FUNCTIONAL BIOMEDICAL INFORMATICS RESEARCH NETWORK: MULTI-CENTER FMRI METHODS.

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Background. Many clinical fMRI studies, for example of schizophrenia, involve sample sizes which are small and restricted to specific populations. The combination of data across institutions allows for rapid data collection, access to unique populations, and assessment of validity and generalizability of findings. Researchers must be ready to account for differences in technique, equipment and population focus to overcome the challenges of accessing and sharing large imaging and clinical datasets. Previous multi-site imaging studies have not assessed intersite variability and reliability of the imaging data prior to data combination; or have avoided data combination in favor meta-analysis methods. Methods. The Function BIRN is a multi-site project funded by NCRR/NIH (www.nbirn.net) for the following goals: 1) Standardized calibration of equipment and imaging activation paradigms using geometric and human phantoms; 2) Developing a multi-site, standardized protocol for fMRI data collection on populations of persons with schizophrenia, including value-added, site-specific data; 3) Use of a federated database to leverage multi-site data, leading to a deeper understanding of the functional neuroanatomy of schizophrenia than would be possible within a single site study or through meta-analysis. The eleven sites involved in the project are dedicated to collecting calibration fMRI data, developing experimental paradigms and analysis methods, populating a virtual data grid, and designing a searchable federated database of MRI and clinical data from multiple sites. Results. Using a set of mechanical phantoms to measure spatial distortions and temporal drift across sites, the FBIRN has collected a unique dataset of machine characteristics in fMRI data, which have served to assess initial inter-site differences. Using a set of traveling human subjects repeatedly scanned at each site, the FBIRN has determined that inter-site variability in the BOLD signals can exceed inter-subject variability, thus limiting the usefulness of combining raw imaging data across sites. Initial assessements indicate that intersite variability can be decreased through use of a variety of calibration methods. Conclusions. The unified efforts of researchers across universities have resulted in novel approaches to human subject data sharing, experimental design, fMRI data standardization, and clinical and imaging database design. Issues related to multi-site differences and integration of fMRI images will be demonstrated. The inter-site calibration and correction, and standardization of protocols, allows multi-center data to be combined more robustly to identify differences between patient groups and treatments, thus increasing the value of multi-site imaging trials.

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