

Supplementary Table S4. Summary of neuroimaging findings related to *C9orf72* expansions

Reference	Modality	Study design	Population	Findings
Bocchetta et al. (2020)	Structural MRI	Cross-sectional	28 <i>C9orf72</i> -FTD, 27 <i>MAPT</i> -FTD, 18 <i>GRN</i> -FTD, 328 sporadic FTD, 104 HC	Selective volume reductions in thalamic nuclei in clinical, genetic and pathological FTD subtypes. <i>C9orf72</i> -FTD was the only group with a lower pulvinar volume than HC.
Chipika et al. (2020)	Structural MRI	Cross-sectional	12 <i>C9orf72</i> -ALS (8 with FTD), 88 sporadic ALS (7 with FTD), 32 sporadic PLS (1 with FTD), 117 HC	<i>C9orf72</i> expansion status associated with thalamic shape deformations but no significant nuclear volume differences.
De Vocht et al. (2020)	Structural MRI	Cross-sectional	17 presymptomatic <i>C9orf72</i> , 25 HC	Presymptomatic <i>C9orf72</i> compared to HC showed volume reductions in the frontotemporal and insular cortices, basal ganglia, and thalami.
	[¹⁸ F]FDG-PET	Cross-sectional	17 presymptomatic <i>C9orf72</i> , 25 HC	Presymptomatic <i>C9orf72</i> compared to HC showed hypometabolism in frontotemporal regions, basal ganglia and thalami, and relative hypermetabolism in the peri-Rolandic region, superior frontal gyrus and precuneus.
Le Blanc et al. (2020)	Structural MRI	Longitudinal	83 presymptomatic <i>C9orf72</i> , 54 symptomatic <i>C9orf72</i> (72.2% bvFTD), 249 HC	Presymptomatic <i>C9orf72</i> compared to HC showed reduced cortical thickness and surface area in the medial frontoparietal lobes and scattered lateral frontal, parietal, and temporal areas. In symptomatic carriers, reductions localized to frontal lobes and temporoparietal areas. Thinning was estimated to emerge in 30s and progress linearly without acceleration around the estimated age of onset.
Müller et al. (2020)	Diffusion MRI	Cross-sectional	23 <i>C9orf72</i> -ALS (4 with FTD), 15 <i>SOD1</i> -ALS, 32 HC	<i>C9orf72</i> -ALS compared to HC showed reduced FA along corticospinal tracts and in frontal and prefrontal brain.
Olney et al. (2020)	Structural MRI	Cross-sectional	40 presymptomatic <i>C9orf72</i> , 19 mildly/questionably symptomatic <i>C9orf72</i> , 36 symptomatic <i>C9orf72</i> , 35 presymptomatic <i>MAPT</i> , 12 mildly/questionably symptomatic <i>MAPT</i> , 20 symptomatic <i>MAPT</i> , 28 presymptomatic <i>GRN</i> , 12 mildly/questionably symptomatic <i>GRN</i> , 16 symptomatic <i>GRN</i> , 102 HC	Most presymptomatic <i>C9orf72</i> compared to HC showed volume loss in the right thalamus and left peri-insular region, most carriers with mild/questionable impairment in the thalamus and patchy regions in the frontal and temporal lobes, and most carriers with FTL in fairly diffuse and varying regions.
van der Burgh et al. (2020)	Structural MRI	Cross-sectional	24 <i>C9orf72</i> -ALS (1 with FTD), 268 other ALS (2 with FTD), 156 HC	<i>C9orf72</i> -ALS compared to other ALS showed more extensive cortical thinning and subcortical volume reductions.
		Longitudinal	17 <i>C9orf72</i> -ALS, 133 other ALS, 72 HC	At 5-month follow-up, <i>C9orf72</i> -ALS showed enlargement of the lateral and third ventricles but no additional cortical thinning over time as patients without the expansion.
	Diffusion MRI	Cross-sectional	24 <i>C9orf72</i> -ALS (1 with FTD), 268 other ALS (2 with FTD), 156 HC	<i>C9orf72</i> -ALS compared to HC showed reduced FA in more extensive tracts than patients without the expansion.
		Longitudinal	17 <i>C9orf72</i> -ALS, 133 other ALS, 72 HC	<i>C9orf72</i> -ALS compared to other ALS showed more extensive additional FA reductions over time.
Castelnovo et al. (2019)	[¹⁸ F]FDG-PET	Cross-sectional	6 symptomatic <i>C9orf72</i> (1 bvFTD, 1 bvFTD with parkinsonism, 1 svPPA, 3 ALS)	Patients with <i>C9orf72</i> -FTD showed hypometabolism consistent with the different clinical phenotypes and occipital and cerebellar hypermetabolism. <i>C9orf72</i> -ALS was associated with variable patterns of hypo- and hypermetabolism.

Diehl-Schmidt et al. (2019)	[¹⁸ F]FDG-PET	Cross-sectional	22 <i>C9orf72</i> -FTLD (16 bvFTD, 4 bvFTD-ALS, 1 SD, 1 CBD with cognitive and behavioral impairment), 22 sporadic FTLD (matched), 23 HC	<i>C9orf72</i> -bvFTD compared to sporadic bvFTD showed hypometabolism in bilateral thalami.
Mutsaerts et al. (2019)	ASL	Cross-sectional	34 presymptomatic <i>C9orf72</i> , 18 presymptomatic <i>MAPT</i> , 55 presymptomatic <i>GRN</i> , 113 HC	Interaction between carrier status and years to age of expected symptom onset suggested hypoperfusion in insular, temporal, and parietal regions, estimated to emerge 12.5 years before symptom onset.
Panman et al. (2019)	Structural MRI	Cross-sectional	11 presymptomatic <i>C9orf72</i> , 14 presymptomatic <i>MAPT</i> , 33 presymptomatic <i>GRN</i> , 53 HC	At baseline, presymptomatic <i>C9orf72</i> compared to HC showed lower volume in the cerebellum, insula, left frontal, and left planum temporale, and thinning in the right postcentral gyrus. At 2-year followup, carriers had lower volume in the orbitofrontal and insular cortices, postcentral gyrus, thalamus and cerebellum, and thinning in bilateral precentral gyrus and right superior parietal lobule.
		Longitudinal	11 presymptomatic <i>C9orf72</i> , 14 presymptomatic <i>MAPT</i> , 33 presymptomatic <i>GRN</i> , 53 HC	No longitudinal difference between presymptomatic <i>C9orf72</i> and HC.
	Diffusion MRI	Cross-sectional	12 presymptomatic <i>C9orf72</i> , 14 presymptomatic <i>MAPT</i> , 28 presymptomatic <i>GRN</i> , 50 HC	At baseline and 2-year follow-up, presymptomatic <i>C9orf72</i> compared to HC showed lower FA in frontotemporal tracts including corticospinal tracts, and higher MD in almost the entire skeleton.
		Longitudinal	12 presymptomatic <i>C9orf72</i> , 14 presymptomatic <i>MAPT</i> , 28 presymptomatic <i>GRN</i> , 50 HC	No longitudinal difference between presymptomatic <i>C9orf72</i> and HC.
van der Burgh et al. (2019)	Structural MRI	Cross-sectional	26 <i>C9orf72</i> -ALS, 108 other ALS, 28 other PLS, 56 other PMA, 114 controls	All patient groups showed lower upper cervical spinal cord area compared to controls.
		Longitudinal	18 <i>C9orf72</i> -ALS, 64 other ALS, 18 other PLS, 41 other PMA, 54 controls	While ALS patients without expansion showed progressive thinning of the cervical cord over time, <i>C9orf72</i> -ALS did not show significant differences to controls or correlation with disease severity.
	Diffusion MRI	Cross-sectional	26 <i>C9orf72</i> -ALS, 108 other ALS, 28 PLS, 56 PMA, 114 controls	Both ALS groups showed increased MD in the cerebral part of the corticospinal tract compared to controls. Only <i>C9orf72</i> -ALS showed significant involvement of other tracts such as the anterior thalamic radiation.
Querin et al. (2019)	Diffusion MRI	Cross-sectional	40 presymptomatic <i>C9orf72</i> , 32 HC	At baseline, presymptomatic <i>C9orf72</i> older than 40 years compared to HC showed white matter reductions at each cervical vertebral level.
		Longitudinal	40 presymptomatic <i>C9orf72</i> , 32 HC	At 18-month follow-up, the carriers older than 40 showed significant FA reductions in corticospinal tract.
Bede et al. (2018)	Structural MRI	Cross-sectional	14 <i>C9orf72</i> -bvFTD-ALS, 12 sporadic bvFTD-ALS, 36 sporadic ALS, 50 HC	<i>C9orf72</i> -bvFTD-ALS compared to HC showed subcortical volume reductions limited to the bilateral thalami, hippocampi, and right accumbens nucleus, whereas sporadic bvFTD-ALS showed involvement of all nuclei of the basal ganglia with the exception of the amygdala.
Bertrand et al. (2018)	Structural MRI	Cross-sectional	41 presymptomatic <i>C9orf72</i> , 39 HC	Presymptomatic <i>C9orf72</i> compared to HC showed diffuse volume loss, which persisted in a subgroup of carriers younger than 40 years in frontal and parietal cortex and thalami.

	Diffusion MRI	Cross-sectional	41 presymptomatic <i>C9orf72</i> , 39 HC	Presymptomatic <i>C9orf72</i> compared to HC showed reduced integrity (FA, MD, AXD, RD) in diffuse regions predominating in frontal regions and affecting corticospinal tracts bilaterally. Carriers younger than 40 years showed significant changes within the anterior thalamic radiation (FA, RD) and right forceps minor (RD).
Cash et al. (2018)	Structural MRI	Cross-sectional	40 presymptomatic <i>C9orf72</i> , 25 symptomatic <i>C9orf72</i> (18 bvFTD, 3 FTD-ALS, 2 nvfPPA, 1 svPPA, 1 other dementia), 23 presymptomatic <i>MAPT</i> , 10 <i>MAPT-bvFTD</i> , 65 presymptomatic <i>GRN</i> , 12 symptomatic <i>GRN</i> (5 bvFTD, 5 nvfPPA, 1 CBS), 144 HC	Presymptomatic <i>C9orf72</i> compared to HC showed grey matter loss in frontotemporal cortex, thalamus and cerebellum. Symptomatic <i>C9orf72</i> compared to HC showed grey matter loss throughout the brain (e.g. frontal, temporal, insula, cingulate, posterior cortical areas, thalamus, hippocampus, amygdala, basal ganglia and cerebellum).
Floeter et al. (2018)	Diffusion MRI	Cross-sectional	7 presymptomatic <i>C9orf72</i> , 21 symptomatic <i>C9orf72</i> (3 bvFTD, 7 FTD-ALS, 11 ALS), 28 HC	At baseline, <i>C9orf72</i> expansion carriers compared to HC showed widespread reduction of white matter integrity (FA, MD).
		Longitudinal	5 presymptomatic <i>C9orf72</i> , 15 symptomatic <i>C9orf72</i> (3 bvFTD, 5 FTD-ALS, 6 ALS), 23 HC	Over a 6 month interval, FA and MD changes in carriers' cognitive-behavioral and motor symptom severity correlated with progressive deficits along the corticospinal and frontotemporal tracts, respectively.
Jiskoot et al. (2018)	Diffusion MRI	Cross-sectional	35 presymptomatic <i>C9orf72</i> , 19 symptomatic <i>C9orf72</i> , 17 presymptomatic <i>MAPT</i> , 13 symptomatic <i>MAPT</i> , 52 presymptomatic <i>GRN</i> , 4 symptomatic <i>GRN</i> , 115 HC	Presymptomatic <i>C9orf72</i> exhibit reduced integrity (FA, MD, AXD, RD) of the posterior thalamic radiation even 30 years before estimated onset, followed by changes in posteriorly located tracts.
Popuri et al. (2018)	Structural MRI	Cross-sectional	15 presymptomatic <i>C9orf72</i> , 9 presymptomatic <i>GRN</i> , 37 HC	Presymptomatic <i>C9orf72</i> compared to HC showed cortical thinning in temporal, parietal and frontal regions and volume reduction in bilateral thalamus and left caudate.
Schöneker et al. (2018)	Structural MRI	Cross-sectional	13 symptomatic <i>C9orf72</i> (FTD, ALS or FTD-ALS), 45 sporadic FTD or FTD-ALS, 19 HC	Symptomatic <i>C9orf72</i> compared to sporadic patients showed volume reductions in thalamus, which correlated with clinical dementia severity.
Wen et al. (2018)	Structural MRI	Cross-sectional	38 presymptomatic <i>C9orf72</i> , 29 HC	Presymptomatic <i>C9orf72</i> compared to HC showed reduced volume in frontal, temporal, parietal, occipital, insular and thalamic ROI.
	Diffusion MRI	Cross-sectional	38 presymptomatic <i>C9orf72</i> , 29 HC	Presymptomatic <i>C9orf72</i> compared to HC showed reduced integrity (NDI, MD, AXD, RD) in fronto-temporal related and cortico-spinal tracts.
Young et al. (2018)	Structural MRI	Cross-sectional	39 presymptomatic <i>C9orf72</i> , 24 symptomatic <i>C9orf72</i> , 22 presymptomatic <i>MAPT</i> , 11 symptomatic <i>MAPT</i> , 62 presymptomatic <i>GRN</i> , 14 symptomatic <i>GRN</i>	Progression modeling grouped <i>C9orf72</i> expansion carriers into distinct frontotemporal and subcortical subtypes.
Agosta et al. (2017)	Structural MRI	Cross-sectional	19 <i>C9orf72</i> -MND, 67 sporadic MND, 22 HC	<i>C9orf72</i> -MND compared to sporadic MND have cerebellar and thalamic atrophy and, as compared to sporadic early-stage MND, occipital cortical thinning.
	Task-free fMRI	Cross-sectional	19 <i>C9orf72</i> -MND, 67 sporadic MND, 22 HC	<i>C9orf72</i> -MND compared to sporadic MND with matching cognitive deficits showed decreased connectivity within SMN and, as compared to sporadic early-stage or motor-only MND, enhanced connectivity within visual network.

Lee et al. (2017)	Structural MRI	Cross-sectional	15 presymptomatic <i>C9orf72</i> , 67 HC	Presymptomatic <i>C9orf72</i> compared to HC showed reduced volume in posterior mid-cingulate, medial pulvinar thalamus, and dorsolateral prefrontal cortex.
	Diffusion MRI	Cross-sectional	12 presymptomatic <i>C9orf72</i> , 29 HC	Presymptomatic <i>C9orf72</i> compared to HC showed reduced FA in corpus callosum, cingulum bundle, and internal and external capsule.
	Task-free fMRI	Cross-sectional	13 presymptomatic <i>C9orf72</i> , 30 HC	Presymptomatic <i>C9orf72</i> compared to HC showed reduced connectivity within SN, SMN, DMN and pulvinar-seeded networks.
Omer et al. (2017)	Structural MRI	Cross-sectional	10 <i>C9orf72</i> -FTD-ALS, 10 sporadic FTD-ALS, 20 sporadic ALS, 40 HC	FTD-ALS cohorts compared to pure ALS showed volume loss in motor and extramotor regions, but the latter was less significant in <i>C9orf72</i> -FTD-ALS.
	Diffusion MRI	Cross-sectional	10 <i>C9orf72</i> -FTD-ALS, 10 sporadic FTD-ALS, 20 sporadic ALS, 40 HC	FTD-ALS cohorts compared to pure ALS showed FA reductions in extramotor regions (e.g. orbitofrontal, cingulate and opercular cortex). Effects were less pronounced in <i>C9orf72</i> -FTD-ALS.
Papma et al. (2017)	Structural MRI	Cross-sectional	18 presymptomatic <i>C9orf72</i> , 15 HC	Presymptomatic <i>C9orf72</i> above 40 years compared to matched HC showed volume loss in the thalamus, cerebellum, and parietal and temporal cortex.
	Diffusion MRI	Cross-sectional	17 presymptomatic <i>C9orf72</i> , 15 HC	Presymptomatic <i>C9orf72</i> compared to HC showed lower FA and higher RD within tracts connecting the frontal lobe, the thalamic radiation, and tracts associated with motor functioning.
Westeneng et al. (2017)	¹ H MRS	Cross-sectional	11 presymptomatic <i>C9orf72</i> , 18 HC	Presymptomatic <i>C9orf72</i> compared to HC showed lower concentrations of tNAA/Cr, Glu/tCr and Glu/tNAA ratios in the left putamen and lower Glu/tNAA in the left thalamus.
Floeter et al. (2016)	Structural MRI	Cross-sectional	7 presymptomatic <i>C9orf72</i> , 20 symptomatic <i>C9orf72</i> (3 bvFTD, 6 FTD-ALS, 11 ALS), 22 sporadic ALS, 28 HC	At baseline, <i>C9orf72</i> -FTD and -FTD-ALS compared to sporadic ALS showed less thinning of the motor cortex but more thinning in frontal and temporal lobes, smaller thalami, and ventricles large for age. Presymptomatic carriers did not differ from HC.
		Longitudinal	5 presymptomatic <i>C9orf72</i> , 19 symptomatic <i>C9orf72</i> (3 bvFTD, 5 ALS-FTD, 6 ALS), 23 HC	At 6 month follow-up, <i>C9orf72</i> -FTD and -FTD-ALS groups showed a faster rate of ventricular enlargement than HC but similar rates of cortical thinning. Presymptomatic carriers did not differ from HC.
Westeneng et al. (2016)	Structural MRI	Cross-sectional	14 <i>C9orf72</i> -ALS, 156 sporadic ALS, 92 HC	<i>C9orf72</i> -ALS compared to sporadic ALS showed more additional cortical thinning in frontal, temporal and parietal sites and smaller volumes of hippocampus and thalamus. A subgroup of sporadic ALS, however, showed a similar widespread pattern that related to cognitive deficits.
	Diffusion MRI	Cross-sectional	14 <i>C9orf72</i> -ALS, 156 sporadic ALS, 92 HC	<i>C9orf72</i> -ALS compared to sporadic ALS showed lower FA in the inferior and superior longitudinal fasciculus.
Mahoney et al. (2015)	Diffusion MRI	Cross-sectional	4 <i>C9orf72</i> -bvFTD, 8 <i>MAPT</i> -bvFTD, 11 sporadic bvFTD, 18 HC	At baseline, <i>C9orf72</i> -bvFTD as compared to HC showed reduced FA in both superior cerebellar peduncle.
	Diffusion MRI	Longitudinal	4 <i>C9orf72</i> -bvFTD, 8 <i>MAPT</i> -bvFTD, 11 sporadic bvFTD, 18 HC	In <i>C9orf72</i> -bvFTD, the greatest FA reduction occurred within right paracallosal cingulum and MD increase in left uncinate fasciculus.

McMillan et al. (2015)	Structural MRI	Cross-sectional	20 symptomatic <i>C9orf72</i> (12 bvFTD, 3 nvfPPA, 4 FTD-ALS, 1 ALS-MCI), 25 HC	Symptomatic <i>C9orf72</i> compared to HC showed reduced grey matter volume in frontotemporal and parietal cortices and cerebellum. Within carriers, increased <i>C9orf72</i> promoter methylation was associated with greater grey matter volume in the right hippocampus, right thalamus, and left premotor cortex.
	Structural MRI	Longitudinal	11 symptomatic <i>C9orf72</i> (7 bvFTD, 2 nvfPPA, 2 FTD-ALS)	In a 1 year followup, regions protected by hypermethylation showed less longitudinal decline.
Rohrer et al. (2015)	Structural MRI	Cross-sectional	33 presymptomatic or symptomatic <i>C9orf72</i> , 52 presymptomatic or symptomatic <i>GRN</i> , 24 presymptomatic or symptomatic <i>MAPT</i> , 93 HC	<i>C9orf72</i> expansion carriers showed volume loss in the thalamus, insula, and posterior cortical areas estimated to emerge 25 years from estimated onset, followed by frontal, temporal lobes and cerebellum 10–20 years from estimated onset.
Solje et al. (2015)	Structural MRI/CT	Cross-sectional	36 <i>C9orf72</i> -bvFTD (4 with MND)	26/36 symptomatic <i>C9orf72</i> showed frontal and/or anterior temporal pattern of atrophy.
	[¹⁸ F]FDG-PET/SPECT	Cross-sectional	17 <i>C9orf72</i> -bvFTD/bvFTD-MND	14/17 symptomatic <i>C9orf72</i> showed frontal and/or temporal pattern of hypoperfusion.
Walhout et al. (2015a)	Structural MRI	Cross-sectional	16 presymptomatic <i>C9orf72</i> , 14 <i>C9orf72</i> -ALS, 51 HC	Presymptomatic <i>C9orf72</i> compared to HC showed cortical thinning in temporal, parietal, and occipital cortices and smaller volumes of the left caudate and putamen. Only <i>C9orf72</i> -ALS showed thinning of the primary motor cortex.
	Diffusion MRI	Cross-sectional	16 presymptomatic <i>C9orf72</i> , 14 <i>C9orf72</i> -ALS, 51 HC	Presymptomatic <i>C9orf72</i> compared to HC did not show significant alterations in structural connectivity, but <i>C9orf72</i> -ALS group showed decreases in motor-related tracts.
Whitwell et al. (2015)	Structural MRI	Longitudinal	11 symptomatic <i>C9orf72</i> (7 bvFTD, 3 FTD-ALS, 1 AD), 21 symptomatic <i>MAPT</i> (19 bvFTD, 1 FTD-ALS, 1 PPA), 11 symptomatic <i>GRN</i> (6 bvFTD, 4 PPA, 1 AD), 15 sporadic bvFTD	Symptomatic <i>C9orf72</i> showed the greatest atrophy rate in frontal and temporal lobes.
Cistaro et al. (2014)	[¹⁸ F]FDG-PET	Cross-sectional	15 <i>C9orf72</i> -ALS, 30 sporadic ALS, 12 sporadic FTD-ALS, 40 HC	<i>C9orf72</i> -ALS compared with sporadic ALS showed significant hypometabolism in the anterior and posterior cingulate cortex, insula, caudate and thalamus, the left frontal and superior temporal cortex, and hypermetabolism in the midbrain, bilateral occipital cortex, globus pallidus and left inferior temporal cortex. <i>C9orf72</i> -ALS compared with sporadic ALS-FTD showed hypometabolism in the left temporal cortex.
Devenney et al. (2014)	Structural MRI	Cross-sectional	10 <i>C9orf72</i> -bvFTD, 19 sporadic bvFTD, 35 HC	<i>C9orf72</i> -bvFTD as compared to sporadic bvFTD showed volume loss in the orbitofrontal cortex, anterior temporal lobe, insula, and anterior cingulate.
	[¹⁸ F]FDG-PET	Cross-sectional	6 <i>C9orf72</i> -bvFTD	3/6 symptomatic <i>C9orf72</i> showed frontal and/or temporal pattern of hypometabolism.
Lee et al. (2014)	Structural MRI	Cross-sectional	14 <i>C9orf72</i> -bvFTD (1 FTD-ALS, 4 FTD-MND), 14 sporadic bvFTD (1 FTD-ALS, 4 FTD-MND), 42 HC	<i>C9orf72</i> -bvFTD compared to sporadic bvFTD showed greater volume loss in bilateral medial pulvinar nucleus and parietal cortex, and less volume loss in bilateral anterior cingulate cortex, medial superior frontal gyri, anterior insulae and left striatum.
	Task-free fMRI	Cross-sectional	14 <i>C9orf72</i> -bvFTD (1 FTD-ALS, 4 FTD-MND), 14 sporadic bvFTD (1 FTD-ALS, 4 FTD-MND), 14 HC	Both patient groups compared to HC showed topographically similar connectivity reductions in SN and SMN, and sporadic bvFTD additional alterations in DMN.

Mahoney et al. (2014)	Diffusion MRI	Cross-sectional	4 symptomatic <i>C9orf72</i> (3 bvFTD, 1 bvFTD-MND), 9 symptomatic <i>MAPT</i> (bvFTD), 14 sporadic FTD (2 bvFTD-PSP, 1 bvFTD-MND, 1 bvFTD-CBS), 25 AD, 20 HC	<i>C9orf72</i> -bvFTD compared to HC showed increased AD within corpus callosum and cingulum bundle.
Rytty et al. (2014)	Task-free fMRI	Cross-sectional	7 <i>C9orf72</i> -bvFTD, 8 HC	<i>C9orf72</i> -FTLD compared to HC showed pronounced anti-correlation between thalamic SN and anterior DMN and connectivity increases within the right dorsal attention network.
Van Laere et al. (2014)	[¹⁸ F]FDG-PET	Cross-sectional	11 <i>C9orf72</i> -ALS, 59 sporadic ALS, 7 sporadic PLS, 4 sporadic PMA, 20 HC	<i>C9orf72</i> -ALS compared with sporadic ALS showed hypometabolism in the thalamus and posterior cingulate.
Bede et al. (2013b)	Structural MRI	Cross-sectional	9 <i>C9orf72</i> -ALS, 30 sporadic ALS, 44 HC	<i>C9orf72</i> -ALS as compared to sporadic ALS showed more extensive cortical and subcortical atrophy (e.g. in orbitofrontal, opercular, and temporal lobes).
	Diffusion MRI	Cross-sectional	9 <i>C9orf72</i> -ALS, 30 sporadic ALS, 44 HC	Both ALS groups as compared to HC showed reduced integrity of corpus callosum and superior corticospinal pathways. In addition, <i>C9orf72</i> -ALS displayed principally frontotemporal and sporadic ALS motor function related FA, RD and MD changes.
Bede et al. (2013c)	Structural MRI	Cross-sectional	9 <i>C9orf72</i> -ALS, 30 sporadic ALS, 44 HC	Basal ganglia involvement was widespread in all ALS groups, but more extensive in <i>C9orf72</i> -ALS compared to sporadic ALS.
Irwin et al. (2013)	Structural MRI	Cross-sectional	14 <i>C9orf72</i> -FTLD (8 bvFTD, 1 svPPA, 2 nfvPPA, 3 ALS-FTLD), 27 sporadic FTLD (17 bvFTD, 4 svPPA, 1 lvPPA, 2 CBS, 3 ALS-FTLD), 36 HC	<i>C9orf72</i> -FTLD compared to sporadic FTLD showed atrophy in the frontal, frontoinsular, cingulate, occipital and parietal cortex, thalami and cerebellum.
Verschueren et al. (2013)	[¹⁸ F]FDG-PET	Cross-sectional	9 <i>C9orf72</i> -ALS, 20 sporadic ALS, 20 HC	Both ALS groups compared to HC showed hypometabolism in the prefrontal cortex, and expansion carriers had more extensive reductions e.g. thalamus, hippocampus and posterior cingulate.
Boeve et al. (2012)	Structural MRI	Cross-sectional	18 symptomatic <i>C9orf72</i> (14 bvFTD, 3 FTD-ALS, 1 ALS)	15/18 symptomatic <i>C9orf72</i> showed atrophy, 12/18 with frontotemporal predominance.
	[¹⁸ F]FDG-PET	Cross-sectional	8 symptomatic <i>C9orf72</i>	7/8 symptomatic <i>C9orf72</i> showed a frontal pattern of hypometabolism and one a more posterior pattern.
	Structural MRI	Longitudinal	8 symptomatic <i>C9orf72</i>	At a followup of two years or more, all symptomatic <i>C9orf72</i> showed pronounced frontal atrophy and ventricular enlargement.
Byrne et al. (2012)	Structural MRI	Cross-sectional	10 <i>C9orf72</i> -ALS, 30 sporadic ALS	<i>C9orf72</i> -ALS compared with sporadic ALS showed pronounced volume loss in right inferior frontal gyrus, right superior frontal gyrus, left anterior cingulate gyrus, and the right precentral gyrus.
Mahoney et al. (2012a)	Structural MRI	Cross-sectional	11 <i>C9orf72</i> -FTLD, 11 <i>MAPT</i> -FTLD, 8 <i>GRN</i> -FTLD, 15 HC	<i>C9orf72</i> -FTLD compared to HC showed atrophy in frontal, temporal and parietal cortices, thalamus and cerebellum.
	Diffusion MRI	Cross-sectional	3 <i>C9orf72</i> -FTLD, 15 HC	<i>C9orf72</i> -FTLD compared to HC showed reduced FA and increased RD in long intrahemispheric, commissural and corticospinal tract.
Mahoney et al. (2012b)	Structural MRI	Longitudinal	6 symptomatic <i>C9orf72</i> (4 bvFTD, 2 bvFTD-MND), 15 HC	Symptomatic <i>C9orf72</i> showed greater change over time than HC in ventricular expansion and atrophy of cerebellum, thalami, and globus pallidus, whereas cortical rates were diffuse and variable.

Sha et al. (2012)	Structural MRI	Cross-sectional	13 <i>C9orf72</i> -bvFTD, 8 <i>C9orf72</i> -FTD-MND, 21 sporadic bvFTD, 6 sporadic FTD-MND, 64 HC	<i>C9orf72</i> -bvFTD compared to sporadic bvFTD showed volume loss in parietal and thalamic and relative sparing of medial frontal regions. In FTD-MND, expansion carriers showed greater volume loss in dorsal frontal and posterior cortex and cerebellum and lesser involvement of ventral and temporal poles.
Whitwell et al. (2012)	Structural MRI	Cross-sectional	19 <i>C9orf72</i> -bvFTD (2 with ALS), 25 <i>MAPT</i> -bvFTD, 12 <i>GRN</i> -bvFTD, 20 sporadic FTD (7 with ALS), 40 HC	<i>C9orf72</i> -bvFTD compared to sporadic bvFTD showed greater volume loss in parietal and occipital lobes, lateral inferior frontal lobe and cerebellum.
Boxer et al. (2011)	Structural MRI	Cross-sectional	5 symptomatic <i>C9orf72</i> (4 bvFTD, 1 ALS), 10 sporadic bvFTD, 13 HC	Both patients groups showed smaller frontal volumes compared to HC. Only expansion carriers showed involvement of parietal and occipital and sporadic bvFTD of temporal lobes.

FTLD, frontotemporal lobar degeneration; FTD, frontotemporal dementia; bvFTD, behavioral variant FTD; PPA, primary progressive aphasia; SD, semantic variant PPA; nvPPA, nonfluent variant PPA; CBD, corticobasal syndrome; CBD, corticobasal degeneration; ALS, amyotrophic lateral sclerosis; PLS, primary lateral sclerosis; PMA, progressive muscular atrophy; MND, motor neurone disease; PSP, progressive supranuclear palsy; MCI, mild cognitive impairment; HC, healthy control; SN, salience network; SMN, sensorimotor network; DMN, default mode network; FA, fractional anisotropy; MD, mean diffusivity; AXD, axial diffusivity; RD, radial diffusivity; NDI, neurite density index; NAA, N-acetylaspartate; Cr, creatine; Glu, glutamate