ADNI Alzheimer's Disease Neuroimaging Initiative

UC Berkeley FDG MetaROI methods

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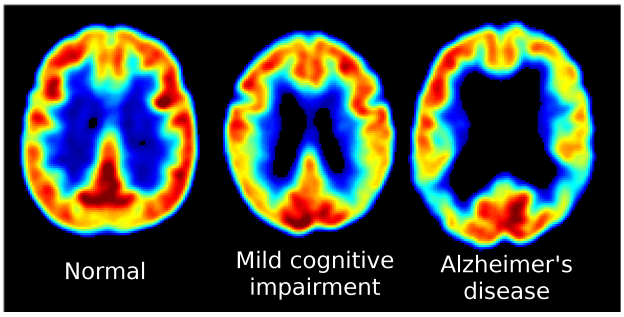
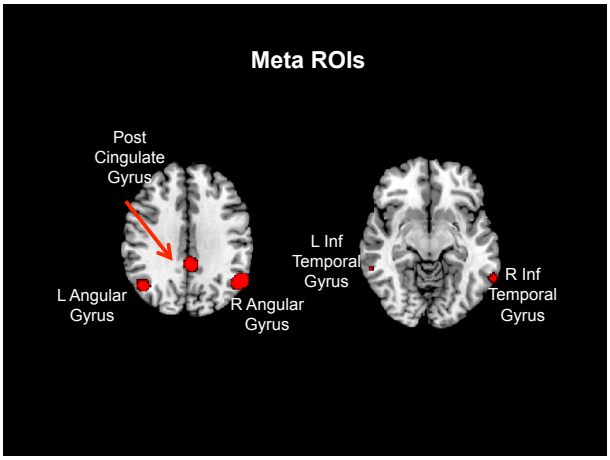


Summary

Our goal was to identify the most important hypometabolic regions that are indicative of pathological metabolic change in MCI and AD. We identified a set of pre-defined regions of interest (MetaROIs) based on coordinates cited frequently in other FDG studies comparing AD, MCI, and Normal subjects. Because these regions are based on a literature review and not anatomy, these MetaROIs are alternatives to template-based ROIs (e.g. AAL regions).

The five individual MetaROI volumes, as well as a composite region made up of all five regions, are available for download on the LONI website in NIFTI format and MNI template space. The citation for these regions is: Landau et al., *Neurobiology of Aging*, 2009. See references below for additional information.



Method

Creation of MetaROIs

We developed the set of MetaROIs by identifying regions cited frequently in FDG-PET studies of AD and MCI patients. We conducted a PubMed meta-analysis in April 2007 using all permutations of the following search terms: AD or Alzheimer's; MCI or Mild Cognitive Impairment; FDG-PET or FDG or glucose metabolism. Within the studies identified by these terms we isolated those that listed coordinates representing results of cross-sectional and/or longitudinal voxelwise analyses in which FDG uptake differed significantly between groups, changed in the same individuals over time, or correlated with cognitive performance. This resulted in a total of 292 MNI or Talairach coordinates and (if available) their accompanying *Z*-scores or *T*-values, of which 209 were from cross-sectional or correlational studies and 31 were coordinates from longitudinal studies. See

Supplementary Table 1 (Landau et al., Neurobiology of Aging, 2009) for the list of studies used to generate the MetaROIs.

The following steps were carried out separately for (1) the set of coordinates from cross-sectional or correlational studies and (2) the set of coordinates from longitudinal studies. All coordinates were transformed into MNI space. Then intensity values were generated for coordinates that reflected a combination of the *Z*-score or *t*-value associated with the coordinate and the degree to which coordinates within the same region overlapped (indicating repeated citations of the same region across studies). All *t*-values were transformed to approximate *Z* scores. Then, overlapping *Z* scores, when they occurred, were added. The volumes were smoothed with a 14mm FWHM smoothing kernel. Finally, the volume was then intensity normalized using the maximum value, resulting in a map with values between 0 and 1. The cross-sectional coordinate mapwas then thresholded at 0.50, and this resulted in a set of four regions located in right and left angular gyri, bilateral posterior cingulate gyrus, and left middle/inferior temporal gyrus. Because the longitudinal mapwas composed of far fewer coordinates than the cross-sectional map and therefore had less regional consistency among coordinates, we thresholded the coordinate intensity values at a higher threshold (0.75), which resulted in a single ROI in right middle/inferior temporal gyrus. (An additional longitudinal FDG-ROI in the prefrontal cortex was identified, but it did not meet our cluster size criterion (20 voxels) and signal to noise in this region was insufficient for analysis.)

The final five MetaROIs that resulted from this procedure (Left Angular Gyrus, Right Angular Gyrus, Bilateral Posterior Cingular, Left Inferior Temporal Gyrus, Right Inferior Temporal Gyrus) were binarized prior to analysis.

Creation of Jagust Lab spreadsheet on LONI containing MetaROI counts

PET data was downloaded from LONI, in the most processed format (Co-reg, Avg, Std Img and Vox Siz, Uniform Resolution). These images were spatially normalized in SPM to the MNI PET template. We extracted the mean counts from the metaROIs for each subject's FDG scans at each timepoint, computing the intensity values with SPM subroutines. We also extracted the mean of the top 50% of voxels within a hand-drawn pons/cerebellar vermis region that was hand-drawn on a T1 template in MNI space. Finally, we intensity normalized each metaROI mean by dividing it by pons/vermis reference region mean.

The metaROI image files (in NIFTI format) are available for download from the LONI website by going to Research → PET analysis.

Dataset Information

This methods document applies to the following dataset(s) available from the ADNI repository:

Dataset Name	Date Submitted
UC Berkeley – FDG analysis	26 March 2012

References

1. Landau SM, Harvey D, Madison CM, et al. Associations between cognitive, functional, and FDG-PET measures of decline in AD and MCI. Neurobiol Aging 2009.
2. Landau SM, Harvey D, Madison CM, et al. Comparing predictors of conversion and decline in mild cognitive impairment. Neurology 2010;75:230-238.

About the Authors

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