

QIBA fMRI Biomarker Committee (BC) Call

Wednesday, March 3, 2021 at 11 a.m. (CT)

Call Summary

In attendance

Feroze Mohamed, PhD (Co-chair)

Jay Pillai, MD (Co-chair)

David Soltysik, PhD (Co-chair)

Shruti Agarwal, PhD

Ichiro Ikuta, MD, MMSc

Andrew Kalnin, MD

Anthony Liu, PhD

Nancy Obuchowski, PhD

Bram Stolk, PhD, MBA

James Voyvodic, PhD

Divya Yadav, MD

Yuxiang Zhou, PhD, DABR

RSNA staff

Joe Koudelik

Susan Stanfa

Review of Previous Call Summary

- The 02.17.2021 call summary was approved as presented

Q1 2021 MR CC Meeting on February 24

- One major focus was on the achievement of Technical Confirmation (TC) (Stage 3) in 2021
- Additional discussion was tabled until Dr. Elsinger (MR CC Co-chair) is present to provide an update

Discussion re: K Matsuo, [Reproducibility of the lateralization index in functional magnetic resonance imaging across language tasks](#). 2021. *Journal of Neurolinguistics*.

[some information taken from Dr. Soltysik's slides]

- Language Tasks included a word detection task (during narration listening in a blocked design), a verb generation task with an event-related design, a lexical decision task for auditory word sounds with an event-related design, and a lexical decision task for visual word displays with an event-related design
- ROIs were roughly within the: mid precentral gyrus, opercular part of the inferior frontal gyrus but also extending to the triangular part, and junction areas of the superior temporal gyrus and the supramarginal gyrus. Also roughly corresponding to the pre-supplementary motor area, as well as a combination of all four ROIs
- The AveLI is simply an average of all sub-LIs computed by setting a threshold at the (positive) *t*-value in each voxel within the given ROIs obtained
- Also discussed: A global threshold-independent LI was determined by comparing the integrated T-score weighted distributions of all positively task-correlated voxels between the left and the right VOIs (from [Pillai and Zaca 2011](#))
- Matsuo et al. calculated six different LIs and compared results
- Results:
 - The LI values for the main language ROIs exhibited leftward asymmetry (>0) in general
 - The p001unc index had the highest value
 - The Verb task yielded higher LI values than the other tasks
- Kendall's W demonstrated diversity in the reproducibility of individual rankings; the AveLI showed the highest reproducibility
- The ANOVA indicated higher reproducibility in AveLI, AveLI_v, and baseLI than in the other LI types in general
- The dispersivity refers to how the LI values spread between -1 and 1, where a low dispersivity indicates a concentration of approximately 0, i.e., bilateral (unsure if this metric is acceptable)
- The reproducibility refers to the degree of concordance of individual rankings in the LI values across the tasks employed
- Takeaways
 - Others are looking at threshold-independent laterality indices
 - Better to use voxel intensities than voxel counts
 - AveLI had high degree of dispersion and high reproducibility

- Brief comparison of Agarwal S, Hua J, Sair HI, Gujar S, Bettegowda C, Lu H, and Pillai JJ. [Repeatability of language fMRI lateralization and localization metrics in brain tumor patients](#). *Hum Brain Mapp*. 2018, to Matsuo paper
 - Two language paradigms based on ASFNR recommendations; tasks included sentence completion (SC) and silent word generation (SWG) tasks
 - Findings indicated that SWG and SC tasks were effective in activating critical language areas
 - Both changes in LI and center of mass (CoM) from the first to the second runs of each task (SWG & SC) were evaluated
 - It was noted that tasks in the Matsuo paper discussed are somewhat similar in word detection and word generation tasks in that both are verbal; the other two tasks are quite different, though there is a semantic component to those tasks
- The Pillai, Zaca paper was referenced: [Relative utility for hemispheric lateralization of different clinical fMRI activation tasks within a comprehensive language paradigm battery in brain tumor patients as assessed by both threshold-dependent and threshold-independent analysis methods](#). *Neuroimage*. 2011.
 - The most effective tasks provided the best lateralization results regardless of the type of LI calculation used
 - Went beyond looking at Wernicke's area (WA) and Broca's area (BA); individual gyral parcellations were included based on the AAL template, as well as larger expressive and receptive language ROIs
 - Standard T-scores were used
 - All subjects were brain tumor patients and were all right-handed, so there was no confound relating to handedness
 - Object naming was the worst task for lateralization regardless of T-value threshold, whereas rhyming and silent word generation were the most effective for lateralization
- Two main factors need to be conclusively determined: the best method of computing LI and the differences that are seen in LIs as a function of the task selected
- Dr. Voyvodic used an AMPLE-based approach for thresholding and he also used current methods for ROI selection (Broca's and Wernicke's areas), but did not include all areas Dr. Pillai used in his study
- Dr. Voyvodic used 50% AMPLE thresholding and did not resort to thresholding-independent approaches
- Dr. Pillai stated that for the fMRI Language-Mapping v2.0 Profile, Dr. Voyvodic's LI reproducibility data are much stronger than his and should be the basis for the new Claims
- Although ground truth (and bias) is not known for LI, Dr. Voyvodic looked at rigorous reproducibility and obtained data with 95% confidence intervals
- Consensus needed on methods for including Dr. Voyvodic's data in the Profile; next steps to be determined
 - It was noted that Dr. Voyvodic's data have not yet been submitted for publication and it was recommended that only published data be used in the Profile
 - Dr. Pillai suggested publishing article pre-prints so they can be cited in the Profile before completion of the lengthy peer-review process
 - This discussion will be continued during the March 17 fMRI BC meeting

Next call: Wednesday, March 17, 2021 at 11 a.m. CT (1st & 3rd weeks of each month)