University of Pittsburgh Analysis of ADNI PIB PET SUVR data
Baseline Results uploaded to LONI, October 2008

SUMMARY of ADNI PIB SUVR RESULTS. *There are 3 types of U Pitt files to download*

1) UPitt_PIBPET_Analysis.pdf (current file, methods)
2) UPitt_PIBPET_SUVR_Results.xls (Excel spreadsheet with 101 baseline SUVR results for 14 regions, by site)
3) UPitt_PIBPET_AD_ROI.pdf (3a); UPitt_PIBPET_MCI_ROI.pdf (3b); UPitt_PIBPET_NL_ROI.pdf (3c)
(*ROI.pdf show example slices for each subject with and without ROIs, see B below)

ADNI PIB Data Processing Using an Automated Template

The following steps describe an automated template-based method that was used to sample multiple regions-of-interest (ROIs) on the ADNI PIB SUVR image.

A. The PIB SUVR image (ADNI Processed #4 PET Image) was downloaded from the ADNI website along with its corresponding ADNI Processed #3 MR image

The #4 PIB SUVR image has been co-registered to the first frame of the raw image file and averaged across frames (for dynamic acquisitions only), reoriented to Talairach space (also called AC-PC space) with dimensions of 160 x 160 x 96 and 1.5mm cubic voxels, intensity normalized using a subject-specific mask so that the average of voxels within the mask was exactly 1, and smoothed to achieve a uniform isotropic resolution of 8 mm FWHM.

The MR image choice was scanner dependent:

#3 MR image (Siemens or GE: corrected for MR gradient field distortions and B1field non-uniformities and sharpened with a histogram peak sharpening algorithm, N3)

#2 MR image (Phillips: sharpened with a histogram peak sharpening algorithm, N3)

B. Fourteen ROIs were generated:
Anterior cingulate (ACG), Anterior ventral striatum (AVS), Cerebellum (CER), Frontal cortex (FRC), Lateral temporal cortex (LTC), Mesial temporal cortex (MTC), Occipital cortex (OCC), Occipital pole (OCP), Parietal cortex (PAR), Precuneus cortex (PRC), Pons (PON), Sensory motor cortex (SMC), Sub-cortical white matter (SWM), and Thalamus (THL).

These ROIs were carefully drawn on a structural MR template image by an experienced individual (MB) and converted into a binary format (ROI map), such that voxels within each ROI were assigned a value of one, while those outside of the ROI were assigned a value of zero. The structural MR template is based upon a single elderly MCI subject (age: 79 years) who was scanned at the University of Pittsburgh PET facility and thoroughly studied on an ROI basis (PIB PET and MR-based atrophy assessment). This will be referred to as the MCI template. Since AD subjects can exhibit a high degree of atrophy and large ventricles, robust image registration of such a brain to that of a young healthy subject is often difficult and can lead to substantial inaccuracies. We therefore selected an "intermediate" MCI brain that exhibits only mild atrophy and ventricular enlargement, in an effort to achieve robust normalization of both healthy elderly control and AD subjects.

C. Processing Steps:

1. Co-register the PET image to the MR image using the coregistration tool in SPM5. This method employs a rigid body transformation algorithm.
2. Normalize the individual's MR image to the MCI template (described in B, above). The normalization process of SPM5, which begins with a 12-parameter affine transformation is followed by a nonlinear deformation procedure. The same parameters that were used to transform the subject's MR to the MCI template were also applied to the individual's PET SUVR image resulting in alignment of the MR and PET images to the MCI template. The PET data were then resliced to the same dimensions as the MCI template.
3. Sample the SUVR PET image using the ROI maps. Each slice of the PET image was multiplied by the corresponding slice of the binary ROI map. In this manner, only voxels of the PET image that were within an ROI contained non-zero values. Prior to taking the mean of each ROI, all voxels in the SUVR-ROI map were first divided by the average SUVR value of the CER ROI. As a result, the mean SUVR of the CER was 1 for each subject. This step was carried out because the CER SUVR values contained a great degree of variance across sites that possibly reflects the general definition of the CER SUV ROI applied in the initial SUVR image. Finally, the average SUVR value was computed across each multi-plane ROI.

NOTE: The CER SUVR is 1 for each subject. The attached figures show a subset of brain slices for each subject, from the PET SUVR image after normalization to the MCI template. The brain slices are shown, with and without ROI outlines, in order to clearly note the location of the ROIs that were used to obtain the average SUVR values.

ADNI PIB PET Baseline Scans from LONI Data Archive

	Site Name	Site ID	Controls	MCI	AD
1	University of California, San Diego	005	1	2	1
2	University of Michigan	006	2	2	1
3	Mayo Clinic, Rochester	007	0	6	1
4	Columbia University	010	2	1	0
5	John Hopkins University	018	0	2	1
6	University of Pittsburgh	024	2	1	2
7	Emory University	032	0	3	1
8	Indiana University	037	3	6	1
9	Yale University School of Medicine	041	3	11	1
10	Brigham and Women's Hospital	094	1	3	2
11	University of Wisconsin	127	1	5	2
12	University of California, Irvine-BIC	128	3	12	5
13	Banner Alzheimer's Institute	129	0	1	0
14	Wake Forest University	137	1	8	1
	Total PIB baseline scans:		19	63	19