Detecting Mild Traumatic Brain Injury with MEG Scan Data: One-vs-K-Sample Tests —Supplementary Materials

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The Supplementary Materials are organised as follows. In Section 1, we provide a list of brain areas of interest in terms of the Desikan-Killiany Atlas. In Section 2, we present the results of applying the FLR-HC and PAD-HC to the abnormal areas claimed by the FLR and PAD respectively. In Section 3, we demonstrate the abilities of the PAD-HC and the FLR-HC in capturing heterogneity in controls and in seperating the case from controls.

1 Brain areas of interest: the Desikan-Killiany Atlas

Index	Region Name
1	ctx-lh-bankssts
2	ctx-lh-caudalanteriorcingulate
3	ctx-lh-caudalmiddlefrontal
4	ctx-lh-cuneus
5	ctx-lh-entorhinal
6	ctx-lh-frontalpole
7	ctx-lh-fusiform
8	ctx-lh-inferiorparietal
9	ctx-lh-inferiortemporal
10	ctx-lh-insula
11	ctx-lh-isthmuscingulate
12	ctx-lh-lateraloccipital
13	ctx-lh-lateralorbitofrontal
14	ctx-lh-lingual
15	ctx-lh-medialorbitofrontal
16	ctx-lh-middletemporal
17	ctx-lh-paracentral
18	ctx-lh-parahippocampal
19	ctx-lh-parsopercularis
20	ctx-lh-parsorbitalis
21	ctx-lh-parstriangularis
22	ctx-lh-pericalcarine
23	ctx-lh-postcentral
24	ctx-lh-posteriorcingulate
25	ctx-lh-precentral
26	ctx-lh-precuneus
27	ctx-lh-rostralanteriorcingulate
28	ctx-lh-rostralmiddlefrontal
29	ctx-lh-superiorfrontal
30	ctx-lh-superiorparietal

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31    ctx-lh-superiortemporal
32    ctx-lh-supramarginal
33    ctx-lh-temporalpole
34    ctx-lh-transversetemporal
35    ctx-rh-bankssts
36    ctx-rh-caudalanteriorcingulate
37    ctx-rh-caudalmiddlefrontal
38    ctx-rh-cuneus
39    ctx-rh-entorhinal
40    ctx-rh-frontalpole
41    ctx-rh-fusiform
42    ctx-rh-inferiorparietal
43    ctx-rh-inferiortemporal
44    ctx-rh-insula
45    ctx-rh-isthmuscingulate
46    ctx-rh-lateraloccipital
47    ctx-rh-lateralorbitofrontal
48    ctx-rh-lingual
49    ctx-rh-medialorbitofrontal
50    ctx-rh-middletemporal
51    ctx-rh-paracentral
52    ctx-rh-parahippocampal
53    ctx-rh-parsopercularis
54    ctx-rh-parsorbitalis
55    ctx-rh-parstriangularis
56   ctx-rh-pericalcarine
57   ctx-rh-postcentral
58   ctx-rh-posteriorcingulate
59   ctx-rh-precentral
60  ctx-rh-precuneus
61  ctx-rh-rostralanteriorcingulate
62  ctx-rh-rostralmiddlefrontal
```

63 ctx-rh-superiorfrontal

64 ctx-rh-superiorparietal

65 ctx-rh-superiortemporal

66 ctx-rh-supramarginal

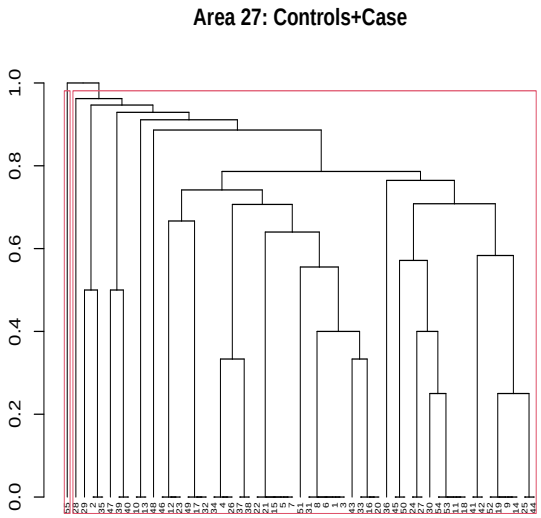
67 ctx-rh-temporalpole

68 ctx-rh-transversetemporal

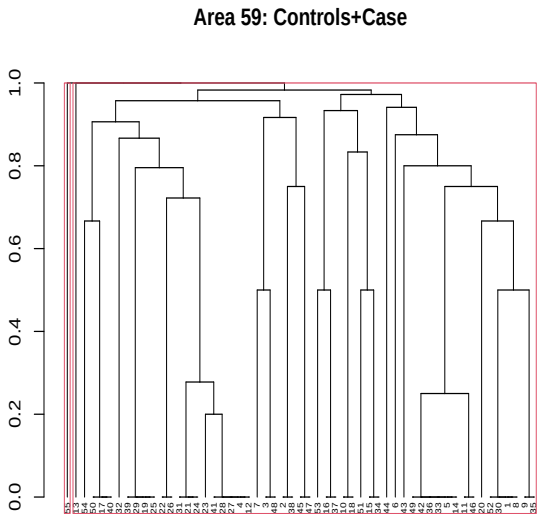
2 Results on hierarchical clustering

In the following, in addition to Figures 8 and 9 in the main text, we present the dendrograms for the abnormal areas claimed by the FLR and PAD in the delta- and gamma-band respectively. We select these areas, where the case-subject 55 is the last one to be merged into the dendrogram, as the FLR-HC and PAD-HC adjusted areas.

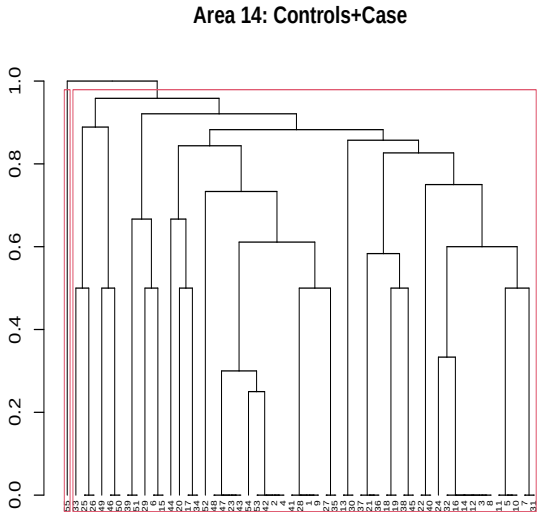
(a) Delta



(b) Delta



(c) Gamma



(d) Gamma

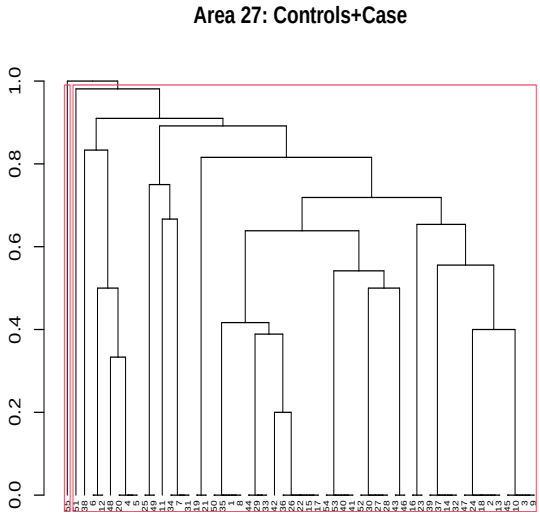
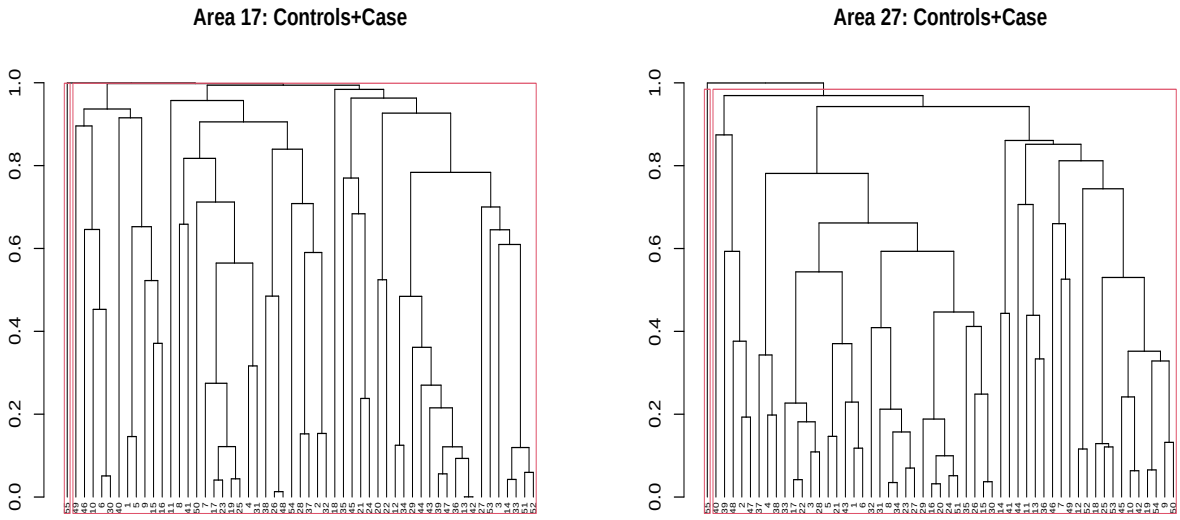


Figure 1: Examples of the FLR-HC dendrograms for the delta- and gamma- band data. Red boxes indicate the cluster borders if we partition 55 subjects into two clusters.

(a) Delta

(b) Delta



(c) Gamma

(d) Gamma

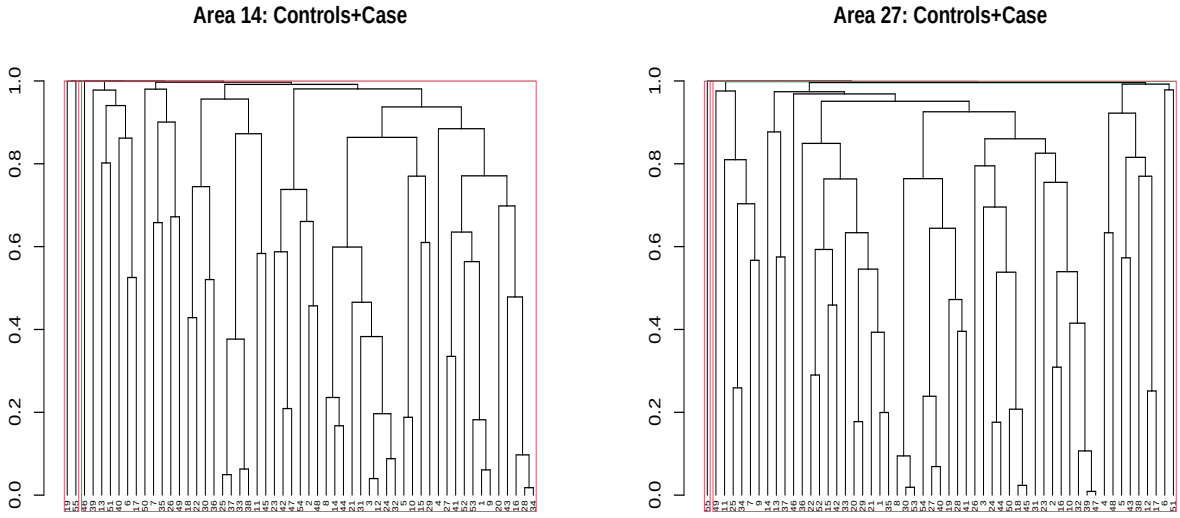
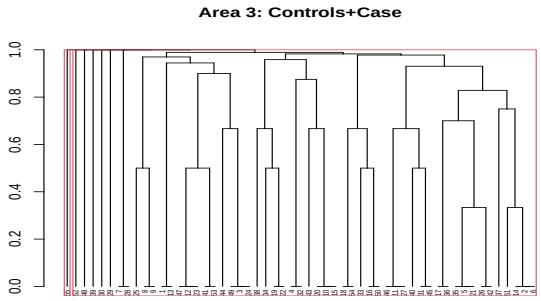
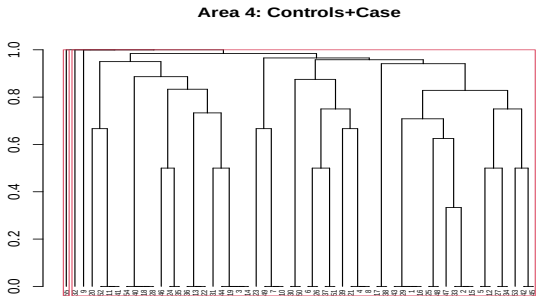


Figure 2: Examples of the PAD-HC dendrograms for the delta- and gamma- band data. Red boxes indicate the cluster borders if we partition 55 subjects into two clusters.

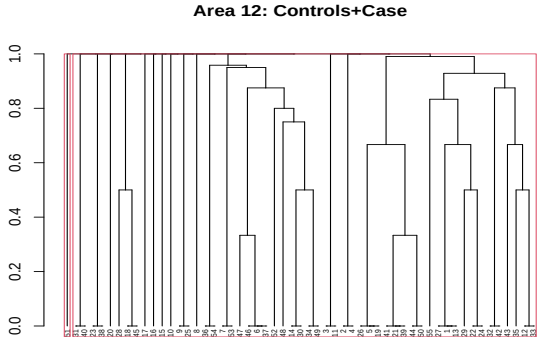
(a) Delta



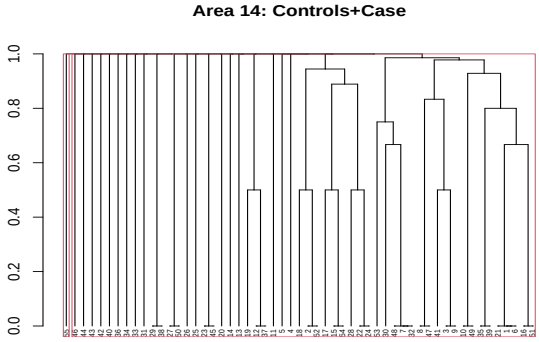
(b) Delta



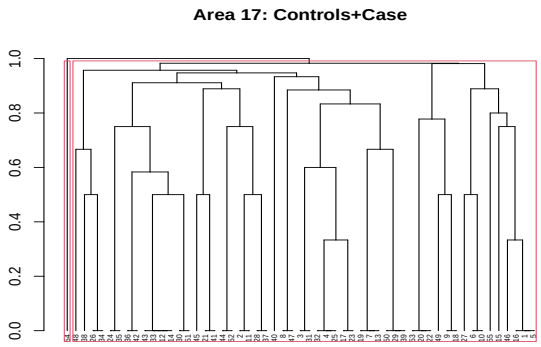
(c) Delta



(d) Delta



(e) Delta



(f) Delta

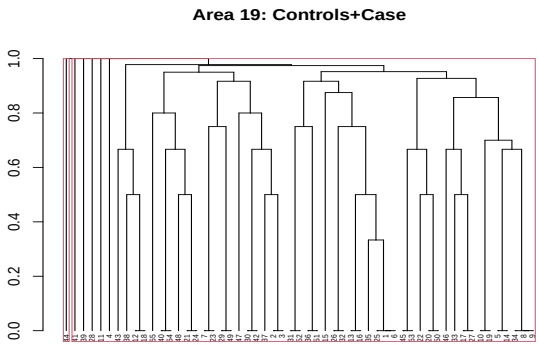
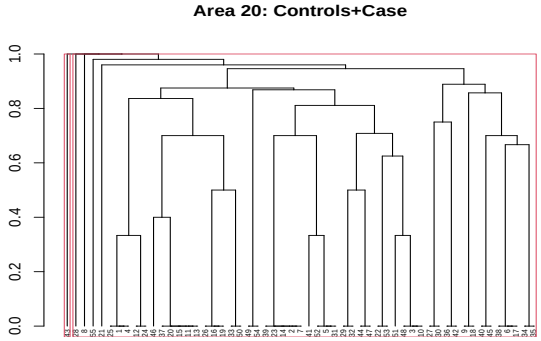
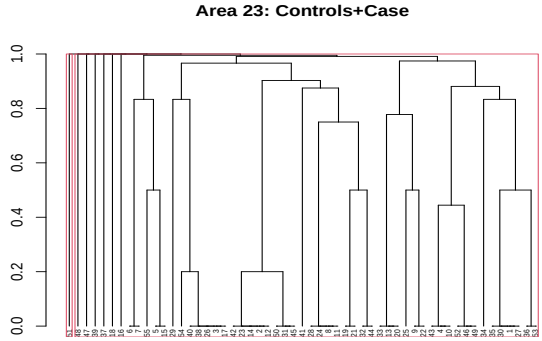


Figure 3: FLR-HC dendrograms for the areas identified as positive by the FLR in the delta band. Red boxes indicate the cluster borders if we partition 55 subjects into two clusters.

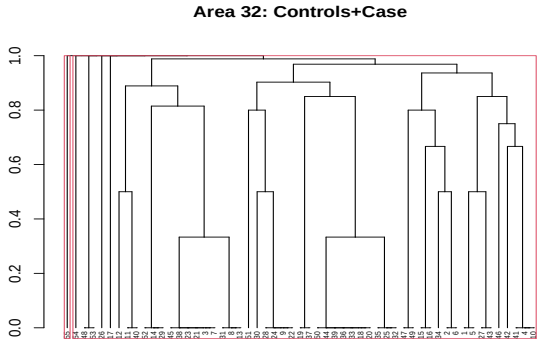
(a) Delta



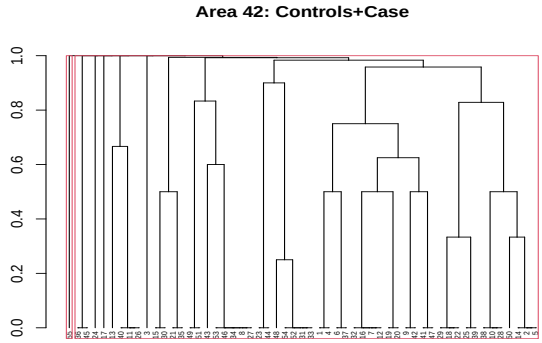
(b) Delta



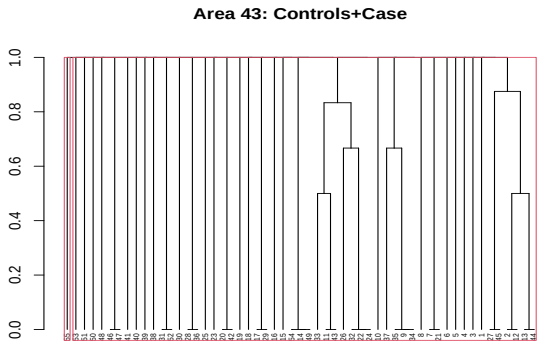
(c) Delta



(d) Delta



(e) Delta



(f) Delta

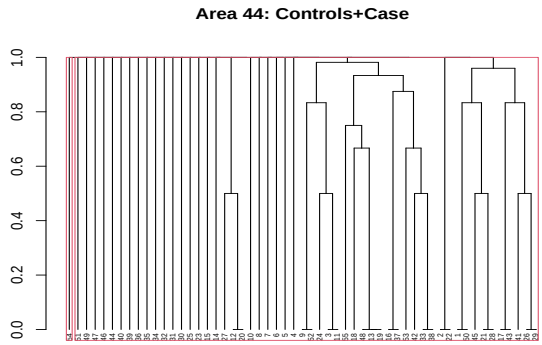
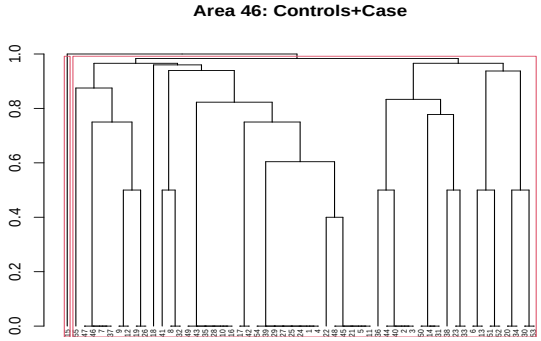
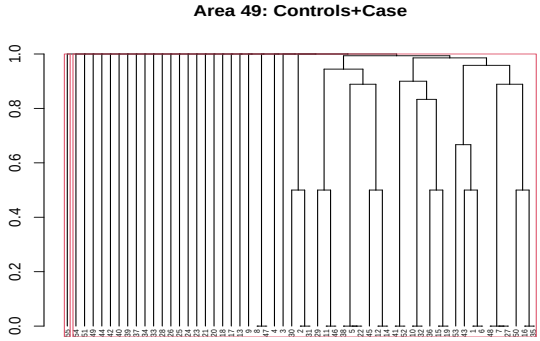


Figure 4: FLR-HC dendrograms for the areas identified as positive by the FLR in the delta band. Red boxes indicate the cluster borders if we partition 55 subjects into two clusters.

(a) Delta



(b) Delta



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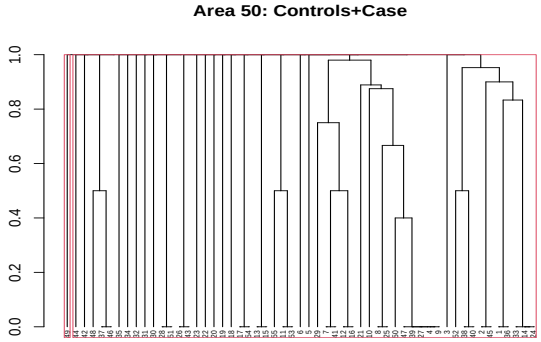
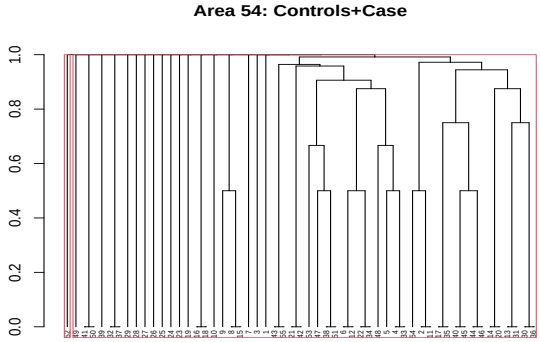
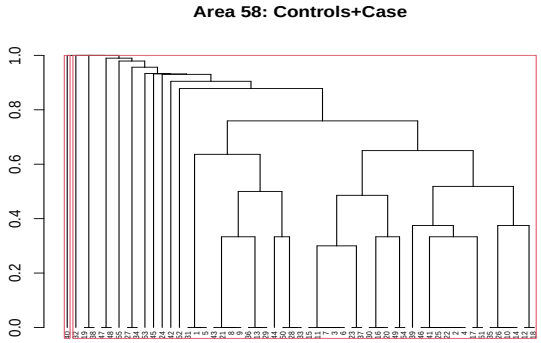


(d) Delta



(e) Delta



(f) Delta

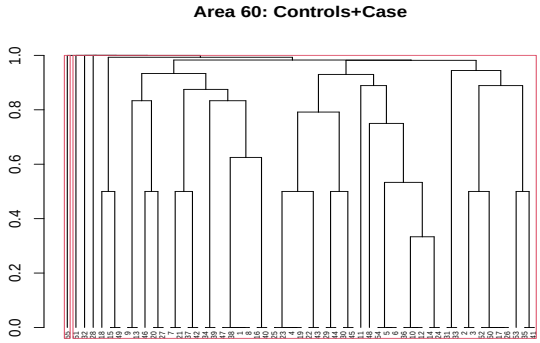
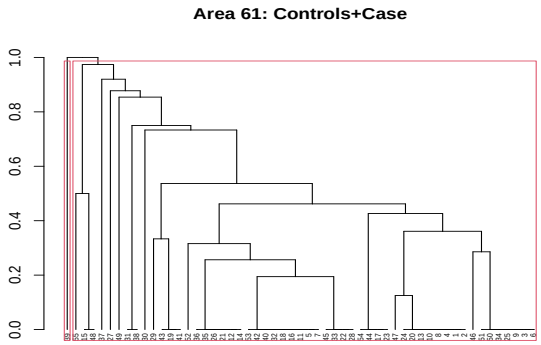
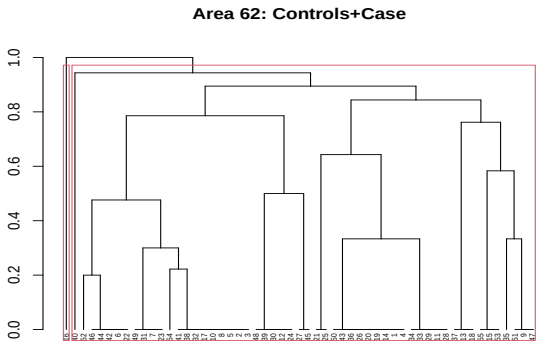


Figure 5: FLR-HC dendrograms for the areas identified as positive by the FLR in the delta band. Red boxes indicate the cluster borders if we partition 55 subjects into two clusters.

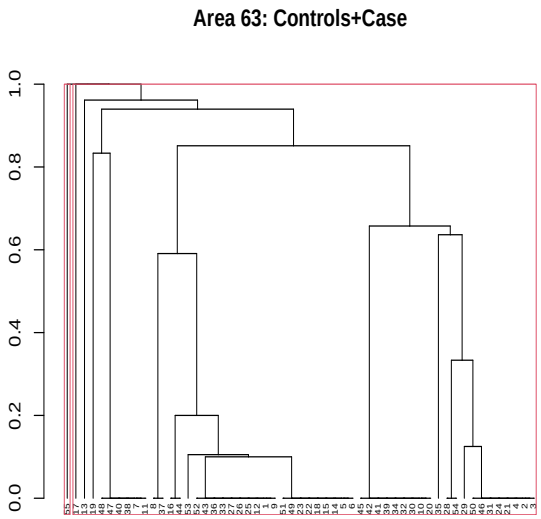
(a) Delta



(b) Delta



(c) Delta



(d) Delta

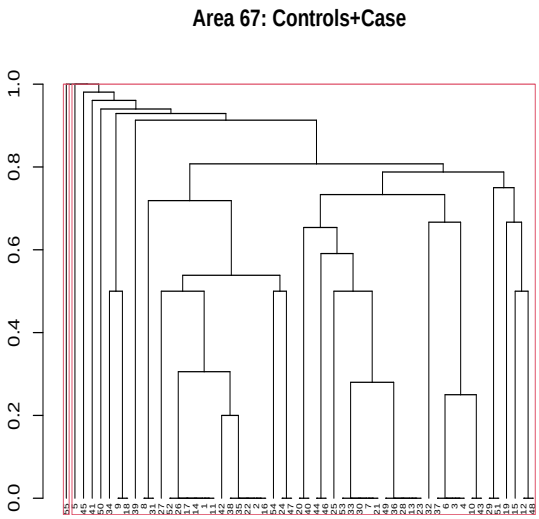
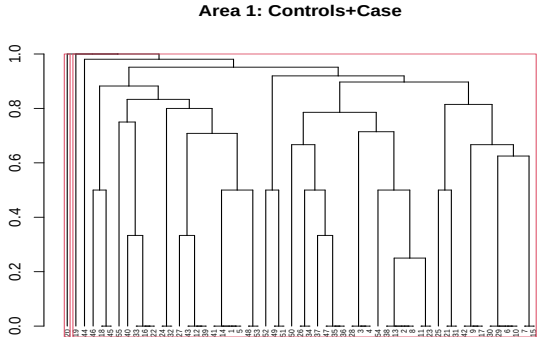
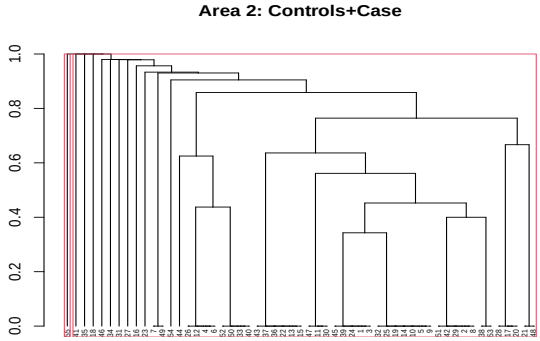


Figure 6: FLR-HC dendrograms for the areas identified as positive by the FLR in the delta band. Red boxes indicate the cluster borders if we partition 55 subjects into two clusters.

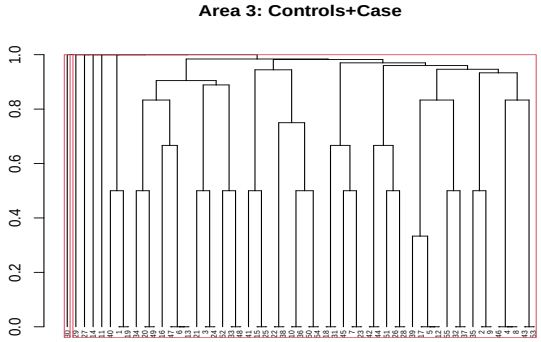
(a) Gamma



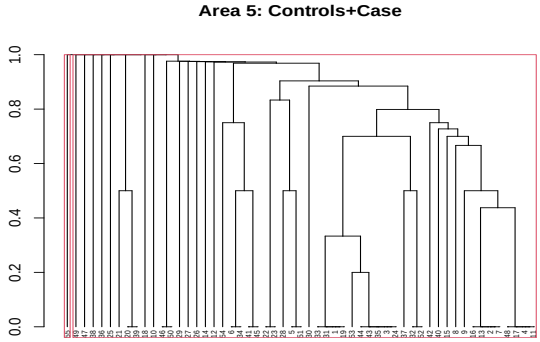
(b) Gamma



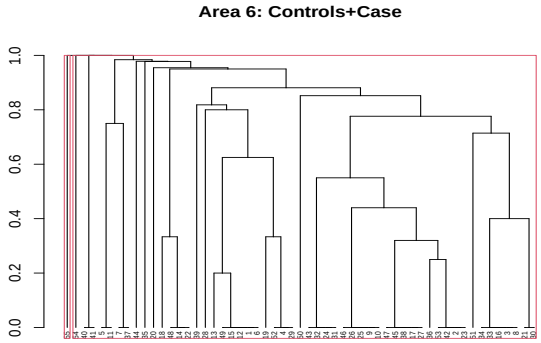
(c) Gamma



(d) Gamma



(e) Gamma



(f) Gamma

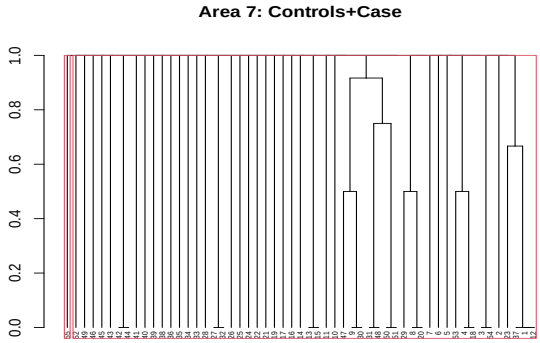
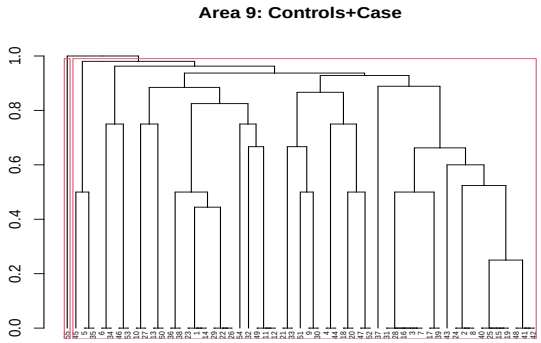
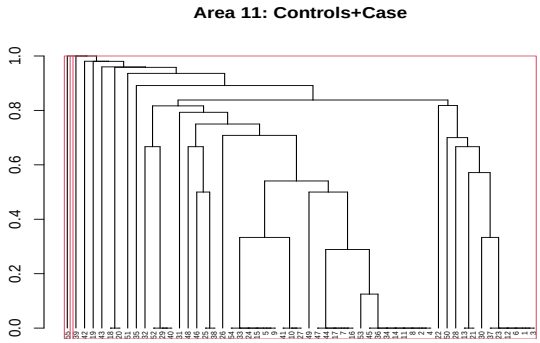


Figure 7: FLR-HC dendrograms for the areas identified as positive by the FLR in the gamma band. Red boxes indicate the cluster borders if we partition 55 subjects into two clusters.

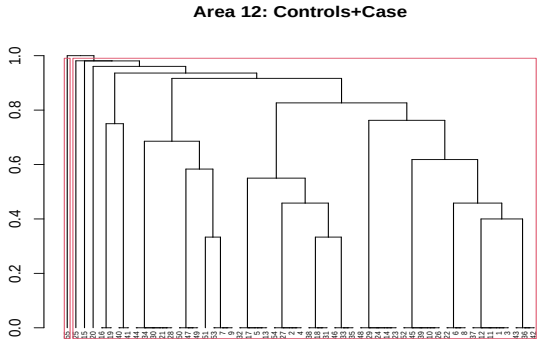
(a) Gamma



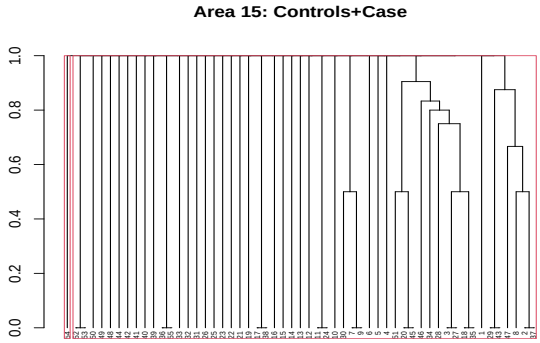
(b) Gamma



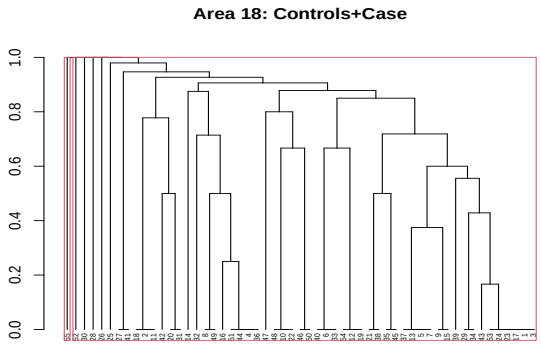
(c) Gamma



(d) Gamma



(e) Gamma



(f) Gamma

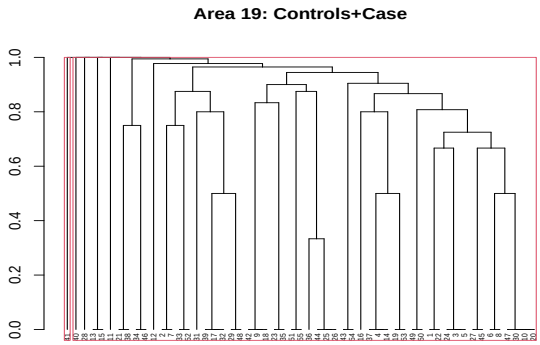
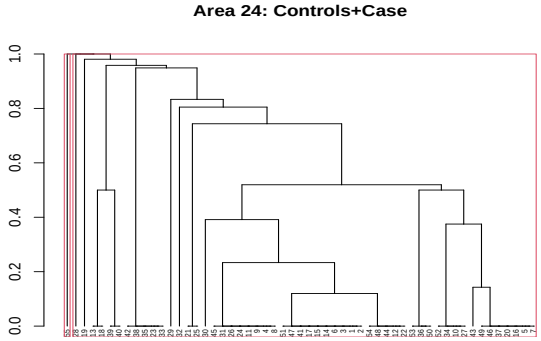
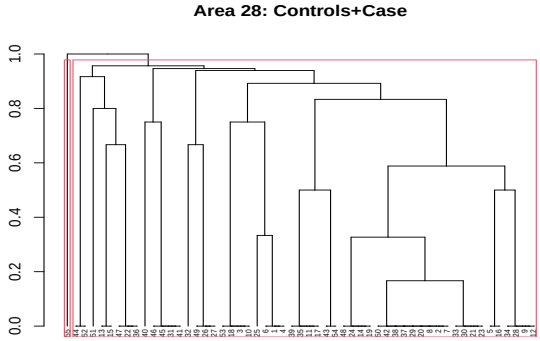


Figure 8: FLR-HC dendrograms for the areas identified as positive by the FLR in the gamma band. Red boxes indicate the cluster borders if we partition 55 subjects into two clusters.

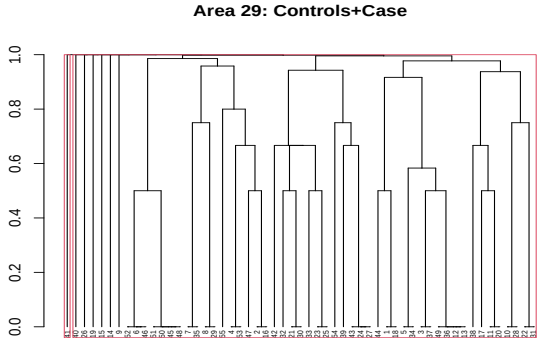
(a) Gamma



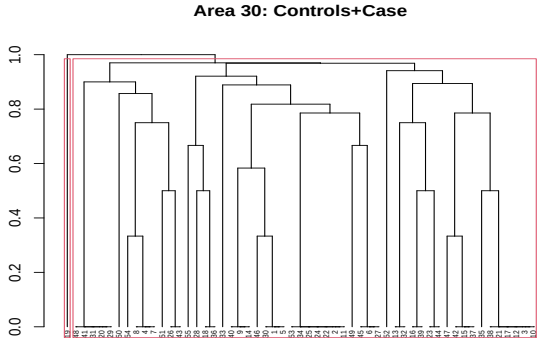
(b) Gamma



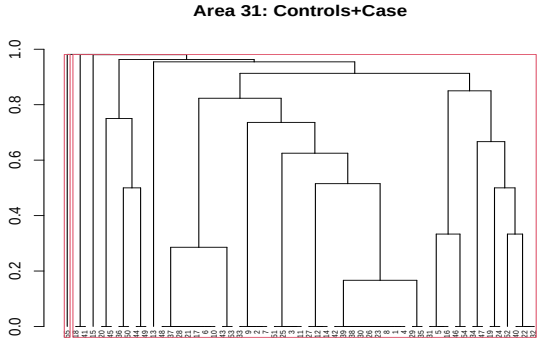
(c) Gamma



(d) Gamma



(e) Gamma



(f) Gamma

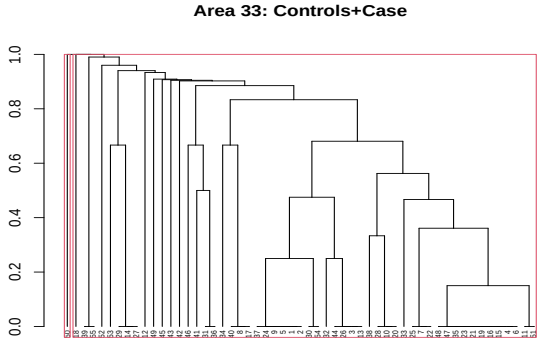
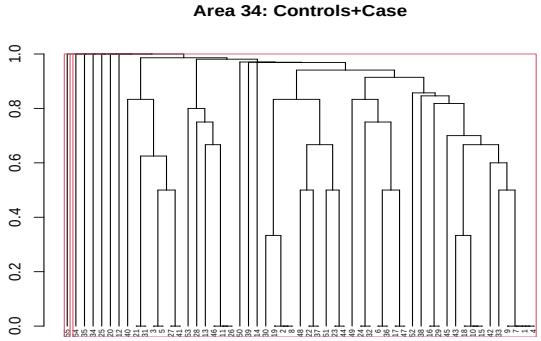
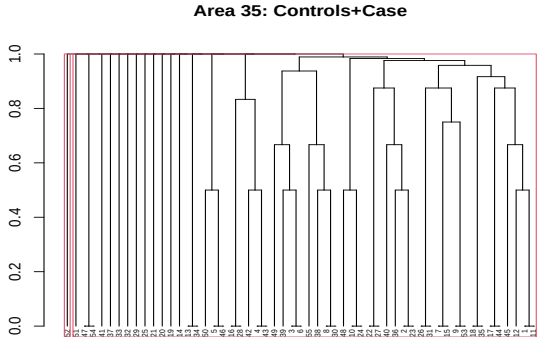


Figure 9: FLR-HC dendrograms for the areas identified as positive by the FLR in the gamma band. Red boxes indicate the cluster borders if we partition 55 subjects into two clusters.

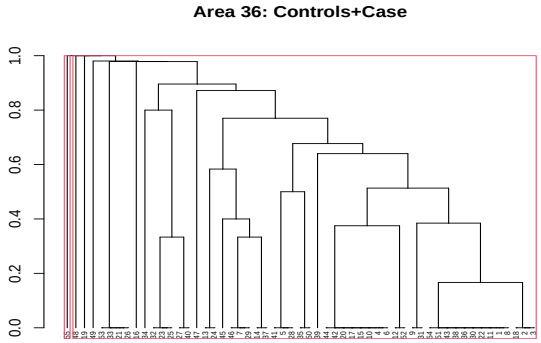
(a) Gamma



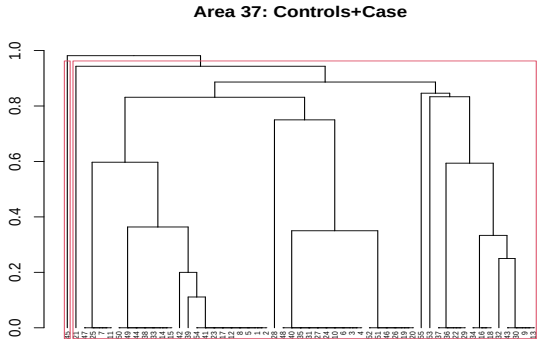
(b) Gamma



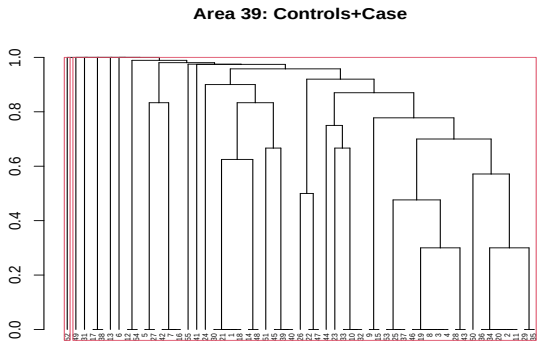
(c) Gamma



(d) Gamma



(e) Gamma



(f) Gamma

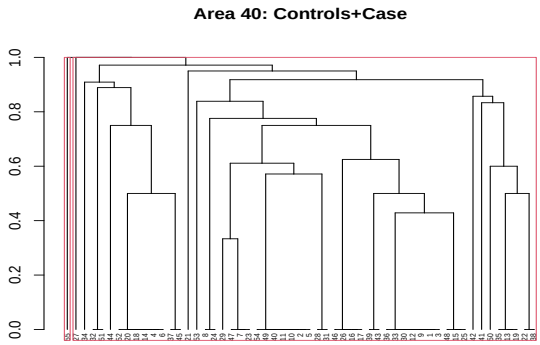
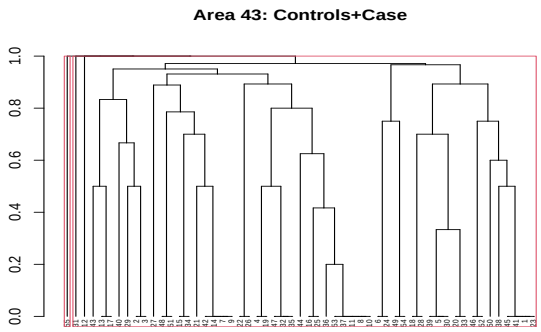
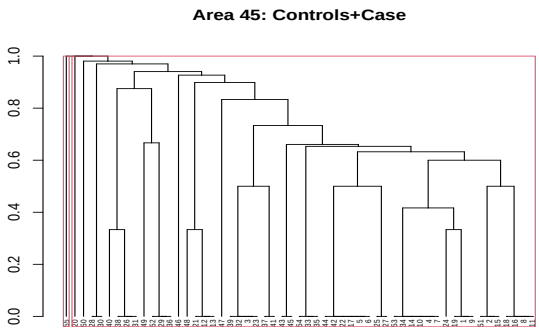


Figure 10: FLR-HC dendrograms for the areas identified as positive by the FLR in the gamma band. Red boxes indicate the cluster borders if we partition 55 subjects into two clusters.

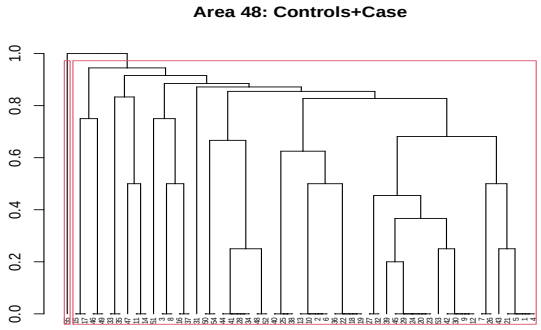
(a) Gamma



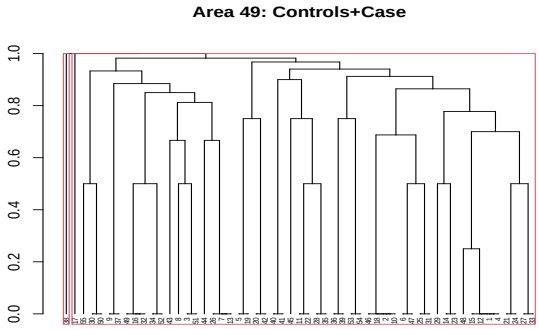
(b) Gamma



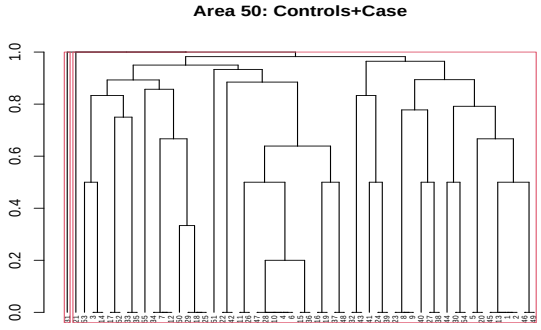
(c) Gamma



(d) Gamma



(e) Gamma



(f) Gamma

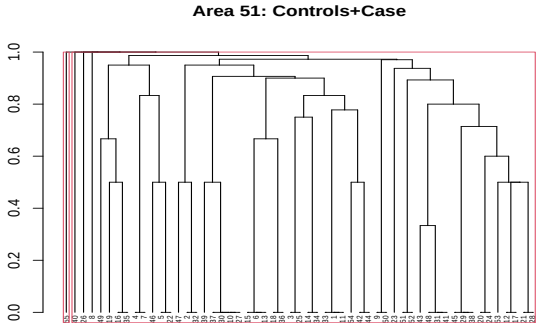
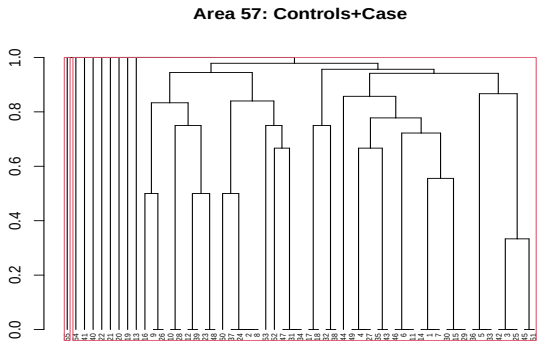
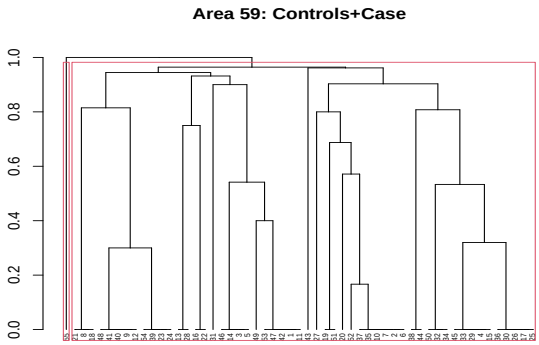


Figure 11: FLR-HC dendrograms for the areas identified as positive by the FLR in the gamma band. Red boxes indicate the cluster borders if we partition 55 subjects into two clusters.

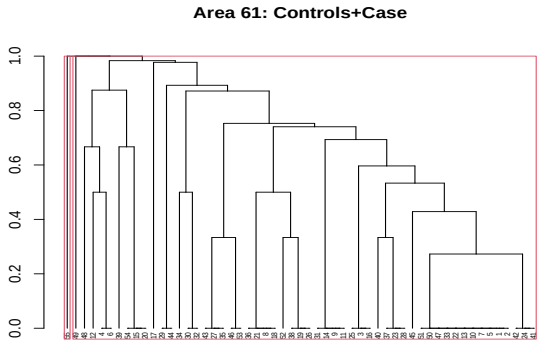
(a) Gamma



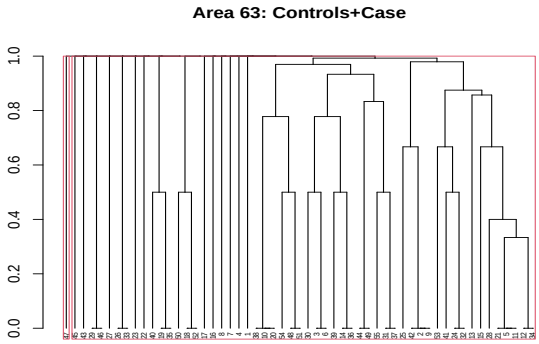
(b) Gamma



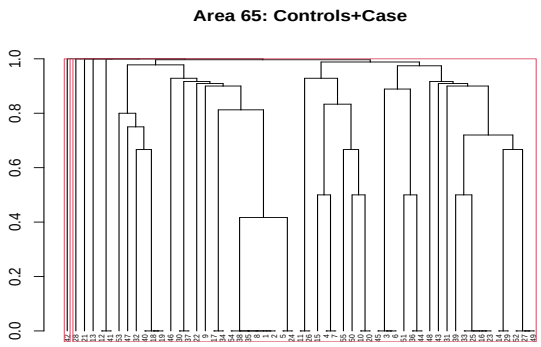
(c) Gamma



(d) Gamma



(e) Gamma



(f) Gamma

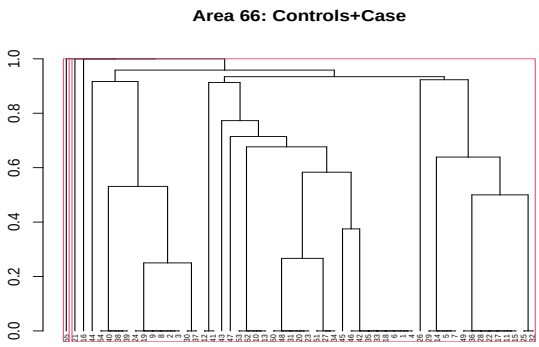
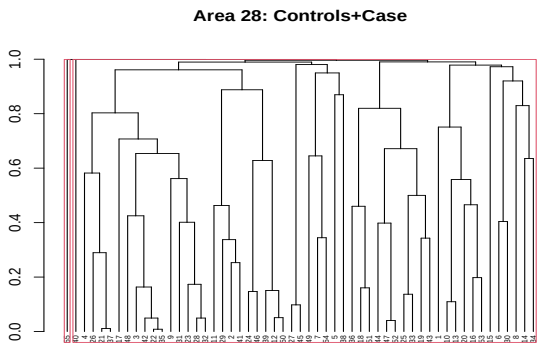
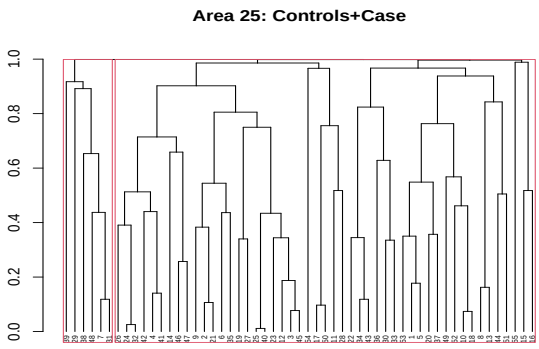


Figure 12: FLR-HC dendrograms for the areas identified as positive by the FLR in the gamma band. Red boxes indicate the cluster borders if we partition 55 subjects into two clusters.

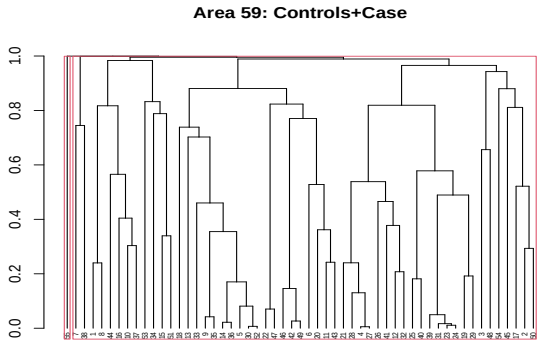
(a) Delta



(b) Delta



(c) Delta



(d) Delta

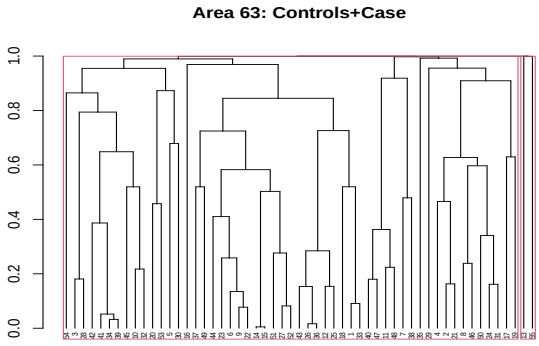
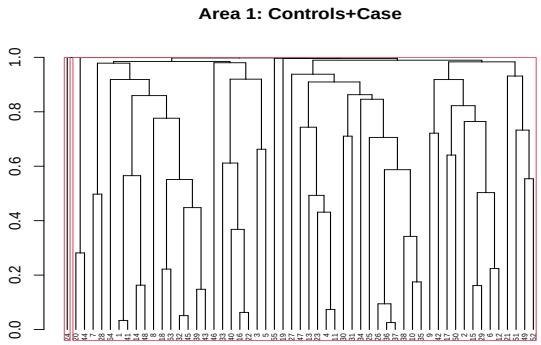
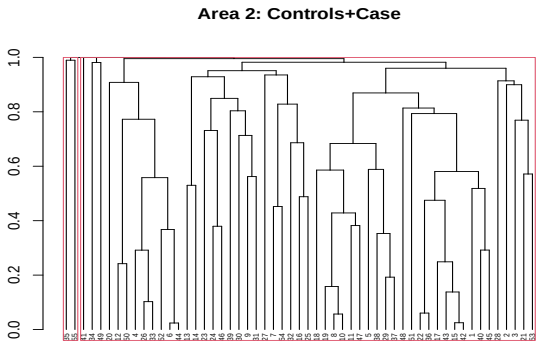


Figure 13: PAD-HC dendrograms in the delta band. Red boxes indicate the cluster borders if we partition 55 subjects into two clusters.

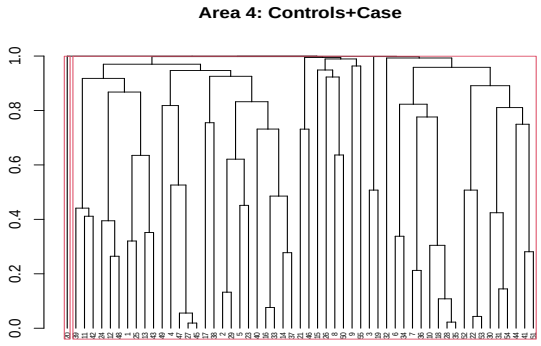
(a) Gamma



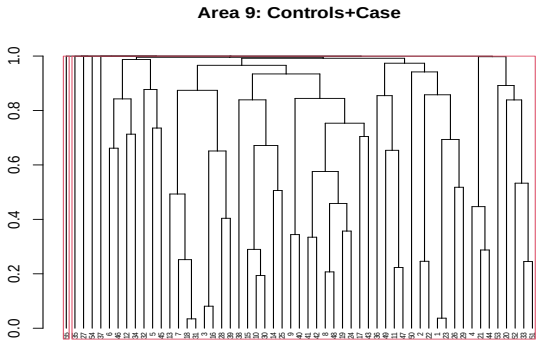
(b) Gamma



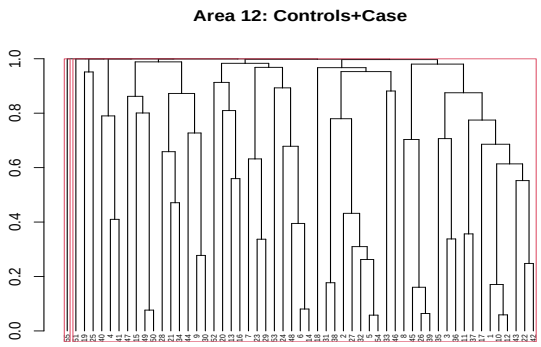
(c) Gamma



(d) Gamma



(e) Gamma



(f) Gamma

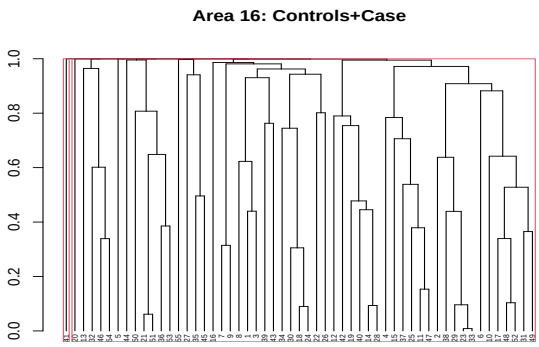
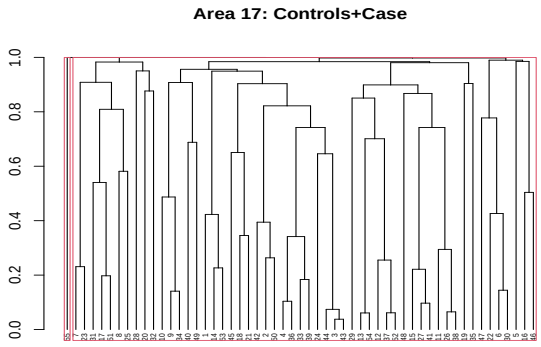
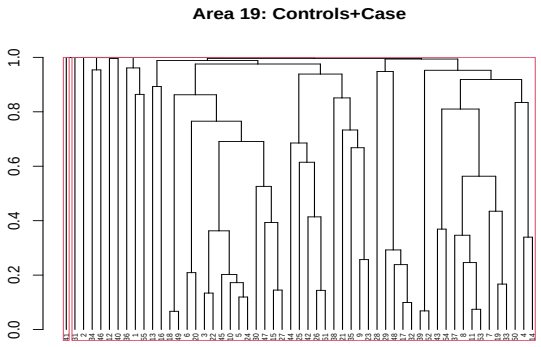


Figure 14: PAD-HC dendrograms in the gamma band. Red boxes indicate the cluster borders if we partition 55 subjects into two clusters.

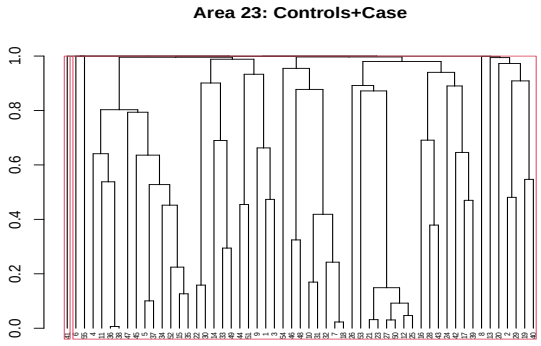
(a) Gamma



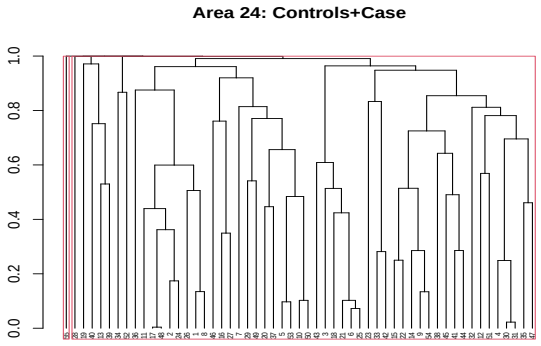
(b) Gamma



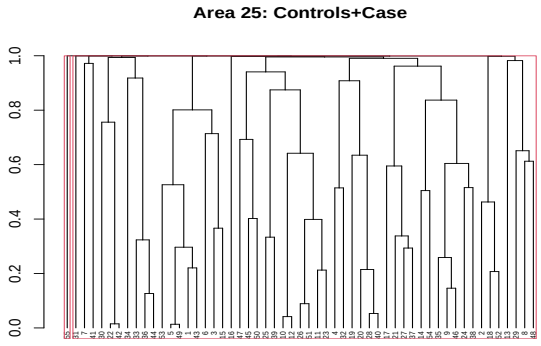
(c) Gamma



(d) Gamma



(e) Gamma



(f) Gamma

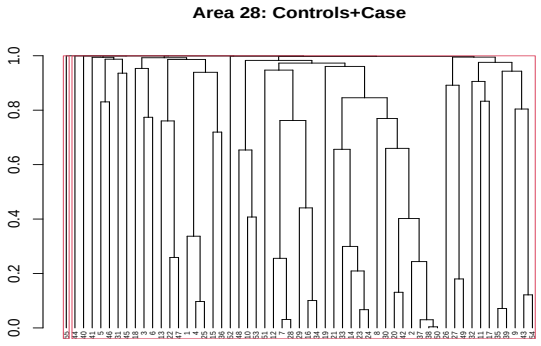
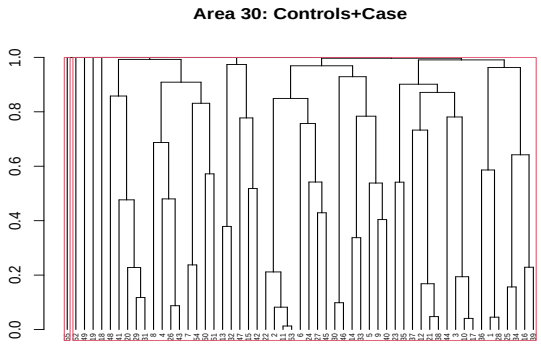
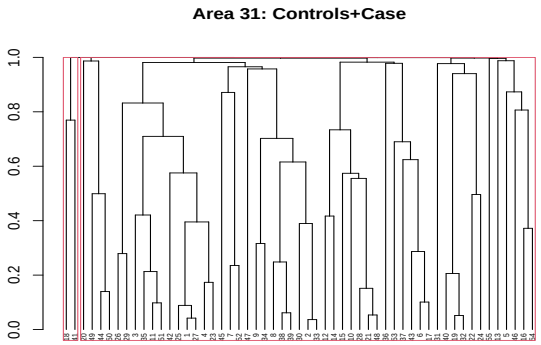


Figure 15: PAD-HC dendrograms in the gamma band. Red boxes indicate the cluster borders if we partition 55 subjects into two clusters.

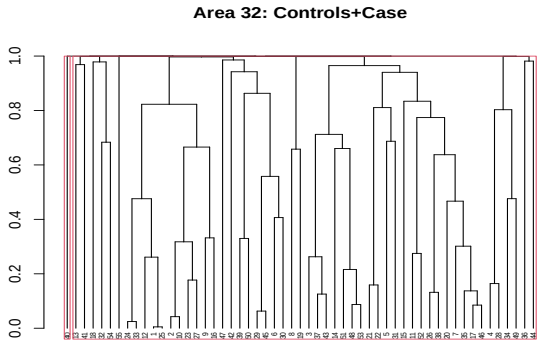
(a) Gamma



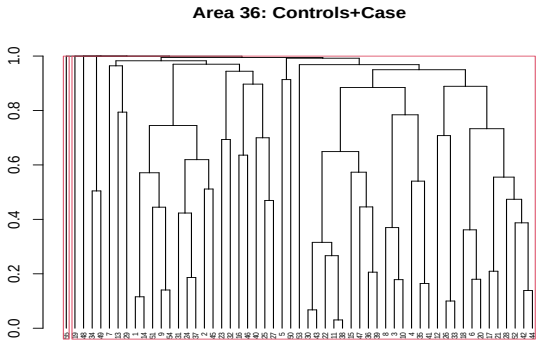
(b) Gamma



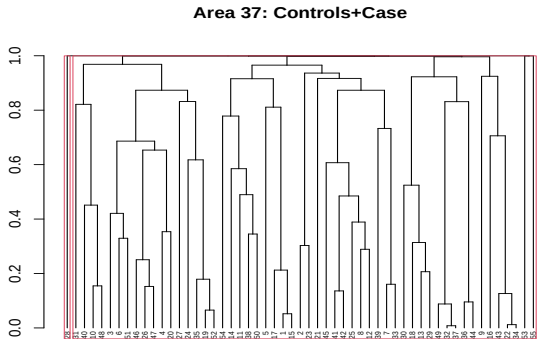
(c) Gamma



(d) Gamma



(e) Gamma



(f) Gamma

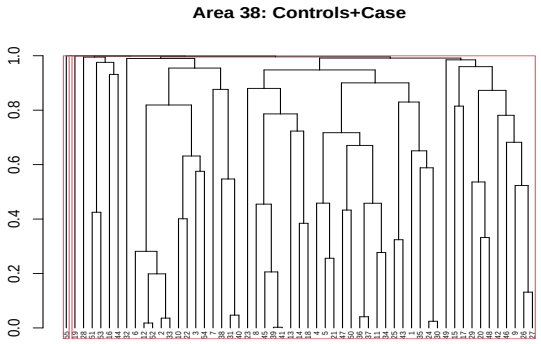
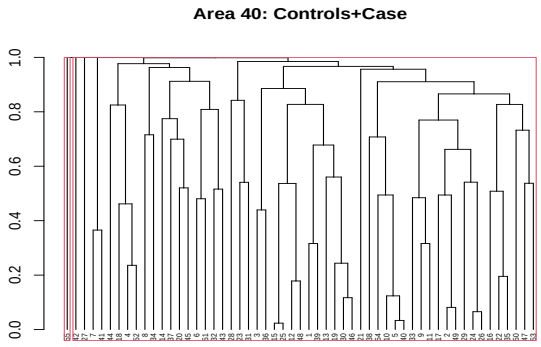
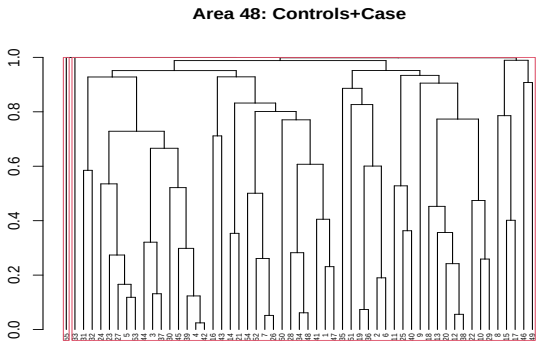


Figure 16: PAD-HC dendrograms in the gamma band. Red boxes indicate the cluster borders if we partition 55 subjects into two clusters.

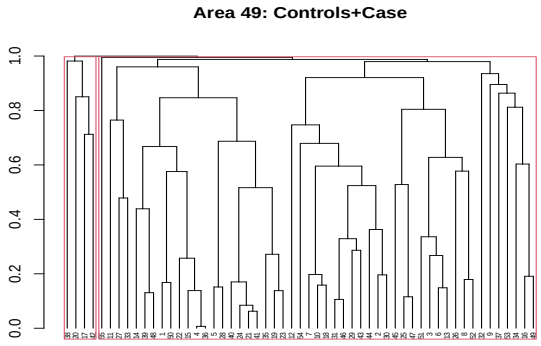
(a) Gamma



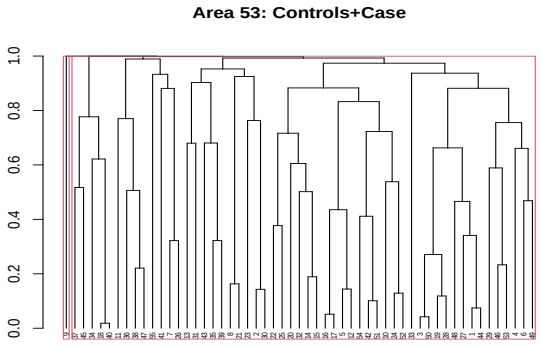
(b) Gamma



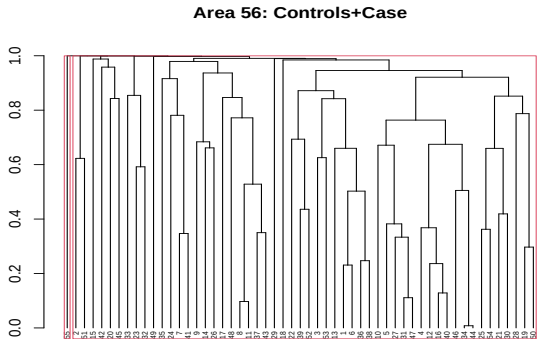
(c) Gamma



(d) Gamma



(e) Gamma



(f) Gamma

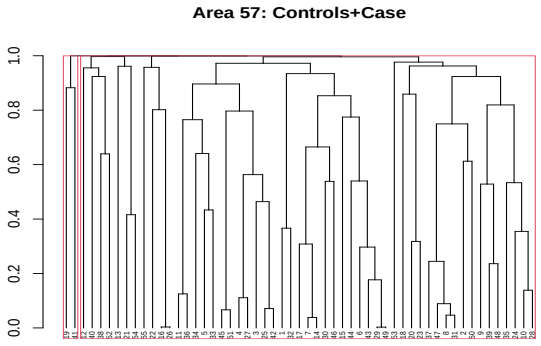
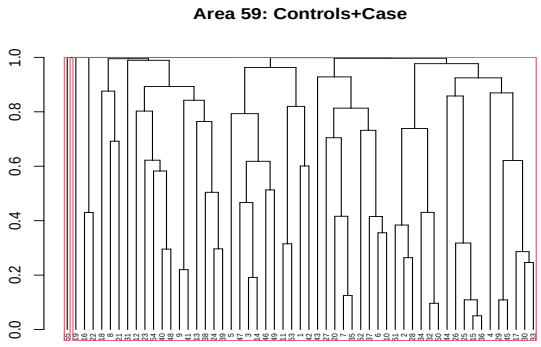
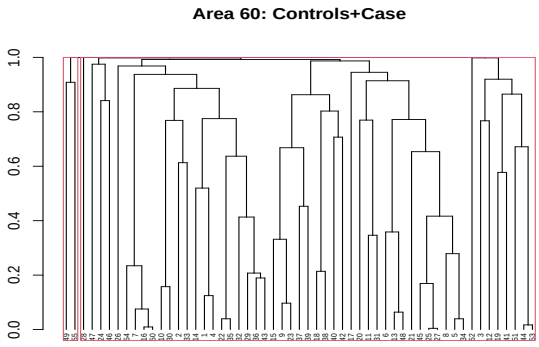


Figure 17: PAD-HC dendrograms in the gamma band. Red boxes indicate the cluster borders if we partition 55 subjects into two clusters.

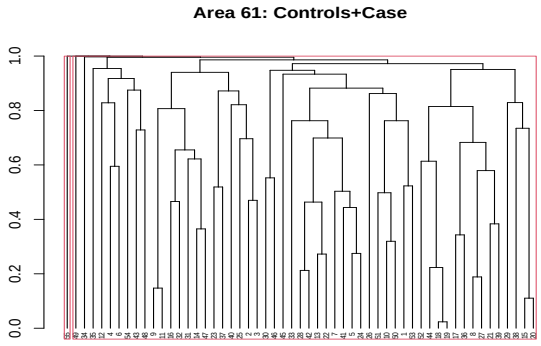
(a) Gamma



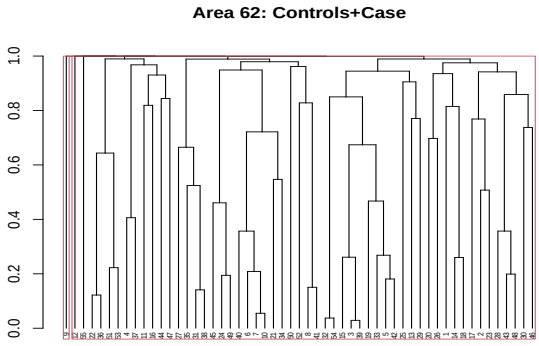
(b) Gamma



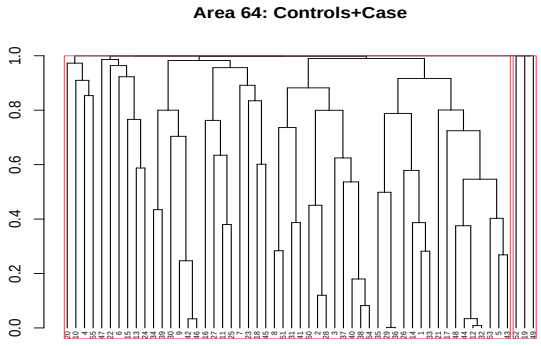
(c) Gamma



(d) Gamma



(e) Gamma



(f) Gamma

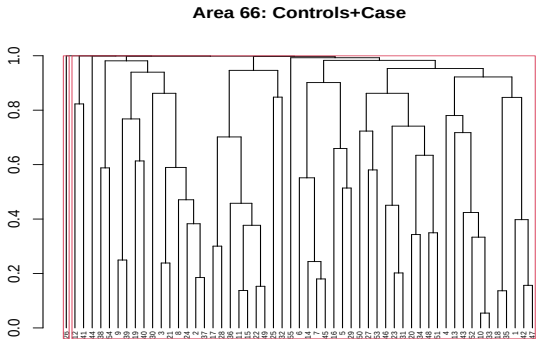


Figure 18: PAD-HC dendrograms in the gamma band. Red boxes indicate the cluster borders if we partition 55 subjects into two clusters.

(a) Gamma

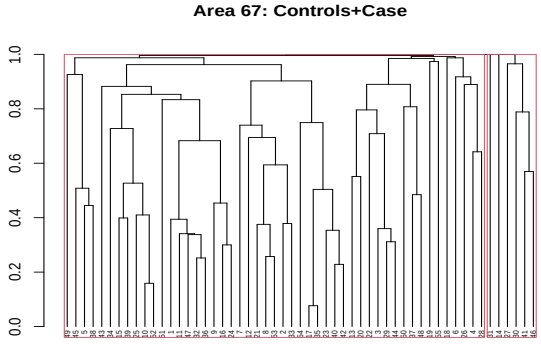


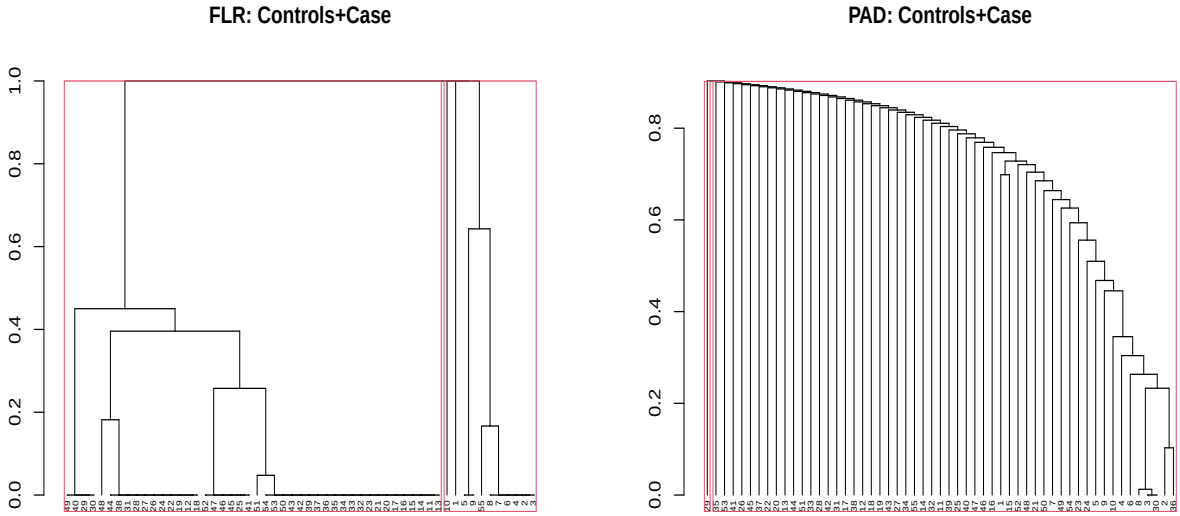
Figure 19: PAD-HC dendrograms in the gamma band. Red boxes indicate the cluster borders if we partition 55 subjects into two clusters.

3 Comparison of PAD-HC and FLR-HC

In this section, we demonstrate the abilities of the PAD-HC and the FLR-HC in separating the case from heterogeneous controls by using simulated Settings 1.1, 1.2 and 1.3, where there are two subgroups in controls. It is clearly shown that the FLR is more capable than the PAD to capture heterogeneity in controls and thus to distinguish the case from the controls.

(a) Setting 1.1

(b) Setting 1.1



(c) Setting 1.3

(d) Setting 1.3

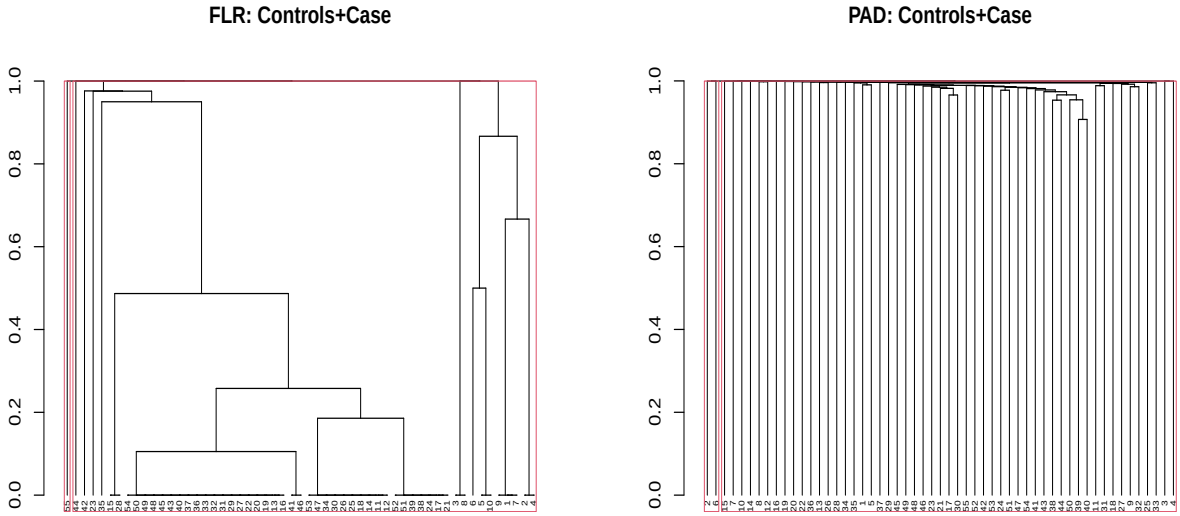
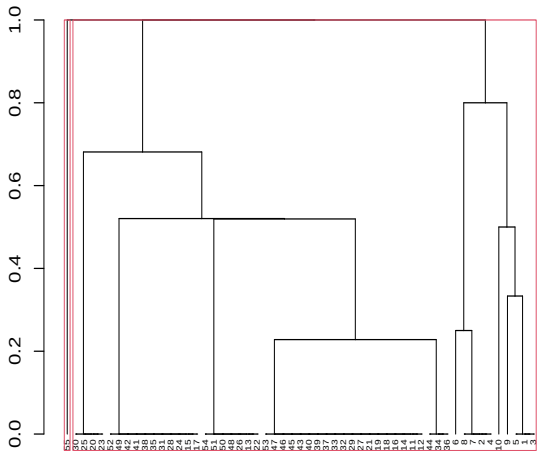
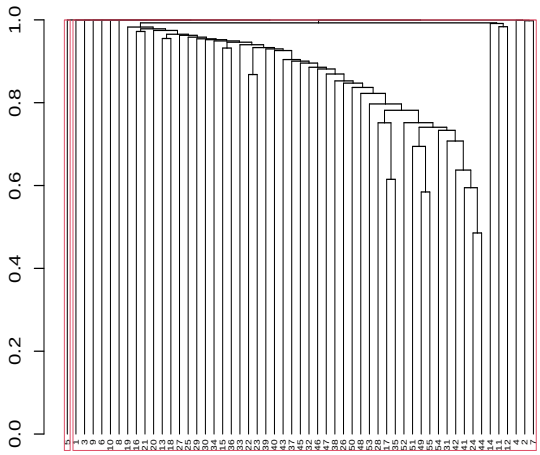


Figure 20: Examples of the FLR-HC dendrograms for the simulated Settings 1.1 and 1.3. Red boxes indicate the cluster borders if we partition 55 subjects into two clusters.

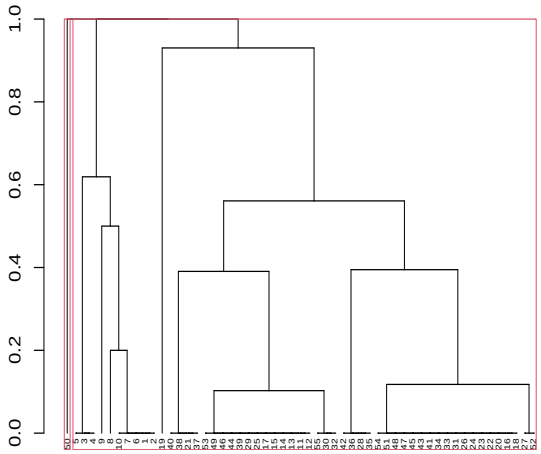
(a) Setting 1.3



(b) Setting 1.3



(c) Setting 1.2



(d) Setting 1.2

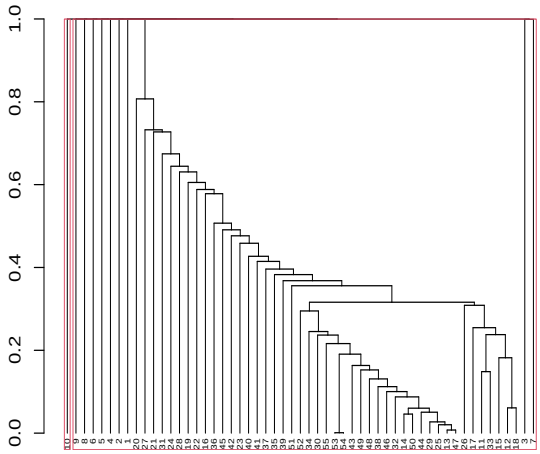


Figure 21: Examples of the FLR-HC dendrograms for the simulated Settings 1.2 and 1.3. Red boxes indicate the cluster borders if we partition 55 subjects into two clusters.