker Committee (BC) Call

Wednesday, September 16, 2020 at 11 a.m. (CT)

Call Summary

In attendance			**RSNA staff**
Feroze Mohamed, PhD (Co-chair)	Cathy Elsinger, PhD	James Voyvodic, PhD	Joe Koudelik
Jay Pillai, MD (Co-chair)	Ichiro Ikuta, MD, MMSc	Francisco Zamorano, PhD	Susan Stanfa
David Soltysik, PhD (Co-chair)	Ho-Ling (Anthony) Liu, PhD	Yuxiang Zhou, PhD, DABR	
Shruti Agarwal, PhD	David Scott, PhD		

Moderator: Dr. Soltysik

Review of Previous Call Summary

- The 09.02.2020 call summary was approved as presented

Groundwork Project Ideas

- It was agreed during the September 2 fMRI BC t-con, that the "Reproducibility of task-free (resting-state[r-s]) fMRI as a clinical brain biomarker" project description would be used as a starting point and modified based on additional BC input
- Discussion continued on the circulated project description; feedback provided by fMRI BC members was reviewed
- It was proposed to use fMRI scan data from patients and volunteers who have undergone either task-free r-s fMRI scans alone, or active task-based fMRI as well as r-s fMRI scans, to quantitatively assess the reproducibility of r-s fMRI and the concordance of the two methods in determination of the sensorimotor network (SMN) and the language network (LN)
    - Suggestion to make LN the primary focus to connect it to fMRI Language-Mapping Profile v2.0
    - The secondary focus could be other common functional connectivity networks (e.g., default mode, executive control, salience, dorsal attention, auditory, sensorimotor, visual)
    - SMN was originally included because of its reliability and relation to fMRI Motor-Mapping Profile v1.0
    - Due to its robustness and extensive evaluation in the research and clinical literature for a variety of applications, suggestion was made to include the DMN as another network of interest.

- Maps of SMN and LN would be generated from resting-state fMRI using independent component analysis or seed-based methods, assessed for reproducibility, and compared to those generated by task-based fMRI
    - It was noted that generated maps are qualitative, not quantitative; some quantitative functional connectivity metrics would need to be identified to make this QIBA-appropriate
        - Though not all can be applied to clinical use yet, proposed ideas were:
            1. Localization (consistent and to compare with tb-fMRI profiles) via seed-based correlation or ICA
            2. Connectivity strength of certain network
            3. Amplitude of low frequency fluctuation (ALFF)
            4. Graph theoretical (or connectomic) metrics
        - Recommendation to adhere to more conventional approaches, e.g., #1 and 4 above; #2 & 3 to be omitted for now

- Dr. Liu referenced the papers: Rubinov M and Sporns O. **Complex network measures of brain connectivity: Uses and interpretations**. *Neuroimage*. 2010; 52(3):1059-1069. and Bullmore E and Sporns O. **Complex brain networks: graph theoretical analysis of structural and functional systems**. *Nature Reviews Neuroscience.* 2019; 10:186-198.
    - Dr. Liu to present on this topic during an upcoming fMRI call

- Whole-brain graph theoretic metrics from the r-s fMRI to be evaluated to assess their reproducibility
    - This project would make use of existing fMRI data collections and shared expertise in QIBA reproducibility studies, clinical fMRI, and r-s fMRI methods
        - Dr. Voyvodic noted that r-s databases are publicly available, reducing the need to recruit and scan patients
    - It was confirmed that whole-brain graph theoretic metrics are quantitative measures from graph theoretical analysis of the whole-brain network, e.g. global and local efficiency and modularity; they often have strong correlations with neuropsychological measures, but the interpretations are often met with skepticism because of its abstract nature and absence of anatomic localization

- Suggestion to add groundwork data in support of a new task-free fMRI reproducibility Claim to enhance the existing Profile in task-based fMRI to assess reproducibility of different networks
- Recommendation to focus on a project related to *existing* fMRI Profiles (v1.0 and 2.0), as QIBA leadership is seeking information about currently unfunded groundwork and clinical studies that could help advance Profiles through the Technically Confirmed and/or Claim Confirmed stages
- An upcoming fMRI BC meeting to be dedicated to the discussion of connectivity metrics

Update on Dr. Voyvodic Projects

- Drafting a paper based on the Round-1 DRO Project: Comparing clinical fMRI analyses was discussed during previous t-cons
    - Most sites were willing to work with Dr. Voyvodic to correct some of the issues, but help is needed to obtain missing information from two of the unresponsive sites, so that remaining issues can be resolved; Dr. Pillai volunteered to help with this
    - Dr. Zamorano to send Dr. Voyvodic a link to access his DRO analysis results

- Dr. Voyvodic reported that he has been focusing on the recently completed language reproducibility study

Next call: Wednesday, October 7, 2020 at 11 a.m. CT (1st & 3rd weeks of each month)
