

QIBA fMRI Reproducibility Subcommittee Update
October 19, 2010
11 am CDT

Call Summary

In attendance:

James T. Voyvodic, PhD (Chair)
Andrew Buckler, MS
Geoffrey Clarke, PhD
Ted DeYoe, PhD
Cathy Elsinger, PhD
Feroze Mohamed, PhD

Jay J. Pillai, MD
James L. Reuss, PhD
Daniel C. Sullivan, MD
Domenico Zaca, PhD
Gudrun Zahlmann, PhD

RSNA:

Joe Koudelik
Julie Lisiecki

fMRI Reproducibility Work Group Update (Dr. Voyvodic)

- Data sets not ready yet; focus on motor-cortex fMRI data
- Same person doing the same task more than one time to study reproducibility

Overview of research (Dr. DeYoe)

- Reviewed work on reproducibility – briefly outlined ongoing study on vision
- Focus: clinical validation of fMRI (for future use as a biomarker in a broader sense)
- Pre-surgical mapping for visual and motor cortex
- Generated vision mapping data on particular subjects
- Collecting more data on vision-mapping and motor-validation control using standardized motor-mapping paradigm and multiple datasets

Saving time and resources in data analysis (Dr. DeYoe)

- Next dataset will be used to study affects of scan-to-scan patient repositioning on reproducibility
- Can also move and reposition patient to see what factors are affecting reproducibility
- Initial focus (Phase 1) based on vision mapping paradigm, not language

How to assess reproducibility

- Functional field mapping commonly used
- Multiple visual areas – use these to compare functional pattern akin to what the observer is seeing
- Spatial correlations of 2D patterns and data processing through AMPLE proposed

Validation aspects

- Can the fMRI activation pattern provide functional integrity of the underlying cortex?
- Test in a quantitative manner using: 1) Functional field map, 2) composite, 3) visual field map
- Each represents a circle which corresponds to a visually responsive voxel placed where it is most responsive, according to the brain's response
- Compare with subject behavior – overlay maps to determine any valid cortical response with fMRI
- Potential error related to field size – bigger circles near periphery - ring of stimulation scales show eccentricity
- Variance in temporal properties in the response
- Symbols can get mapped to other body parts (functional validity mapping)
 - Neurovascular effects on validity? Uncoupling?
 - Behavioral map – functional based on behavior
 - Use comparison with behavior to validate fMRI; use discrepancy to evaluate de-coupling
 - Any lack of correspondence and behavior gets coded as an invalid correlation
 - Valid or invalid: establish probability analysis/ validity of behavioral function

Patient behavior

- Patient may be unable to detect visual stimulant; patient's behavior does not correspond to the brain's signal, i.e., a "high-level disconnect"
- This reaction, or lack thereof, is a result of neural un-coupling (an invalid correlation)

Quantification of reproducibility in fMRI

- Functional field mapping
- Motor and language mapping paradigms
- Magnitude of brain responses to different challenges
- fMRI needs more organization and groundwork to move forward
 - Need to set model of measurements of interest
 - Focus on target area with data
 - Implement process procedures

Quantification of reproducibility

- Determine the center of activation (center-of-mass or peak statistical significance)
- Laterality can be quantified via laterality index
- Spatial extent of activation; % of active voxels
- There are many thresholds of computation methods, many paradigms, and widely divergent results
- Estimate degree of reproducibility within a particular paradigm + within a particular person
- Method itself must be quantifiable and reproducible; move on to assessing paradigm
- Dr. DeYoe to pursue vision mapping and Dr. Pillai to provide anecdotal examples and determine how data is to be quantified; though vision mapping not a QIBA focus at this time
- Suggestions needed on how to quantify data acquired at different sites
- Abundant data exists already; group to work on existing data first

Next Steps:

- Dr. DeYoe welcomes feedback from additional data users
- Dr. DeYoe to begin a document on data collection/ post-processing description; this will serve as the beginning of the Profile.
- Group to consider what kinds of data analysis would be most useful for next call.
- Next call is Tuesday, November 2, at 11:00 am CDT