**Supplementary Material**

**Supplementary Table 1**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Gene mutation |  | ***GRN*** (n=75) | | ***C9orf72*** (n=60) | | ***MAPT*** (n=32) | |
| Clinical status |  | Sx  (n=12) | PreSx  (n=63) | Sx  (n=23) | PreSx  (n=37) | Sx  (n=10) | PreSx  (n=22) |
| Visual hallucinations | Severity (n,%)  0  0.5  1  2  3 | 9(75%)  0 (0%)  2(17%)  1(8%)  0 (0%) | 63(100%)  0(0%)  0(0%)  0(0%)  0(0%) | 20(87%)  0(0%)  0(0%)  2(9%)  1(4%) | 36(97%)  0 (0%)  0(0%)  1(3%)  0 (0%) | 9(90%)  0(0%)  1 (10%)  0(0%)  0(0%) | 21(95%)  1(5%)  0(0%)  0(0%)  0(0%) |
| Auditory hallucinations | Severity (n,%)  0  0.5  1  2  3 | 9(75%)  0 (0%)  2(17%)  1(8%)  0 (0%) | 63(100%)  0(0%)  0(0%)  0(0%)  0(0%) | 21(97%)  1(3%)  0(0%)  0(0%)  1(0%) | 36(97%)  0 (0%)  0(0%)  1(3%)  0 (0%) | 8(80%)  1(10%)  1(10%)  0(0%)  0(0%) | 22(100%)  0(0%)  0(0%)  0(0%)  0(0%) |
| Tactile hallucinations | Severity (n,%)  0  0.5  1  2  3 | 9(75%)  0 (0%)  2(17%)  1(8%)  0 (0%) | 63(100%)  0(0%)  0(0%)  0(0%)  0(0%) | 22(95%)  1(5%)  0(0%)  0(0%)  0(0%) | 36(97%)  0 (0%)  0(0%)  1(3%)  0 (0%) | 9(90%)  0(0%)  1(10%)  0(0%)  0(0%) | 22(100%)  0(0%)  0(0%)  0(0%)  0(0%) |
| Delusions | Severity  0  0.5  1  2  3 | 8(67%)  0(0%)  3(25%)  1(8%)  0(0%) | 63(100%)  0(0%)  0(0%)  0(0%)  0(0%) | 17(74%)  1(4%)  2(9%)  1(4%)  2(9%) | 36(97%)  0 (0%)  0(0%)  1(3%)  0 (0%) | 7(70%)  0(0%)  2(20%)  1(10%)  0(0%) | 22(100%)  0(0%)  0(0%)  0(0%)  0(0%) |
| Depression | Severity (n,%)  0  0.5  1  2  3 | 5(42%)  0(0%)  6(50%)  1(8%)  0(0%) | 54(86%)  4(6%)  2(3%)  3(5%)  0(0%) | 13(57%)  3(13%)  5(22%)  2(8%)  0(0%) | 29(78.5%)  1(3%)  5(13.5%)  2(5%)  0(0%) | 5(50%)  1(10%)  3(30%)  1(10%)  0(0%) | 21(95%)  0(0%)  0(0%)  1(5%)  0(0%) |
| Anxiety | Severity (n,%)  0  0.5  1  2  3 | 6(50%)  0(0%)  5(42%)  1(8%)  0(0%) | 57(90%)  3(5%)  1(2%)  2(3%)  0(0%) | 12(52%)  1(5%)  7(30%)  3(13%)  0(0%) | 31(84%)  1(3%)  3(8%)  2(5%)  0(0%) | 4(40%)  1(10%)  3(30%)  2(20%)  0(0%) | 19(86.5%)  1(4.5%)  1(4.5%)  1(4.5%)  0(0%) |

Sx, symptomatic; PreSx, presymptomatic

Frequency is reported as No.(%) Severity was assessed using a NPS Scale:0 = absent, 0.5 = very mild, 1 = mild, 2 = moderate, 3=severe.

**Results of the VBM analyses in the genetic groups**

**Supplementary Table 2.** Results of the VBM analyses forvisual hallucinations in *GRN* mutation carriers

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Set-level |  |  | Cluster-level |  |  |  | Peak-level |  |  |  | MNI coordinates | | | Label |
| p | c | p(FWE-corr) | p(FDR-corr) | equivk | p(unc) | p(FWE-corr) | p(FDR-corr) | T | equivZ | p(unc) | x,y,z {mm} | | |  |
| 0.000 | 77.00 | 0.000 |  | 16855 | 0.000 | 0.001 | 0.001 | 6.126 | 5.455 | 0.000 | -15 | -30 | -6 | left thalamus proper |
|  |  |  |  |  |  | 0.001 | 0.001 | 6.113 | 5.446 | 0.000 | -17 | -26 | 3 | left thalamus proper |
|  |  |  |  |  |  | 0.007 | 0.001 | 5.667 | 5.117 | 0.000 | -42 | 12 | 47 | left middle frontal gyrus |
|  |  | 0.000 |  | 23367 | 0.000 | 0.002 | 0.001 | 5.979 | 5.348 | 0.000 | -20 | -65 | 62 | Left superior parietal lobule |
|  |  |  |  |  |  | 0.004 | 0.001 | 5.840 | 5.246 | 0.000 | -53 | -72 | 8 | left inferior occipital gyrus |
|  |  |  |  |  |  | 0.006 | 0.001 | 5.688 | 5.133 | 0.000 | -47 | -71 | 39 | left angular gyrus |
|  |  | 0.973 |  | 42 | 0.377 | 0.273 | 0.002 | 4.491 | 4.192 | 0.000 | 5 | 63 | 21 | superior frontal gyrus medial segment |
|  |  | 0.001 |  | 1346 | 0.000 | 0.326 | 0.002 | 4.420 | 4.133 | 0.000 | 44 | 14 | 8 | right frontal operculum |
|  |  |  |  |  |  | 0.428 | 0.002 | 4.303 | 4.036 | 0.000 | 53 | 8 | 21 | right precentral gyrus |
|  |  |  |  |  |  | 0.614 | 0.003 | 4.119 | 3.881 | 0.000 | 35 | 18 | 0 | right anterior insula |
|  |  | 0.000 |  | 1651 | 0.000 | 0.337 | 0.002 | 4.407 | 4.122 | 0.000 | 33 | -66 | -32 | right cerebellum exterior |
|  |  |  |  |  |  | 0.575 | 0.003 | 4.157 | 3.913 | 0.000 | 21 | -80 | -21 | right cerebellum exterior |
|  |  |  |  |  |  | 0.620 | 0.003 | 4.113 | 3.876 | 0.000 | 24 | -71 | -30 |  |
|  |  | 0.445 |  | 203 | 0.062 | 0.451 | 0.002 | 4.279 | 4.016 | 0.000 | -26 | -83 | -20 | left occipital fusiform gyrus |
|  |  |  |  |  |  | 0.810 | 0.003 | 3.919 | 3.710 | 0.000 | -18 | -74 | -12 | left lingual gyrus |
|  |  |  |  |  |  | 0.981 | 0.005 | 3.583 | 3.419 | 0.000 | -20 | -89 | -14 | left occipital fusiform gyrus |
|  |  | 0.872 |  | 83 | 0.216 | 0.463 | 0.002 | 4.267 | 4.005 | 0.000 | 3 | 56 | -8 | right medial frontal cortex |
|  |  | 0.701 |  | 130 | 0.126 | 0.567 | 0.003 | 4.164 | 3.919 | 0.000 | -47 | 42 | 9 | inferior frontal gyrus |
|  |  |  |  |  |  | 0.907 | 0.004 | 3.785 | 3.595 | 0.000 | -50 | 42 | -5 |  |
|  |  | 0.953 |  | 53 | 0.321 | 0.632 | 0.003 | 4.101 | 3.866 | 0.000 | 45 | -71 | 44 | right angula gyrus |
|  |  | 0.674 |  | 137 | 0.117 | 0.638 | 0.003 | 4.096 | 3.862 | 0.000 | 41 | -86 | 21 | right middle occipital gyrus |
|  |  |  |  |  |  | 0.818 | 0.003 | 3.909 | 3.702 | 0.000 | 41 | -78 | 38 |  |
|  |  |  |  |  |  | 0.995 | 0.006 | 3.471 | 3.320 | 0.000 | 38 | -83 | 29 |  |
|  |  | 0.567 |  | 166 | 0.088 | 0.668 | 0.003 | 4.067 | 3.837 | 0.000 | 41 | -72 | -50 | right cerebellum exterior |
|  |  | 0.035 |  | 578 | 0.004 | 0.688 | 0.003 | 4.047 | 3.820 | 0.000 | -54 | -6 | -36 | left middle temporal gyrus |
|  |  |  |  |  |  | 0.814 | 0.003 | 3.913 | 3.706 | 0.000 | -45 | 3 | -36 |  |
|  |  |  |  |  |  | 0.821 | 0.003 | 3.906 | 3.699 | 0.000 | -39 | 5 | -44 | left temporal pole |
|  |  | 0.983 |  | 34 | 0.429 | 0.708 | 0.003 | 4.027 | 3.803 | 0.000 | 3 | 62 | 9 | superior frontal gyrus medial segment |
|  |  | 0.920 |  | 67 | 0.264 | 0.734 | 0.003 | 4.001 | 3.781 | 0.000 | -5 | 59 | 8 | superior frontal gyrus medial segment |
|  |  |  |  |  |  | 0.999 | 0.006 | 3.373 | 3.233 | 0.001 | -11 | 53 | 5 |  |
|  |  | 0.947 |  | 56 | 0.307 | 0.777 | 0.003 | 3.956 | 3.742 | 0.000 | 27 | 30 | 53 | right superior frontal gyrus |
|  |  |  |  |  |  | 0.999 | 0.007 | 3.344 | 3.208 | 0.001 | 21 | 33 | 48 |  |
|  |  | 0.992 |  | 24 | 0.511 | 0.793 | 0.003 | 3.938 | 3.727 | 0.000 | 56 | -66 | -12 | right inferior temporal gyrus |
|  |  | 0.996 |  | 18 | 0.575 | 0.887 | 0.004 | 3.817 | 3.623 | 0.000 | -11 | -87 | -8 |  |
|  |  | 0.989 |  | 28 | 0.475 | 0.890 | 0.004 | 3.812 | 3.618 | 0.000 | 35 | 44 | 39 | right middle frontall gyrus |
|  |  | 0.963 |  | 48 | 0.345 | 0.898 | 0.004 | 3.799 | 3.607 | 0.000 | 20 | 51 | 33 | right superior frontal gyrus |
|  |  | 0.991 |  | 26 | 0.493 | 0.922 | 0.004 | 3.757 | 3.571 | 0.000 | 35 | -15 | -12 |  |
|  |  | 0.799 |  | 104 | 0.168 | 0.924 | 0.004 | 3.754 | 3.568 | 0.000 | 11 | -90 | -15 | right lingual gyrus |
|  |  | 0.499 |  | 186 | 0.072 | 0.967 | 0.004 | 3.643 | 3.472 | 0.000 | -9 | -69 | -32 | left cerebellum exterior |
|  |  |  |  |  |  | 0.991 | 0.005 | 3.518 | 3.362 | 0.000 | -17 | -75 | -26 |  |
|  |  | 0.980 |  | 37 | 0.408 | 0.969 | 0.004 | 3.636 | 3.466 | 0.000 | 14 | 60 | 29 | right superior frontal gyrus |
|  |  | 0.999 |  | 10 | 0.688 | 0.974 | 0.005 | 3.618 | 3.450 | 0.000 | -62 | -17 | -8 |  |
|  |  | 0.965 |  | 47 | 0.350 | 0.979 | 0.005 | 3.597 | 3.431 | 0.000 | -18 | -78 | -42 | left cerebellum exterior |
|  |  | 0.976 |  | 40 | 0.389 | 0.980 | 0.005 | 3.592 | 3.427 | 0.000 | 0 | -47 | -27 | cerebellar vermal lobule I-V |
|  |  | 0.996 |  | 17 | 0.587 | 0.981 | 0.005 | 3.588 | 3.423 | 0.000 | 11 | 15 | -26 |  |
|  |  | 0.994 |  | 22 | 0.531 | 0.982 | 0.005 | 3.578 | 3.414 | 0.000 | 15 | -36 | 8 |  |
|  |  | 0.994 |  | 22 | 0.531 | 0.984 | 0.005 | 3.571 | 3.408 | 0.000 | -17 | -95 | 27 |  |
|  |  | 0.995 |  | 19 | 0.563 | 0.985 | 0.005 | 3.560 | 3.399 | 0.000 | 18 | -80 | 47 |  |
|  |  | 0.986 |  | 32 | 0.444 | 0.990 | 0.005 | 3.521 | 3.364 | 0.000 | -26 | -3 | -39 | left entorhinal area |
|  |  | 0.998 |  | 11 | 0.671 | 0.991 | 0.005 | 3.516 | 3.360 | 0.000 | -39 | 0 | 45 |  |
|  |  | 0.999 |  | 10 | 0.688 | 0.992 | 0.005 | 3.509 | 3.354 | 0.000 | 15 | 63 | -21 |  |
|  |  | 0.999 |  | 7 | 0.744 | 0.993 | 0.005 | 3.492 | 3.339 | 0.000 | -54 | -50 | 45 |  |
|  |  | 0.925 |  | 65 | 0.272 | 0.994 | 0.005 | 3.486 | 3.334 | 0.000 | -39 | -72 | -47 | left cerebellum exterior |
|  |  |  |  |  |  | 1.000 | 0.008 | 3.261 | 3.133 | 0.001 | -29 | -77 | -45 |  |
|  |  | 0.996 |  | 17 | 0.587 | 0.994 | 0.005 | 3.486 | 3.334 | 0.000 | -45 | -8 | -15 |  |
|  |  | 0.999 |  | 9 | 0.705 | 0.994 | 0.006 | 3.481 | 3.330 | 0.000 | 57 | -32 | 51 |  |
|  |  | 0.991 |  | 26 | 0.493 | 0.994 | 0.006 | 3.481 | 3.329 | 0.000 | -29 | 57 | -2 | left middle frontal gyrus |
|  |  | 0.998 |  | 13 | 0.640 | 0.995 | 0.006 | 3.473 | 3.323 | 0.000 | 12 | 45 | 50 |  |
|  |  | 0.997 |  | 16 | 0.599 | 0.995 | 0.006 | 3.463 | 3.313 | 0.000 | -41 | 30 | -18 |  |
|  |  | 0.995 |  | 20 | 0.552 | 0.995 | 0.006 | 3.462 | 3.313 | 0.000 | -21 | -26 | 56 |  |
|  |  | 0.788 |  | 107 | 0.162 | 0.996 | 0.006 | 3.459 | 3.309 | 0.000 | 20 | -80 | -41 | right cerebellum exterior |
|  |  | 0.999 |  | 5 | 0.790 | 0.997 | 0.006 | 3.434 | 3.288 | 0.001 | -26 | -89 | -14 |  |
|  |  | 0.997 |  | 15 | 0.612 | 0.997 | 0.006 | 3.426 | 3.281 | 0.001 | 32 | 50 | 27 |  |
|  |  | 0.994 |  | 21 | 0.541 | 0.997 | 0.006 | 3.425 | 3.279 | 0.001 | 9 | -60 | -41 |  |
|  |  | 0.999 |  | 6 | 0.766 | 0.997 | 0.006 | 3.420 | 3.275 | 0.001 | 21 | 65 | 12 |  |
|  |  | 0.998 |  | 13 | 0.640 | 0.998 | 0.006 | 3.410 | 3.267 | 0.001 | -57 | -47 | 38 |  |
|  |  | 0.996 |  | 17 | 0.587 | 0.998 | 0.006 | 3.406 | 3.263 | 0.001 | -50 | -53 | -21 |  |
|  |  | 0.999 |  | 5 | 0.790 | 0.998 | 0.006 | 3.404 | 3.261 | 0.001 | -50 | 27 | 23 |  |
|  |  | 0.999 |  | 6 | 0.766 | 0.998 | 0.006 | 3.384 | 3.244 | 0.001 | 35 | 63 | -5 |  |
|  |  | 1.000 |  | 4 | 0.816 | 0.998 | 0.006 | 3.383 | 3.243 | 0.001 | -18 | -56 | 59 |  |
|  |  | 0.988 |  | 30 | 0.459 | 0.999 | 0.007 | 3.345 | 3.208 | 0.001 | -33 | -62 | -33 | left cerebellum exterior |
|  |  | 1.000 |  | 3 | 0.846 | 0.999 | 0.007 | 3.341 | 3.206 | 0.001 | -53 | -26 | 2 |  |
|  |  | 0.999 |  | 9 | 0.705 | 0.999 | 0.007 | 3.337 | 3.202 | 0.001 | 15 | 11 | 0 |  |
|  |  | 0.999 |  | 6 | 0.766 | 0.999 | 0.007 | 3.324 | 3.190 | 0.001 | 51 | -66 | 36 |  |
|  |  | 0.999 |  | 6 | 0.766 | 0.999 | 0.007 | 3.319 | 3.186 | 0.001 | 5 | 53 | 35 |  |
|  |  | 0.998 |  | 11 | 0.671 | 1.000 | 0.007 | 3.311 | 3.179 | 0.001 | -24 | 48 | 6 |  |
|  |  | 1.000 |  | 3 | 0.846 | 1.000 | 0.007 | 3.299 | 3.168 | 0.001 | -12 | -11 | 65 |  |
|  |  | 0.999 |  | 9 | 0.705 | 1.000 | 0.007 | 3.296 | 3.165 | 0.001 | -48 | -53 | -44 |  |
|  |  | 1.000 |  | 2 | 0.880 | 1.000 | 0.007 | 3.295 | 3.165 | 0.001 | -42 | -42 | -24 |  |
|  |  | 1.000 |  | 2 | 0.880 | 1.000 | 0.007 | 3.277 | 3.148 | 0.001 | 60 | -56 | 33 |  |
|  |  | 1.000 |  | 3 | 0.846 | 1.000 | 0.008 | 3.265 | 3.137 | 0.001 | 24 | 20 | 53 |  |
|  |  | 1.000 |  | 4 | 0.816 | 1.000 | 0.008 | 3.257 | 3.130 | 0.001 | 35 | -71 | 50 |  |
|  |  | 0.999 |  | 6 | 0.766 | 1.000 | 0.008 | 3.253 | 3.127 | 0.001 | 12 | -66 | -17 |  |
|  |  | 1.000 |  | 1 | 0.923 | 1.000 | 0.008 | 3.250 | 3.124 | 0.001 | 50 | 48 | -8 |  |
|  |  | 1.000 |  | 1 | 0.923 | 1.000 | 0.008 | 3.244 | 3.119 | 0.001 | -33 | 36 | 23 |  |
|  |  | 1.000 |  | 1 | 0.923 | 1.000 | 0.008 | 3.242 | 3.116 | 0.001 | 26 | -15 | -12 |  |
|  |  | 1.000 |  | 1 | 0.923 | 1.000 | 0.008 | 3.240 | 3.115 | 0.001 | -39 | 32 | 26 |  |
|  |  | 1.000 |  | 3 | 0.846 | 1.000 | 0.008 | 3.240 | 3.115 | 0.001 | 33 | -51 | -45 |  |
|  |  | 1.000 |  | 1 | 0.923 | 1.000 | 0.008 | 3.233 | 3.109 | 0.001 | 32 | -78 | -15 |  |
|  |  | 1.000 |  | 1 | 0.923 | 1.000 | 0.008 | 3.230 | 3.106 | 0.001 | -47 | -20 | -2 |  |
|  |  | 1.000 |  | 3 | 0.846 | 1.000 | 0.008 | 3.230 | 3.106 | 0.001 | -24 | -63 | -50 |  |
|  |  | 1.000 |  | 3 | 0.846 | 1.000 | 0.008 | 3.225 | 3.102 | 0.001 | -8 | 33 | 17 |  |
|  |  | 1.000 |  | 1 | 0.923 | 1.000 | 0.008 | 3.221 | 3.098 | 0.001 | 33 | 6 | -14 |  |
|  |  | 1.000 |  | 1 | 0.923 | 1.000 | 0.008 | 3.217 | 3.094 | 0.001 | -8 | -60 | -42 |  |
|  |  | 1.000 |  | 1 | 0.923 | 1.000 | 0.008 | 3.217 | 3.094 | 0.001 | -48 | -18 | -3 |  |
|  |  | 1.000 |  | 1 | 0.923 | 1.000 | 0.008 | 3.214 | 3.092 | 0.001 | -59 | -44 | 26 |  |

**Supplementary Table 3.** Results of the VBM analyses for visual hallucinations in *C9orf72* expansion carriers

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Set-level |  |  | Cluster-level |  |  |  | Peak-level |  |  |  | MNI coordinates | | | Label |
| p | c | p(FWE-corr) | p(FDR-corr) | equivk | p(unc) | p(FWE-corr) | p(FDR-corr) | T | equivZ | p(unc) | x,y,z {mm} | | |  |
| 0.99 | 2.000 | 0.998 |  | 14 | 0.617 | 0.858 | 0.993 | 3.934 | 3.672 | 0.000 | -12 | -93 | 15 | left occipital pole |
|  |  | 0.944 |  | 57 | 0.292 | 0.970 | 0.993 | 3.698 | 3.476 | 0.000 | -21 | -62 | 41 | left superior parietal lobule |
|  |  |  |  |  |  | 0.995 | 0.993 | 3.529 | 3.332 | 0.000 | -27 | -66 | 38 | left angular gyrus |

**Supplementary Table 4.** Results of the VBM analyses forvisual hallucinations in *MAPT* mutation carriers

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Set-level |  |  | Cluster-level |  |  |  | Peak-level |  |  |  | MNI coordinates | | | Label |
| p | c | p(FWE-corr) | p(FDR-corr) | equivk | p(unc) | p(FWE-corr) | p(FDR-corr) | T | equivZ | p(unc) | x,y,z {mm} | | |  |
| 0.029 | 19.000 | 0.810 |  | 94 | 0.143 | 0.403 | 0.246 | 5.011 | 4.154 | 0.000 | -6 | -57 | 0 | left lingual gyrus |
|  |  | 0.056 |  | 423 | 0.005 | 0.453 | 0.26 | 4.937 | 4.110 | 0.000 | -6 | -32 | 66 | precentral gyrus medial segment |
|  |  |  |  |  |  | 0.504 | 0.246 | 4.865 | 4.065 | 0.000 | 0 | -26 | 66 | precentral gyrus medial segment |
|  |  | 0.992 |  | 28 | 0.420 | 0.789 | 0.246 | 4.479 | 3.821 | 0.000 | -36 | -72 | 48 | left angular gyrus |
|  |  | 0.973 |  | 44 | 0.310 | 0.965 | 0.312 | 4.099 | 3.567 | 0.000 | 45 | -62 | -20 | right fusiform gyrus |
|  |  | 1.000 |  | 8 | 0.686 | 0.983 | 0.329 | 3.997 | 3.497 | 0.000 | 38 | -32 | 69 |  |
|  |  | 0.998 |  | 18 | 0.524 | 0.985 | 0.335 | 3.985 | 3.488 | 0.000 | 48 | -53 | -48 |  |
|  |  | 0.998 |  | 18 | 0.524 | 0.985 | 0.336 | 3.981 | 3.485 | 0.000 | 21 | 21 | 63 |  |
|  |  | 0.999 |  | 13 | 0.594 | 0.991 | 0.360 | 3.926 | 3.447 | 0.000 | 23 | 3 | 63 |  |
|  |  | 0.985 |  | 36 | 0.359 | 0.992 | 0.369 | 3.903 | 3.431 | 0.000 | 3 | -2 | 59 | supplementary motor cortex |
|  |  | 0.992 |  | 29 | 0.411 | 0.993 | 0.369 | 3.902 | 3.430 | 0.000 | 33 | -6 | 62 | right precentral gyrus |
|  |  | 0.999 |  | 15 | 0.564 | 0.998 | 0.416 | 3.773 | 3.339 | 0.000 | 57 | -48 | 24 |  |
|  |  | 1.000 |  | 2 | 0.861 | 0.999 | 0.417 | 3.751 | 3.323 | 0.000 | 51 | 41 | 14 |  |
|  |  | 1.000 |  | 6 | 0.733 | 0.999 | 0.417 | 3.751 | 3.322 | 0.000 | 35 | -17 | 53 |  |
|  |  | 0.998 |  | 17 | 0.537 | 0.999 | 0.421 | 3.742 | 3.316 | 0.000 | 5 | -59 | 5 |  |
|  |  | 0.998 |  | 17 | 0.537 | 0.999 | 0.422 | 3.734 | 3.310 | 0.000 | 39 | -78 | -17 |  |
|  |  | 1.000 |  | 4 | 0.789 | 0.999 | 0.422 | 3.720 | 3.300 | 0.000 | 5 | 6 | 71 |  |
|  |  | 1.000 |  | 3 | 0.822 | 0.999 | 0.423 | 3.677 | 3.269 | 0.001 | 50 | -69 | 39 |  |
|  |  | 1.000 |  | 2 | 0.861 | 1.000 | 0.423 | 3.489 | 3.131 | 0.001 | 15 | 5 | 63 |  |
|  |  | 1.000 |  | 1 | 0.910 | 1.000 | 0.423 | 3.459 | 3.108 | 0.001 | 41 | 41 | 36 |  |

**Supplementary Table 5.** Results of the VBM analyses forauditory hallucinations in *GRN* mutation carriers

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Set-level |  |  | Cluster-level |  |  |  |  | Peak-level |  | |  | MNI coordinates | | | Label |
| p | c | p(FWE-corr) | p(FDR-corr) | equivk | p(unc) | p(FWE-corr) | p(FDR-corr) | T | equivZ | p(unc) | | x,y,z {mm} | | |  |
| 0.000 | 63.00 | 0.000 |  | 29119 | 0.000 | 0.000 | 0.000 | 6.496 | 5.718 | | 0.000 | -39 | -3 | 4.5 | left anterior insula |
|  |  |  |  |  |  | 0.001 | 0.000 | 6.146 | 5.469 | | 0.000 | -16.5 | -25.5 | 3 | left thalamus proper |
|  |  |  |  |  |  | 0.004 | 0.000 | 5.807 | 5.222 | | 0.000 | -42 | 12 | 49.5 | left middle frontal gyrus |
|  |  | 0.545 |  | 175 | 0.085 | 0.145 | 0.002 | 4.711 | 4.371 | | 0.000 | -22.5 | 48 | 34.5 | left superior frontal gyrus |
|  |  |  |  |  |  | 0.896 | 0.005 | 3.792 | 3.601 | | 0.000 | -27 | 39 | 34 | left middle frontal gyrus |
|  |  | 0.915 |  | 69 | 0.266 | 0.580 | 0.003 | 4.141 | 3.899 | | 0.000 | -52.5 | -72 | 7.5 | left inferior occipital gyrus |
|  |  | 0.864 |  | 86 | 0.215 | 0.602 | 0.003 | 4.120 | 3.882 | | 0.000 | 7.5 | 25.5 | 63 | right superior frontal gyrus |
|  |  | 0.471 |  | 198 | 0.069 | 0.664 | 0.003 | 4.060 | 3.831 | | 0.000 | -24 | 58.5 | 15 | left superior frontal gyrus |
|  |  | 0.886 |  | 79 | 0.234 | 0.732 | 0.003 | 3.992 | 3.773 | | 0.000 | -39 | 4.5 | -45 | left temporal pole |
|  |  | 0.992 |  | 24 | 0.519 | 0.741 | 0.004 | 3.983 | 3.766 | | 0.000 | -48 | -1.5 | 54 | left precentral gyrus |
|  |  | 0.871 |  | 84 | 0.221 | 0.826 | 0.004 | 3.888 | 3.684 | | 0.000 | -63 | -31.5 | 1.5 | left superior temporal gyrus |
|  |  | 0.995 |  | 19 | 0.571 | 0.847 | 0.004 | 3.862 | 3.662 | | 0.000 | 34.500 | 43.500 | 39.000 |  |
|  |  | 0.915 |  | 69 | 0.266 | 0.862 | 0.004 | 3.842 | 3.644 | | 0.000 | -46.500 | -49.500 | -42.000 | left cerebellum exterior |
|  |  | 0.999 |  | 6 | 0.771 | 0.885 | 0.005 | 3.809 | 3.616 | | 0.000 | 27.000 | 30.000 | 52.500 |  |
|  |  | 0.987 |  | 30 | 0.467 | 0.887 | 0.005 | 3.806 | 3.613 | | 0.000 | -3.000 | 46.500 | 16.500 | superior frontal gyrus medial segment |
|  |  | 0.983 |  | 34 | 0.437 | 0.911 | 0.005 | 3.766 | 3.579 | | 0.000 | -22.500 | -76.500 | -15.000 | left occipital fusifrom gyrus |
|  |  | 0.003 |  | 1006 | 0.000 | 0.923 | 0.005 | 3.744 | 3.560 | | 0.000 | 27.000 | -57.000 | -34.500 | right cerebellum exterior |
|  |  |  |  |  |  | 0.934 | 0.005 | 3.722 | 3.541 | | 0.000 | 42.000 | -61.500 | -30.000 |  |
|  |  |  |  |  |  | 0.940 | 0.005 | 3.709 | 3.529 | | 0.000 | 36.000 | -58.500 | -34.500 |  |
|  |  | 0.997 |  | 15 | 0.619 | 0.939 | 0.005 | 3.710 | 3.530 | | 0.000 | -64.500 | -48.000 | 10.500 |  |
|  |  | 0.994 |  | 21 | 0.549 | 0.940 | 0.005 | 3.707 | 3.528 | | 0.000 | 0.000 | -46.500 | -27.000 |  |
|  |  | 0.987 |  | 30 | 0.467 | 0.944 | 0.005 | 3.699 | 3.520 | | 0.000 | -21.000 | -25.500 | 55.500 | left precentral gyrus |
|  |  | 0.995 |  | 18 | 0.582 | 0.957 | 0.006 | 3.664 | 3.490 | | 0.000 | -37.500 | -27.000 | -24.000 |  |
|  |  | 0.995 |  | 19 | 0.571 | 0.965 | 0.006 | 3.641 | 3.470 | | 0.000 | -45.000 | 25.500 | -19.500 |  |
|  |  | 0.969 |  | 44 | 0.374 | 0.970 | 0.006 | 3.621 | 3.453 | | 0.000 | -55.500 | 3.000 | 3.000 | left central operculum |
|  |  | 0.990 |  | 26 | 0.501 | 0.975 | 0.006 | 3.601 | 3.435 | | 0.000 | -52.500 | -61.500 | 0.000 | left middle temporal gyrus |
|  |  | 0.990 |  | 27 | 0.492 | 0.982 | 0.007 | 3.567 | 3.405 | | 0.000 | -58.500 | -60.000 | -13.500 | left inferior temporal gyrus |
|  |  | 0.957 |  | 51 | 0.338 | 0.984 | 0.007 | 3.559 | 3.398 | | 0.000 | -43.500 | 42.000 | 7.500 | left inferior frontal gyrus |
|  |  | 0.999 |  | 8 | 0.730 | 0.987 | 0.007 | 3.536 | 3.377 | | 0.000 | 45.000 | -70.500 | 43.500 |  |
|  |  | 0.994 |  | 21 | 0.549 | 0.989 | 0.007 | 3.519 | 3.363 | | 0.000 | 1.500 | -7.500 | -13.500 |  |
|  |  | 0.992 |  | 24 | 0.519 | 0.990 | 0.007 | 3.513 | 3.358 | | 0.000 | -21.000 | -58.500 | -10.500 | left lingual gyrus |
|  |  | 0.993 |  | 22 | 0.539 | 0.991 | 0.007 | 3.507 | 3.352 | | 0.000 | -9.000 | 60.000 | 28.500 |  |
|  |  | 0.998 |  | 10 | 0.694 | 0.992 | 0.007 | 3.498 | 3.344 | | 0.000 | -63.000 | -18.000 | -7.500 |  |
|  |  | 0.991 |  | 25 | 0.510 | 0.993 | 0.008 | 3.487 | 3.334 | | 0.000 | -9.000 | -88.500 | 19.500 |  |
|  |  | 0.994 |  | 21 | 0.549 | 0.993 | 0.008 | 3.479 | 3.327 | | 0.000 | -24.000 | -37.500 | -15.000 |  |
|  |  | 1.000 |  | 4 | 0.820 | 0.994 | 0.008 | 3.468 | 3.318 | | 0.000 | 1.500 | 45.000 | 30.000 |  |
|  |  | 0.994 |  | 20 | 0.560 | 0.994 | 0.008 | 3.468 | 3.317 | | 0.000 | 7.500 | -51.000 | 69.000 |  |
|  |  | 0.998 |  | 13 | 0.647 | 0.994 | 0.008 | 3.464 | 3.315 | | 0.000 | 34.500 | -70.500 | 49.500 |  |
|  |  | 0.999 |  | 8 | 0.730 | 0.995 | 0.008 | 3.460 | 3.311 | | 0.000 | -63.000 | -13.500 | 9.000 |  |
|  |  | 0.998 |  | 12 | 0.662 | 0.996 | 0.008 | 3.446 | 3.298 | | 0.000 | 52.500 | 7.500 | 21.000 |  |
|  |  | 1.000 |  | 4 | 0.820 | 0.996 | 0.008 | 3.432 | 3.286 | | 0.001 | 4.500 | 63.000 | 21.000 |  |
|  |  | 0.998 |  | 13 | 0.647 | 0.997 | 0.009 | 3.414 | 3.270 | | 0.001 | -24.000 | -16.500 | -24.000 |  |
|  |  | 0.999 |  | 6 | 0.771 | 0.997 | 0.009 | 3.409 | 3.266 | | 0.001 | -4.500 | 58.500 | 9.000 |  |
|  |  | 0.979 |  | 37 | 0.417 | 0.998 | 0.009 | 3.402 | 3.259 | | 0.001 | -24.000 | 49.500 | 6.000 |  |
|  |  | 0.998 |  | 12 | 0.662 | 0.998 | 0.009 | 3.400 | 3.258 | | 0.001 | 9.000 | -61.500 | -37.500 |  |
|  |  | 0.999 |  | 8 | 0.730 | 0.998 | 0.009 | 3.393 | 3.251 | | 0.001 | -12.000 | -85.500 | -9.000 |  |
|  |  | 0.996 |  | 16 | 0.606 | 0.998 | 0.009 | 3.389 | 3.248 | | 0.001 | -10.500 | 52.500 | 27.000 |  |
|  |  | 0.999 |  | 8 | 0.730 | 0.998 | 0.009 | 3.387 | 3.246 | | 0.001 | 40.500 | -70.500 | -49.500 |  |
|  |  | 0.999 |  | 6 | 0.771 | 0.998 | 0.009 | 3.370 | 3.231 | | 0.001 | -63.000 | -28.500 | 24.000 |  |
|  |  | 0.999 |  | 6 | 0.771 | 0.999 | 0.010 | 3.348 | 3.211 | | 0.001 | -3.000 | -84.000 | 36.000 |  |
|  |  | 0.987 |  | 30 | 0.467 | 0.999 | 0.010 | 3.334 | 3.199 | | 0.001 | -39.000 | -57.000 | -36.000 | left cerebellum exterior |
|  |  | 1.000 |  | 2 | 0.882 | 0.999 | 0.010 | 3.323 | 3.189 | | 0.001 | -49.500 | -33.000 | 46.500 |  |
|  |  | 0.993 |  | 23 | 0.529 | 0.999 | 0.010 | 3.316 | 3.183 | | 0.001 | 13.500 | -57.000 | -18.000 |  |
|  |  | 0.999 |  | 5 | 0.794 | 0.999 | 0.010 | 3.302 | 3.171 | | 0.001 | 13.500 | -85.500 | 42.000 |  |
|  |  | 0.999 |  | 8 | 0.730 | 1.000 | 0.010 | 3.297 | 3.166 | | 0.001 | 33.000 | 19.500 | 1.500 |  |
|  |  | 1.000 |  | 2 | 0.882 | 1.000 | 0.010 | 3.297 | 3.166 | | 0.001 | -55.500 | -28.500 | 4.500 |  |
|  |  | 1.000 |  | 2 | 0.882 | 1.000 | 0.011 | 3.275 | 3.146 | | 0.001 | -9.000 | -60.000 | -40.500 |  |
|  |  | 1.000 |  | 2 | 0.882 | 1.000 | 0.011 | 3.270 | 3.142 | | 0.001 | 22.500 | -70.500 | -16.500 |  |
|  |  | 0.999 |  | 6 | 0.771 | 1.000 | 0.011 | 3.258 | 3.131 | | 0.001 | -28.500 | -57.000 | -33.000 |  |
|  |  | 1.000 |  | 3 | 0.849 | 1.000 | 0.011 | 3.254 | 3.128 | | 0.001 | -10.500 | -1.500 | -13.500 |  |
|  |  | 1.000 |  | 3 | 0.849 | 1.000 | 0.011 | 3.251 | 3.125 | | 0.001 | 18.000 | -10.500 | 73.500 |  |
|  |  | 1.000 |  | 1 | 0.924 | 1.000 | 0.011 | 3.241 | 3.116 | | 0.001 | -9.000 | -69.000 | -31.500 |  |
|  |  | 1.000 |  | 1 | 0.924 | 1.000 | 0.011 | 3.240 | 3.115 | | 0.001 | -36.000 | -39.000 | 46.500 |  |
|  |  | 1.000 |  | 2 | 0.882 | 1.000 | 0.011 | 3.236 | 3.111 | | 0.001 | -6.000 | -88.500 | 15.000 |  |
|  |  | 1.000 |  | 1 | 0.924 | 1.000 | 0.012 | 3.234 | 3.109 | | 0.001 | -28.500 | -88.500 | 24.000 |  |
|  |  | 1.000 |  | 1 | 0.924 | 1.000 | 0.012 | 3.232 | 3.107 | | 0.001 | 57.000 | -31.500 | 51.000 |  |
|  |  | 1.000 |  | 1 | 0.924 | 1.000 | 0.012 | 3.218 | 3.095 | | 0.001 | -54.000 | 3.000 | 10.500 |  |
|  |  | 1.000 |  | 1 | 0.924 | 1.000 | 0.012 | 3.217 | 3.094 | | 0.001 | 10.500 | -91.500 | -13.500 |  |

**Supplementary Table 6.** Results of the VBM analyses forauditory hallucinations in *C9orf72* expansion carriers

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Set-level |  |  | Cluster-level |  |  |  | Peak-level |  |  |  | MNI coordinates | | | Label |
| p | c | p(FWE-corr) | p(FDR-corr) | equivk | p(unc) | p(FWE-corr) | p(FDR-corr) | T | equivZ | p(unc) | x,y,z {mm} | | |  |
| 1.000 | 1.000 | 0.999 |  | 11 | 0.663 | 0.977 | 0.825 | 3.671 | 3.453 | 0.000 | -38 | 42 | 14 | left middle frontal gyrus |

**Supplementary Table 7.** Results of the VBM analyses forauditory hallucinations in *MAPT* mutation carriers

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Set-level |  |  | Cluster-level |  | |  |  | Peak-level |  |  |  | MNI coordinates | | | Label |
| p | c | p(FWE-corr) | p(FDR-corr) | equivk | p(unc) | | p(FWE-corr) | p(FDR-corr) | T | equivZ | p(unc) |  | x,y,z{mm} |  |  |
| 0.990 | 5.000 | 0.999 |  | 14 | 0.580 | | 0.999 | 0.439 | 3.702 | 3.287 | 0.001 | 62 | -54 | 29 | right angular gyrus |
|  |  | 1.000 |  | 2 | 0.862 | | 1.000 | 0.439 | 3.567 | 3.189 | 0.001 | 0 | 45 | 23 |  |
|  |  | 1.000 |  | 2 | 0.862 | | 1.000 | 0.439 | 3.538 | 3.167 | 0.001 | 6 | -14 | -3 |  |
|  |  | 1.000 |  | 2 | | 0.862 | 1.000 | 0.439 | 3.533 | 3.163 | 0.001 | 0 | -6 | 12 |  |
|  |  | 1.000 |  | 2 | | 0.862 | 1.000 | 0.439 | 3.483 | 3.126 | 0.001 | 2 | -32 | -17 |  |

**Supplementary Table 8.** Results of the VBM analyses fortactile hallucinations in *GRN* mutation carriers

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Set-level |  |  | Cluster-level |  |  |  | Peak-level |  |  |  | MNI coordinates | | | label |
| p | c | p(FWE-corr) | p(FDR-corr) | equivk | p(unc) | p(FWE-corr) | p(FDR-corr) | T | equivZ | p(unc) | x,y,z {mm} | | |  |
| 0.000 | 63.000 | 0.000 |  | 29119 | 0.000 | 0.000 | 0.000 | 6.496 | 5.718 | 0.000 | -39 | -3 | 4.5 | Left anterior insula |
|  |  |  |  |  |  | 0.001 | 0.000 | 6.146 | 5.469 | 0.000 | -16.5 | -25.5 | 3 | left thalamus proper |
|  |  |  |  |  |  | 0.004 | 0.000 | 5.807 | 5.222 | 0.000 | -42 | 12 | 49.5 | left middle frontal gyrus |
|  |  | 0.545 |  | 175 | 0.085 | 0.145 | 0.002 | 4.711 | 4.371 | 0.000 | -22.5 | 48 | 34.5 | left superior frontal gyrus |
|  |  |  |  |  |  | 0.896 | 0.005 | 3.792 | 3.601 | 0.000 | -27 | 39 | 34.5 |  |
|  |  | 0.915 |  | 69 | 0.266 | 0.580 | 0.003 | 4.141 | 3.899 | 0.000 | -52.5 | -72 | 7.5 | left inferior occipital gyrus |
|  |  | 0.864 |  | 86 | 0.215 | 0.602 | 0.003 | 4.120 | 3.882 | 0.000 | 7.5 | 25.5 | 63 |  |
|  |  | 0.471 |  | 198 | 0.069 | 0.664 | 0.003 | 4.060 | 3.831 | 0.000 | -24 | 58.5 | 15 | left superior frontal gyrus |
|  |  | 0.886 |  | 79 | 0.234 | 0.732 | 0.003 | 3.992 | 3.773 | 0.000 | -39 | 4.5 | -45 | left temporal pole |
|  |  | 0.992 |  | 24 | 0.519 | 0.741 | 0.004 | 3.983 | 3.766 | 0.000 | -48 | -1.5 | 54 |  |
|  |  | 0.871 |  | 84 | 0.221 | 0.826 | 0.004 | 3.888 | 3.684 | 0.000 | -63 | -31.5 | 1.5 | left superior temporal gyrus |
|  |  | 0.995 |  | 19 | 0.571 | 0.847 | 0.004 | 3.862 | 3.662 | 0.000 | 34.5 | 43.5 | 39 |  |
|  |  | 0.915 |  | 69 | 0.266 | 0.862 | 0.004 | 3.842 | 3.644 | 0.000 | -46.5 | -49.5 | -42 | left cerebellum exterior |
|  |  | 0.999 |  | 6 | 0.771 | 0.885 | 0.005 | 3.809 | 3.616 | 0.000 | 27 | 30 | 52.5 |  |
|  |  | 0.987 |  | 30 | 0.467 | 0.887 | 0.005 | 3.806 | 3.613 | 0.000 | -3 | 46.5 | 16.5 |  |
|  |  | 0.983 |  | 34 | 0.437 | 0.911 | 0.005 | 3.766 | 3.579 | 0.000 | -22.5 | -76.5 | -15 | left occipital fusifrom gyrus |
|  |  | 0.003 |  | 1006 | 0.000 | 0.923 | 0.005 | 3.744 | 3.560 | 0.000 | 27 | -57 | -34.5 | right cerebellum exterior |
|  |  |  |  |  |  | 0.934 | 0.005 | 3.722 | 3.541 | 0.000 | 42 | -61.5 | -30 | right cerebellum exterior |
|  |  |  |  |  |  | 0.940 | 0.005 | 3.709 | 3.529 | 0.000 | 36 | -58.5 | -34.5 | right cerebellum exterior |
|  |  | 0.997 |  | 15 | 0.619 | 0.939 | 0.005 | 3.710 | 3.530 | 0.000 | -64.5 | -48 | 10.5 |  |
|  |  | 0.994 |  | 21 | 0.549 | 0.940 | 0.005 | 3.707 | 3.528 | 0.000 | 0.0 | -46.5 | -27 |  |
|  |  | 0.987 |  | 30 | 0.467 | 0.944 | 0.005 | 3.699 | 3.520 | 0.000 | -21 | -25.5 | 55.5 |  |
|  |  | 0.995 |  | 18 | 0.582 | 0.957 | 0.006 | 3.664 | 3.490 | 0.000 | -37.5 | -27 | -24 |  |
|  |  | 0.995 |  | 19 | 0.571 | 0.965 | 0.006 | 3.641 | 3.470 | 0.000 | -45 | 25.5 | -19.5 |  |
|  |  | 0.969 |  | 44 | 0.374 | 0.970 | 0.006 | 3.621 | 3.453 | 0.000 | -55.500 | 3.000 | 3.000 | left central operculum |
|  |  | 0.990 |  | 26 | 0.501 | 0.975 | 0.006 | 3.601 | 3.435 | 0.000 | -52.500 | -61.500 | 0.000 |  |
|  |  | 0.990 |  | 27 | 0.492 | 0.982 | 0.007 | 3.567 | 3.405 | 0.000 | -58.500 | -60.000 | -13.500 |  |
|  |  | 0.957 |  | 51 | 0.338 | 0.984 | 0.007 | 3.559 | 3.398 | 0.000 | -43.500 | 42.000 | 7.500 | left inferior frontal gyrus |
|  |  | 0.999 |  | 8 | 0.730 | 0.987 | 0.007 | 3.536 | 3.377 | 0.000 | 45.000 | -70.500 | 43.500 |  |
|  |  | 0.994 |  | 21 | 0.549 | 0.989 | 0.007 | 3.519 | 3.363 | 0.000 | 1.500 | -7.500 | -13.500 |  |
|  |  | 0.992 |  | 24 | 0.519 | 0.990 | 0.007 | 3.513 | 3.358 | 0.000 | -21.000 | -58.500 | -10.500 |  |
|  |  | 0.993 |  | 22 | 0.539 | 0.991 | 0.007 | 3.507 | 3.352 | 0.000 | -9.000 | 60.000 | 28.500 |  |
|  |  | 0.998 |  | 10 | 0.694 | 0.992 | 0.007 | 3.498 | 3.344 | 0.000 | -63.000 | -18.000 | -7.500 |  |
|  |  | 0.991 |  | 25 | 0.510 | 0.993 | 0.008 | 3.487 | 3.334 | 0.000 | -9.000 | -88.500 | 19.500 | left cuneus |
|  |  | 0.994 |  | 21 | 0.549 | 0.993 | 0.008 | 3.479 | 3.327 | 0.000 | -24.000 | -37.500 | -15.000 |  |
|  |  | 1.000 |  | 4 | 0.820 | 0.994 | 0.008 | 3.468 | 3.318 | 0.000 | 1.500 | 45.000 | 30.000 |  |
|  |  | 0.994 |  | 20 | 0.560 | 0.994 | 0.008 | 3.468 | 3.317 | 0.000 | 7.500 | -51.000 | 69.000 |  |
|  |  | 0.998 |  | 13 | 0.647 | 0.994 | 0.008 | 3.464 | 3.315 | 0.000 | 34.500 | -70.500 | 49.500 |  |
|  |  | 0.999 |  | 8 | 0.730 | 0.995 | 0.008 | 3.460 | 3.311 | 0.000 | -63.000 | -13.500 | 9.000 |  |
|  |  | 0.998 |  | 12 | 0.662 | 0.996 | 0.008 | 3.446 | 3.298 | 0.000 | 52.500 | 7.500 | 21.000 |  |
|  |  | 1.000 |  | 4 | 0.820 | 0.996 | 0.008 | 3.432 | 3.286 | 0.001 | 4.500 | 63.000 | 21.000 |  |
|  |  | 0.998 |  | 13 | 0.647 | 0.997 | 0.009 | 3.414 | 3.270 | 0.001 | -24.000 | -16.500 | -24.000 |  |
|  |  | 0.999 |  | 6 | 0.771 | 0.997 | 0.009 | 3.409 | 3.266 | 0.001 | -4.500 | 58.500 | 9.000 |  |
|  |  | 0.979 |  | 37 | 0.417 | 0.998 | 0.009 | 3.402 | 3.259 | 0.001 | -24.000 | 49.500 | 6.000 |  |
|  |  | 0.998 |  | 12 | 0.662 | 0.998 | 0.009 | 3.400 | 3.258 | 0.001 | 9.000 | -61.500 | -37.500 |  |
|  |  | 0.999 |  | 8 | 0.730 | 0.998 | 0.009 | 3.393 | 3.251 | 0.001 | -12.000 | -85.500 | -9.000 |  |
|  |  | 0.996 |  | 16 | 0.606 | 0.998 | 0.009 | 3.389 | 3.248 | 0.001 | -10.500 | 52.500 | 27.000 |  |
|  |  | 0.999 |  | 8 | 0.730 | 0.998 | 0.009 | 3.387 | 3.246 | 0.001 | 40.500 | -70.500 | -49.500 |  |
|  |  | 0.999 |  | 6 | 0.771 | 0.998 | 0.009 | 3.370 | 3.231 | 0.001 | -63.000 | -28.500 | 24.000 |  |
|  |  | 0.999 |  | 6 | 0.771 | 0.999 | 0.010 | 3.348 | 3.211 | 0.001 | -3.000 | -84.000 | 36.000 |  |
|  |  | 0.987 |  | 30 | 0.467 | 0.999 | 0.010 | 3.334 | 3.199 | 0.001 | -39.000 | -57.000 | -36.000 | left cerebellum exterior |
|  |  | 1.000 |  | 2 | 0.882 | 0.999 | 0.010 | 3.323 | 3.189 | 0.001 | -49.500 | -33.000 | 46.500 |  |
|  |  | 0.993 |  | 23 | 0.529 | 0.999 | 0.010 | 3.316 | 3.183 | 0.001 | 13.500 | -57.000 | -18.000 |  |
|  |  | 0.999 |  | 5 | 0.794 | 0.999 | 0.010 | 3.302 | 3.171 | 0.001 | 13.500 | -85.500 | 42.000 |  |
|  |  | 0.999 |  | 8 | 0.730 | 1.000 | 0.010 | 3.297 | 3.166 | 0.001 | 33.000 | 19.500 | 1.500 |  |
|  |  | 1.000 |  | 2 | 0.882 | 1.000 | 0.010 | 3.297 | 3.166 | 0.001 | -55.500 | -28.500 | 4.500 |  |
|  |  | 1.000 |  | 2 | 0.882 | 1.000 | 0.011 | 3.275 | 3.146 | 0.001 | -9.000 | -60.000 | -40.500 |  |
|  |  | 1.000 |  | 2 | 0.882 | 1.000 | 0.011 | 3.270 | 3.142 | 0.001 | 22.500 | -70.500 | -16.500 |  |
|  |  | 0.999 |  | 6 | 0.771 | 1.000 | 0.011 | 3.258 | 3.131 | 0.001 | -28.500 | -57.000 | -33.000 |  |
|  |  | 1.000 |  | 3 | 0.849 | 1.000 | 0.011 | 3.254 | 3.128 | 0.001 | -10.500 | -1.500 | -13.500 |  |
|  |  | 1.000 |  | 3 | 0.849 | 1.000 | 0.011 | 3.251 | 3.125 | 0.001 | 18.000 | -10.500 | 73.500 |  |
|  |  | 1.000 |  | 1 | 0.924 | 1.000 | 0.011 | 3.241 | 3.116 | 0.001 | -9.000 | -69.000 | -31.500 |  |
|  |  | 1.000 |  | 1 | 0.924 | 1.000 | 0.011 | 3.240 | 3.115 | 0.001 | -36.000 | -39.000 | 46.500 |  |
|  |  | 1.000 |  | 2 | 0.882 | 1.000 | 0.011 | 3.236 | 3.111 | 0.001 | -6.000 | -88.500 | 15.000 |  |
|  |  | 1.000 |  | 1 | 0.924 | 1.000 | 0.012 | 3.234 | 3.109 | 0.001 | -28.500 | -88.500 | 24.000 |  |
|  |  | 1.000 |  | 1 | 0.924 | 1.000 | 0.012 | 3.232 | 3.107 | 0.001 | 57.000 | -31.500 | 51.000 |  |
|  |  | 1.000 |  | 1 | 0.924 | 1.000 | 0.012 | 3.218 | 3.095 | 0.001 | -54.000 | 3.000 | 10.500 |  |
|  |  | 1.000 |  | 1 | 0.924 | 1.000 | 0.012 | 3.217 | 3.094 | 0.001 | 10.500 | -91.500 | -13.500 |  |

**Supplementary Table 9.** Results of the VBM analyses fortactile hallucinations in *C9orf72* expansion carriers

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Set-level | |  |  | Cluster-level |  |  |  | Peak-level |  |  |  |  | MNI coordinates |  | Label |
| p | c | | p(FWE-corr) | p(FDR-corr) | equivk | p(unc) | p(FWE-corr) | p(FDR-corr) | T | equivZ | p(unc) |  | x,y,z {mm} |  |  |
| 1.000 | 5 | | 0.979 | 0.590 | 100 | 0.118 | 0.999 | 0.497 | 3.94 | 3.67 | 0.000 | -34 | 10 | 27 | opercular part of the inferior frontal gyrus |
|  |  | | 1.000 | 0.654 | 35 | 0.346 | 1.000 | 0.497 | 3.75 | 3.52 | 0.000 | -36 | -88 | 32 |  |
|  |  | | 1.000 | 0.654 | 29 | 0.392 | 1.000 | 0.497 | 3.75 | 3.52 | 0.000 | -12 | -42 | 4 | posterior cingulate gyrus |
|  |  | | 1.000 | 0.789 | 10 | 0.631 | 1.000 | 0.629 | 3.55 | 3.35 | 0.000 | -38 | 42 | 12 |  |
|  |  | | 1.000 | 0.814 | 3 | 0.814 | 1.000 | 0.878 | 3.31 | 3.15 | 0.001 | -12 | 60 | -22 |  |

**Supplementary Table 10.** Results of the VBM analyses fortactile hallucinations in *MAPT* mutation carriers

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Set-level |  |  | Cluster-level |  |  |  | Peak-level |  |  |  | |  | MNI coordinates |  | Label |
| p | c | p(FWE-corr) | p(FDR-corr) | equivk | p(unc) | p(FWE-corr) | p(FDR-corr) | T | equivZ | p(unc) |  | | x,y,z{mm} |  |  |
| 0.889 | 8 | 0.997 | 0.911 | 19 | 0.514 | 0.979 | 0.875 | 4.02 | 3.51 | 0.000 | -2 | | -62 | 4 | left lingual gyrus |
|  |  | 0.995 | 0.911 | 24 | 0.459 | 0.982 | 0.875 | 4.00 | 3.50 | 0.000 | 33 | | -6 | 60 | right precentral gyrus |
|  |  | 0.983 | 0.911 | 37 | 0.354 | 0.996 | 0.875 | 3.82 | 3.38 | 0.000 | -3 | | -26 | 64 | precentral gyrus medial segment |
|  |  | 1.000 | 0.911 | 5 | 0.761 | 0.997 | 0.875 | 3.80 | 3.36 | 0.000 | 51 | | 40 | 12 | right middle frontal gyrus |
|  |  | 1.000 | 0.911 | 2 | 0.862 | 1.000 | 0.875 | 3.64 | 3.24 | 0.001 | -36 | | -74 | 48 | left angular gyrus |
|  |  | 1.000 | 0.911 | 6 | 0.734 | 1.000 | 0.875 | 3.62 | 3.23 | 0.001 | 4 | | -14 | -3 | right thalamus |
|  |  | 1.000 | 0.911 | 1 | 0.911 | 1.000 | 0.875 | 3.58 | 3.20 | 0.001 | 4 | | -70 | -6 | right lingual gyrus |
|  |  | 1.000 | 0.911 | 1 | 0.911 | 1.000 | 0.935 | 3.47 | 3.12 | 0.001 | 21 | | 21 | 63 | rigth superior frontal gyrus |

**Supplementary Table 11.** Results of the VBM analyses fordelusions in *GRN* mutation carriers

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Set-level |  |  | Cluster-level |  |  |  | Peak-level |  |  |  | MNI coordinates | | | Label |
| p | c | p(FWE-corr) | p(FDR-corr) | equivk | p(unc) | p(FWE-corr) | p(FDR-corr) | T | equivZ | p(unc) | x,y,z {mm} | | |  |
| 0.000 | 90.000 | 0.000 |  | 48419 | 0.000 | 0.000 | 0.000 | 7.023 | 6.079 | 0.000 | -16.500 | -25.500 | 3.000 | left thalamus proper |
|  |  |  |  |  |  | 0.000 | 0.000 | 6.439 | 5.678 | 0.000 | -16.500 | -28.500 | -6.000 | left thalamus proper |
|  |  |  |  |  |  | 0.001 | 0.000 | 6.357 | 5.621 | 0.000 | -39.000 | -3.000 | 4.500 | left anterior insula |
|  |  | 0.100 |  | 418 | 0.011 | 0.030 | 0.000 | 5.220 | 4.775 | 0.000 | -51.000 | -70.500 | 9.000 | left inferior occipital gyrus |
|  |  |  |  |  |  | 0.715 | 0.001 | 4.020 | 3.797 | 0.000 | -52.500 | -61.500 | 0.000 | left middle occipital gyrus |
|  |  |  |  |  |  | 0.995 | 0.004 | 3.473 | 3.322 | 0.000 | -43.500 | -72.000 | 15.000 | left middle occipital gyrus |
|  |  | 0.888 |  | 78 | 0.230 | 0.144 | 0.000 | 4.723 | 4.381 | 0.000 | 34.500 | 43.500 | 39.000 | right middle frontal gyrus |
|  |  | 0.000 |  | 1845 | 0.000 | 0.263 | 0.001 | 4.506 | 4.204 | 0.000 | 34.500 | 18.000 | 0.000 | right anterior insula |
|  |  |  |  |  |  | 0.358 | 0.001 | 4.382 | 4.101 | 0.000 | 43.500 | 13.500 | 6.000 | right frontal operculum |
|  |  |  |  |  |  | 0.827 | 0.002 | 3.898 | 3.693 | 0.000 | 15.000 | 10.500 | 0.000 | right caudate |
|  |  | 0.000 |  | 2381 | 0.000 | 0.267 | 0.001 | 4.500 | 4.199 | 0.000 | 31.500 | -69.000 | -33.000 | right cerebellum exterior |
|  |  |  |  |  |  | 0.560 | 0.001 | 4.171 | 3.925 | 0.000 | 27.000 | -57.000 | -34.500 | right cerebellum exterior |
|  |  |  |  |  |  | 0.567 | 0.001 | 4.164 | 3.919 | 0.000 | 24.000 | -72.000 | -30.000 | right cerebellum exterior |
|  |  | 0.818 |  | 99 | 0.178 | 0.284 | 0.001 | 4.475 | 4.178 | 0.000 | 27.000 | 30.000 | 52.500 | right superior frontal gyrus |
|  |  |  |  |  |  | 0.818 | 0.002 | 3.909 | 3.702 | 0.000 | 25.500 | 19.500 | 54.000 |  |
|  |  | 0.366 |  | 232 | 0.048 | 0.288 | 0.001 | 4.470 | 4.174 | 0.000 | 52.500 | 7.500 | 21.000 | right precentral gyrus |
|  |  |  |  |  |  | 0.905 | 0.002 | 3.788 | 3.597 | 0.000 | 61.500 | 9.000 | 10.500 |  |
|  |  | 0.305 |  | 258 | 0.038 | 0.588 | 0.001 | 4.144 | 3.902 | 0.000 | -45.000 | 42.000 | 7.500 | left inferior frontal gyrus |
|  |  |  |  |  |  | 0.936 | 0.003 | 3.729 | 3.546 | 0.000 | -49.500 | 42.000 | -6.000 |  |
|  |  | 0.983 |  | 34 | 0.429 | 0.655 | 0.001 | 4.079 | 3.847 | 0.000 | -10.500 | -87.000 | -7.500 |  |
|  |  | 0.818 |  | 99 | 0.178 | 0.669 | 0.001 | 4.065 | 3.835 | 0.000 | -3.000 | -45.000 | -25.500 | cerebellar vermal lobule I-V |
|  |  | 0.940 |  | 59 | 0.295 | 0.756 | 0.002 | 3.978 | 3.761 | 0.000 | -22.500 | -25.500 | 54.000 | left precentral gyrus |
|  |  | 0.556 |  | 169 | 0.085 | 0.789 | 0.002 | 3.942 | 3.730 | 0.000 | -57.000 | -61.500 | -10.500 | left inferior temporal gyrus |
|  |  |  |  |  |  | 0.943 | 0.003 | 3.713 | 3.533 | 0.000 | -61.500 | -45.000 | -12.000 | left middle temporal gyrus |
|  |  |  |  |  |  | 0.995 | 0.004 | 3.461 | 3.311 | 0.000 | -57.000 | -54.000 | -4.500 |  |
|  |  | 0.853 |  | 89 | 0.201 | 0.814 | 0.002 | 3.913 | 3.706 | 0.000 | 19.500 | 49.500 | 33.000 | left superior frontal gyrus |
|  |  |  |  |  |  | 0.982 | 0.003 | 3.580 | 3.416 | 0.000 | 12.000 | 49.500 | 30.000 |  |
|  |  | 0.167 |  | 344 | 0.019 | 0.850 | 0.002 | 3.869 | 3.667 | 0.000 | -28.500 | 36.000 | -16.500 | left anterior orbital gyrus |
|  |  |  |  |  |  | 0.976 | 0.003 | 3.611 | 3.444 | 0.000 | -27.000 | 43.500 | -13.500 |  |
|  |  |  |  |  |  | 0.990 | 0.004 | 3.521 | 3.364 | 0.000 | -24.000 | 51.000 | -9.000 |  |
|  |  | 0.553 |  | 170 | 0.084 | 0.865 | 0.002 | 3.848 | 3.650 | 0.000 | -52.500 | -31.500 | 36.000 |  |
|  |  |  |  |  |  | 0.886 | 0.002 | 3.818 | 3.623 | 0.000 | -51.000 | -33.000 | 48.000 | left supramarginal gyrus |
|  |  |  |  |  |  | 1.000 | 0.006 | 3.244 | 3.118 | 0.001 | -37.500 | -28.500 | 39.000 |  |
|  |  | 0.991 |  | 26 | 0.493 | 0.867 | 0.002 | 3.846 | 3.647 | 0.000 | 45.000 | -70.500 | 43.500 |  |
|  |  | 0.959 |  | 50 | 0.335 | 0.887 | 0.002 | 3.817 | 3.623 | 0.000 | 3.000 | 54.000 | -9.000 | right medial frontal cortx |
|  |  | 0.995 |  | 20 | 0.552 | 0.887 | 0.002 | 3.817 | 3.622 | 0.000 | 18.000 | -10.500 | 73.500 |  |
|  |  | 0.990 |  | 27 | 0.484 | 0.905 | 0.002 | 3.788 | 3.597 | 0.000 | 57.000 | -30.000 | 52.500 |  |
|  |  | 0.197 |  | 320 | 0.023 | 0.910 | 0.002 | 3.779 | 3.590 | 0.000 | -36.000 | 7.500 | -40.500 | left temporal pole |
|  |  |  |  |  |  | 0.952 | 0.003 | 3.690 | 3.512 | 0.000 | -45.000 | 15.000 | -39.000 |  |
|  |  |  |  |  |  | 0.999 | 0.005 | 3.319 | 3.185 | 0.001 | -28.500 | 10.500 | -33.000 |  |
|  |  | 0.949 |  | 55 | 0.312 | 0.912 | 0.002 | 3.776 | 3.587 | 0.000 | 31.500 | 49.500 | 27.000 | right middle frontal gyrus |
|  |  | 0.556 |  | 169 | 0.085 | 0.934 | 0.003 | 3.733 | 3.550 | 0.000 | -24.000 | 48.000 | 6.000 |  |
|  |  |  |  |  |  | 0.991 | 0.004 | 3.517 | 3.361 | 0.000 | -30.000 | 51.000 | 1.500 | left middle frontal gyrus |
|  |  |  |  |  |  | 0.996 | 0.004 | 3.456 | 3.307 | 0.000 | -33.000 | 43.500 | 7.500 |  |
|  |  | 0.728 |  | 123 | 0.136 | 0.936 | 0.003 | 3.728 | 3.546 | 0.000 | -40.500 | -87.000 | 4.500 | left inferior occipital gyrus |
|  |  |  |  |  |  | 0.991 | 0.004 | 3.512 | 3.357 | 0.000 | -36.000 | -84.000 | 16.500 | left middle occipital gyrus |
|  |  | 0.989 |  | 28 | 0.476 | 0.937 | 0.003 | 3.726 | 3.544 | 0.000 | -61.500 | -31.500 | -22.500 |  |
|  |  | 0.971 |  | 43 | 0.372 | 0.948 | 0.003 | 3.701 | 3.522 | 0.000 | -9.000 | -69.000 | -31.500 |  |
|  |  | 0.983 |  | 34 | 0.429 | 0.955 | 0.003 | 3.681 | 3.505 | 0.000 | 10.500 | 19.500 | -10.500 |  |
|  |  | 0.997 |  | 14 | 0.626 | 0.969 | 0.003 | 3.638 | 3.467 | 0.000 | 34.500 | 63.000 | -4.500 |  |
|  |  | 0.991 |  | 26 | 0.493 | 0.973 | 0.003 | 3.621 | 3.452 | 0.000 | 10.500 | 16.500 | -25.500 |  |
|  |  | 0.997 |  | 14 | 0.626 | 0.978 | 0.003 | 3.601 | 3.435 | 0.000 | -45.000 | 25.500 | -19.500 |  |
|  |  | 0.998 |  | 12 | 0.655 | 0.983 | 0.003 | 3.572 | 3.410 | 0.000 | 4.500 | 63.000 | 21.000 |  |
|  |  | 0.999 |  | 10 | 0.688 | 0.983 | 0.003 | 3.572 | 3.410 | 0.000 | 22.500 | 66.000 | 13.500 |  |
|  |  | 0.856 |  | 88 | 0.203 | 0.984 | 0.003 | 3.570 | 3.408 | 0.000 | -42.000 | -40.500 | -22.500 | left fusiform gyrus |
|  |  |  |  |  |  | 0.994 | 0.004 | 3.484 | 3.332 | 0.000 | -49.500 | -51.000 | -21.000 |  |
|  |  | 0.422 |  | 211 | 0.057 | 0.986 | 0.004 | 3.555 | 3.395 | 0.000 | -28.500 | -58.500 | -31.500 | left cerebellum exterior |
|  |  | 0.998 |  | 12 | 0.655 | 0.987 | 0.004 | 3.551 | 3.391 | 0.000 | 12.000 | 61.500 | 30.000 |  |
|  |  | 0.995 |  | 19 | 0.563 | 0.987 | 0.004 | 3.550 | 3.390 | 0.000 | 31.500 | 4.500 | -13.500 |  |
|  |  | 0.971 |  | 43 | 0.372 | 0.987 | 0.004 | 3.549 | 3.389 | 0.000 | 15.000 | -10.500 | -13.500 | right amygdala |
|  |  | 0.992 |  | 25 | 0.502 | 0.988 | 0.004 | 3.539 | 3.381 | 0.000 | -24.000 | -78.000 | -13.500 |  |
|  |  | 0.998 |  | 11 | 0.671 | 0.989 | 0.004 | 3.530 | 3.372 | 0.000 | 4.500 | 60.000 | 7.500 |  |
|  |  | 0.994 |  | 21 | 0.542 | 0.991 | 0.004 | 3.519 | 3.363 | 0.000 | 33.000 | -69.000 | 49.500 |  |
|  |  | 0.996 |  | 17 | 0.587 | 0.993 | 0.004 | 3.491 | 3.339 | 0.000 | -16.500 | -78.000 | -40.500 |  |
|  |  | 0.983 |  | 34 | 0.429 | 0.994 | 0.004 | 3.487 | 3.334 | 0.000 | -3.000 | -16.500 | 73.500 |  |
|  |  | 0.999 |  | 8 | 0.724 | 0.994 | 0.004 | 3.477 | 3.326 | 0.000 | 43.500 | 54.000 | 13.500 |  |
|  |  | 0.998 |  | 13 | 0.640 | 0.995 | 0.004 | 3.464 | 3.314 | 0.000 | -16.500 | -94.500 | 25.500 |  |
|  |  | 0.999 |  | 9 | 0.706 | 0.995 | 0.004 | 3.461 | 3.312 | 0.000 | 15.000 | -34.500 | 7.500 |  |
|  |  | 0.999 |  | 7 | 0.745 | 0.996 | 0.004 | 3.457 | 3.308 | 0.000 | -61.500 | -16.500 | -7.500 |  |
|  |  | 0.999 |  | 9 | 0.706 | 0.996 | 0.004 | 3.456 | 3.307 | 0.000 | -40.500 | -60.000 | 22.500 |  |
|  |  | 0.996 |  | 17 | 0.587 | 0.996 | 0.004 | 3.454 | 3.305 | 0.000 | 10.500 | -7.500 | 64.500 |  |
|  |  | 0.999 |  | 9 | 0.706 | 0.996 | 0.004 | 3.443 | 3.296 | 0.000 | 22.500 | -72.000 | -15.000 |  |
|  |  | 0.994 |  | 21 | 0.542 | 0.996 | 0.004 | 3.441 | 3.294 | 0.000 | -54.000 | -7.500 | -34.500 |  |
|  |  | 0.965 |  | 47 | 0.350 | 0.997 | 0.004 | 3.438 | 3.292 | 0.000 | -48.000 | -52.500 | 24.000 | left supramarginal gyrus |
|  |  | 0.999 |  | 6 | 0.766 | 0.997 | 0.004 | 3.426 | 3.281 | 0.001 | 34.500 | -13.500 | -12.000 |  |
|  |  | 0.992 |  | 24 | 0.511 | 0.997 | 0.005 | 3.422 | 3.277 | 0.001 | -61.500 | -12.000 | 10.500 |  |
|  |  | 0.976 |  | 40 | 0.390 | 0.997 | 0.005 | 3.419 | 3.275 | 0.001 | 39.000 | -70.500 | -49.500 |  |
|  |  | 0.995 |  | 19 | 0.563 | 0.997 | 0.005 | 3.417 | 3.272 | 0.001 | -25.500 | -3.000 | -40.500 |  |
|  |  | 0.997 |  | 16 | 0.599 | 0.998 | 0.005 | 3.408 | 3.265 | 0.001 | 7.500 | -51.000 | 69.000 |  |
|  |  | 0.999 |  | 10 | 0.688 | 0.998 | 0.005 | 3.407 | 3.264 | 0.001 | 12.000 | 46.500 | 48.000 |  |
|  |  | 1.000 |  | 1 | 0.923 | 0.998 | 0.005 | 3.399 | 3.257 | 0.001 | 67.500 | -46.500 | 6.000 |  |
|  |  | 0.999 |  | 6 | 0.766 | 0.998 | 0.005 | 3.382 | 3.242 | 0.001 | 22.500 | 52.500 | 12.000 |  |
|  |  | 0.999 |  | 5 | 0.790 | 0.999 | 0.005 | 3.374 | 3.234 | 0.001 | -19.500 | -1.500 | -45.000 |  |
|  |  | 0.978 |  | 38 | 0.402 | 0.999 | 0.005 | 3.358 | 3.221 | 0.001 | -28.500 | -73.500 | -33.000 | left cerebellum exterior |
|  |  |  |  |  |  | 0.999 | 0.005 | 3.333 | 3.198 | 0.001 | -21.000 | -76.500 | -31.500 |  |
|  |  | 0.999 |  | 5 | 0.790 | 0.999 | 0.005 | 3.346 | 3.209 | 0.001 | -10.500 | -49.500 | -49.500 |  |
|  |  | 0.999 |  | 7 | 0.745 | 0.999 | 0.005 | 3.342 | 3.206 | 0.001 | -10.500 | -90.000 | 19.500 |  |
|  |  | 0.999 |  | 5 | 0.790 | 0.999 | 0.005 | 3.338 | 3.202 | 0.001 | -61.500 | -22.500 | -16.500 |  |
|  |  | 1.000 |  | 3 | 0.846 | 0.999 | 0.005 | 3.335 | 3.200 | 0.001 | -55.500 | -46.500 | 39.000 |  |
|  |  | 0.999 |  | 5 | 0.790 | 0.999 | 0.005 | 3.329 | 3.195 | 0.001 | 54.000 | 30.000 | 21.000 |  |
|  |  | 0.999 |  | 10 | 0.688 | 0.999 | 0.005 | 3.320 | 3.186 | 0.001 | 6.000 | -52.500 | -12.000 |  |
|  |  | 0.999 |  | 6 | 0.766 | 0.999 | 0.005 | 3.319 | 3.185 | 0.001 | -54.000 | -49.500 | 45.000 |  |
|  |  | 1.000 |  | 2 | 0.880 | 1.000 | 0.006 | 3.301 | 3.170 | 0.001 | 18.000 | 39.000 | 51.000 |  |
|  |  | 0.999 |  | 7 | 0.745 | 1.000 | 0.006 | 3.296 | 3.165 | 0.001 | 15.000 | -82.500 | 45.000 |  |
|  |  | 1.000 |  | 2 | 0.880 | 1.000 | 0.006 | 3.293 | 3.162 | 0.001 | 31.500 | -78.000 | -13.500 |  |
|  |  | 0.999 |  | 5 | 0.790 | 1.000 | 0.006 | 3.280 | 3.150 | 0.001 | -10.500 | -42.000 | 78.000 |  |
|  |  | 1.000 |  | 2 | 0.880 | 1.000 | 0.006 | 3.278 | 3.149 | 0.001 | -43.500 | -61.500 | -15.000 |  |
|  |  | 1.000 |  | 3 | 0.846 | 1.000 | 0.006 | 3.270 | 3.142 | 0.001 | -3.000 | -90.000 | 3.000 |  |
|  |  | 1.000 |  | 2 | 0.880 | 1.000 | 0.006 | 3.267 | 3.139 | 0.001 | -19.500 | -88.500 | -13.500 |  |
|  |  | 0.999 |  | 5 | 0.790 | 1.000 | 0.006 | 3.262 | 3.134 | 0.001 | -37.500 | 43.500 | 25.500 |  |
|  |  | 1.000 |  | 2 | 0.880 | 1.000 | 0.006 | 3.256 | 3.129 | 0.001 | 54.000 | -55.500 | 24.000 |  |
|  |  | 0.999 |  | 5 | 0.790 | 1.000 | 0.006 | 3.253 | 3.127 | 0.001 | -13.500 | -69.000 | -25.500 |  |
|  |  | 1.000 |  | 1 | 0.923 | 1.000 | 0.006 | 3.244 | 3.119 | 0.001 | 42.000 | 10.500 | -12.000 |  |
|  |  | 0.999 |  | 8 | 0.724 | 1.000 | 0.006 | 3.240 | 3.115 | 0.001 | -36.000 | -63.000 | -49.500 |  |
|  |  | 1.000 |  | 1 | 0.923 | 1.000 | 0.006 | 3.238 | 3.113 | 0.001 | -13.500 | 45.000 | 9.000 |  |
|  |  | 1.000 |  | 3 | 0.846 | 1.000 | 0.006 | 3.235 | 3.111 | 0.001 | -15.000 | -91.500 | -9.000 |  |
|  |  | 1.000 |  | 1 | 0.923 | 1.000 | 0.006 | 3.234 | 3.109 | 0.001 | -45.000 | 31.500 | 6.000 |  |
|  |  | 1.000 |  | 2 | 0.880 | 1.000 | 0.006 | 3.233 | 3.109 | 0.001 | 10.500 | -49.500 | -49.500 |  |
|  |  | 1.000 |  | 2 | 0.880 | 1.000 | 0.006 | 3.233 | 3.109 | 0.001 | -25.500 | -90.000 | -13.500 |  |
|  |  | 1.000 |  | 1 | 0.923 | 1.000 | 0.006 | 3.229 | 3.105 | 0.001 | -37.500 | -36.000 | -19.500 |  |
|  |  | 1.000 |  | 2 | 0.880 | 1.000 | 0.006 | 3.228 | 3.104 | 0.001 | 15.000 | 63.000 | -21.000 |  |
|  |  | 1.000 |  | 2 | 0.880 | 1.000 | 0.007 | 3.227 | 3.103 | 0.001 | -43.500 | -82.500 | 16.500 |  |
|  |  | 1.000 |  | 1 | 0.923 | 1.000 | 0.007 | 3.224 | 3.101 | 0.001 | 34.500 | 3.000 | -22.500 |  |
|  |  | 1.000 |  | 1 | 0.923 | 1.000 | 0.007 | 3.215 | 3.093 | 0.001 | -40.500 | -75.000 | 7.500 |  |
|  |  | 1.000 |  | 1 | 0.923 | 1.000 | 0.007 | 3.214 | 3.092 | 0.001 | -16.500 | -81.000 | 43.500 |  |

**Supplementary Table 12.** Results of the VBM analyses fordelusions in *C9orf72* expansion carriers

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Set-level |  |  | Cluster-level |  |  |  | Peak-level |  |  |  | MNI coordinates | | | Label |
| p | c | p(FWE-corr) | p(FDR-corr) | equivk | p(unc) | p(FWE-corr) | p(FDR-corr) | T | equivZ | p(unc) | x,y,z {mm} | | |  |
| 0.863 | 7.000 | 0.968 |  | 45 | 0.349 | 0.626 | 0.751 | 4.196 | 3.886 | 0.000 | -27 | 35 | 36 | left middle frontal gyrus |
|  |  | 0.927 |  | 64 | 0.264 | 0.751 | 0.751 | 4.065 | 3.780 | 0.000 | -42 | 14 | 29 | left middle frontal gyrus |
|  |  | 0.999 |  | 11 | 0.663 | 0.970 | 0.751 | 3.701 | 3.478 | 0.000 | -23 | 53 | 36 | left superior frontal gyrus |
|  |  | 1.000 |  | 4 | 0.811 | 1.000 | 0.751 | 3.365 | 3.192 | 0.001 | -44 | 54 | 0 | left middle frontal gyrus |
|  |  | 1.000 |  | 2 | 0.876 | 1.000 | 0.751 | 3.353 | 3.182 | 0.001 | -51 | 6 | -42 |  |
|  |  | 1.000 |  | 2 | 0.876 | 1.000 | 0.751 | 3.329 | 3.161 | 0.001 | 35 | -17 | -42 |  |
|  |  | 1.000 |  | 3 | 0.841 | 1.000 | 0.751 | 3.300 | 3.136 | 0.001 | -51 | -23 | -30 | left inferior temporal gyrus |

**Supplementary Table 13.** Results of the VBM analyses fordelusions in *MAPT* mutation carriers

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Set-level |  |  | Cluster-level |  |  |  | Peak-level |  |  |  | MNI coordinates | | | Label |
| p | c | p(FWE-corr) | p(FDR-corr) | equivk | p(unc) | p(FWE-corr) | p(FDR-corr) | T | equivZ | p(unc) | x,y,z {mm} | | |  |
| 0.000 | 91.000 | 0.388 |  | 188 | 0.040 | 0.012 | 0.010 | 6.831 | 5.124 | 0.000 | -42 | 24 | 44 | left middle frontal gyrus |
|  |  | 0.000 |  | 5185 | 0.000 | 0.016 | 0.010 | 6.663 | 5.044 | 0.000 | -69 | -26 | -12 | left middle temporal gyrus |
|  |  |  |  |  |  | 0.041 | 0.010 | 6.223 | 4.827 | 0.000 | -63 | -35 | -5 | left middle temporal gyrus |
|  |  |  |  |  |  | 0.088 | 0.010 | 5.854 | 4.634 | 0.000 | -56 | 3 | -23 | left middle temporal gyrus |
|  |  | 0.000 |  | 2181 | 0.000 | 0.102 | 0.010 | 5.780 | 4.594 | 0.000 | -3 | 47 | 20 | superior frontal gyrus medial segment |
|  |  |  |  |  |  | 0.333 | 0.011 | 5.154 | 4.239 | 0.000 | -5 | 14 | -3 | left subcallosal area |
|  |  |  |  |  |  | 0.337 | 0.011 | 5.146 | 4.235 | 0.000 | -2 | 17 | -11 | left subcallosal area |
|  |  | 0.969 |  | 46 | 0.284 | 0.134 | 0.010 | 5.640 | 4.518 | 0.000 | -63 | -41 | 35 | left supramarginal gyrus |
|  |  | 0.134 |  | 305 | 0.012 | 0.166 | 0.010 | 5.534 | 4.458 | 0.000 | 6 | -63 | 26 | right precuneus |
|  |  | 0.855 |  | 82 | 0.157 | 0.219 | 0.010 | 5.386 | 4.375 | 0.000 | -26 | 21 | 51 | left middle frontal gyrus |
|  |  | 0.336 |  | 204 | 0.033 | 0.377 | 0.012 | 5.080 | 4.195 | 0.000 | -3 | 44 | 41 | superior frontal gyrus medial segment |
|  |  |  |  |  |  | 1.000 | 0.028 | 3.665 | 3.261 | 0.001 | -9 | 53 | 36 | left superior frontal gyrus |
|  |  | 0.887 |  | 74 | 0.177 | 0.404 | 0.012 | 5.037 | 4.170 | 0.000 | 51 | 24 | 39 | right middle frontal gyrus |
|  |  | 0.677 |  | 120 | 0.092 | 0.408 | 0.012 | 5.030 | 4.166 | 0.000 | -57 | -47 | 42 | left supramarginal gyrus |
|  |  | 0.175 |  | 276 | 0.016 | 0.489 | 0.013 | 4.913 | 4.095 | 0.000 | 3 | -42 | 62 | right precuneus |
|  |  |  |  |  |  | 0.563 | 0.014 | 4.812 | 4.033 | 0.000 | 9 | -44 | 69 |  |
|  |  |  |  |  |  | 0.999 | 0.026 | 3.750 | 3.322 | 0.000 | 8 | -36 | 54 | precentral gyrus medial segment |
|  |  | 0.846 |  | 84 | 0.152 | 0.586 | 0.014 | 4.782 | 4.014 | 0.000 | -9 | -54 | 66 | left superior parietal lobule |
|  |  | 0.365 |  | 195 | 0.037 | 0.663 | 0.015 | 4.681 | 3.951 | 0.000 | -47 | -14 | 48 | left precentral gyrus |
|  |  | 0.749 |  | 105 | 0.113 | 0.669 | 0.015 | 4.673 | 3.945 | 0.000 | -47 | -50 | 45 | left supramarginal gyrus |
|  |  |  |  |  |  | 0.935 | 0.019 | 4.229 | 3.655 | 0.000 | -41 | -45 | 51 |  |
|  |  |  |  |  |  | 0.998 | 0.024 | 3.819 | 3.372 | 0.000 | -51 | -51 | 53 |  |
|  |  | 0.981 |  | 39 | 0.324 | 0.711 | 0.015 | 4.617 | 3.909 | 0.000 | -29 | 29 | 45 | left middle frontal gyrus |
|  |  | 0.981 |  | 39 | 0.324 | 0.716 | 0.015 | 4.609 | 3.905 | 0.000 | 54 | 32 | 26 | right middle frontal gyrus |
|  |  | 0.446 |  | 172 | 0.048 | 0.754 | 0.016 | 4.558 | 3.872 | 0.000 | -32 | -51 | -11 | left fusiform gyrus |
|  |  |  |  |  |  | 0.999 | 0.026 | 3.734 | 3.310 | 0.000 | -21 | -65 | -6 | left lingual gyrus |
|  |  | 0.994 |  | 26 | 0.423 | 0.782 | 0.016 | 4.518 | 3.846 | 0.000 | -36 | -62 | 51 |  |
|  |  | 0.985 |  | 36 | 0.343 | 0.782 | 0.016 | 4.516 | 3.845 | 0.000 | -33 | 45 | 29 | left middle frontal gyrus |
|  |  | 0.932 |  | 61 | 0.219 | 0.807 | 0.017 | 4.480 | 3.821 | 0.000 | -6 | -32 | 47 | left posterior cingulate gyrus |
|  |  | 0.997 |  | 20 | 0.485 | 0.810 | 0.017 | 4.474 | 3.818 | 0.000 | -3 | -41 | 57 |  |
|  |  | 0.735 |  | 108 | 0.108 | 0.829 | 0.017 | 4.444 | 3.798 | 0.000 | -26 | 36 | 39 | left middle frontal gyrus |
|  |  | 0.998 |  | 18 | 0.510 | 0.853 | 0.017 | 4.403 | 3.771 | 0.000 | 44 | 36 | 36 |  |
|  |  | 0.725 |  | 110 | 0.105 | 0.856 | 0.017 | 4.398 | 3.768 | 0.000 | -39 | -72 | 44 | left angular gyrus |
|  |  |  |  |  |  | 0.997 | 0.024 | 3.838 | 3.385 | 0.000 | -51 | -66 | 39 | left angular gyrus |
|  |  | 0.629 |  | 130 | 0.081 | 0.861 | 0.017 | 4.390 | 3.763 | 0.000 | -56 | 12 | 11 | opercular part of the inferior frontal gyrus |
|  |  |  |  |  |  | 0.966 | 0.020 | 4.118 | 3.580 | 0.000 | -50 | 17 | 29 | opercular part of the inferior frontal gyrus |
|  |  |  |  |  |  | 0.999 | 0.026 | 3.758 | 3.328 | 0.000 | -54 | 11 | 24 | lefft precentral gyrus |
|  |  | 0.778 |  | 99 | 0.123 | 0.880 | 0.018 | 4.354 | 3.739 | 0.000 | -57 | 5 | -3 | left planum polare |
|  |  |  |  |  |  | 0.883 | 0.018 | 4.348 | 3.735 | 0.000 | -57 | 11 | -12 | left temporal pole |
|  |  |  |  |  |  | 1.000 | 0.030 | 3.560 | 3.183 | 0.001 | -48 | 2 | -3 |  |
|  |  | 0.867 |  | 79 | 0.164 | 0.909 | 0.018 | 4.293 | 3.699 | 0.000 | -39 | 18 | 2 | left frontal operculum |
|  |  |  |  |  |  | 0.972 | 0.020 | 4.094 | 3.564 | 0.000 | -39 | 21 | -6 | left anterior insula |
|  |  |  |  |  |  | 1.000 | 0.031 | 3.538 | 3.167 | 0.001 | -38 | 15 | 11 |  |
|  |  | 0.983 |  | 38 | 0.330 | 0.911 | 0.018 | 4.288 | 3.695 | 0.000 | -45 | 39 | 18 |  |
|  |  | 0.986 |  | 35 | 0.350 | 0.924 | 0.018 | 4.256 | 3.674 | 0.000 | -38 | -5 | 59 |  |
|  |  | 0.686 |  | 118 | 0.094 | 0.936 | 0.019 | 4.225 | 3.653 | 0.000 | -35 | -27 | -12 | left hippocampus |
|  |  |  |  |  |  | 1.000 | 0.027 | 3.676 | 3.268 | 0.001 | -35 | -12 | -20 |  |
|  |  | 0.998 |  | 17 | 0.523 | 0.944 | 0.019 | 4.202 | 3.637 | 0.000 | -17 | -45 | 63 |  |
|  |  | 0.995 |  | 25 | 0.432 | 0.950 | 0.019 | 4.182 | 3.624 | 0.000 | 44 | -65 | 50 |  |
|  |  | 0.164 |  | 283 | 0.015 | 0.955 | 0.019 | 4.165 | 3.612 | 0.000 | -38 | -9 | 9 | left anterior insula |
|  |  |  |  |  |  | 0.986 | 0.021 | 4.004 | 3.502 | 0.000 | -39 | 0 | 6 | left anterior insula |
|  |  |  |  |  |  | 0.999 | 0.026 | 3.711 | 3.294 | 0.000 | -35 | 11 | 3 | left anterior insula |
|  |  | 0.887 |  | 74 | 0.177 | 0.955 | 0.019 | 4.163 | 3.611 | 0.000 | 3 | -24 | 54 | precentral gyrus medial segment |
|  |  | 0.998 |  | 18 | 0.510 | 0.956 | 0.019 | 4.162 | 3.610 | 0.000 | -24 | -57 | 66 |  |
|  |  | 0.996 |  | 24 | 0.442 | 0.960 | 0.020 | 4.144 | 3.598 | 0.000 | -59 | -54 | 17 |  |
|  |  | 0.935 |  | 60 | 0.222 | 0.970 | 0.020 | 4.100 | 3.568 | 0.000 | 47 | -59 | 27 | right angular gyrus |
|  |  | 0.994 |  | 27 | 0.414 | 0.975 | 0.020 | 4.077 | 3.552 | 0.000 | 3 | 24 | 41 |  |
|  |  |  |  |  |  | 0.994 | 0.023 | 3.915 | 3.439 | 0.000 | 3 | 30 | 33 |  |
|  |  | 0.963 |  | 49 | 0.269 | 0.979 | 0.021 | 4.055 | 3.537 | 0.000 | -26 | -39 | -15 | left fusiform gyrus |
|  |  | 0.983 |  | 38 | 0.330 | 0.979 | 0.021 | 4.055 | 3.537 | 0.000 | -8 | 65 | 17 | left frontal pole |
|  |  | 0.999 |  | 16 | 0.536 | 0.981 | 0.021 | 4.038 | 3.525 | 0.000 | 18 | -56 | 66 |  |
|  |  | 1.000 |  | 10 | 0.634 | 0.987 | 0.021 | 3.991 | 3.493 | 0.000 | 26 | -44 | 65 |  |
|  |  | 0.999 |  | 15 | 0.551 | 0.992 | 0.023 | 3.932 | 3.452 | 0.000 | -27 | 54 | 23 |  |
|  |  | 0.999 |  | 13 | 0.581 | 0.994 | 0.023 | 3.905 | 3.432 | 0.000 | 14 | -59 | 57 |  |
|  |  | 1.000 |  | 10 | 0.634 | 0.995 | 0.023 | 3.898 | 3.428 | 0.000 | -53 | 6 | 39 |  |
|  |  | 1.000 |  | 10 | 0.634 | 0.996 | 0.024 | 3.870 | 3.408 | 0.000 | 5 | -6 | 69 |  |
|  |  | 1.000 |  | 7 | 0.698 | 0.997 | 0.024 | 3.855 | 3.397 | 0.000 | -18 | 48 | 42 |  |
|  |  | 0.999 |  | 14 | 0.566 | 0.997 | 0.024 | 3.837 | 3.384 | 0.000 | -18 | -47 | -9 |  |
|  |  | 0.996 |  | 24 | 0.442 | 0.999 | 0.025 | 3.782 | 3.345 | 0.000 | -27 | -11 | -6 |  |
|  |  | 0.999 |  | 14 | 0.566 | 0.999 | 0.026 | 3.761 | 3.330 | 0.000 | 41 | -75 | 42 |  |
|  |  | 1.000 |  | 10 | 0.634 | 0.999 | 0.026 | 3.754 | 3.325 | 0.000 | -35 | -53 | 54 |  |
|  |  | 0.999 |  | 12 | 0.598 | 0.999 | 0.026 | 3.743 | 3.317 | 0.000 | 0 | 30 | 50 |  |
|  |  | 1.000 |  | 5 | 0.751 | 0.999 | 0.026 | 3.741 | 3.315 | 0.000 | -12 | 51 | 17 |  |
|  |  | 1.000 |  | 4 | 0.781 | 1.000 | 0.027 | 3.686 | 3.276 | 0.001 | -50 | -77 | 17 |  |
|  |  | 1.000 |  | 10 | 0.634 | 1.000 | 0.028 | 3.664 | 3.260 | 0.001 | -5 | 47 | -29 |  |
|  |  | 1.000 |  | 2 | 0.856 | 1.000 | 0.028 | 3.655 | 3.253 | 0.001 | -18 | 32 | 56 |  |
|  |  | 1.000 |  | 5 | 0.751 | 1.000 | 0.028 | 3.653 | 3.252 | 0.001 | -30 | 38 | -18 |  |
|  |  | 1.000 |  | 2 | 0.856 | 1.000 | 0.028 | 3.640 | 3.242 | 0.001 | 20 | -45 | 62 |  |
|  |  | 1.000 |  | 6 | 0.723 | 1.000 | 0.028 | 3.637 | 3.240 | 0.001 | -12 | -83 | 42 |  |
|  |  | 1.000 |  | 9 | 0.654 | 1.000 | 0.028 | 3.636 | 3.239 | 0.001 | -30 | -29 | 65 |  |
|  |  | 0.999 |  | 11 | 0.616 | 1.000 | 0.028 | 3.634 | 3.238 | 0.001 | -27 | -39 | 63 |  |
|  |  | 0.999 |  | 12 | 0.598 | 1.000 | 0.029 | 3.621 | 3.229 | 0.001 | 62 | -53 | 26 |  |
|  |  | 1.000 |  | 6 | 0.723 | 1.000 | 0.029 | 3.613 | 3.222 | 0.001 | -15 | 41 | -21 |  |
|  |  | 1.000 |  | 2 | 0.856 | 1.000 | 0.029 | 3.595 | 3.209 | 0.001 | 57 | -57 | 41 |  |
|  |  | 1.000 |  | 2 | 0.856 | 1.000 | 0.029 | 3.587 | 3.203 | 0.001 | 47 | -42 | -38 |  |
|  |  | 1.000 |  | 5 | 0.751 | 1.000 | 0.030 | 3.562 | 3.185 | 0.001 | -38 | -30 | -18 |  |
|  |  | 1.000 |  | 5 | 0.751 | 1.000 | 0.030 | 3.559 | 3.183 | 0.001 | 18 | -5 | 68 |  |
|  |  | 1.000 |  | 3 | 0.815 | 1.000 | 0.030 | 3.556 | 3.180 | 0.001 | 2 | -9 | 66 |  |
|  |  | 1.000 |  | 2 | 0.856 | 1.000 | 0.030 | 3.551 | 3.177 | 0.001 | 35 | 36 | 36 |  |
|  |  | 1.000 |  | 4 | 0.781 | 1.000 | 0.031 | 3.535 | 3.165 | 0.001 | -3 | -5 | 53 |  |
|  |  | 1.000 |  | 3 | 0.815 | 1.000 | 0.031 | 3.533 | 3.163 | 0.001 | -44 | -59 | 42 |  |
|  |  | 1.000 |  | 2 | 0.856 | 1.000 | 0.031 | 3.523 | 3.156 | 0.001 | -27 | -66 | 54 |  |
|  |  | 1.000 |  | 2 | 0.856 | 1.000 | 0.032 | 3.509 | 3.146 | 0.001 | -36 | -21 | -32 |  |
|  |  | 1.000 |  | 4 | 0.781 | 1.000 | 0.032 | 3.507 | 3.144 | 0.001 | -3 | -33 | 26 |  |
|  |  | 1.000 |  | 3 | 0.815 | 1.000 | 0.032 | 3.501 | 3.139 | 0.001 | 38 | -18 | 57 |  |
|  |  | 1.000 |  | 1 | 0.907 | 1.000 | 0.032 | 3.499 | 3.139 | 0.001 | -36 | 21 | -30 |  |
|  |  | 1.000 |  | 2 | 0.856 | 1.000 | 0.032 | 3.496 | 3.136 | 0.001 | -3 | -9 | 48 |  |
|  |  | 1.000 |  | 2 | 0.856 | 1.000 | 0.032 | 3.491 | 3.133 | 0.001 | -41 | 50 | 20 |  |
|  |  | 1.000 |  | 2 | 0.856 | 1.000 | 0.032 | 3.487 | 3.129 | 0.001 | -3 | 54 | -26 |  |
|  |  | 1.000 |  | 1 | 0.907 | 1.000 | 0.032 | 3.481 | 3.125 | 0.001 | -45 | 9 | 51 |  |
|  |  | 1.000 |  | 1 | 0.907 | 1.000 | 0.032 | 3.480 | 3.124 | 0.001 | -30 | -93 | 18 |  |
|  |  | 1.000 |  | 1 | 0.907 | 1.000 | 0.033 | 3.478 | 3.122 | 0.001 | -44 | -3 | -2 |  |
|  |  | 1.000 |  | 2 | 0.856 | 1.000 | 0.033 | 3.472 | 3.118 | 0.001 | -47 | -63 | 2 |  |
|  |  | 1.000 |  | 2 | 0.856 | 1.000 | 0.033 | 3.470 | 3.117 | 0.001 | -30 | -32 | -24 |  |
|  |  | 1.000 |  | 6 | 0.723 | 1.000 | 0.033 | 3.464 | 3.112 | 0.001 | 24 | -3 | 69 |  |
|  |  | 1.000 |  | 1 | 0.907 | 1.000 | 0.033 | 3.456 | 3.106 | 0.001 | -24 | 35 | 48 |  |
|  |  | 1.000 |  | 1 | 0.907 | 1.000 | 0.033 | 3.454 | 3.104 | 0.001 | -48 | -21 | 59 |  |
|  |  | 1.000 |  | 2 | 0.856 | 1.000 | 0.033 | 3.453 | 3.104 | 0.001 | -42 | -60 | 18 |  |
|  |  | 1.000 |  | 1 | 0.907 | 1.000 | 0.034 | 3.445 | 3.098 | 0.001 | -29 | -42 | 47 |  |
|  |  | 1.000 |  | 1 | 0.907 | 1.000 | 0.034 | 3.439 | 3.093 | 0.001 | -9 | -38 | -27 |  |
|  |  | 1.000 |  | 1 | 0.907 | 1.000 | 0.034 | 3.436 | 3.091 | 0.001 | 39 | -24 | 47 |  |
|  |  | 1.000 |  | 1 | 0.907 | 1.000 | 0.034 | 3.436 | 3.091 | 0.001 | -24 | -35 | 60 |  |

**Supplementary Table 14**: Results of the VBM analyses fordepression in *GRN* mutation carriers

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Set-level |  |  | Cluster-level |  |  |  | Peak-level |  |  |  | MNI coordinates | | | | Label |
| p | c | p(FWE-corr) | p(FDR-corr) | equivk | p(unc) | p(FWE-corr) | p(FDR-corr) | T | equivZ | p(unc) | | x,y,z {mm} | | |  |
| 0.000 | 66.0 | 0.000 |  | 2652 | 0.000 | 0.088 | 0.042 | 4.873 | 4.502 | 0.000 | 4.500 | | 49.500 | 18.0 | right superior frontal gyrus medial segment |
|  |  |  |  |  |  | 0.206 | 0.042 | 4.579 | 4.264 | 0.000 | 1.500 | | 9.000 | -15.0 | right subcallosal area |
|  |  |  |  |  |  | 0.292 | 0.042 | 4.447 | 4.155 | 0.000 | 13.500 | | 48.000 | 0.0 |  |
|  |  | 0.162 |  | 362 | 0.019 | 0.143 | 0.042 | 4.709 | 4.369 | 0.000 | -24.000 | | -1.500 | 51.0 | left middle frontal gyrus |
|  |  | 0.859 |  | 88 | 0.216 | 0.177 | 0.042 | 4.634 | 4.309 | 0.000 | -25.500 | | -40.500 | 52.500 | left superior parietal lobule |
|  |  | 0.154 |  | 370 | 0.018 | 0.313 | 0.042 | 4.420 | 4.133 | 0.000 | -27.000 | | -57.000 | -34.500 | left cerebellum exterior |
|  |  | 0.002 |  | 1136 | 0.000 | 0.336 | 0.042 | 4.390 | 4.108 | 0.000 | -36.000 | | -6.000 | 18.000 | left central operculum |
|  |  |  |  |  |  | 0.446 | 0.042 | 4.267 | 4.005 | 0.000 | -31.500 | | 24.000 | 12.000 | left anterior insula |
|  |  |  |  |  |  | 0.631 | 0.042 | 4.084 | 3.852 | 0.000 | -31.500 | | 1.500 | 15.000 | left anterior insula |
|  |  | 0.045 |  | 564 | 0.005 | 0.525 | 0.042 | 4.187 | 3.939 | 0.000 | 0.000 | | -15.000 | 34.500 | left middle cingulate gyrus |
|  |  |  |  |  |  | 0.723 | 0.042 | 3.994 | 3.775 | 0.000 | 4.500 | | -25.500 | 31.500 | left middle cingulate gyrus |
|  |  |  |  |  |  | 0.999 | 0.044 | 3.300 | 3.169 | 0.001 | -6.000 | | -34.500 | 31.500 |  |
|  |  | 0.301 |  | 269 | 0.040 | 0.550 | 0.042 | 4.163 | 3.918 | 0.000 | -33.000 | | -36.000 | -3.000 | left hippocampus |
|  |  |  |  |  |  | 0.986 | 0.042 | 3.537 | 3.379 | 0.000 | -31.500 | | -25.500 | -12.000 | left hippocampus |
|  |  | 0.856 |  | 89 | 0.213 | 0.617 | 0.042 | 4.098 | 3.863 | 0.000 | -7.500 | | -48.000 | 54.000 | left precuneus |
|  |  | 0.972 |  | 42 | 0.392 | 0.701 | 0.042 | 4.015 | 3.793 | 0.000 | -1.500 | | -48.000 | -27.000 |  |
|  |  | 0.009 |  | 841 | 0.001 | 0.781 | 0.042 | 3.933 | 3.722 | 0.000 | 31.500 | | 18.000 | 9.000 | right anterior insula |
|  |  |  |  |  |  | 0.927 | 0.042 | 3.729 | 3.546 | 0.000 | 34.500 | | 31.500 | -4.500 |  |
|  |  |  |  |  |  | 0.951 | 0.042 | 3.673 | 3.498 | 0.000 | 34.500 | | -19.500 | 12.000 |  |
|  |  | 0.097 |  | 441 | 0.011 | 0.824 | 0.042 | 3.882 | 3.679 | 0.000 | 15.000 | | -66.000 | -30.000 | right cerebellum exterior |
|  |  |  |  |  |  | 0.976 | 0.042 | 3.589 | 3.424 | 0.000 | 27.000 | | -55.500 | -34.500 |  |
|  |  | 0.890 |  | 78 | 0.243 | 0.887 | 0.042 | 3.797 | 3.606 | 0.000 | -45.000 | | -49.500 | 15.000 |  |
|  |  | 0.822 |  | 99 | 0.190 | 0.899 | 0.042 | 3.778 | 3.589 | 0.000 | -61.500 | | -34.500 | -22.500 | left inferior temporal gyrus |
|  |  |  |  |  |  | 0.977 | 0.042 | 3.582 | 3.419 | 0.000 | -60.000 | | -27.000 | -16.500 |  |
|  |  | 0.447 |  | 209 | 0.065 | 0.910 | 0.042 | 3.759 | 3.573 | 0.000 | 43.500 | | -6.000 | -12.000 | right planum polare |
|  |  |  |  |  |  | 0.952 | 0.042 | 3.669 | 3.494 | 0.000 | 43.500 | | -16.500 | -7.500 |  |
|  |  |  |  |  |  | 0.998 | 0.043 | 3.392 | 3.250 | 0.001 | 43.500 | | 6.000 | -15.000 |  |
|  |  | 0.984 |  | 32 | 0.458 | 0.941 | 0.042 | 3.698 | 3.520 | 0.000 | 1.500 | | 21.000 | 48.000 |  |
|  |  | 0.762 |  | 116 | 0.158 | 0.946 | 0.042 | 3.685 | 3.509 | 0.000 | 39.000 | | -82.500 | 9.000 | right middle occipital gyrus |
|  |  |  |  |  |  | 0.970 | 0.042 | 3.613 | 3.445 | 0.000 | 36.000 | | -73.500 | 6.000 |  |
|  |  | 0.968 |  | 44 | 0.380 | 0.949 | 0.042 | 3.679 | 3.503 | 0.000 | -39.000 | | -79.500 | 4.500 |  |
|  |  | 0.989 |  | 27 | 0.498 | 0.950 | 0.042 | 3.676 | 3.500 | 0.000 | -24.000 | | -91.500 | -12.000 |  |
|  |  | 0.887 |  | 79 | 0.240 | 0.959 | 0.042 | 3.652 | 3.479 | 0.000 | 40.500 | | -1.500 | 48.000 | right precentral gyrus |
|  |  | 0.998 |  | 9 | 0.715 | 0.963 | 0.042 | 3.639 | 3.468 | 0.000 | 18.000 | | 24.000 | 48.000 |  |
|  |  | 0.995 |  | 19 | 0.576 | 0.963 | 0.042 | 3.637 | 3.466 | 0.000 | 3.000 | | 33.000 | 31.500 |  |
|  |  | 0.999 |  | 7 | 0.753 | 0.967 | 0.042 | 3.623 | 3.454 | 0.000 | -7.500 | | -67.500 | -30.000 |  |
|  |  | 0.987 |  | 29 | 0.481 | 0.973 | 0.042 | 3.603 | 3.437 | 0.000 | -16.500 | | 22.500 | 46.500 |  |
|  |  | 0.997 |  | 13 | 0.651 | 0.974 | 0.042 | 3.597 | 3.432 | 0.000 | 25.500 | | 42.000 | 25.500 |  |
|  |  | 0.942 |  | 58 | 0.313 | 0.974 | 0.042 | 3.597 | 3.431 | 0.000 | -27.000 | | -81.000 | 28.500 | left middle occipital gyrus |
|  |  | 0.984 |  | 32 | 0.458 | 0.982 | 0.042 | 3.559 | 3.398 | 0.000 | 39.000 | | 49.500 | -9.000 |  |
|  |  | 0.999 |  | 5 | 0.797 | 0.991 | 0.042 | 3.491 | 3.338 | 0.000 | -19.500 | | -13.500 | -10.500 |  |
|  |  | 0.995 |  | 18 | 0.587 | 0.992 | 0.042 | 3.480 | 3.329 | 0.000 | -25.500 | | 12.000 | 58.500 |  |
|  |  | 0.967 |  | 45 | 0.375 | 0.993 | 0.042 | 3.476 | 3.325 | 0.000 | 24.000 | | 12.000 | 49.500 | right superior frontal gyrus |
|  |  | 0.984 |  | 32 | 0.458 | 0.993 | 0.042 | 3.474 | 3.323 | 0.000 | -42.000 | | -64.500 | 43.500 |  |
|  |  | 1.000 |  | 2 | 0.884 | 0.994 | 0.042 | 3.459 | 3.310 | 0.000 | -9.000 | | -63.000 | 40.500 |  |
|  |  | 0.998 |  | 9 | 0.715 | 0.994 | 0.042 | 3.458 | 3.309 | 0.000 | 58.500 | | -16.500 | -18.000 |  |
|  |  | 0.999 |  | 7 | 0.753 | 0.995 | 0.042 | 3.448 | 3.301 | 0.000 | 13.500 | | 33.000 | 19.500 |  |
|  |  | 0.982 |  | 34 | 0.443 | 0.995 | 0.042 | 3.442 | 3.295 | 0.000 | -4.500 | | -42.000 | 22.500 | left posterior cingulate gyrus |
|  |  | 0.998 |  | 11 | 0.681 | 0.995 | 0.042 | 3.440 | 3.293 | 0.000 | -21.000 | | -88.500 | 21.000 |  |
|  |  | 0.998 |  | 11 | 0.681 | 0.995 | 0.042 | 3.439 | 3.292 | 0.000 | 63.000 | | -24.000 | -4.500 |  |
|  |  | 0.999 |  | 6 | 0.774 | 0.996 | 0.042 | 3.435 | 3.289 | 0.001 | -51.000 | | -72.000 | 7.500 |  |
|  |  | 0.998 |  | 9 | 0.715 | 0.996 | 0.042 | 3.429 | 3.283 | 0.001 | 3.000 | | -39.000 | 46.500 |  |
|  |  | 0.998 |  | 10 | 0.698 | 0.996 | 0.042 | 3.425 | 3.280 | 0.001 | 0.000 | | -61.500 | 39.000 |  |
|  |  | 0.997 |  | 15 | 0.624 | 0.996 | 0.042 | 3.422 | 3.277 | 0.001 | 16.500 | | -10.500 | -12.000 |  |
|  |  | 0.999 |  | 8 | 0.733 | 0.996 | 0.042 | 3.420 | 3.275 | 0.001 | 63.000 | | -16.500 | -6.000 |  |
|  |  | 0.999 |  | 5 | 0.797 | 0.996 | 0.042 | 3.420 | 3.275 | 0.001 | -1.500 | | 21.000 | 48.000 |  |
|  |  | 0.998 |  | 9 | 0.715 | 0.997 | 0.042 | 3.414 | 3.270 | 0.001 | -48.000 | | -36.000 | 16.500 |  |
|  |  | 0.998 |  | 11 | 0.681 | 0.998 | 0.043 | 3.394 | 3.252 | 0.001 | 25.500 | | 40.500 | 36.000 |  |
|  |  | 0.999 |  | 5 | 0.797 | 0.999 | 0.043 | 3.356 | 3.218 | 0.001 | 19.500 | | 64.500 | 13.500 |  |
|  |  | 0.998 |  | 9 | 0.715 | 0.999 | 0.043 | 3.343 | 3.207 | 0.001 | 54.000 | | -15.000 | -12.000 |  |
|  |  | 1.000 |  | 1 | 0.925 | 0.999 | 0.044 | 3.329 | 3.194 | 0.001 | 46.500 | | 4.500 | -3.000 |  |
|  |  | 0.998 |  | 9 | 0.715 | 0.999 | 0.044 | 3.321 | 3.187 | 0.001 | -55.500 | | -40.500 | -13.500 |  |
|  |  | 1.000 |  | 3 | 0.851 | 0.999 | 0.044 | 3.313 | 3.180 | 0.001 | -18.000 | | -93.000 | 18.000 |  |
|  |  | 0.998 |  | 11 | 0.681 | 0.999 | 0.044 | 3.308 | 3.176 | 0.001 | 25.500 | | 30.000 | 46.500 |  |
|  |  | 0.999 |  | 5 | 0.797 | 0.999 | 0.044 | 3.300 | 3.169 | 0.001 | -24.000 | | -97.500 | 0.000 |  |
|  |  | 0.999 |  | 7 | 0.753 | 0.999 | 0.045 | 3.295 | 3.165 | 0.001 | 55.500 | | -40.500 | -13.500 |  |
|  |  | 1.000 |  | 2 | 0.884 | 1.000 | 0.045 | 3.274 | 3.145 | 0.001 | -43.500 | | -75.000 | 7.500 |  |
|  |  | 1.000 |  | 3 | 0.851 | 1.000 | 0.045 | 3.273 | 3.145 | 0.001 | 30.000 | | 55.500 | 15.000 |  |
|  |  | 1.000 |  | 2 | 0.884 | 1.000 | 0.045 | 3.273 | 3.144 | 0.001 | 36.000 | | 27.000 | 34.500 |  |
|  |  | 1.000 |  | 1 | 0.925 | 1.000 | 0.046 | 3.254 | 3.127 | 0.001 | -15.000 | | -63.000 | 49.500 |  |
|  |  | 1.000 |  | 3 | 0.851 | 1.000 | 0.046 | 3.252 | 3.126 | 0.001 | 40.500 | | 15.000 | 0.000 |  |
|  |  | 0.999 |  | 4 | 0.823 | 1.000 | 0.046 | 3.248 | 3.122 | 0.001 | 10.500 | | -55.500 | 46.500 |  |
|  |  | 1.000 |  | 2 | 0.884 | 1.000 | 0.046 | 3.237 | 3.112 | 0.001 | -43.500 | | -7.500 | -15.000 |  |
|  |  | 1.000 |  | 1 | 0.925 | 1.000 | 0.046 | 3.233 | 3.109 | 0.001 | 21.000 | | 55.500 | 9.000 |  |
|  |  | 1.000 |  | 1 | 0.925 | 1.000 | 0.046 | 3.231 | 3.107 | 0.001 | 37.500 | | -15.000 | -15.000 |  |
|  |  | 1.000 |  | 1 | 0.925 | 1.000 | 0.047 | 3.225 | 3.102 | 0.001 | -31.500 | | 37.500 | -16.500 |  |
|  |  | 1.000 |  | 1 | 0.925 | 1.000 | 0.047 | 3.225 | 3.102 | 0.001 | -6.000 | | 9.000 | -22.500 |  |
|  |  | 1.000 |  | 1 | 0.925 | 1.000 | 0.047 | 3.222 | 3.099 | 0.001 | 49.500 | | -19.500 | 24.000 |  |
|  |  | 1.000 |  | 1 | 0.925 | 1.000 | 0.047 | 3.217 | 3.094 | 0.001 | 6.000 | | 22.500 | 36.000 |  |
|  |  | 1.000 |  | 1 | 0.925 | 1.000 | 0.047 | 3.215 | 3.092 | 0.001 | -10.500 | | -48.000 | 39.000 |  |

**Supplementary Table 15.** Results of the VBM analyses fordepression in *C9orf72* expansion carriers

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Set-level |  |  | Cluster-level |  |  |  | Peak-level |  |  |  | MNI coordinates | | | Label |
| p | c | p(FWE-corr) | p(FDR-corr) | equivk | p(unc) | p(FWE-corr) | p(FDR-corr) | T | equivZ | p(unc) | x,y,z {mm} | | |  |
| 0.969 | 5.000 | 0.889 |  | 77 | 0.222 | 0.982 | 0.887 | 3.647 | 3.433 | 0.000 | 5 | -44 | 51 | left precuneus |
|  |  |  |  |  |  | 0.999 | 0.887 | 3.407 | 3.228 | 0.001 | 6 | -53 | 54 | left precuneus |
|  |  | 0.988 |  | 30 | 0.448 | 0.987 | 0.887 | 3.611 | 3.402 | 0.000 | 23 | 20 | 59 | left superior frontal gyrus |
|  |  | 1.000 |  | 3 | 0.841 | 0.993 | 0.887 | 3.559 | 3.358 | 0.000 | 30 | -53 | 68 | left superior parietal lobule |
|  |  | 1.000 |  | 1 | 0.920 | 1.000 | 0.887 | 3.278 | 3.116 | 0.001 | 12 | -54 | 47 |  |
|  |  | 1.000 |  | 1 | 0.920 | 1.000 | 0.887 | 3.260 | 3.101 | 0.001 | 12 | -51 | 59 |  |

**Supplementary Table 16.** Results of the VBM analyses fordepression in *MAPT* mutation carriers

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Set-level |  |  |  | Cluster-level |  |  | Peak-level |  |  |  | MNI coordinates | | | Label |
| p | c | p(FWE-corr) | p(FDR-corr) | equivk | p(unc) | p(FWE-corr) | p(FDR-corr) | T | equivZ | p(unc) | x,y,z {mm} | | |  |
| 0.000 | 40.000 | 0.102 |  | 349 | 0.009 | 0.492 | 0.184 | 4.885 | 4.078 | 0.000 | -14 | -33 | 66 | left postcentral gyrus |
|  |  |  |  |  |  | 0.966 | 0.184 | 4.095 | 3.564 | 0.000 | -29 | -29 | 65 | left postcentral gyrus |
|  |  | 0.168 |  | 291 | 0.016 | 0.528 | 0.184 | 4.836 | 4.047 | 0.000 | 47 | -48 | -23 | right inferior temporal gyrus |
|  |  |  |  |  |  | 0.833 | 0.184 | 4.414 | 3.779 | 0.000 | 39 | -47 | -14 | right fusiform gyrus |
|  |  | 0.996 |  | 22 | 0.476 | 0.609 | 0.184 | 4.728 | 3.980 | 0.000 | 30 | -20 | 56 |  |
|  |  | 0.969 |  | 46 | 0.297 | 0.621 | 0.184 | 4.713 | 3.971 | 0.000 | 12 | -62 | -11 | right cerebellum exterior |
|  |  | 0.382 |  | 196 | 0.041 | 0.819 | 0.184 | 4.437 | 3.793 | 0.000 | 24 | -47 | -17 | right fusiform gyrus |
|  |  |  |  |  |  | 1.000 | 0.184 | 3.586 | 3.202 | 0.001 | 21 | -56 | -14 | right lingual gyrus |
|  |  | 0.908 |  | 69 | 0.204 | 0.836 | 0.184 | 4.409 | 3.775 | 0.000 | 30 | -12 | -23 | right hippocampus |
|  |  | 0.723 |  | 113 | 0.110 | 0.894 | 0.184 | 4.303 | 3.705 | 0.000 | 0 | -3 | 59 | supplementary motor cortex |
|  |  |  |  |  |  | 1.000 | 0.184 | 3.659 | 3.256 | 0.001 | -8 | 0 | 65 | supplementary motor cortex |
|  |  | 0.999 |  | 13 | 0.593 | 0.921 | 0.184 | 4.240 | 3.663 | 0.000 | 66 | -8 | -14 |  |
|  |  | 0.700 |  | 118 | 0.103 | 0.964 | 0.184 | 4.104 | 3.570 | 0.000 | 42 | -20 | -21 | right fusiform gyrus |
|  |  |  |  |  |  | 0.999 | 0.184 | 3.726 | 3.305 | 0.000 | 41 | -20 | -32 | right fusiform gyrus |
|  |  | 0.809 |  | 94 | 0.141 | 0.980 | 0.184 | 4.019 | 3.512 | 0.000 | 45 | -32 | -26 | right inferior temporal gyrus |
|  |  | 0.974 |  | 43 | 0.313 | 0.981 | 0.184 | 4.017 | 3.510 | 0.000 | 24 | -2 | -9 |  |
|  |  | 0.985 |  | 36 | 0.356 | 0.984 | 0.184 | 3.994 | 3.494 | 0.000 | 6 | -14 | 51 | supplementary motor cortex |
|  |  | 0.998 |  | 16 | 0.548 | 0.990 | 0.184 | 3.941 | 3.458 | 0.000 | -38 | -65 | 48 |  |
|  |  | 0.967 |  | 47 | 0.292 | 0.993 | 0.184 | 3.903 | 3.431 | 0.000 | 36 | -33 | 51 | right post central gyrus |
|  |  | 1.000 |  | 8 | 0.685 | 0.994 | 0.184 | 3.888 | 3.421 | 0.000 | 18 | -56 | 66 |  |
|  |  | 0.990 |  | 31 | 0.393 | 0.994 | 0.184 | 3.878 | 3.413 | 0.000 | 41 | -74 | -17 | right occipital fusiform gyrus |
|  |  | 1.000 |  | 4 | 0.788 | 0.994 | 0.184 | 3.877 | 3.413 | 0.000 | 57 | -60 | 36 |  |
|  |  | 1.000 |  | 9 | 0.664 | 0.995 | 0.184 | 3.855 | 3.397 | 0.000 | -23 | -2 | 60 |  |
|  |  | 0.992 |  | 29 | 0.409 | 0.996 | 0.184 | 3.854 | 3.397 | 0.000 | 3 | -21 | 66 | precentral gyrus medial segment |
|  |  | 0.976 |  | 42 | 0.319 | 0.996 | 0.184 | 3.844 | 3.389 | 0.000 | 32 | -81 | -45 | right cerebellum exterior |
|  |  | 1.000 |  | 6 | 0.732 | 0.997 | 0.184 | 3.804 | 3.361 | 0.000 | -36 | 29 | 50 |  |
|  |  | 0.999 |  | 11 | 0.626 | 0.998 | 0.184 | 3.786 | 3.347 | 0.000 | 41 | -23 | 57 |  |
|  |  | 1.000 |  | 3 | 0.821 | 0.998 | 0.184 | 3.770 | 3.336 | 0.000 | 15 | -35 | 68 |  |
|  |  | 1.000 |  | 4 | 0.788 | 0.999 | 0.184 | 3.727 | 3.305 | 0.000 | 21 | -68 | 62 |  |
|  |  | 1.000 |  | 8 | 0.685 | 0.999 | 0.184 | 3.705 | 3.290 | 0.001 | 5 | -21 | 53 |  |
|  |  | 0.998 |  | 16 | 0.548 | 0.999 | 0.184 | 3.675 | 3.268 | 0.001 | 12 | -36 | 5 |  |
|  |  | 0.999 |  | 10 | 0.645 | 1.000 | 0.184 | 3.661 | 3.257 | 0.001 | 9 | -11 | 68 |  |
|  |  | 0.800 |  | 96 | 0.138 | 1.000 | 0.184 | 3.654 | 3.252 | 0.001 | -17 | -54 | -21 | left cerebellum exterior |
|  |  |  |  |  |  | 1.000 | 0.184 | 3.485 | 3.128 | 0.001 | -14 | -56 | -11 | left cerebellum exterior |
|  |  | 0.999 |  | 10 | 0.645 | 1.000 | 0.184 | 3.627 | 3.233 | 0.001 | 2 | -30 | 69 |  |
|  |  | 1.000 |  | 7 | 0.707 | 1.000 | 0.184 | 3.585 | 3.202 | 0.001 | 39 | -63 | -20 |  |
|  |  | 1.000 |  | 4 | 0.788 | 1.000 | 0.184 | 3.557 | 3.181 | 0.001 | 50 | -38 | 53 |  |
|  |  | 1.000 |  | 5 | 0.758 | 1.000 | 0.184 | 3.556 | 3.180 | 0.001 | 36 | -72 | 42 |  |
|  |  | 1.000 |  | 1 | 0.910 | 1.000 | 0.184 | 3.543 | 3.171 | 0.001 | 48 | 39 | 27 |  |
|  |  | 1.000 |  | 4 | 0.788 | 1.000 | 0.184 | 3.535 | 3.165 | 0.001 | 48 | 8 | -15 |  |
|  |  | 1.000 |  | 4 | 0.788 | 1.000 | 0.184 | 3.520 | 3.154 | 0.001 | 21 | -59 | -29 |  |
|  |  | 1.000 |  | 1 | 0.910 | 1.000 | 0.184 | 3.501 | 3.139 | 0.001 | -17 | -68 | 53 |  |
|  |  | 1.000 |  | 1 | 0.910 | 1.000 | 0.184 | 3.495 | 3.135 | 0.001 | -35 | -17 | -41 |  |
|  |  | 1.000 |  | 4 | 0.788 | 1.000 | 0.184 | 3.485 | 3.128 | 0.001 | 5 | -63 | 17 |  |
|  |  | 1.000 |  | 1 | 0.910 | 1.000 | 0.184 | 3.446 | 3.099 | 0.001 | -62 | -35 | -27 |  |
|  |  | 1.000 |  | 1 | 0.910 | 1.000 | 0.184 | 3.435 | 3.090 | 0.001 | -18 | -62 | 53 |  |

**Supplementary Table 17.** Results of the VBM analyses foranxiety in *GRN* mutation carriers

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Set-level |  |  | Cluster-level |  |  |  | Peak-level |  |  |  | MNI coordinates | | | Label |
| p | c | p(FWE-corr) | p(FDR-corr) | equivk | p(unc) | p(FWE-corr) | p(FDR-corr) | T | equivZ | p(unc) | x,y,z {mm} | | |  |
| 0.000 | 94 | 0.000 |  | 1825 | 0.000 | 0.029 | 0.010 | 5.218 | 4.774 | 0.000 | -6 | -49.5 | 55.5 | left precuneus |
|  |  |  |  |  |  | 0.283 | 0.010 | 4.464 | 4.169 | 0.000 | -4.5 | -40.5 | 28.5 | left posterior cingulate gyrus |
|  |  |  |  |  |  | 0.442 | 0.011 | 4.276 | 4.013 | 0.000 | 0.0 | -61.5 | 39 | left precuneus |
|  |  | 0.000 |  | 1644 | 0.000 | 0.046 | 0.010 | 5.080 | 4.666 | 0.000 | -25.5 | -1.5 | 51 | left middle frontal gyrus |
|  |  |  |  |  |  | 0.264 | 0.010 | 4.491 | 4.192 | 0.000 | -19.5 | 27 | 45 | left superior frontal gyrus |
|  |  |  |  |  |  | 0.268 | 0.010 | 4.485 | 4.187 | 0.000 | -19.5 | 4.5 | 60 |  |
|  |  | 0.000 |  | 2994 | 0.000 | 0.061 | 0.010 | 4.995 | 4.598 | 0.000 | -36 | -4.5 | 18 | left central operculum |
|  |  |  |  |  |  | 0.104 | 0.010 | 4.820 | 4.459 | 0.000 | -33 | 12 | 13.5 |  |
|  |  |  |  |  |  | 0.116 | 0.010 | 4.786 | 4.431 | 0.000 | -39 | -1.5 | 7.5 | left anterior insula |
|  |  | 0.094 |  | 440 | 0.011 | 0.095 | 0.010 | 4.851 | 4.484 | 0.000 | -27 | -79.5 | 28.5 | left superior occipital gyrus |
|  |  |  |  |  |  | 0.993 | 0.020 | 3.476 | 3.325 | 0.000 | -39 | -79.5 | 36 | left middle occipital gyrus |
|  |  | 0.073 |  | 479 | 0.008 | 0.201 | 0.010 | 4.594 | 4.276 | 0.000 | -33 | -36 | -3 | left hippocampus |
|  |  |  |  |  |  | 0.977 | 0.018 | 3.592 | 3.427 | 0.000 | -31.5 | -22.5 | -13.5 | left hippocampus |
|  |  |  |  |  |  | 0.998 | 0.021 | 3.394 | 3.253 | 0.001 | -13.5 | -31.5 | -6 |  |
|  |  | 0.047 |  | 548 | 0.005 | 0.252 | 0.010 | 4.510 | 4.207 | 0.000 | -28.5 | -57 | -34.5 | left cerebellum exterior |
|  |  | 0.000 |  | 1629 | 0.000 | 0.293 | 0.010 | 4.450 | 4.158 | 0.000 | 4.500 | 48.000 | 18.000 | right superior frontal gyrus medial segment |
|  |  |  |  |  |  | 0.642 | 0.012 | 4.078 | 3.846 | 0.000 | 0.000 | 13.500 | -13.500 |  |
|  |  |  |  |  |  | 0.684 | 0.012 | 4.037 | 3.812 | 0.000 | 0.000 | 31.500 | -16.500 | right medial frontal cortex |
|  |  | 0.155 |  | 365 | 0.018 | 0.309 | 0.010 | 4.429 | 4.141 | 0.000 | -61.500 | -33.000 | -21.000 | left inferior temporal gyrus |
|  |  |  |  |  |  | 0.867 | 0.014 | 3.832 | 3.636 | 0.000 | -61.500 | -25.500 | -16.500 | left middle temporal gyrus |
|  |  |  |  |  |  | 0.984 | 0.018 | 3.555 | 3.394 | 0.000 | -54.000 | -42.000 | -15.000 |  |
|  |  | 0.004 |  | 988 | 0.000 | 0.313 | 0.010 | 4.425 | 4.137 | 0.000 | 45.000 | 4.500 | 0.000 | right central operculum |
|  |  |  |  |  |  | 0.906 | 0.015 | 3.772 | 3.584 | 0.000 | 36.000 | -1.500 | 18.000 |  |
|  |  |  |  |  |  | 0.925 | 0.015 | 3.738 | 3.554 | 0.000 | 31.500 | 21.000 | 6.000 | right anterior insula |
|  |  | 0.753 |  | 118 | 0.152 | 0.317 | 0.010 | 4.419 | 4.132 | 0.000 | -27.000 | -42.000 | 52.500 | left superior parietal lobule |
|  |  | 0.196 |  | 330 | 0.024 | 0.382 | 0.010 | 4.341 | 4.068 | 0.000 | -54.000 | -7.500 | 18.000 | left precentral gyrus |
|  |  |  |  |  |  | 0.575 | 0.011 | 4.143 | 3.901 | 0.000 | -55.500 | -3.000 | 31.500 |  |
|  |  | 0.646 |  | 147 | 0.113 | 0.383 | 0.010 | 4.339 | 4.066 | 0.000 | -48.000 | 15.000 | 43.500 | left middle frontal gyrus |
|  |  |  |  |  |  | 0.910 | 0.015 | 3.765 | 3.578 | 0.000 | -40.500 | 9.000 | 31.500 |  |
|  |  | 0.720 |  | 127 | 0.138 | 0.475 | 0.011 | 4.241 | 3.984 | 0.000 | 34.500 | 42.000 | 37.500 | right middle frontal gyrus |
|  |  |  |  |  |  | 0.989 | 0.019 | 3.520 | 3.363 | 0.000 | 18.000 | 40.500 | 34.500 |  |
|  |  | 0.002 |  | 1102 | 0.000 | 0.496 | 0.011 | 4.220 | 3.966 | 0.000 | 19.500 | -64.500 | -30.000 | right cerebellum exterior |
|  |  |  |  |  |  | 0.566 | 0.011 | 4.151 | 3.908 | 0.000 | 10.500 | -67.500 | -30.000 | right cerebellum exterior |
|  |  |  |  |  |  | 0.585 | 0.011 | 4.134 | 3.893 | 0.000 | 34.500 | -60.000 | -33.000 |  |
|  |  | 0.871 |  | 84 | 0.223 | 0.688 | 0.012 | 4.034 | 3.808 | 0.000 | 4.500 | 7.500 | 60.000 | supplementary motor cortex |
|  |  | 0.091 |  | 445 | 0.010 | 0.732 | 0.012 | 3.990 | 3.771 | 0.000 | 3.000 | 19.500 | 49.500 |  |
|  |  |  |  |  |  | 0.990 | 0.019 | 3.506 | 3.352 | 0.000 | -4.500 | 30.000 | 48.000 | superior frontal gyrus medial segment |
|  |  |  |  |  |  | 0.999 | 0.022 | 3.356 | 3.219 | 0.001 | 10.500 | 18.000 | 57.000 |  |
|  |  | 0.635 |  | 150 | 0.110 | 0.739 | 0.012 | 3.982 | 3.764 | 0.000 | -42.000 | -64.500 | 43.500 | left angular gyrus |
|  |  | 0.990 |  | 26 | 0.503 | 0.828 | 0.013 | 3.883 | 3.680 | 0.000 | -19.500 | -1.500 | -45.000 |  |
|  |  | 0.760 |  | 116 | 0.155 | 0.845 | 0.014 | 3.862 | 3.662 | 0.000 | 0.000 | -15.000 | 34.500 | left middle cingulate gyrus |
|  |  | 0.081 |  | 463 | 0.009 | 0.850 | 0.014 | 3.854 | 3.655 | 0.000 | -13.500 | 3.000 | 19.500 | left caudate |
|  |  |  |  |  |  | 0.891 | 0.014 | 3.796 | 3.605 | 0.000 | -15.000 | -6.000 | 22.500 |  |
|  |  |  |  |  |  | 0.915 | 0.015 | 3.755 | 3.569 | 0.000 | -19.500 | 6.000 | 15.000 |  |
|  |  | 0.471 |  | 199 | 0.069 | 0.870 | 0.014 | 3.828 | 3.632 | 0.000 | -42.000 | -58.500 | 19.500 | left angular gyrus |
|  |  |  |  |  |  | 0.959 | 0.017 | 3.654 | 3.481 | 0.000 | -45.000 | -51.000 | 16.500 | left middle temporal gyrus |
|  |  | 0.960 |  | 49 | 0.350 | 0.878 | 0.014 | 3.816 | 3.622 | 0.000 | -1.500 | -48.000 | -27.000 |  |
|  |  | 0.980 |  | 36 | 0.426 | 0.885 | 0.014 | 3.806 | 3.613 | 0.000 | -18.000 | -12.000 | 70.500 |  |
|  |  | 0.980 |  | 36 | 0.426 | 0.900 | 0.015 | 3.783 | 3.593 | 0.000 | -1.500 | 36.000 | 37.500 |  |
|  |  | 0.972 |  | 42 | 0.388 | 0.904 | 0.015 | 3.775 | 3.586 | 0.000 | -48.000 | -34.500 | 18.000 |  |
|  |  | 0.986 |  | 31 | 0.462 | 0.907 | 0.015 | 3.770 | 3.582 | 0.000 | 25.500 | 42.000 | 25.500 |  |
|  |  | 0.981 |  | 35 | 0.432 | 0.921 | 0.015 | 3.746 | 3.561 | 0.000 | -13.500 | -64.500 | 49.500 |  |
|  |  | 0.942 |  | 58 | 0.309 | 0.925 | 0.015 | 3.736 | 3.553 | 0.000 | 7.500 | -49.500 | 66.000 | right precuneus |
|  |  | 0.976 |  | 39 | 0.406 | 0.928 | 0.016 | 3.731 | 3.549 | 0.000 | 16.500 | 15.000 | 64.500 | right superior frontal gyrus |
|  |  | 0.988 |  | 29 | 0.477 | 0.952 | 0.016 | 3.675 | 3.499 | 0.000 | -19.500 | -13.500 | -10.500 |  |
|  |  | 0.992 |  | 23 | 0.531 | 0.954 | 0.017 | 3.670 | 3.495 | 0.000 | 19.500 | 66.000 | 13.500 |  |
|  |  | 0.933 |  | 62 | 0.293 | 0.958 | 0.017 | 3.659 | 3.486 | 0.000 | 40.500 | 1.500 | 48.000 | right middle frontal gyrus |
|  |  | 0.946 |  | 56 | 0.318 | 0.961 | 0.017 | 3.650 | 3.477 | 0.000 | 21.000 | -13.500 | -12.000 |  |
|  |  | 0.970 |  | 43 | 0.382 | 0.961 | 0.017 | 3.648 | 3.476 | 0.000 | 7.500 | 22.500 | -4.500 |  |
|  |  | 0.999 |  | 6 | 0.772 | 0.963 | 0.017 | 3.642 | 3.471 | 0.000 | 18.000 | 25.500 | 48.000 |  |
|  |  | 0.997 |  | 15 | 0.621 | 0.965 | 0.017 | 3.636 | 3.466 | 0.000 | -15.000 | 45.000 | 45.000 |  |
|  |  | 0.996 |  | 17 | 0.596 | 0.966 | 0.017 | 3.635 | 3.464 | 0.000 | -18.000 | -72.000 | 52.500 |  |
|  |  | 0.997 |  | 13 | 0.648 | 0.973 | 0.018 | 3.609 | 3.442 | 0.000 | 16.500 | 40.500 | 49.500 |  |
|  |  | 0.985 |  | 32 | 0.454 | 0.976 | 0.018 | 3.596 | 3.431 | 0.000 | 39.000 | -9.000 | -10.500 |  |
|  |  | 0.969 |  | 44 | 0.377 | 0.980 | 0.018 | 3.577 | 3.414 | 0.000 | -42.000 | -1.500 | 52.500 |  |
|  |  | 0.266 |  | 285 | 0.034 | 0.983 | 0.018 | 3.561 | 3.400 | 0.000 | 12.000 | 12.000 | 15.000 | right caudate |
|  |  | 0.989 |  | 28 | 0.486 | 0.984 | 0.018 | 3.552 | 3.392 | 0.000 | 43.500 | -16.500 | -7.500 |  |
|  |  | 0.999 |  | 9 | 0.712 | 0.986 | 0.019 | 3.542 | 3.383 | 0.000 | -7.500 | -67.500 | -30.000 |  |
|  |  | 0.975 |  | 40 | 0.400 | 0.987 | 0.019 | 3.533 | 3.375 | 0.000 | 9.000 | -55.500 | 46.500 |  |
|  |  | 0.999 |  | 7 | 0.751 | 0.987 | 0.019 | 3.530 | 3.373 | 0.000 | 18.000 | -12.000 | 73.500 |  |
|  |  | 0.991 |  | 25 | 0.512 | 0.987 | 0.019 | 3.530 | 3.372 | 0.000 | -51.000 | -72.000 | 7.500 |  |
|  |  | 0.995 |  | 19 | 0.572 | 0.990 | 0.019 | 3.511 | 3.356 | 0.000 | 39.000 | 52.500 | -7.500 |  |
|  |  | 0.979 |  | 37 | 0.419 | 0.991 | 0.019 | 3.497 | 3.343 | 0.000 | 25.500 | 13.500 | 49.500 |  |
|  |  | 0.999 |  | 4 | 0.821 | 0.994 | 0.020 | 3.470 | 3.320 | 0.000 | -16.500 | -93.000 | 15.000 |  |
|  |  | 1.000 |  | 2 | 0.883 | 0.995 | 0.020 | 3.445 | 3.298 | 0.000 | 25.500 | -57.000 | 45.000 |  |
|  |  | 0.998 |  | 12 | 0.663 | 0.996 | 0.020 | 3.442 | 3.295 | 0.000 | -22.500 | 0.000 | 7.500 |  |
|  |  | 0.992 |  | 24 | 0.521 | 0.996 | 0.020 | 3.442 | 3.295 | 0.000 | 12.000 | 57.000 | -13.500 |  |
|  |  | 0.982 |  | 34 | 0.439 | 0.996 | 0.020 | 3.442 | 3.295 | 0.000 | 1.500 | -10.500 | -3.000 |  |
|  |  | 0.991 |  | 25 | 0.512 | 0.996 | 0.020 | 3.440 | 3.293 | 0.000 | 27.000 | -9.000 | 61.500 |  |
|  |  | 0.997 |  | 13 | 0.648 | 0.996 | 0.020 | 3.435 | 3.289 | 0.001 | 36.000 | -15.000 | -13.500 |  |
|  |  | 0.999 |  | 9 | 0.712 | 0.996 | 0.020 | 3.431 | 3.285 | 0.001 | -6.000 | -90.000 | 1.500 |  |
|  |  | 0.999 |  | 5 | 0.795 | 0.997 | 0.020 | 3.422 | 3.278 | 0.001 | 13.500 | 61.500 | 28.500 |  |
|  |  | 0.999 |  | 6 | 0.772 | 0.997 | 0.021 | 3.413 | 3.269 | 0.001 | -49.500 | -33.000 | 37.500 |  |
|  |  | 0.999 |  | 8 | 0.731 | 0.998 | 0.021 | 3.400 | 3.257 | 0.001 | 18.000 | 49.500 | 34.500 |  |
|  |  | 0.997 |  | 13 | 0.648 | 0.998 | 0.021 | 3.395 | 3.253 | 0.001 | -15.000 | -84.000 | 33.000 |  |
|  |  | 0.993 |  | 22 | 0.541 | 0.998 | 0.021 | 3.387 | 3.246 | 0.001 | 37.500 | -76.500 | 9.000 |  |
|  |  | 0.999 |  | 4 | 0.821 | 0.998 | 0.021 | 3.372 | 3.233 | 0.001 | -9.000 | -63.000 | 40.500 |  |
|  |  | 0.998 |  | 10 | 0.695 | 0.998 | 0.021 | 3.370 | 3.231 | 0.001 | 4.500 | 0.000 | 66.000 |  |
|  |  | 1.000 |  | 1 | 0.925 | 0.999 | 0.021 | 3.363 | 3.225 | 0.001 | 52.500 | 27.000 | 24.000 |  |
|  |  | 0.999 |  | 7 | 0.751 | 0.999 | 0.022 | 3.357 | 3.220 | 0.001 | -25.500 | 52.500 | -9.000 |  |
|  |  | 0.996 |  | 16 | 0.608 | 0.999 | 0.022 | 3.343 | 3.207 | 0.001 | 55.500 | -40.500 | -13.500 |  |
|  |  | 0.999 |  | 7 | 0.751 | 0.999 | 0.022 | 3.319 | 3.186 | 0.001 | -6.000 | -82.500 | 24.000 |  |
|  |  | 0.999 |  | 5 | 0.795 | 0.999 | 0.022 | 3.314 | 3.181 | 0.001 | -9.000 | 43.500 | 25.500 |  |
|  |  | 0.999 |  | 5 | 0.795 | 0.999 | 0.023 | 3.303 | 3.172 | 0.001 | -30.000 | -70.500 | 48.000 |  |
|  |  | 0.999 |  | 5 | 0.795 | 1.000 | 0.023 | 3.297 | 3.166 | 0.001 | 22.500 | 6.000 | 64.500 |  |
|  |  | 1.000 |  | 2 | 0.883 | 1.000 | 0.023 | 3.295 | 3.165 | 0.001 | -12.000 | -84.000 | -9.000 |  |
|  |  | 1.000 |  | 3 | 0.850 | 1.000 | 0.023 | 3.286 | 3.156 | 0.001 | 52.500 | -15.000 | -10.500 |  |
|  |  | 1.000 |  | 2 | 0.883 | 1.000 | 0.023 | 3.285 | 3.155 | 0.001 | 40.500 | -82.500 | 3.000 |  |
|  |  | 0.999 |  | 7 | 0.751 | 1.000 | 0.023 | 3.282 | 3.153 | 0.001 | 39.000 | -36.000 | 48.000 |  |
|  |  | 1.000 |  | 2 | 0.883 | 1.000 | 0.023 | 3.280 | 3.150 | 0.001 | 7.500 | -60.000 | -37.500 |  |
|  |  | 1.000 |  | 3 | 0.850 | 1.000 | 0.023 | 3.277 | 3.148 | 0.001 | 31.500 | 51.000 | 28.500 |  |
|  |  | 1.000 |  | 2 | 0.883 | 1.000 | 0.023 | 3.273 | 3.144 | 0.001 | -31.500 | 37.500 | -16.500 |  |
|  |  | 1.000 |  | 2 | 0.883 | 1.000 | 0.023 | 3.273 | 3.144 | 0.001 | -15.000 | 1.500 | 70.500 |  |
|  |  | 1.000 |  | 2 | 0.883 | 1.000 | 0.023 | 3.271 | 3.143 | 0.001 | 24.000 | 25.500 | 39.000 |  |
|  |  | 0.999 |  | 5 | 0.795 | 1.000 | 0.023 | 3.262 | 3.134 | 0.001 | 7.500 | 33.000 | -4.500 |  |
|  |  | 1.000 |  | 1 | 0.925 | 1.000 | 0.023 | 3.259 | 3.132 | 0.001 | 45.000 | -7.500 | 4.500 |  |
|  |  | 0.999 |  | 5 | 0.795 | 1.000 | 0.023 | 3.257 | 3.130 | 0.001 | 4.500 | 6.000 | 0.000 |  |
|  |  | 1.000 |  | 3 | 0.850 | 1.000 | 0.023 | 3.252 | 3.126 | 0.001 | -4.500 | -3.000 | 63.000 |  |
|  |  | 1.000 |  | 1 | 0.925 | 1.000 | 0.023 | 3.251 | 3.125 | 0.001 | -34.500 | 16.500 | -18.000 |  |
|  |  | 1.000 |  | 1 | 0.925 | 1.000 | 0.024 | 3.241 | 3.116 | 0.001 | -33.000 | 18.000 | -16.500 |  |
|  |  | 1.000 |  | 2 | 0.883 | 1.000 | 0.024 | 3.240 | 3.115 | 0.001 | -31.500 | -49.500 | 45.000 |  |
|  |  | 1.000 |  | 1 | 0.925 | 1.000 | 0.024 | 3.233 | 3.109 | 0.001 | 34.500 | -19.500 | 13.500 |  |
|  |  | 1.000 |  | 1 | 0.925 | 1.000 | 0.024 | 3.227 | 3.103 | 0.001 | -45.000 | -45.000 | -40.500 |  |
|  |  | 1.000 |  | 1 | 0.925 | 1.000 | 0.024 | 3.226 | 3.103 | 0.001 | -34.500 | -52.500 | 58.500 |  |
|  |  | 1.000 |  | 2 | 0.883 | 1.000 | 0.024 | 3.225 | 3.102 | 0.001 | -27.000 | -72.000 | 46.500 |  |
|  |  | 1.000 |  | 1 | 0.925 | 1.000 | 0.024 | 3.224 | 3.100 | 0.001 | 1.500 | -54.000 | 36.000 |  |
|  |  | 1.000 |  | 1 | 0.925 | 1.000 | 0.024 | 3.219 | 3.096 | 0.001 | -7.500 | -85.500 | 30.000 |  |
|  |  | 1.000 |  | 1 | 0.925 | 1.000 | 0.024 | 3.214 | 3.091 | 0.001 | -37.500 | -78.000 | 3.000 |  |
|  |  | 1.000 |  | 1 | 0.925 | 1.000 | 0.024 | 3.213 | 3.091 | 0.001 | -52.500 | 25.500 | 7.500 |  |

**Supplementary Table 18.** Results of the VBM analyses foranxiety in *C9orf72* expansion carriers

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Set-level |  |  | Cluster-level |  |  |  | Peak-level |  |  |  | MNI coordinates | | | Label |
| p | c | p(FWE-corr) | p(FDR-corr) | equivk | p(unc) | p(FWE-corr) | p(FDR-corr) | T | equivZ | p(unc) | x,y,z {mm} | | |  |
| 0.530 | 10.000 | 0.319 |  | 244 | 0.039 | 0.434 | 0.658 | 4.396 | 4.046 | 0.000 | -41 | 12 | 24 | opercular part of the inferior frontal gyrus |
|  |  | 0.642 |  | 142 | 0.104 | 0.781 | 0.658 | 4.033 | 3.753 | 0.000 | -11 | -81 | -29 | left cerebellum exterior |
|  |  | 0.994 |  | 23 | 0.510 | 0.877 | 0.658 | 3.908 | 3.650 | 0.000 | -5 | 11 | 50 | supplementary motor cortex |
|  |  | 0.987 |  | 31 | 0.440 | 0.961 | 0.658 | 3.734 | 3.506 | 0.000 | 48 | -41 | 23 | right superior temporal gyrus |
|  |  | 0.932 |  | 62 | 0.271 | 0.964 | 0.658 | 3.722 | 3.496 | 0.000 | -35 | -17 | -23 | left fusiform gyrus |
|  |  | 1.000 |  | 1 | 0.920 | 0.999 | 0.679 | 3.394 | 3.217 | 0.001 | 48 | -42 | 3 |  |
|  |  | 1.000 |  | 2 | 0.876 | 0.999 | 0.690 | 3.375 | 3.201 | 0.001 | -47 | -14 | -32 |  |
|  |  | 1.000 |  | 5 | 0.784 | 1.000 | 0.693 | 3.357 | 3.185 | 0.001 | -54 | -17 | -9 |  |
|  |  | 1.000 |  | 2 | 0.876 | 1.000 | 0.715 | 3.304 | 3.139 | 0.001 | -3 | 42 | 29 |  |
|  |  | 1.000 |  | 1 | 0.920 | 1.000 | 0.716 | 3.280 | 3.118 | 0.001 | -20 | -92 | 14 |  |

**Supplementary Table 19.** Results of the VBM analyses foranxiety in *MAPT* mutation carriers

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Set-level |  |  | Cluster-level |  |  |  | Peak-level |  |  |  | MNI coordinates | | | Label |
| p | c | p(FWE-corr) | p(FDR-corr) | equivk | p(unc) | p(FWE-corr) | p(FDR-corr) | T | equivZ | p(unc) | x,y,z {mm} | | |  |
| 0.000 | 67 | 0.021 | 0.118 | 538 | 0.002 | 0.182 | 0.841 | 5.47 | 4.42 | 0.000 | -34 | -66 | 45 | left angular gyrus |
|  |  |  |  |  |  | 0.338 | 0.841 | 5.13 | 4.23 | 0.000 | -40 | -50 | 51 | left angular gyrus |
|  |  |  |  |  |  | 0.868 | 0.841 | 4.36 | 3.74 | 0.000 | -42 | -58 | 44 | left angular gyrus |
|  |  | 0.846 | 0.909 | 85 | 0.157 | 0.431 | 0.841 | 4.98 | 4.14 | 0.000 | -26 | -82 | 39 | left sup occipit gyrus |
|  |  | 0.969 | 0.909 | 46 | 0.292 | 0.567 | 0.841 | 4.79 | 4.02 | 0.000 | 6 | -81 | 39 | right cuneus |
|  |  | 0.854 | 0.909 | 83 | 0.161 | 0.570 | 0.841 | 4.79 | 4.02 | 0.000 | -10 | -56 | 69 | left sup parital lobule |
|  |  | 0.202 | 0.635 | 266 | 0.019 | 0.572 | 0.841 | 4.79 | 4.02 | 0.000 | -56 | 8 | -32 | left temporal pole |
|  |  |  |  |  |  | 0.823 | 0.841 | 4.44 | 3.79 | 0.000 | -50 | 9 | -38 | left temporal pole |
|  |  |  |  |  |  | 0.997 | 0.900 | 3.81 | 3.37 | 0.000 | -44 | 12 | -44 | left temporal pole |
|  |  | 0.381 | 0.712 | 194 | 0.040 | 0.658 | 0.841 | 4.67 | 3.94 | 0.000 | -40 | -3 | 57 | left precentral gyrus |
|  |  |  |  |  |  | 0.972 | 0.900 | 4.08 | 3.55 | 0.000 | -51 | 3 | 45 | left precentral gyrus |
|  |  |  |  |  |  | 0.992 | 0.900 | 3.92 | 3.44 | 0.000 | -45 | 6 | 52 | left mid frontal gyrus |
|  |  | 0.828 | 0.909 | 89 | 0.148 | 0.709 | 0.841 | 4.60 | 3.90 | 0.000 | -2 | -80 | 26 | left cuneus |
|  |  | 0.990 | 0.909 | 31 | 0.388 | 0.743 | 0.841 | 4.56 | 3.87 | 0.000 | 44 | -69 | 44 | right angular gyrus |
|  |  | 0.866 | 0.909 | 80 | 0.169 | 0.755 | 0.841 | 4.54 | 3.86 | 0.000 | -60 | 2 | -6 | left sup temporal gyrus |
|  |  |  |  |  |  | 0.998 | 0.900 | 3.80 | 3.36 | 0.000 | -58 | 9 | -12 | left temporal pole |
|  |  | 0.978 | 0.909 | 41 | 0.320 | 0.810 | 0.841 | 4.46 | 3.81 | 0.000 | 9 | -44 | 72 | right post central gyr |
|  |  | 0.993 | 0.909 | 28 | 0.413 | 0.830 | 0.841 | 4.43 | 3.79 | 0.000 | -63 | -39 | 34 | left supramarginal |
|  |  | 0.998 | 0.909 | 17 | 0.530 | 0.851 | 0.841 | 4.39 | 3.76 | 0.000 | 24 | -44 | 63 |  |
|  |  | 0.676 | 0.909 | 122 | 0.095 | 0.855 | 0.841 | 4.39 | 3.76 | 0.000 | 36 | -38 | 57 | right sup parietal lobule |
|  |  |  |  |  |  | 0.953 | 0.900 | 4.16 | 3.61 | 0.000 | 30 | -42 | 54 | right sup parietal lobule |
|  |  | 0.971 | 0.909 | 45 | 0.297 | 0.856 | 0.841 | 4.38 | 3.76 | 0.000 | -27 | -92 | 9 | left mid occipital gyr |
|  |  | 0.979 | 0.909 | 40 | 0.326 | 0.862 | 0.841 | 4.37 | 3.75 | 0.000 | -28 | -40 | 63 | left sup parietal lobule |
|  |  | 0.920 | 0.909 | 65 | 0.212 | 0.933 | 0.900 | 4.22 | 3.65 | 0.000 | 9 | 3 | 72 | right sup frontal gyr |
|  |  | 0.854 | 0.909 | 83 | 0.161 | 0.952 | 0.900 | 4.16 | 3.61 | 0.000 | 30 | -8 | -48 | right inf temporal gyr |
|  |  | 0.846 | 0.909 | 85 | 0.157 | 0.955 | 0.900 | 4.15 | 3.60 | 0.000 | -68 | -14 | -12 | left mid temporal gyr |
|  |  | 0.997 | 0.909 | 21 | 0.482 | 0.960 | 0.900 | 4.13 | 3.59 | 0.000 | -66 | -21 | -26 |  |
|  |  | 0.992 | 0.909 | 29 | 0.404 | 0.973 | 0.900 | 4.07 | 3.55 | 0.000 | 22 | 15 | -38 | right temporal lobe |
|  |  | 0.398 | 0.712 | 189 | 0.043 | 0.977 | 0.900 | 4.05 | 3.53 | 0.000 | -26 | -52 | -14 | left fusiform gyr |
|  |  |  |  |  |  | 0.996 | 0.900 | 3.86 | 3.40 | 0.000 | -20 | -63 | -10 | left lingual gyr |
|  |  |  |  |  |  | 1.000 | 0.909 | 3.68 | 3.27 | 0.001 | -24 | -57 | -6 |  |
|  |  | 0.949 | 0.909 | 55 | 0.250 | 0.978 | 0.900 | 4.04 | 3.53 | 0.000 | -39 | 2 | -48 | left inf temporal gyr |
|  |  | 0.988 | 0.909 | 33 | 0.373 | 0.979 | 0.900 | 4.04 | 3.52 | 0.000 | 16 | 9 | 66 | right sup frontal gyr |
|  |  | 0.999 | 0.909 | 15 | 0.558 | 0.980 | 0.900 | 4.03 | 3.52 | 0.000 | -8 | -84 | 40 |  |
|  |  | 0.998 | 0.909 | 18 | 0.518 | 0.980 | 0.900 | 4.03 | 3.52 | 0.000 | 38 | -32 | 68 |  |
|  |  | 0.944 | 0.909 | 57 | 0.242 | 0.983 | 0.900 | 4.01 | 3.50 | 0.000 | -4 | 14 | 60 | supp motor cortex |
|  |  | 0.984 | 0.909 | 37 | 0.345 | 0.988 | 0.900 | 3.97 | 3.48 | 0.000 | 42 | -24 | 63 | right post central gyr |
|  |  | 0.998 | 0.909 | 17 | 0.530 | 0.988 | 0.900 | 3.96 | 3.47 | 0.000 | 22 | -44 | -16 |  |
|  |  | 0.998 | 0.909 | 19 | 0.505 | 0.991 | 0.900 | 3.94 | 3.45 | 0.000 | 3 | 21 | 39 |  |
|  |  | 0.996 | 0.909 | 23 | 0.460 | 0.993 | 0.900 | 3.91 | 3.43 | 0.000 | -3 | 10 | 44 |  |
|  |  | 0.999 | 0.909 | 15 | 0.558 | 0.994 | 0.900 | 3.90 | 3.43 | 0.000 | 2 | -28 | 56 |  |
|  |  | 0.996 | 0.909 | 22 | 0.471 | 0.995 | 0.900 | 3.87 | 3.41 | 0.000 | -33 | -12 | -16 |  |
|  |  | 1.000 | 0.909 | 2 | 0.859 | 0.996 | 0.900 | 3.86 | 3.40 | 0.000 | -36 | -44 | -14 |  |
|  |  | 0.994 | 0.909 | 26 | 0.431 | 0.997 | 0.900 | 3.84 | 3.38 | 0.000 | -42 | -56 | -21 | left fusiform gyr |
|  |  | 0.994 | 0.909 | 26 | 0.431 | 0.997 | 0.900 | 3.83 | 3.38 | 0.000 | 18 | -24 | 70 | right precentral gyr |
|  |  | 1.000 | 0.909 | 8 | 0.681 | 0.997 | 0.900 | 3.82 | 3.37 | 0.000 | 34 | 15 | -46 |  |
|  |  | 0.999 | 0.909 | 15 | 0.558 | 0.997 | 0.900 | 3.82 | 3.37 | 0.000 | 46 | 15 | -42 |  |
|  |  | 0.999 | 0.909 | 12 | 0.605 | 0.998 | 0.900 | 3.81 | 3.36 | 0.000 | 9 | 3 | 62 |  |
|  |  | 0.996 | 0.909 | 23 | 0.460 | 0.998 | 0.900 | 3.80 | 3.36 | 0.000 | -27 | -8 | -50 |  |
|  |  | 0.993 | 0.909 | 28 | 0.413 | 0.999 | 0.900 | 3.76 | 3.33 | 0.000 | 0 | -39 | 22 | posterior cingulate gyrus |
|  |  | 0.999 | 0.909 | 11 | 0.622 | 0.999 | 0.900 | 3.73 | 3.31 | 0.000 | -30 | -27 | 66 |  |
|  |  | 0.999 | 0.909 | 14 | 0.573 | 0.999 | 0.900 | 3.73 | 3.31 | 0.000 | 12 | -70 | 38 |  |
|  |  | 0.999 | 0.909 | 12 | 0.605 | 0.999 | 0.903 | 3.72 | 3.30 | 0.000 | 38 | -18 | 58 |  |
|  |  | 0.998 | 0.909 | 16 | 0.544 | 0.999 | 0.909 | 3.69 | 3.28 | 0.001 | -3 | -9 | 58 |  |
|  |  | 1.000 | 0.909 | 9 | 0.660 | 1.000 | 0.909 | 3.66 | 3.26 | 0.001 | -36 | 20 | -10 |  |
|  |  | 1.000 | 0.909 | 6 | 0.729 | 1.000 | 0.909 | 3.66 | 3.25 | 0.001 | -26 | -57 | 68 |  |
|  |  | 1.000 | 0.909 | 2 | 0.859 | 1.000 | 0.909 | 3.64 | 3.24 | 0.001 | -26 | 6 | 64 |  |
|  |  | 1.000 | 0.909 | 5 | 0.755 | 1.000 | 0.911 | 3.63 | 3.24 | 0.001 | 62 | -60 | 2 |  |
|  |  | 1.000 | 0.909 | 8 | 0.681 | 1.000 | 0.911 | 3.63 | 3.23 | 0.001 | 8 | -44 | 60 |  |
|  |  | 1.000 | 0.909 | 4 | 0.785 | 1.000 | 0.930 | 3.59 | 3.21 | 0.001 | -26 | 33 | -20 |  |
|  |  | 1.000 | 0.909 | 1 | 0.909 | 1.000 | 0.940 | 3.58 | 3.20 | 0.001 | 50 | 27 | 39 |  |
|  |  | 1.000 | 0.909 | 2 | 0.859 | 1.000 | 0.940 | 3.57 | 3.19 | 0.001 | 14 | -50 | 62 |  |
|  |  | 1.000 | 0.909 | 2 | 0.859 | 1.000 | 0.943 | 3.56 | 3.18 | 0.001 | -39 | -44 | -14 |  |
|  |  | 1.000 | 0.909 | 5 | 0.755 | 1.000 | 0.943 | 3.56 | 3.18 | 0.001 | -4 | -9 | 51 |  |
|  |  | 1.000 | 0.909 | 2 | 0.859 | 1.000 | 0.944 | 3.54 | 3.17 | 0.001 | -36 | -76 | 27 |  |
|  |  | 1.000 | 0.909 | 6 | 0.729 | 1.000 | 0.944 | 3.54 | 3.17 | 0.001 | -24 | -100 | 6 |  |
|  |  | 1.000 | 0.909 | 2 | 0.859 | 1.000 | 0.949 | 3.53 | 3.16 | 0.001 | -38 | -39 | -15 |  |
|  |  | 1.000 | 0.909 | 4 | 0.785 | 1.000 | 0.966 | 3.51 | 3.15 | 0.001 | 3 | -64 | 27 |  |
|  |  | 1.000 | 0.909 | 1 | 0.909 | 1.000 | 0.970 | 3.50 | 3.14 | 0.001 | -40 | -45 | -16 |  |
|  |  | 1.000 | 0.909 | 4 | 0.785 | 1.000 | 0.970 | 3.49 | 3.13 | 0.001 | -45 | 46 | -14 |  |
|  |  | 1.000 | 0.909 | 2 | 0.859 | 1.000 | 0.970 | 3.49 | 3.13 | 0.001 | -10 | -90 | 32 |  |
|  |  | 1.000 | 0.909 | 1 | 0.909 | 1.000 | 0.970 | 3.48 | 3.12 | 0.001 | 9 | -84 | 22 |  |
|  |  | 1.000 | 0.909 | 2 | 0.859 | 1.000 | 0.970 | 3.48 | 3.12 | 0.001 | 16 | -81 | 44 |  |
|  |  | 1.000 | 0.909 | 1 | 0.909 | 1.000 | 0.972 | 3.47 | 3.12 | 0.001 | -9 | 15 | -24 |  |
|  |  | 1.000 | 0.909 | 1 | 0.909 | 1.000 | 0.990 | 3.45 | 3.10 | 0.001 | 4 | 27 | 48 |  |
|  |  | 1.000 | 0.909 | 1 | 0.909 | 1.000 | 0.990 | 3.44 | 3.10 | 0.001 | 63 | 2 | -26 |  |
|  |  | 1.000 | 0.909 | 1 | 0.909 | 1.000 | 0.990 | 3.44 | 3.09 | 0.001 | -4 | -102 | 8 |  |