

QIBA fMRI Biomarker Committee (BC) Call

Wednesday, July 15, 2020 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

Michael Boss, PhD

Christopher Conklin, PhD

Ichiro Ikuta, MD, MMSc

Ho-Ling (Anthony) Liu, PhD

David Scott, PhD

James Voyvodic, PhD

Francisco Zamorano, PhD

RSNA staff

Joe Koudelik

Susan Stanfa

Review of Previous Call Summary

- The 07.01.2020 call summary was approved as presented

Discussion Continued on Elliott ML, et al., [What Is the Test-Retest Reliability of Common Task-Functional MRI Measures? New Empirical Evidence and a Meta-Analysis](#), published in *Psychological Science*

- The authors claimed that all fMRI results are suspect because the technique is fundamentally non-reproducible
- Due to significant variability, measures were deemed unsuitable for brain biomarkers discovery
- The BC members believe the article is flawed because of variability in task designs and inherent problems of reproducibility related to such task designs (rather than fMRI itself) was not considered
- Also not taken into consideration were subject task performance and variability in cognitive paradigms (i.e., event-related vs. block designs)

QIBA fMRI BC plans for a response to the Elliot article

- The fMRI BC is drafting a rebuttal to the editor of *Association for Psychological Science (APS)* claiming that the conclusions are incorrect
- Dr. Scott had agreed to draft a letter; he provided an overview of his work
 - It was noted that this letter focuses on psychology, while the QIBA fMRI BC concern is on fMRI's reproducibility and use for presurgical planning
 - The letter should focus on the argument of why fMRI is reproducible and assert that it should be continued to be used for presurgical planning/mapping
- If done properly, fMRI is a reliable and reproducible way of looking at brain activity
- Suggestion to agree with the author's interpretation that many experiments are irreproducible, but distinguish it from clinical fMRI as a statistical problem and more broadly typical of cognitive psychology experiments
- When the QIBA fMRI BC was formed, the use of fMRI in clinical trials was a hot topic
 - The original impetus for establishing the fMRI BC, was to show that if done properly, fMRI could be a useful tool for clinical trials/drug discovery
 - The fMRI BC's goal was to determine how to make it reproducible, so that it could be effective in clinical trials and the group was ultimately successful in accomplishing this with its Profile efforts
- In stating that the BOLD signal itself is not unreliable, the author left an opening for the fMRI BC to rebut that the administration of tasks is the key factor in reproducibility; it will be noted that the problem is the interpretation, not BOLD fMRI itself
- The QIBA fMRI BC has spent years working to demonstrate that fMRI is a reproducible biomarker and will explain how it can be done; this effort would serve as publicity for the fMRI Profile, the BC, and QIBA in general

- Suggestion to emphasize the point that this is not an inherent flaw or limitation of technique, the problem is the application of the fMRI technique
 - Suggestion to shorten/summarize the statistical limitations of some prior fMRI studies, and expand the clinical utility of fMRI in neurosurgical planning
 - Elliott et al. may have made too broad a statement (beyond psychology), and excellent clinical neurosurgical applications of fMRI have been proven and do exist
 - The broad interpretation of results by Elliott et al. does not apply to clinical neurosurgery planning where fMRI applications provide improved clinical results
- It was noted that there is one defined, billable clinical application for fMRI, which is presurgical or pretherapeutic planning

Discussion re: Botvinik-Nezer R, et al. [Variability in the analysis of a single neuroimaging dataset by many teams](#)

- This article on the reproducibility of fMRI results was published in May 2020 and was brought to Dr. Boss' attention by the ISMRM Reproducible Research Study Group
- The study claims that the variability of analysis pipelines represents a major source of variability in fMRI; this is not surprising and supports the fMRI profile's requirements for specific processing methods
- The focus was on a decision-making task, which does not relate very closely to the motor and language tasks being used for presurgical planning
- This points to the fact that the analysis of DRO data from multiple sites should still be submitted for publication
 - In Dr. Voyvodic's DRO study, seven groups analyzed the same data within the context of neurosurgical planning; there was not as much variability as there was in the Botvinik-Nezer study, but there were differences among sites in the application of normalization, which may have impacted the results
 - The study was halted due to a multitude of normalization methodologies utilized across these sites
- Dr. Voyvodic recommended that the fMRI BC pursue this paper and discuss study results (e.g., what were the findings other than variable workflow) during an upcoming call and form a plan
 - Variability comes from how data is analyzed; it is not inherent in the data itself and can be overcome

Action Items

- fMRI BC members were asked to submit references citing supportive evidence for using task-based fMRI and presurgical mapping to Dr. Scott for inclusion in the letter
- Dr. Obuchowski's statistical expertise to be sought
- Dr. Scott to circulate the draft letter and request edits and references; he will then make updates and have a new draft for review during the Aug. 5 call

Post-meeting Note:

- Following this July 15 call, based on response from the Editor-in-Chief of *Psychological Science* (Dr. Bauer) to a query from Dr. Ikuta, it appears that the editorial planned by Dr. Scott may not be accepted at this point unless further notification to the contrary is received from Dr. Bauer

Next call: Wednesday, August 5, 2020 at 11 a.m. CT (1st & 3rd weeks of each month)

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