

## P59: Comparison of Down syndrome PiB PET templates for MRI-less PET quantification

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**Background:** Amyloid-beta accumulation in Down syndrome (DS) is an ongoing area of investigation. However, many factors including atypical DS brain morphology and motion artifacts can confound MRI-based techniques.

**Objective:** To develop and assess DS-population [<sup>11</sup>C]PiB PET templates for accurate regional quantification in the absence of MRI.

**Methods:** [<sup>11</sup>C]PiB and T1 MRI images were acquired in 80 DS subjects. MRIs were processed using FreeSurfer, and parcellations were visually inspected and manually edited where appropriate. Nine subjects failed parcellation and were excluded.

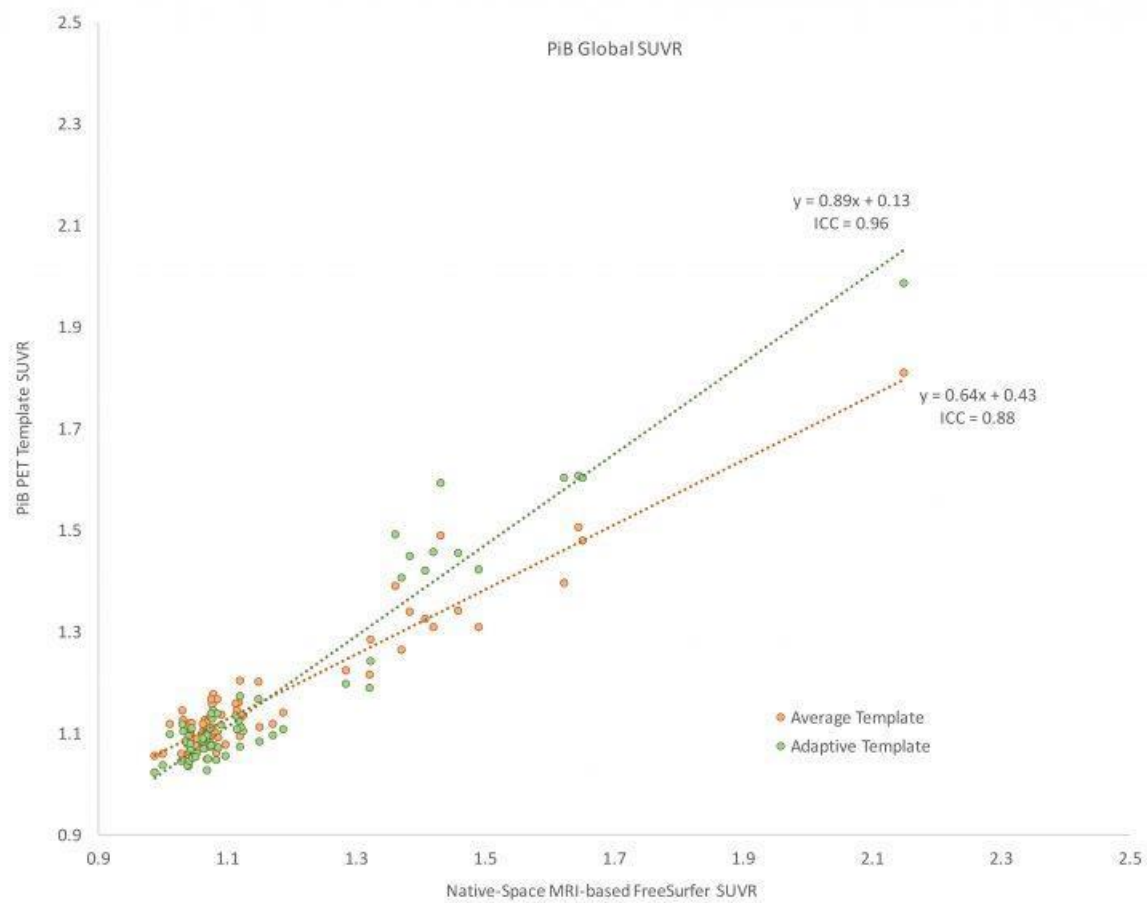
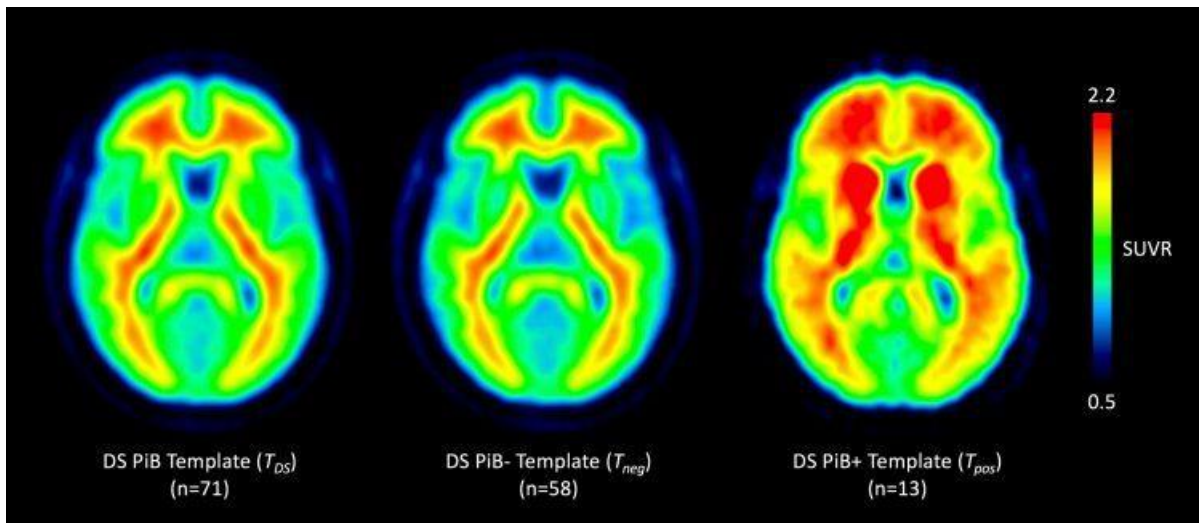
Global SUVR was assessed using a composite cortical grey matter (GM) FreeSurfer region and cerebellar GM as reference. Subjects were classified as [<sup>11</sup>C]PiB-positive (PiB+) or [<sup>11</sup>C]PiB-negative (PiB-) using a cutoff of 1.35.

MRIs were segmented and non-linearly registered via DARTEL (SPM12) to generate a DS-specific tissue probability template. Subject-specific DARTEL flow fields were applied to native-space FreeSurfer parcellations and [<sup>11</sup>C]PiB images, to generate an average DS-specific FreeSurfer atlas and two [<sup>11</sup>C]PiB templates: (1) an average template of all [<sup>11</sup>C]PiB images ( $T_{DS}$ ), and (2) an adaptive template ( $T_A$ ) where:  $T_A = w * T_{pos} + (1-w) * T_{neg}$ ;  $T_{pos}$  = average PiB+ image;  $T_{neg}$  = average PiB- image; and  $w$  = subject-specific weight (0-1), optimized during subject-to-template registration (Bourgeat et al., 2015).

[<sup>11</sup>C]PiB images were non-linearly registered to both templates independently using stereotactic normalization (SPM12). Global SUVRs were assessed using the DS-specific FreeSurfer atlas and correlated to native-space MRI-based FreeSurfer SUVRs.

**Results:** Of 71 subjects, 13 were PiB+ and 58 PiB-. Intraclass correlation coefficients relative to MRI-based FreeSurfer SUVRs were 0.88 (95% CI: 0.82,0.93) for the average template and 0.96 (95% CI: 0.94,0.98) for the adaptive template.

**Discussion:** Due to the greater number of PiB- subjects, the average template  $T_{DS}$  was biased towards PiB- and underestimated SUVR. The adaptive template  $T_A$  outperformed the average template  $T_{DS}$  with some bias still present. Thus, additional non-linear registration and template methods should be explored.



Keywords: PiB, PET, Down syndrome, template