

The PSP subcortical atlas - a neuroimaging atlas for progressive supranuclear palsy Richardson's syndrome

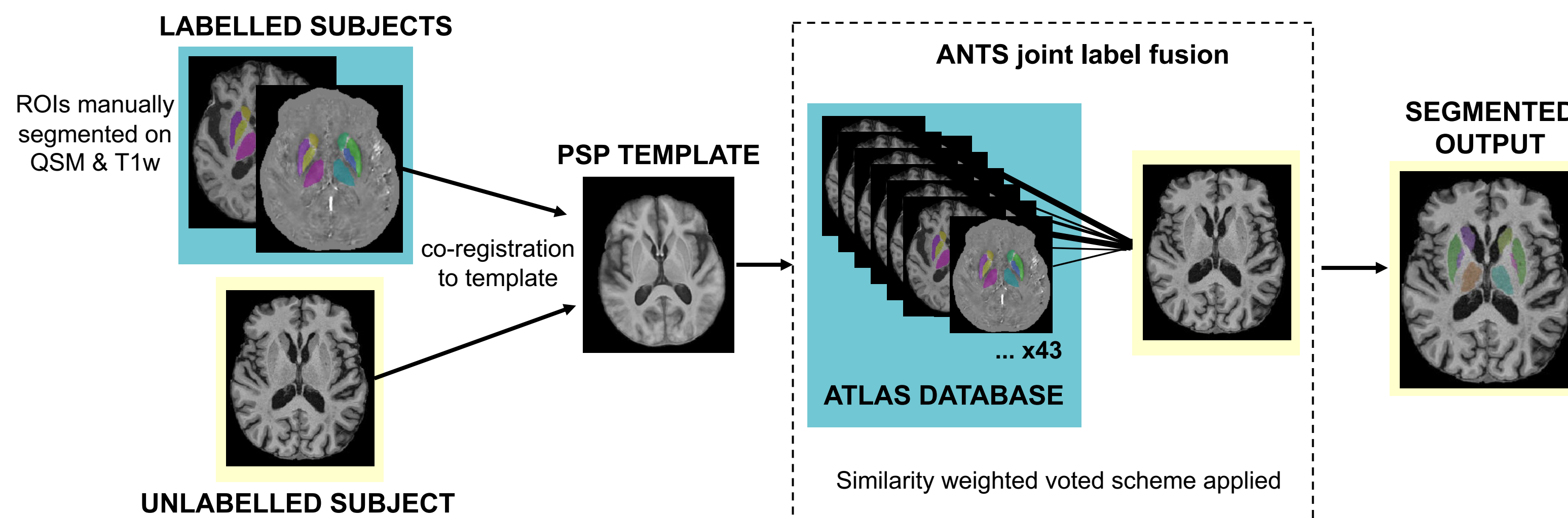
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INTRODUCTION: The severe atrophy in progressive supranuclear palsy (PSP) creates challenges in neuroimaging research as often, subcortical regions are not accurately segmented with existing atlases or require labour intense manual segmentation. We aimed to create a PSP specific neuroimaging atlas.

METHODS Seven regions of interest (ROIs) were manually segmented on quantitative susceptibility mapping (QSM) & T1w images in 33 PSP-RS subjects. The labelled data was then used in ANTS Joint label fusion (JLF) to segment 10 unlabelled subjects.

Figure 1. Atlas development pipeline



RESULTS: Using a leave-one-out validation approach, each of the 43 subjects were segmented through the ANTS JLF pipeline once. Dice coefficients (DC) and 95% Hausdorff Distance (HD95) were calculated using the manual segmentations as the gold standard and compared to existing atlases & segmentation pipelines.

Figure 2. Mean Dice coefficients & HD95 across atlas types
Mean based on all available regions (caudate, globus pallidus, putamen, thalamus)

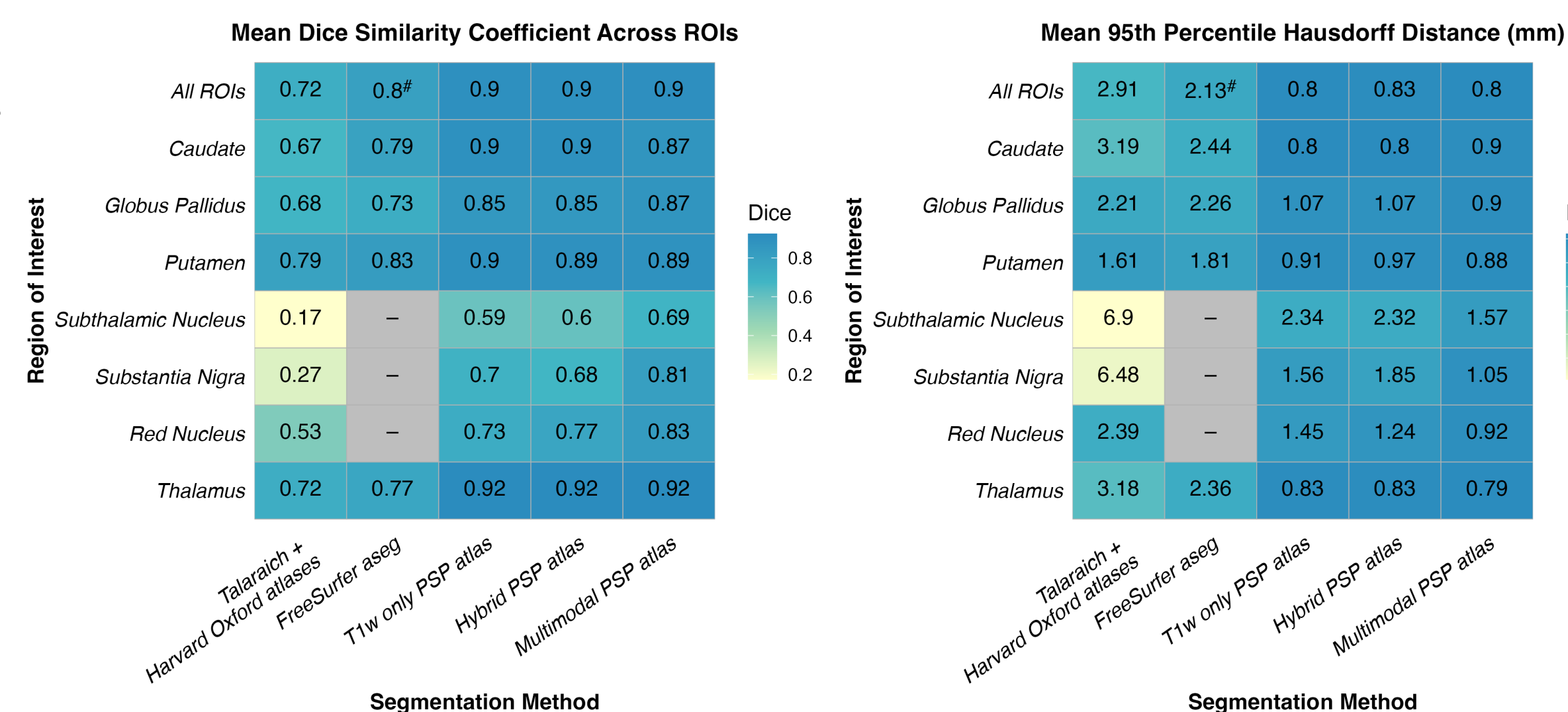


Figure 3. Visual comparison of T1w only PSP atlas to manual segmentations and Talairach+Harvard-Oxford atlases

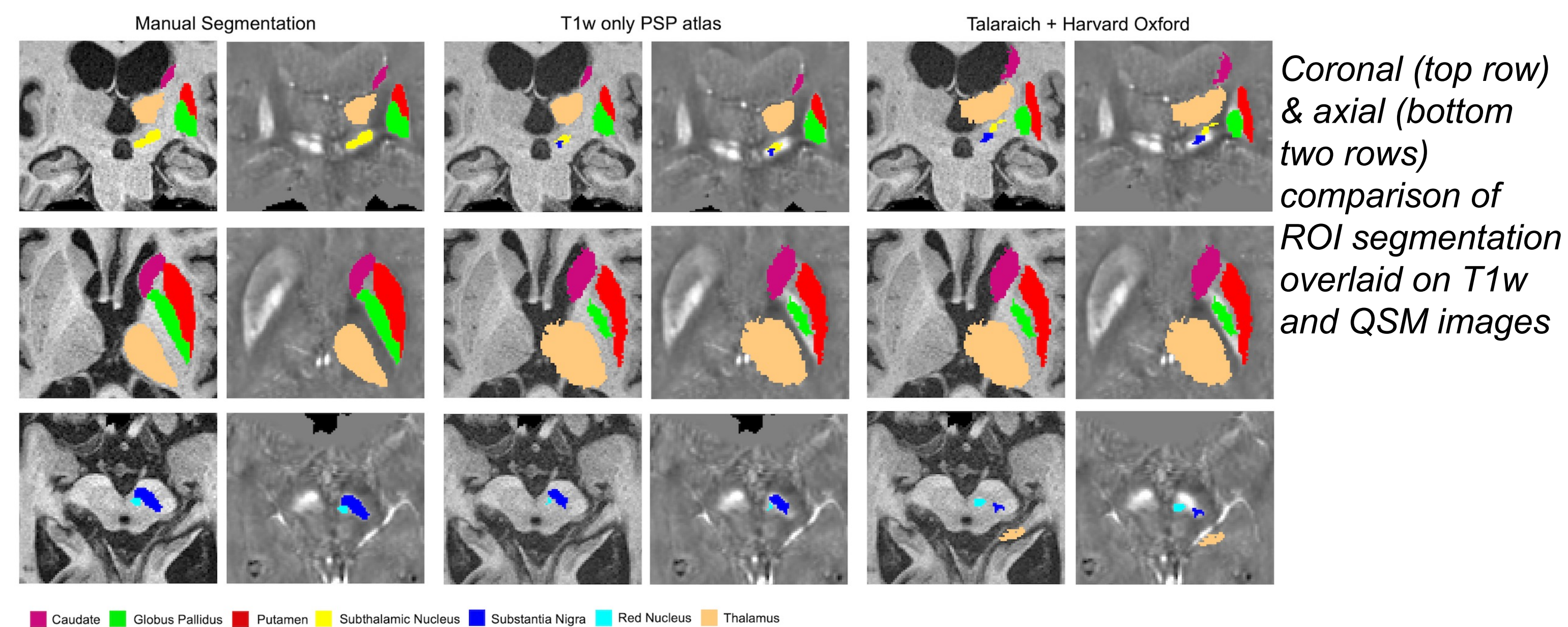


Table 1. Significant differences between atlas types

Comparison	metric	Δ	SE	df	t ratio	Adj pval
Freesurfer – Talairach+Harvard-Oxford	DC	0.072	0.005	126	14.576	<0.001***
	HD95	-0.585	0.092	126	-6.351	<0.001***
Multimodal PSP - Freesurfer	DC	0.092	0.005	126	18.656	<0.001***
	HD95	-1.240	0.092	126	-13.460	<0.001***
Multimodal PSP – Talairach+Harvard-Oxford	DC	0.163	0.005	126	33.233	<0.001***
	HD95	-1.826	0.092	126	-19.811	<0.001***
Multimodal - T1w only PSP	DC	-0.001	0.005	126	-0.176	0.998
	HD95	-0.013	0.092	126	-0.136	0.999
T1w only PSP - Freesurfer	DC	0.093	0.005	126	18.832	<0.001***
	HD95	-1.228	0.092	126	-13.323	<0.001***
T1w only PSP – Talairach+Harvard-Oxford	DC	0.164	0.005	126	33.409	<0.001***
	HD95	-1.813	0.092	126	-19.675	<0.001***

Results from the ANOVA's post hoc Tukey's HSD analyses. HD95 values are reported in mm

CONCLUSIONS: The PSP atlas greatly outperformed existing atlases and segmentation pipelines and can be applied to multimodal datasets and T1w images alone to obtain subcortical segmentations with high accuracy.