10   Supplementary materials

10.1   Model validation with synthetic data

To ensure that the proposed model could recover the real parameter values based on the causal structure, we tested the model with synthetic data before feeding it the real data. We fixed the average, age, and BMI (α, β, and γ) effects on glenoid BMD and we generated data stochastically as follows (For simplicity we did not consider the kernel effect here).

$$BMD_i \sim Normal(\mu_i, \sigma) \tag{15}$$

$$\mu_i = \alpha_{l[i],g[i]} + \beta_{l[i],g[i]}(age_i - \overline{age}) + \gamma_{l[i],g[i]}(BMI_i - \overline{BMI}) + \epsilon \tag{16}$$

Where ϵ is the noise term, considered to be $Normal(0,1)$. For a better match of the data generation process with the real data, we considered a similar number of subjects for each group as in the real dataset of the study. The code for this validation is also available in the repository (gitLab). With this process, we also assessed the necessary number of subjects for a reliable estimate of the parameters. We found out that 300 (synthetic) subjects would produce reliable estimates of the parameters (Fig A2, A3, A4). This number of synthetic subjects justified the number of real subjects used in this study. With 300 (synthetic) subjects, the difference of the estimates compared to the real effect was 0 [-0.08, 0.05] with the unit of [z-score of ST BMD] for average effect (α), 0 [-0.01 0.01] [z-score of ST BMD / One unit change of age] for age effect (β), and -0.01 [-0.02, 0.00] [z-score of ST BMD / One unit change of BMI] for BMI effect (γ). We point out that this synthetic data simulation, indeed could not capture everything that may happen in the real dataset, nonetheless, it helped in providing insight into the number of data necessary for the study to have reliable estimates. This analysis was also sensitive to the noise term ϵ. We believe that a $Normal(0,1)$ noise added to the generated BMD can be a reliable method for evaluating the performance of the model. Increasing/decreasing the noise level obviously decreases/increases the estimate's reliability.

10.2   Likelihood evaluation

For the outcome distribution, we argue that a normal distribution was a suitable choice. We showed this point by plotting the pareto-smoothed importance sampling cross-validation (PSIS) [64] and widely applicable information criteria (WAIC) [65] of the model (Fig. A5). For the normal-based model's out-of-sample

predictions, there were no points with higher PSIS Pareto k than 0.7 which could make the importance ₅₃₅ weight unreliable and WAIC penalty high [64].

10.3   Prior predictive simulation

Predictive prior simulation is assessing what we might see from our set of priors, before introducing real data to the model [66]. This technique could be useful in designing priors to minimize unrealistic predictions. In Stan, we could use the same model definition and just disable the likelihood part of the model. We used this ₅₄₀ technique to design the priors of the model and evaluated the predicted BMD differences (Fig. A6, A7, A8, A9). The tuned set of the priors resulted in a mainly higher ST BMD for OA than CTRL subjects, with a higher density between 100 to 300 HU (Fig. A6, A8), and a mainly CTA-CTRL difference in the range of -100 to 200 HU (Fig. A7, A9). Moreover, the ST BMD changes with age and BMI also seemed reasonable. There were a few extreme and unrealistic slopes, which was indeed expected as samples could be drawn from ₅₄₅ tails of the parameters distribution leading to strange predictions.

10.4   More simulations from posterior distribution

Here we provided more simulations with the Bayesian model. We kept age constant at 50, 60, 70, 80, and 90 years old, and at each age, we simulated OA-CTRL and CTA-CTRL ST BMD differences for female and male, at BMI of 17, 25, and 33 (Fig. A13). ₅₅₀

10.5   CT Kernel

We assessed the kernel effect on calculated ST BMD differences for OA-CTRL female (Fig. A14). As before we kept all of the variables constant and only changed the kernel. Differences were negligible and the highest difference happened in anterior-superior octant (24.8 [13.1 36.8] HU at 65 years).

## 10.6   HMC Convergence ₅₅₅

The trace of the HMC sampling illustrated a robust sampling procedure for all model parameters (Fig A1). The sampling has been performed for 4 chains and 2000 iterations per chain. The initial 50% of the iterations were considered for warm-up and the last 50% for sampling. The trace exhibited characteristics indicative of

a sound HMC sampling process: stationary, where the chains remained within the high-probability region of the posterior distribution; mixing, where the chains effectively explored the distribution; and convergence, where multiple chains converged to the same high-probability region.

10.7   Figures

(a)

(b)

36

(c)

(d)
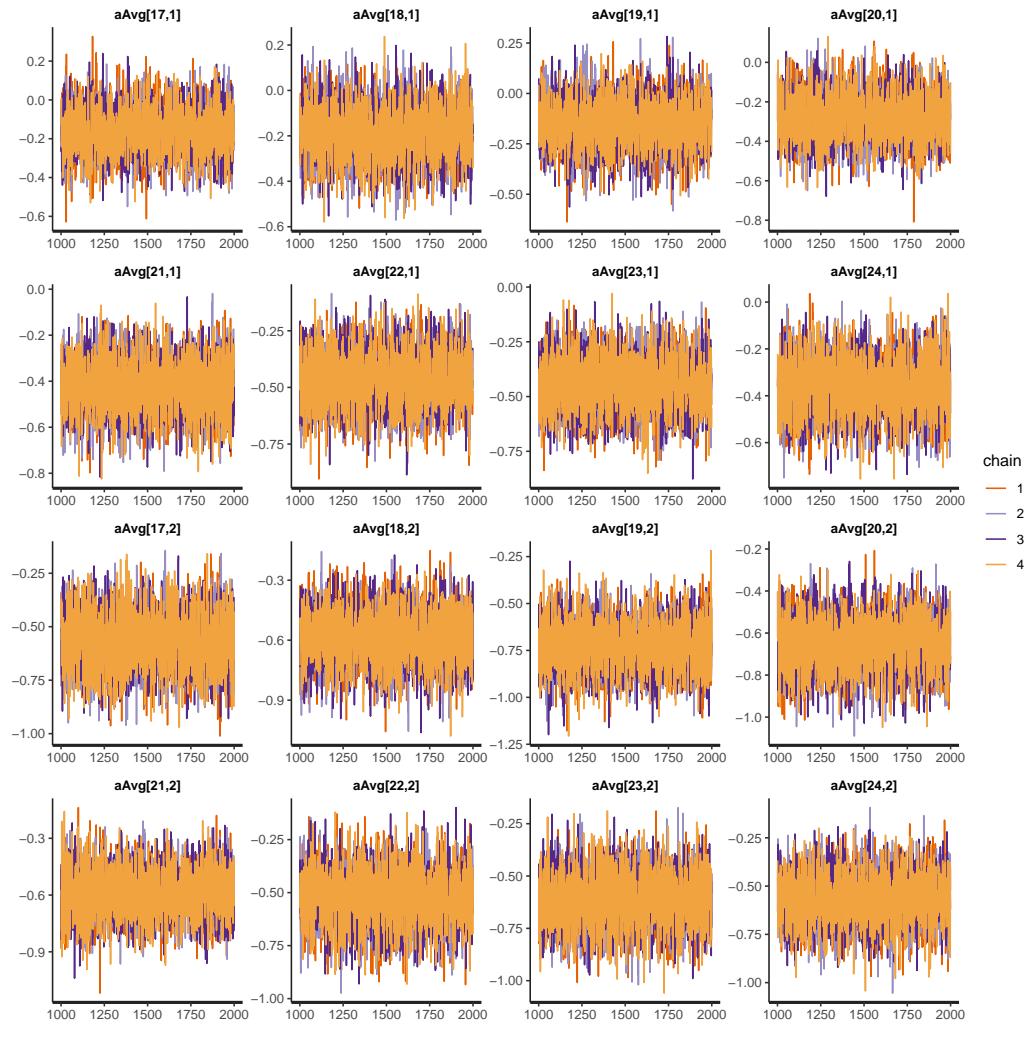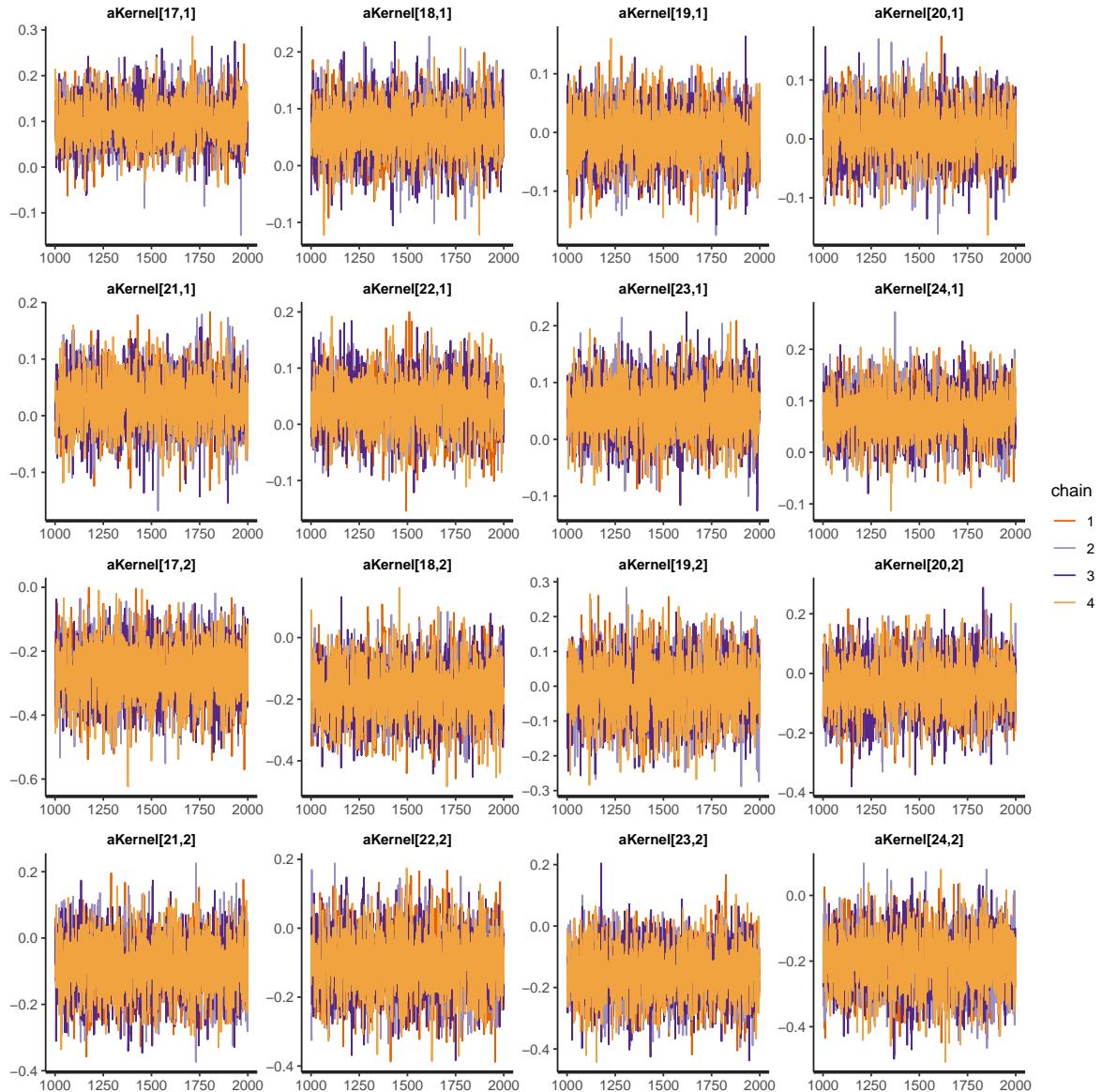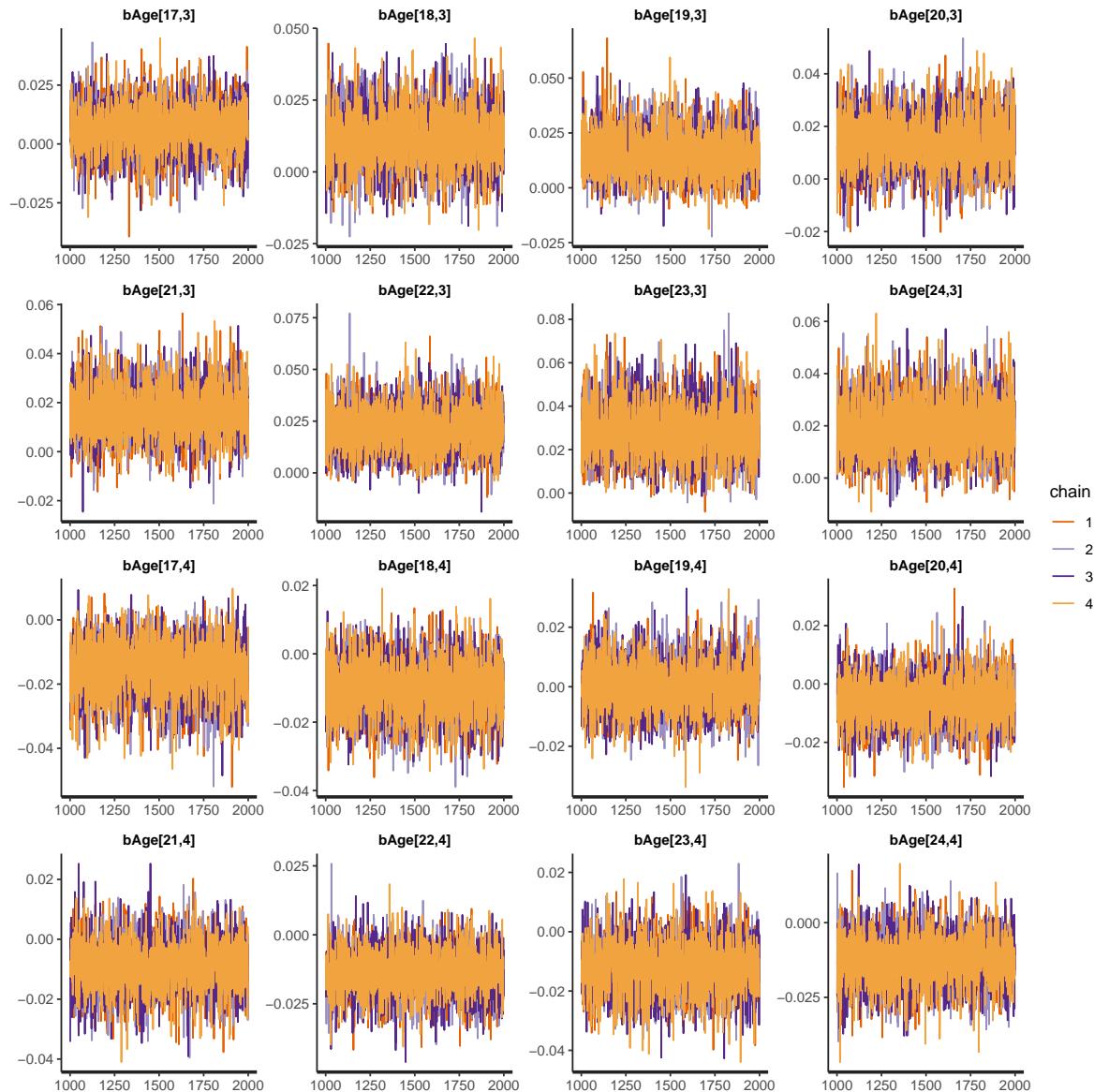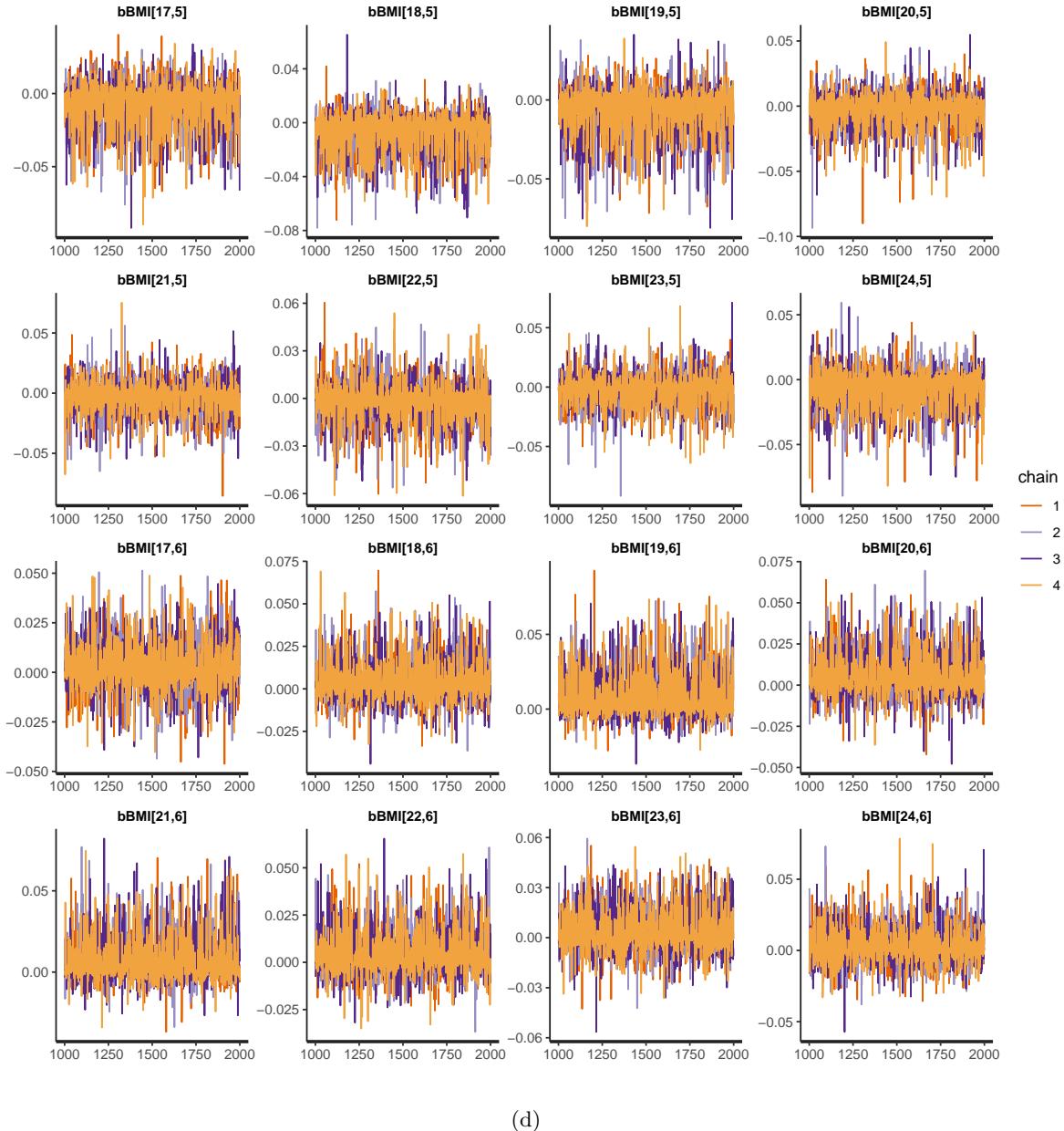
Figure A1: Trace of the sampling procedures of the four chains for some of the subsets of (a) α, (b) β, (c) γ, (d) ζ parameters. The x-axis corresponded to iterations of the chains, and the y-axis to the magnitude of the parameters represented as the titles of the graphs.

ST Superior−Anterior

Average effect

(a)

ST Anterior−Superior

Average effect

(b)

ST Anterior–Inferior

(c)
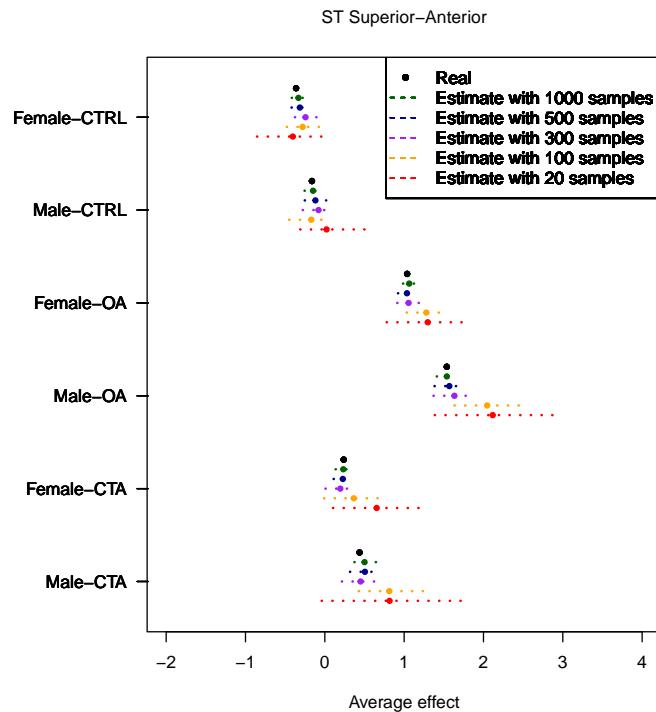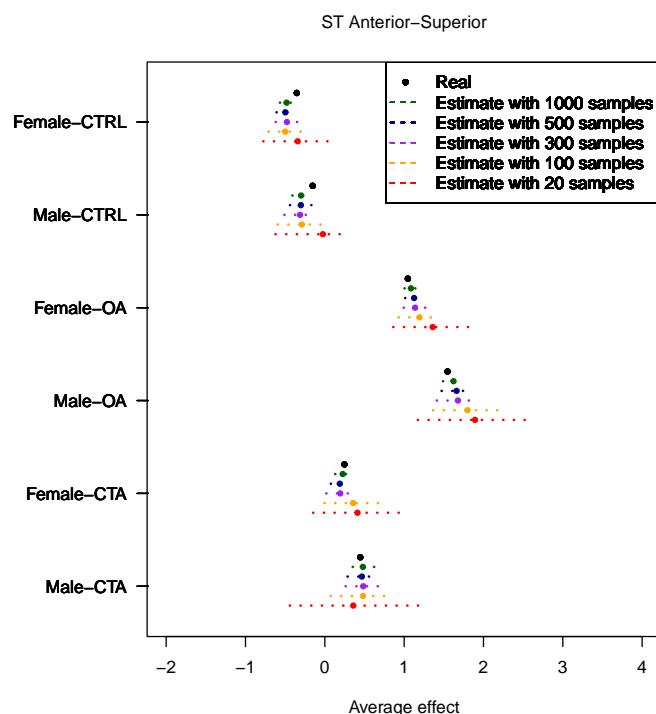
ST Inferior–Anterior
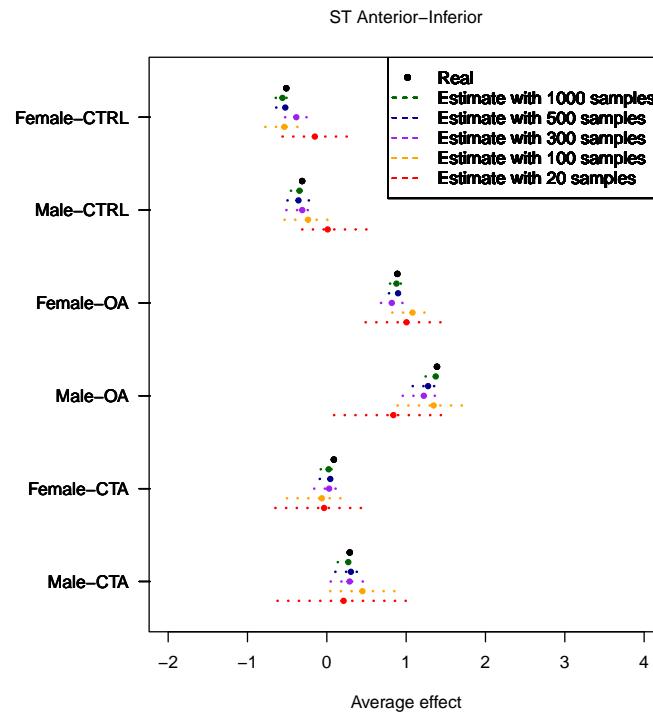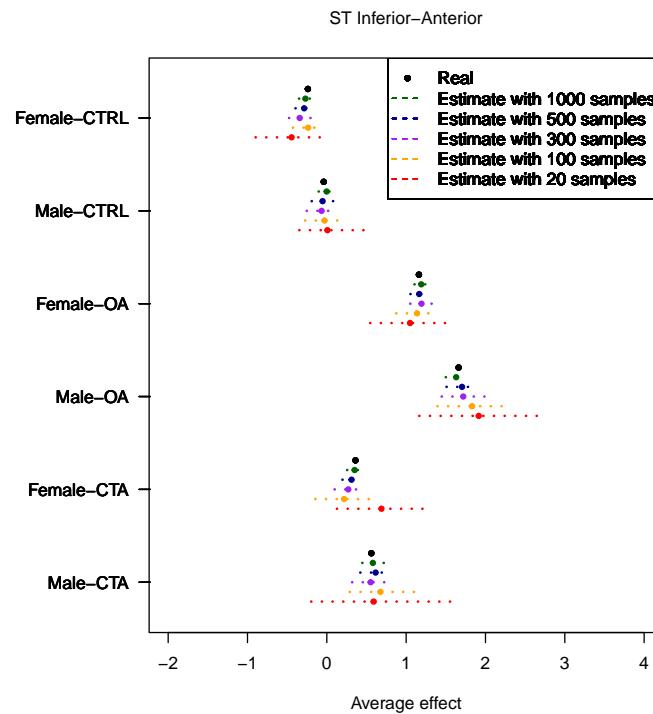
(d)
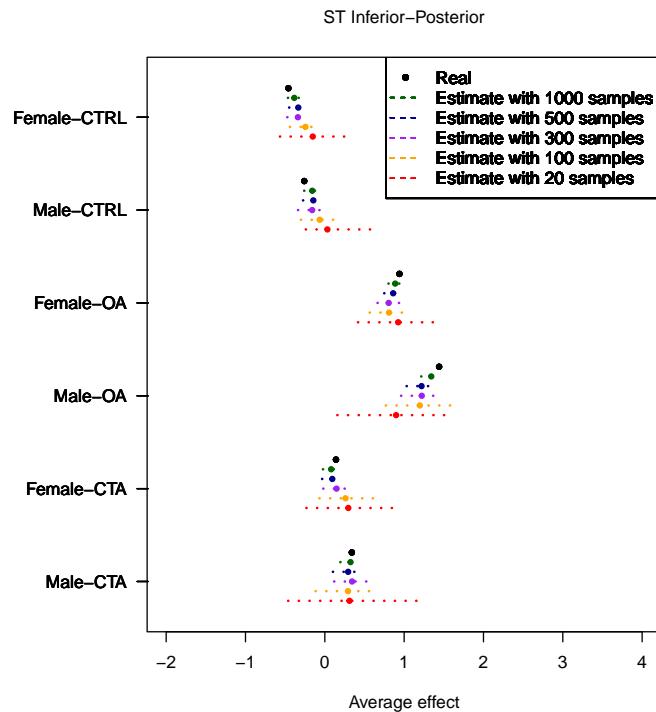
(e)
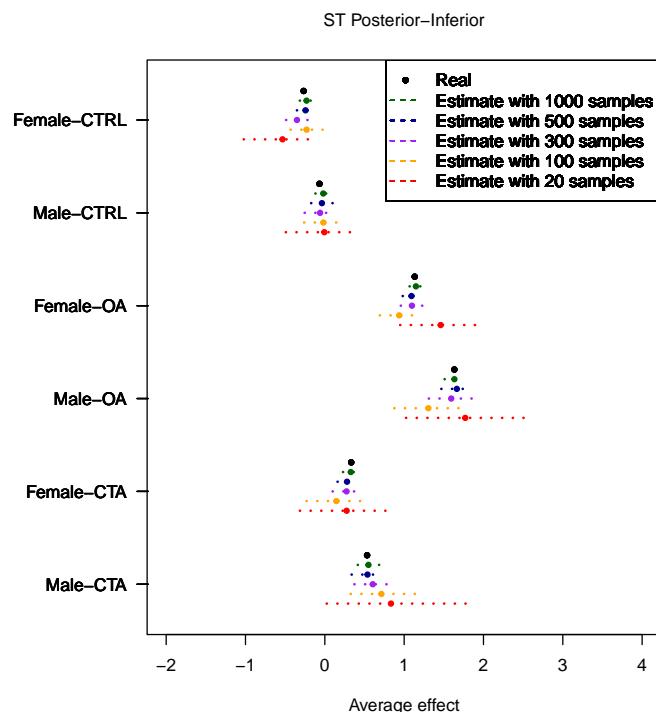
(f)
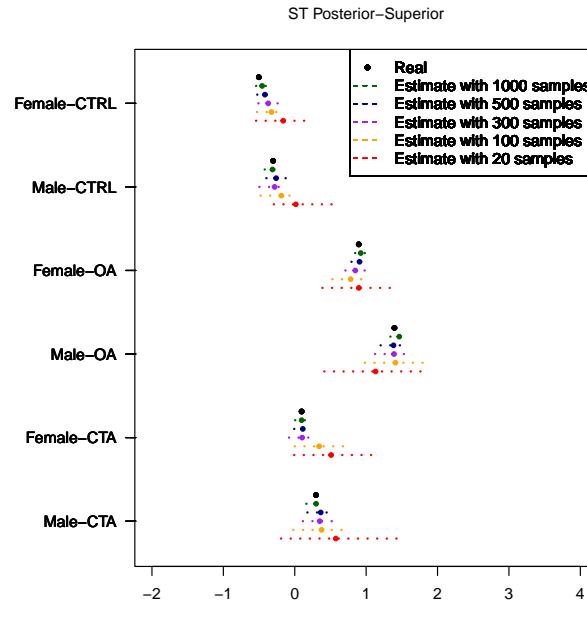
(g)
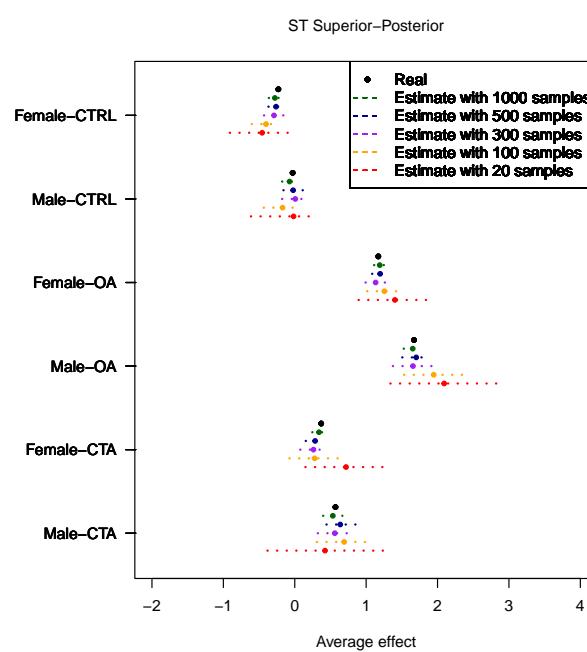
(h)

Figure A2: Real and estimated values of the average effect of location and group ($\alpha_{l,g}$ in Eq. 16) based on 1000, 500, 300, 100, and 20 synthetic subjects, for each octant, from superior-anterior (a) to superior-posterior (h) of the ST VOI.

ST Superior−Anterior

(a)

ST Anterior−Superior

(b)

ST Anterior−Inferior

(c)

ST Inferior−Anterior

(d)

ST Inferior−Posterior

(e)

ST Posterior−Inferior

(f)

ST Posterior–Superior

(g)
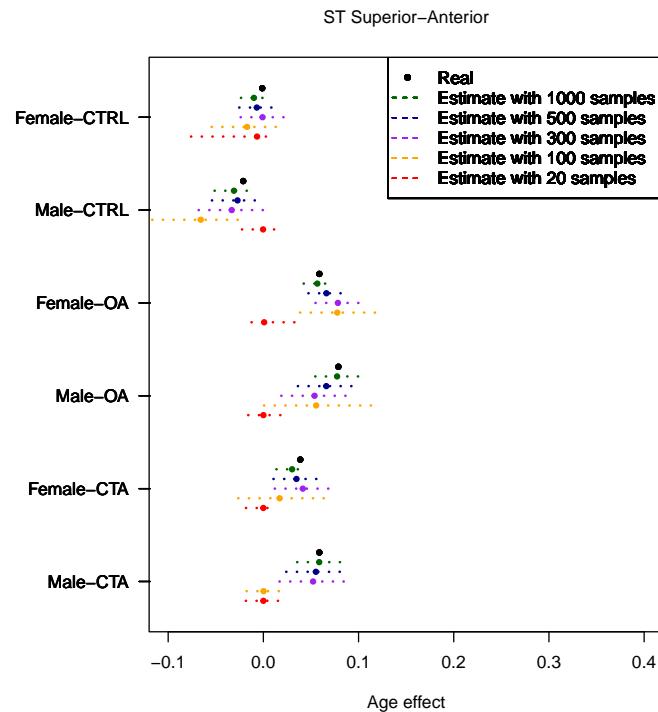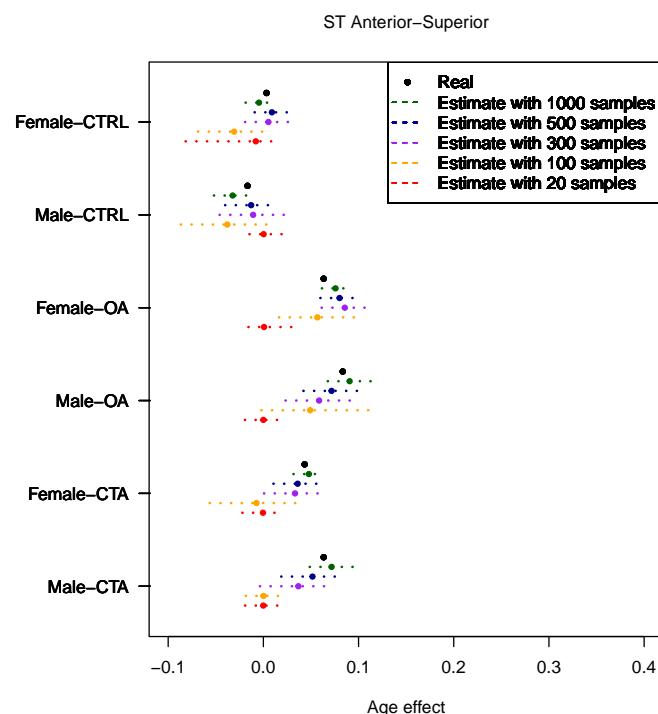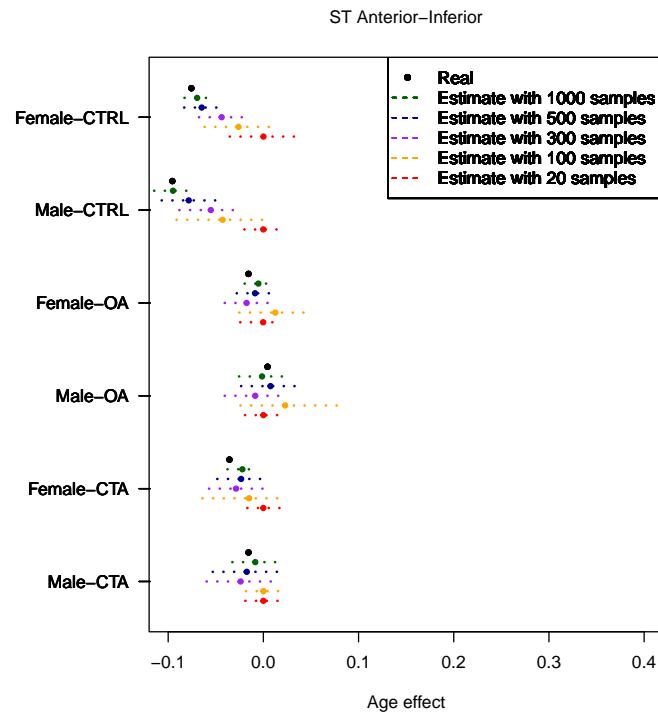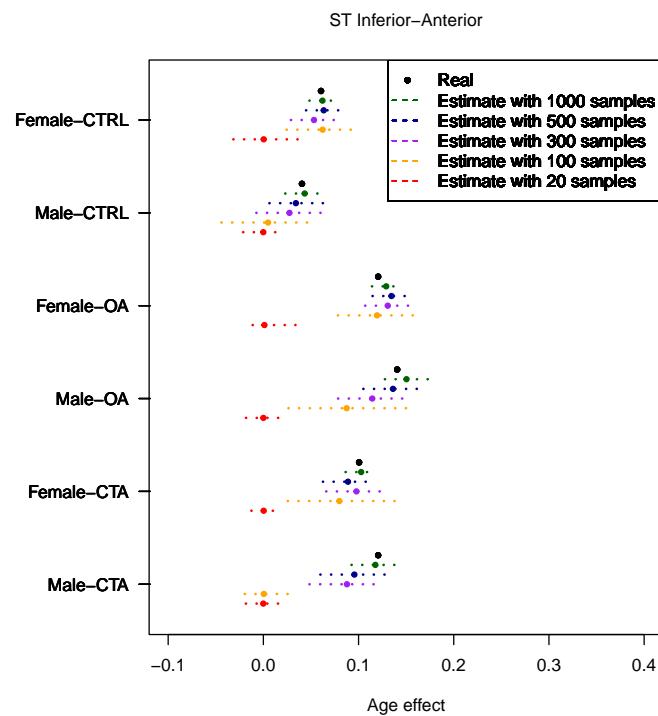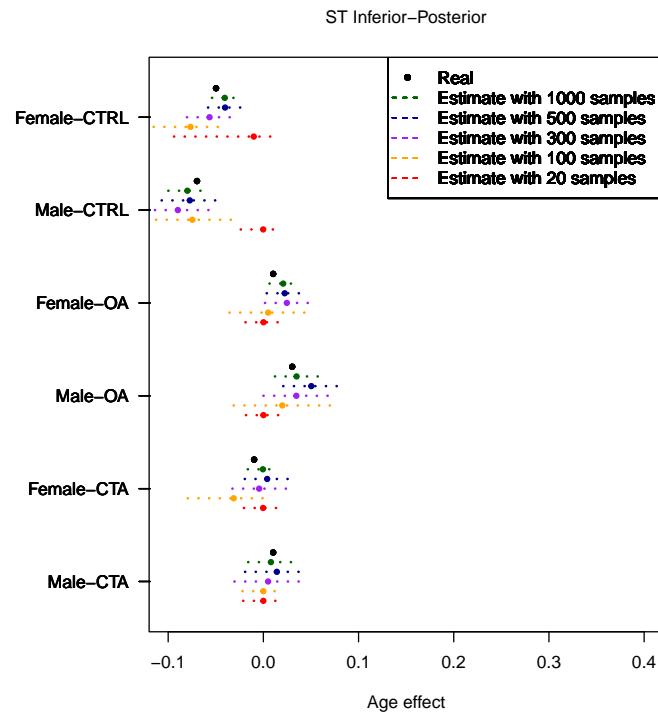
ST Superior–Posterior
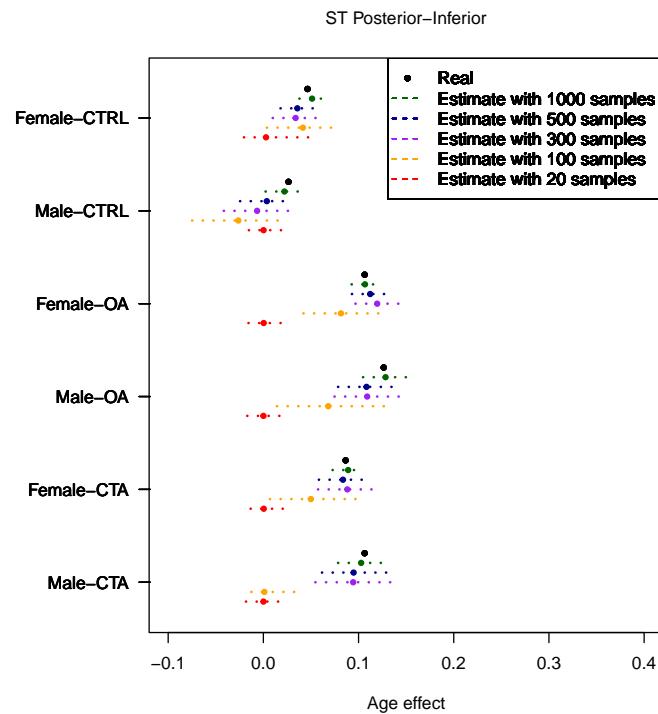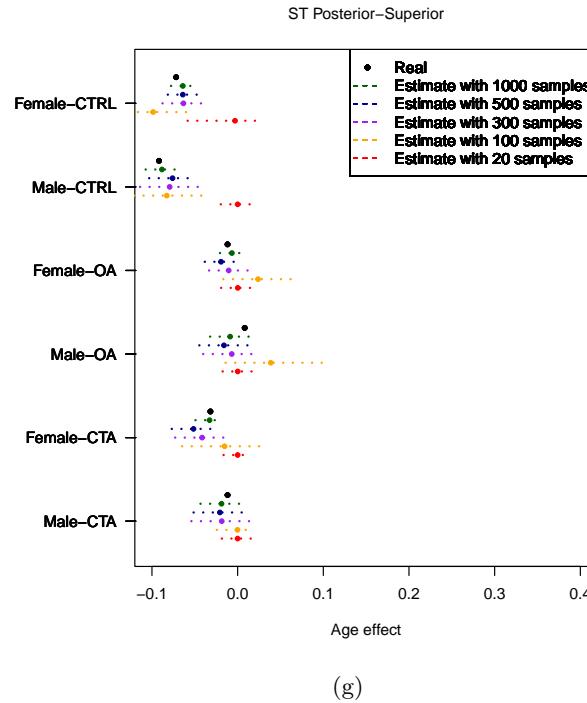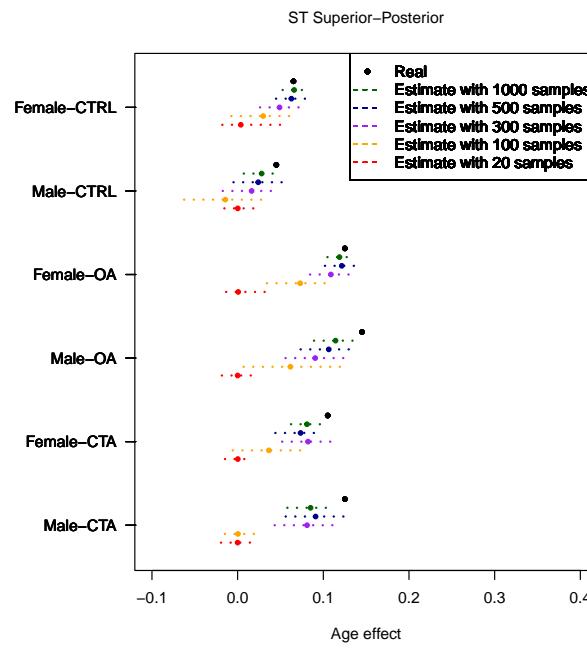
(h)

Figure A3: Real and estimated values of the age effect of location and group ($\beta_{l,g}$ in Eq. 16) based on 1000, 500, 300, 100, and 20 synthetic subjects, for each octant, from superior-anterior (a) to superior-posterior (h) of the ST VOI.

ST Superior–Anterior

(a)

ST Anterior–Superior

(b)

ST Anterior–Inferior

(c)

ST Inferior–Anterior

(d)

ST Inferior−Posterior

(e)

ST Posterior−Inferior

(f)
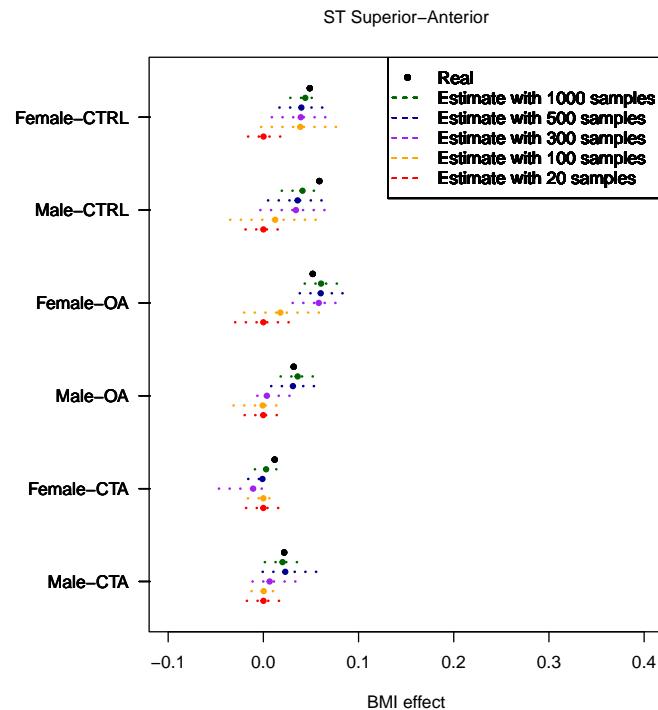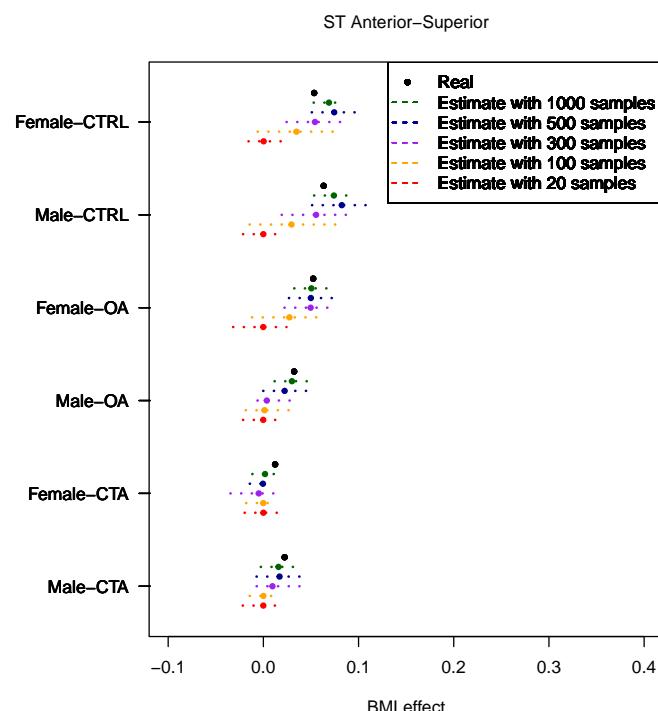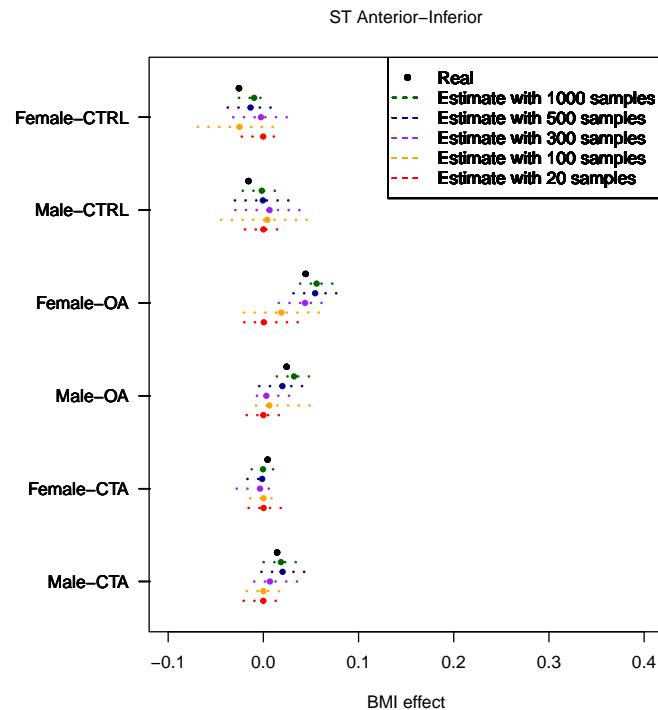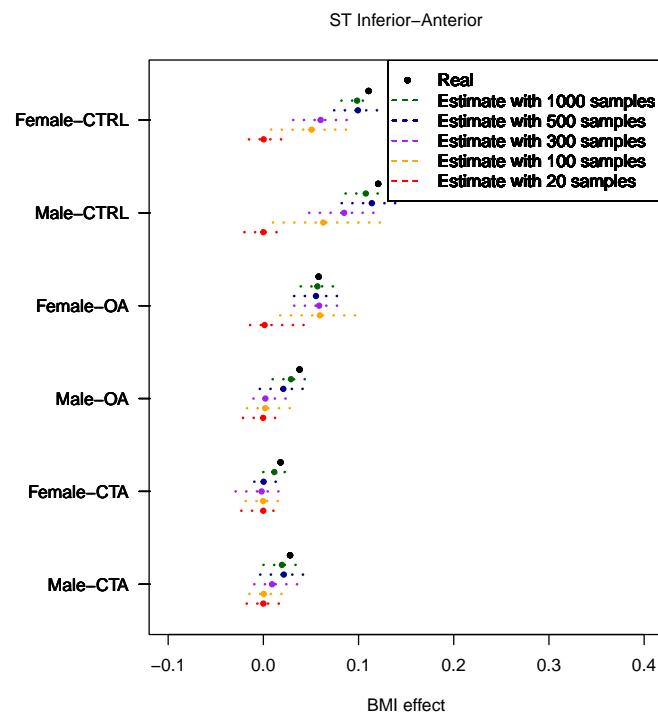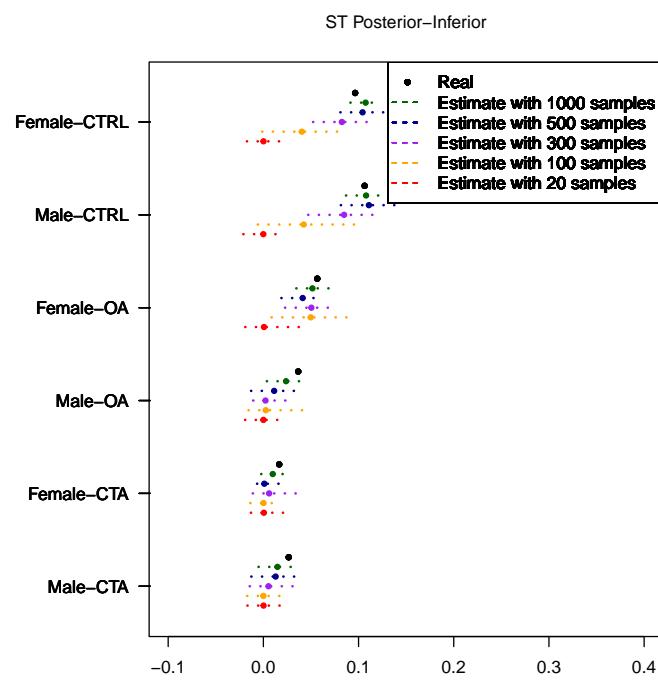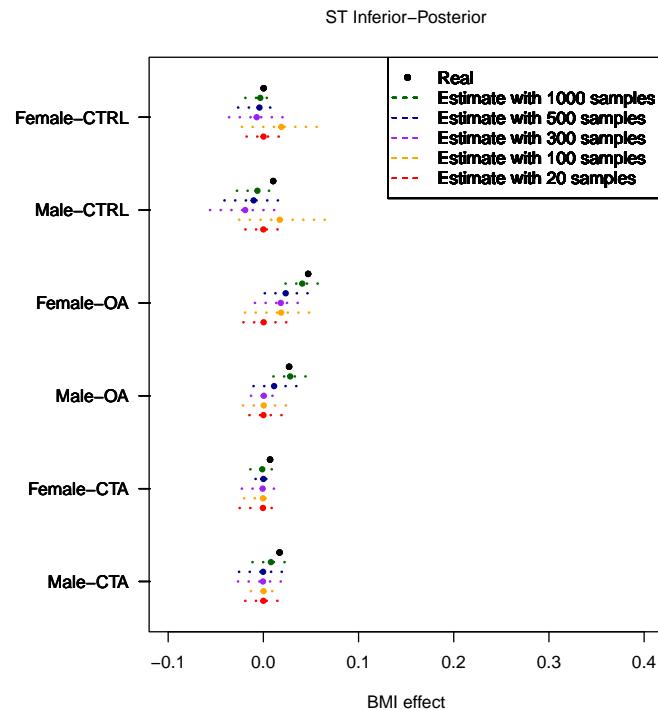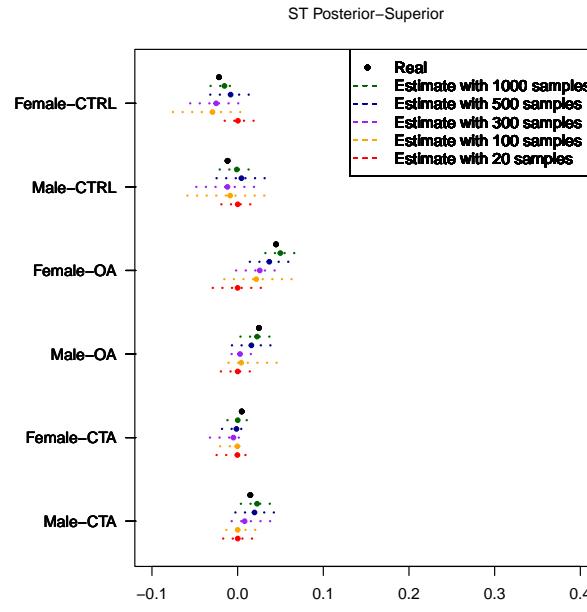
(g)
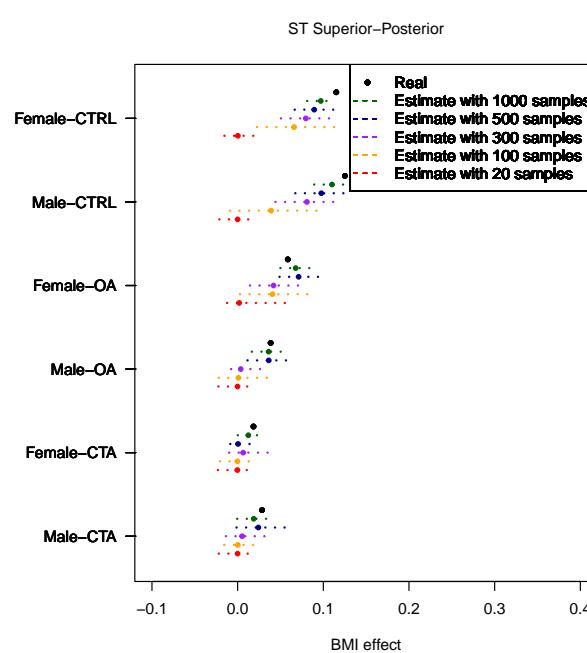
(h)

Figure A4: Real and estimated values of the BMI effect of location and group ($\gamma_{l,g}$ in Eq. 16) based on 1000, 500, 300, 100, and 20 synthetic subjects, for each octant, from superior-anterior (a) to superior-posterior (h) of the ST VOI.
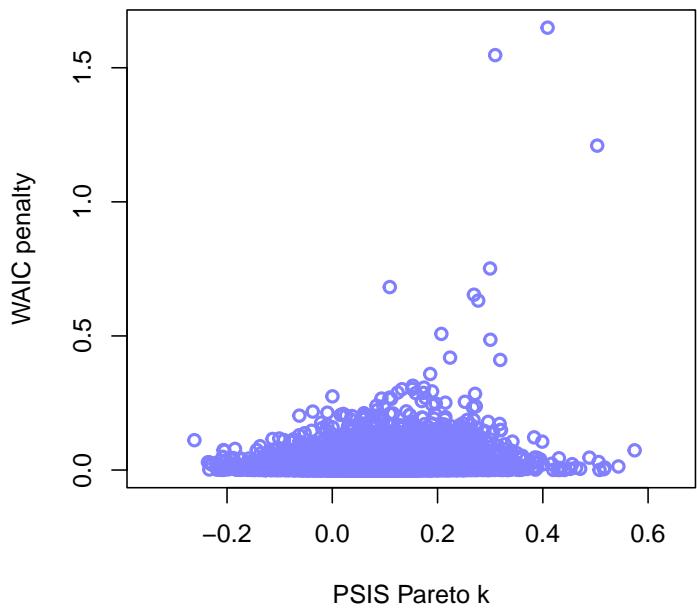
Figure A5: The pareto k from pareto-smoothed importance sampling cross-validation (PSIS) and widely applicable information criteria (WAIC) for the model with normal distribution as the outcome.
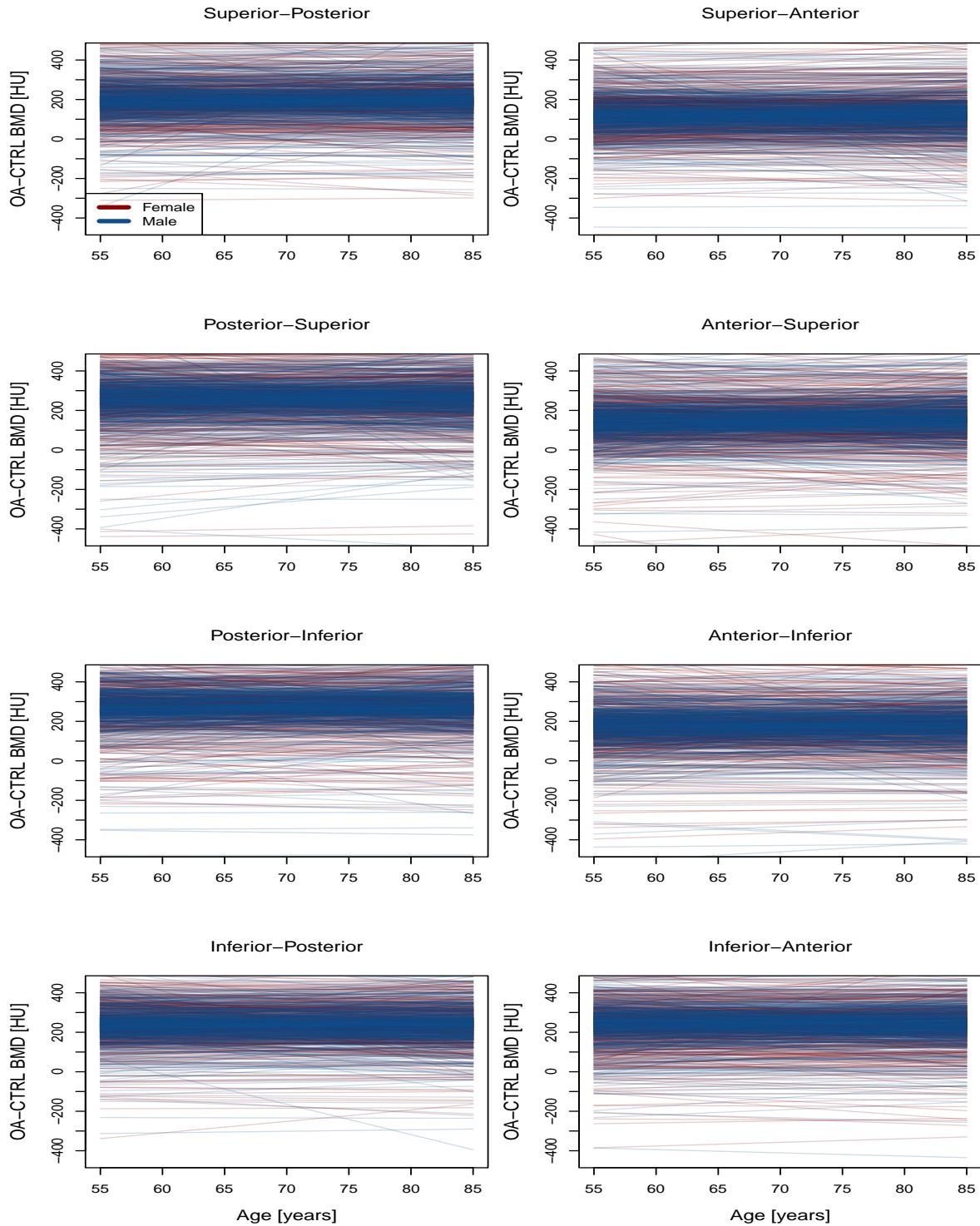
Figure A6: Prior predictive distribution of difference of BMD in ST between OA and CTRL (vertical axis) vs age (horizontal axis), for male and female, and for the 8 locations, while keeping BMI at 25 kg/m^2.
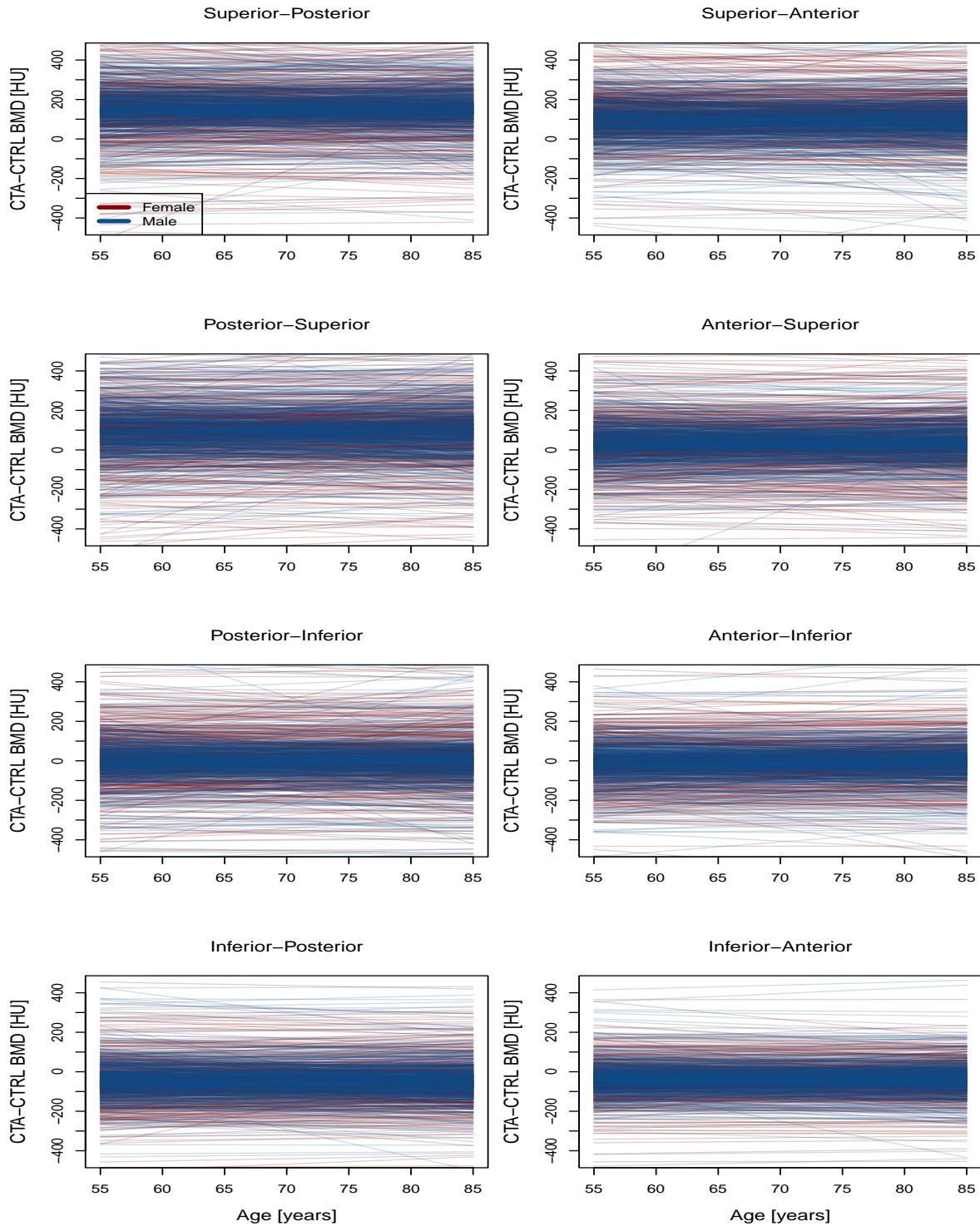
Figure A7: Prior predictive distribution of difference of BMD in ST between CTA and CTRL (vertical axis) vs age (horizontal axis), for male and female, and for the 8 locations, while keeping BMI at 25 kg/m^2.
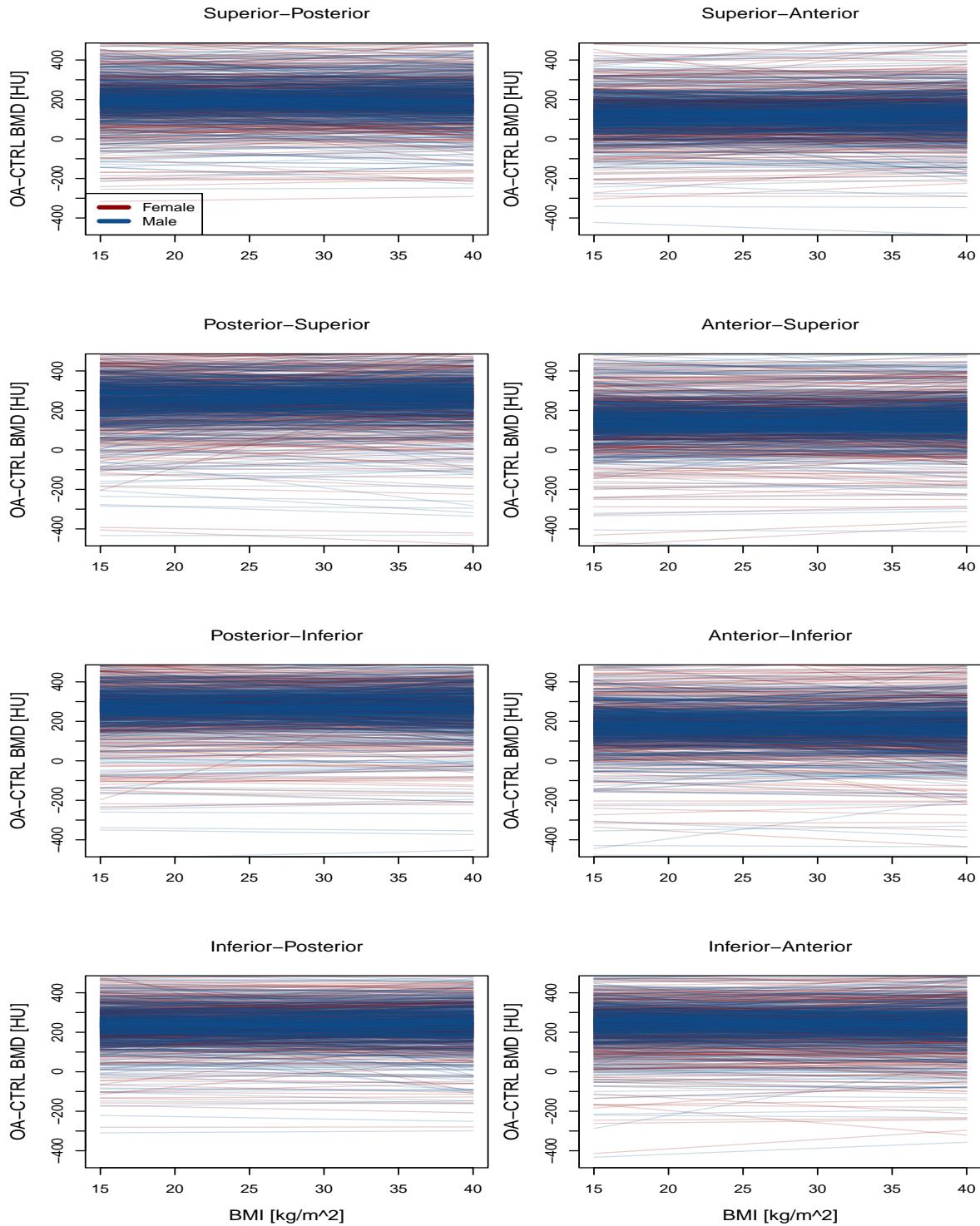
Figure A8: Prior predictive distribution of difference of BMD in ST between OA and CTRL (vertical axis) vs BMI (horizontal axis), for male and female, and for the 8 locations, while keeping age at 65 years.
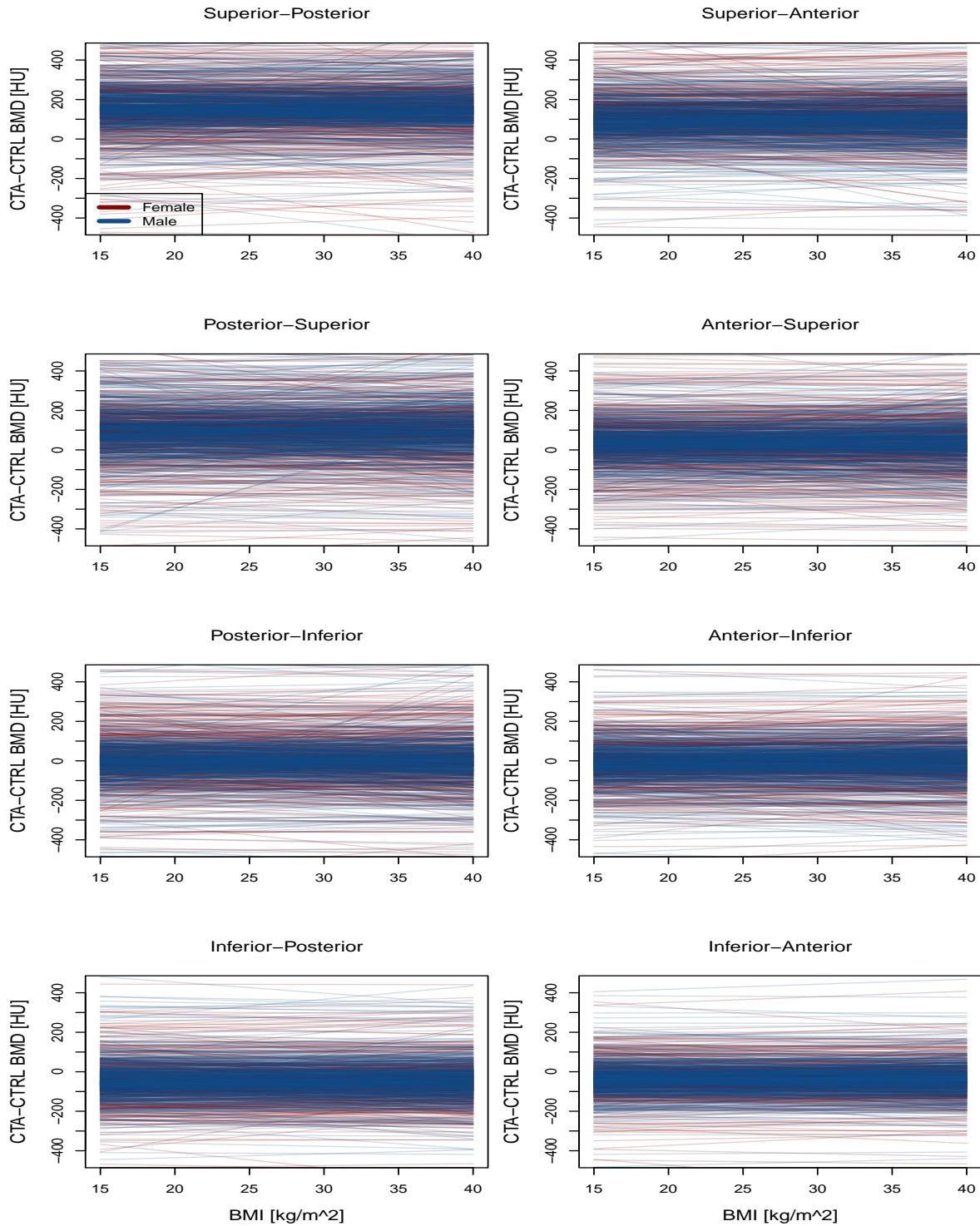
Figure A9: Prior predictive distribution of difference of BMD in ST between CTA and CTRL (vertical axis) vs BMI (horizontal axis), for male and female, and for the 8 locations, while keeping age at 65 years.

(a)

(a)

(a)

(a)

(b)
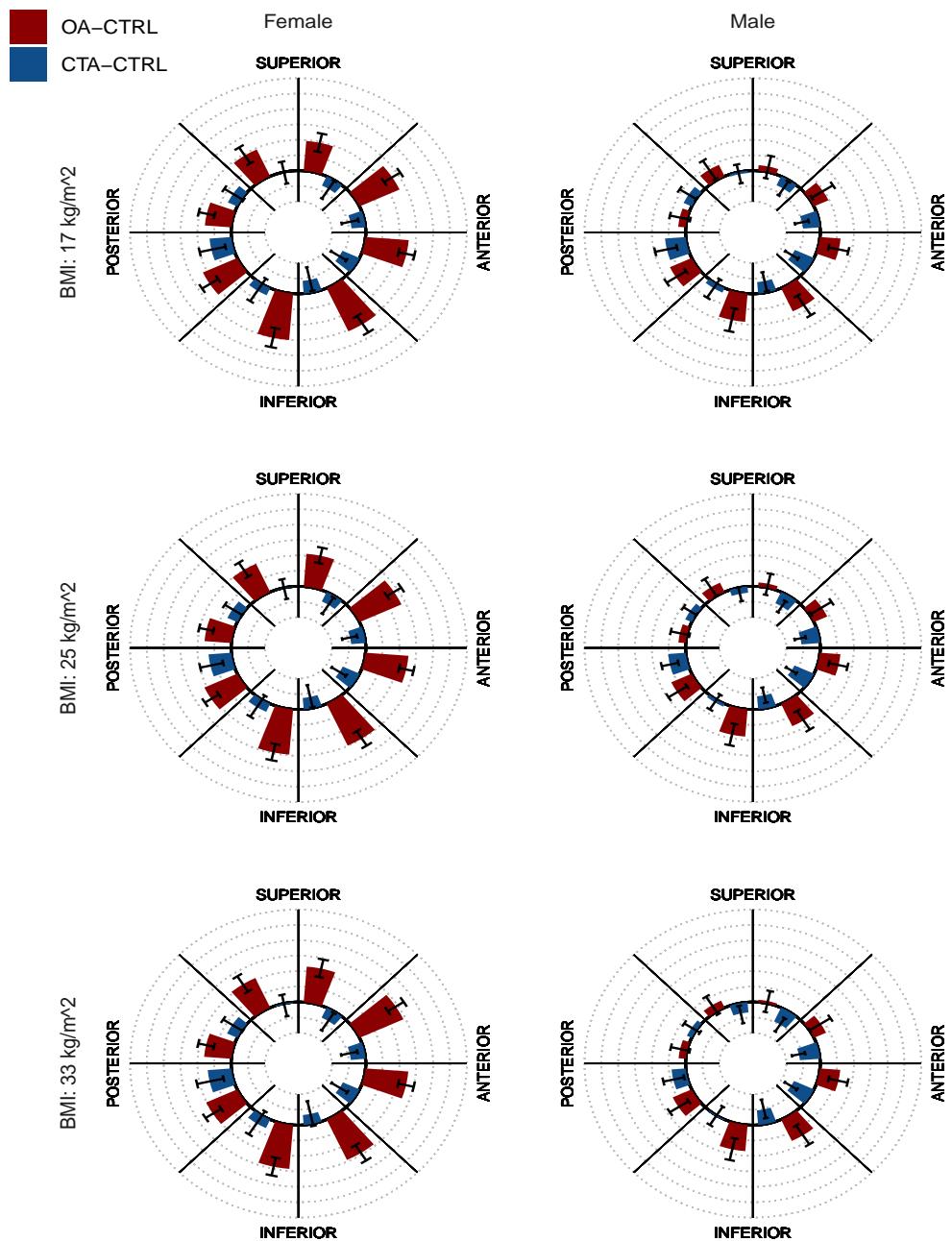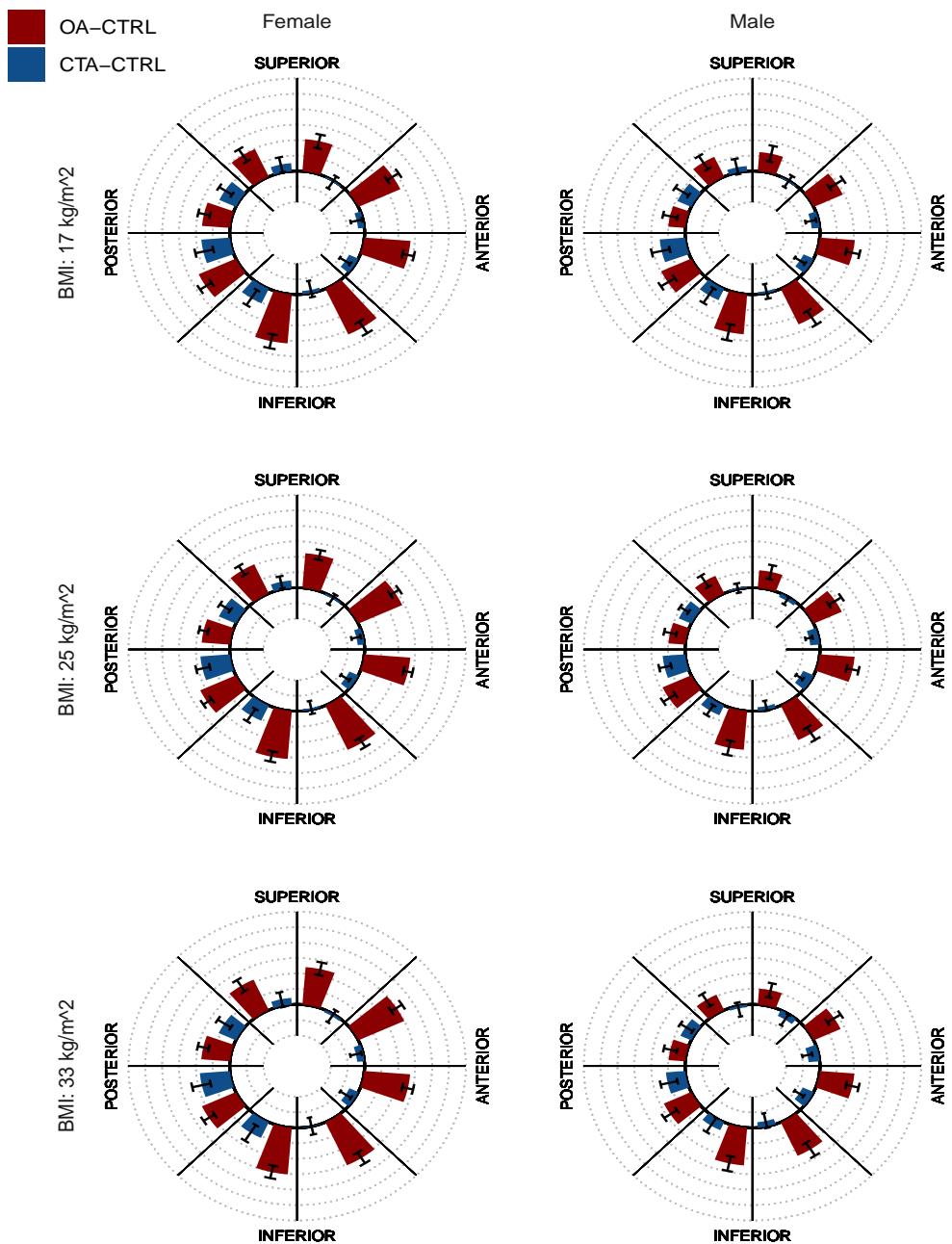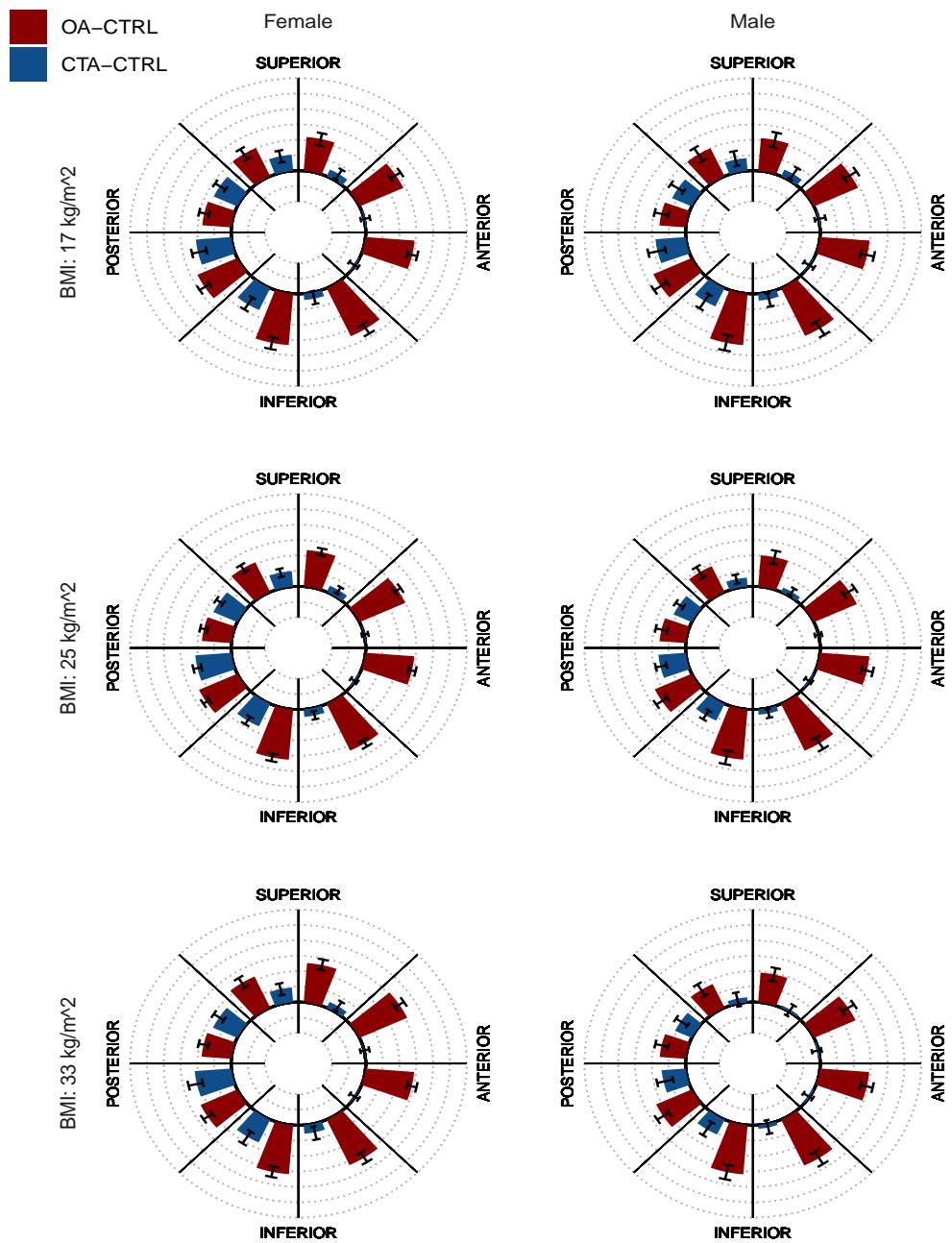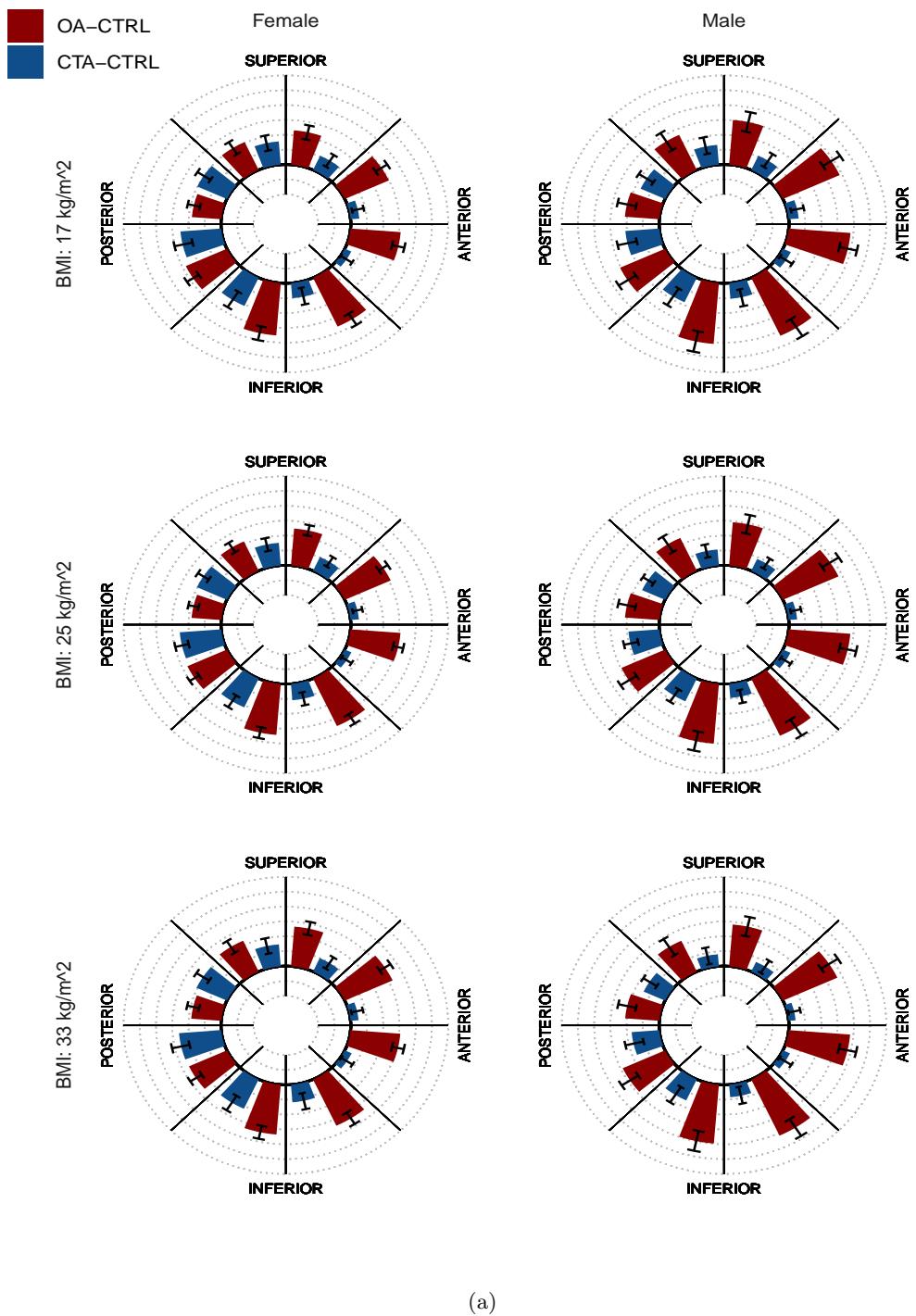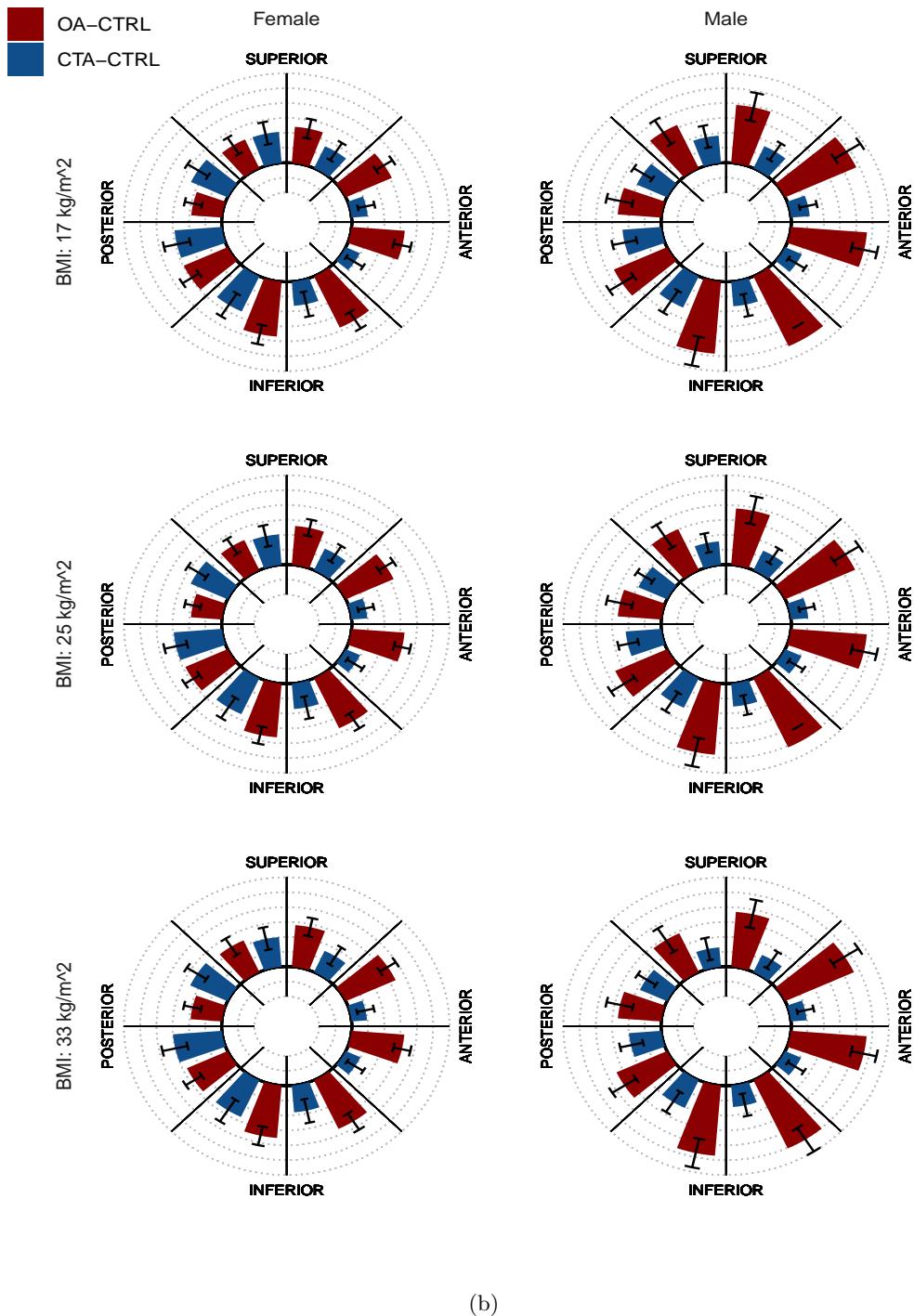
Figure A13: Difference and 89th percentile interval (errorbar) of BMD in ST between pathological and CTR, for male and female at BMIs 17, 25, and 33 kg/m^2 while keeping age at (a) 50 (b) 60 (c) 70 (d) 80 (e) 90 years. The solid circle corresponds to 0 HU and the interval between the concentric circles corresponds to 100 HU.
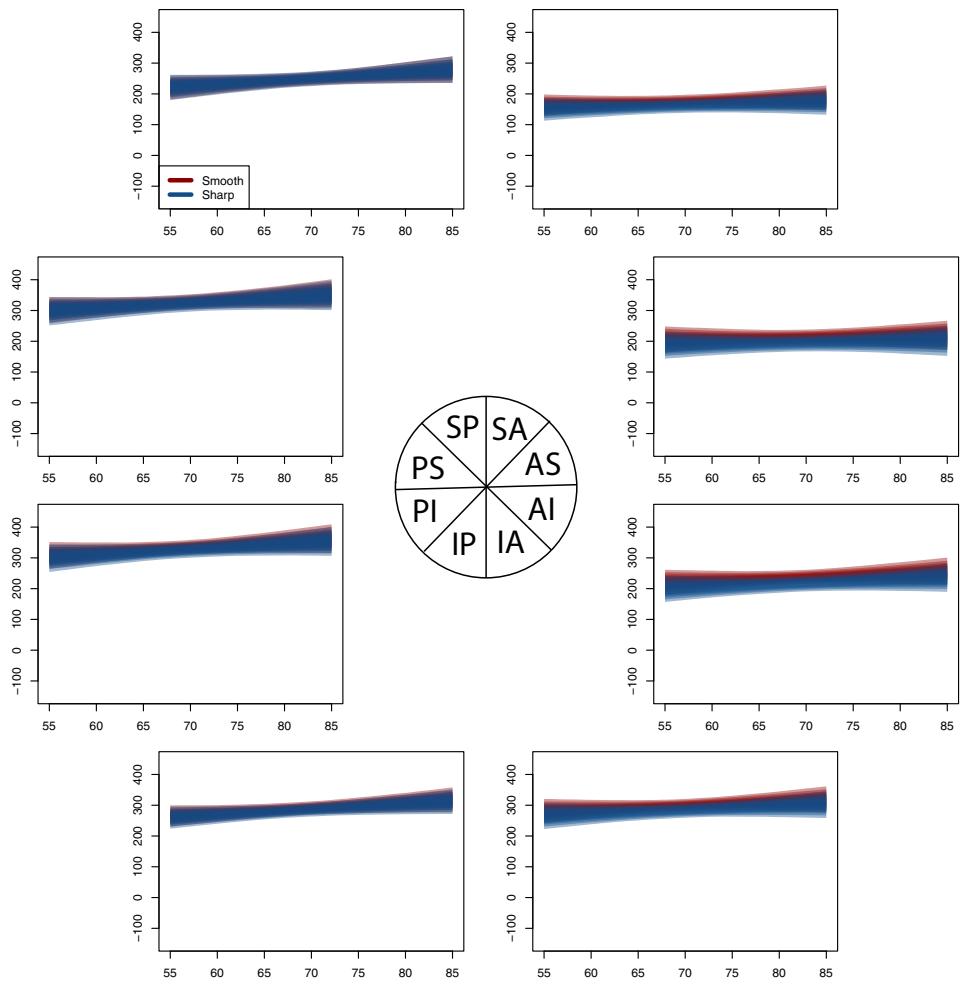
Figure A14: Difference of BMD in ST between female OA and CTRL (vertical axis) vs age (horizontal axis), while keeping BMI at 25 kg/m^2, for sharp and smooth kernels, and for the 8 locations. The colored surface corresponds to the 89th percentile.

10.8 Tables

Table A1: Difference and 89th percentile interval of BMD in ST between OA and CTRL, for male and female at ages 50, 60, 70, 80, and 90 years old, while keeping BMI at 25 kg/m^2.

Sex	Location	50 years	60 years	70 years	80 years	90 years
Female	Superior-Anterior	159.4 [117, 204]	167.6 [139.9, 194.7]	174.9 [154.1, 197.2]	182.7 [150.7, 214.9]	190.4 [141.1, 240]
	Anterior-Superior	201.3 [150.9, 257.5]	207.3 [173.8, 242.3]	212.6 [186, 237.9]	217.5 [179.9, 254.8]	222.4 [162.8, 279.9]
	Anterior-Inferior	212.8 [164.2, 265.8]	225.2 [194.7, 258.6]	237.4 [215.1, 261.2]	249.3 [215, 285.6]	261.7 [207.6, 317.5]
	Inferior-Anterior	274.3 [225.4, 325.1]	286.9 [257.2, 317.7]	299.2 [278.9, 320.6]	311.6 [279.9, 344.8]	323.9 [272, 377.9]
	Inferior-Posterior	255.6 [213.6, 299.8]	272.9 [246.2, 300.2]	290.3 [270, 312.6]	308.4 [276.8, 340.2]	326.1 [276.6, 376.2]
	Posterior-Inferior	298.7 [243.4, 353.2]	316 [283.7, 350.2]	333.9 [311.3, 358.3]	351.7 [316.7, 389.3]	369.2 [313, 429.2]
	Posterior-Superior	294.6 [239.7, 346.7]	311.5 [276.4, 343.3]	328 [303.6, 352.6]	344.4 [307.7, 381.7]	361.8 [304.4, 421.3]
	Superior-Posterior	214.9 [161.4, 259.7]	231.9 [200.4, 260.8]	250 [227.3, 271]	268 [235.7, 303.2]	285.4 [235.4, 342.5]
Male	Superior-Anterior	43.6 [-14.3, 99.3]	99.5 [61.2, 135.7]	155.9 [119.5, 190.8]	211.9 [158.5, 266.6]	267.5 [190.2, 349.7]
	Anterior-Superior	66 [1.1, 131.1]	125.1 [81.4, 167.2]	184.3 [142.5, 223.1]	243.1 [182, 302.6]	303 [212.3, 392.1]
	Anterior-Inferior	26.4 [-47, 92.4]	114 [66.2, 157.8]	202.7 [160, 245]	291.9 [229.2, 354.3]	379.8 [290.1, 475.8]
	Inferior-Anterior	86.9 [9.8, 154.9]	182.8 [137, 226]	279.9 [241.4, 317.8]	376.7 [318.1, 439.3]	473.1 [385.8, 570.4]
	Inferior-Posterior	121.7 [63.6, 175.8]	207 [171, 244.1]	293.6 [260.5, 328.8]	380.4 [329, 433.6]	467.1 [390.6, 546.3]
	Posterior-Inferior	159.7 [86.9, 229.5]	246 [199.6, 293.6]	334.5 [291.7, 377]	423.4 [358.9, 486.5]	510.7 [418.7, 605.5]
	Posterior-Superior	177.6 [105.5, 247.6]	251.3 [205.7, 299.3]	327.2 [284.7, 372.3]	403.2 [337.5, 467.8]	479 [383.1, 576]
	Superior-Posterior	133.6 [64, 194.9]	186.8 [141.7, 228.5]	241.1 [202.7, 281.4]	295.6 [240.1, 356.3]	349.9 [267.6, 439.6]

Table A2: Difference and 89th percentile interval of BMD in ST between CTA and CTRL, for male and female at ages 50, 60, 70, 80, and 90 years, while keeping BMI at 25 kg/m^2.

Sex	Location	50 years	60 years	70 years	80 years	90 years
Female	Superior-Anterior	64.8 [-4.9, 119.4]	110.3 [70.3, 143.3]	156.3 [131.6, 179.7]	203.1 [164.3, 243.7]	249.6 [186.7, 320.2]
	Anterior-Superior	-2.8 [-74.7, 56.5]	48.2 [5.3, 84.3]	100.1 [72, 125.9]	152.7 [108.5, 196.3]	205.3 [135.1, 278.7]
	Anterior-Inferior	-67.7 [-136.9, -12.6]	-11.4 [-53.3, 21.6]	44.8 [20, 67.6]	101.4 [65.6, 139.8]	159 [100.2, 224.3]
	Inferior-Anterior	-85.4 [-133.9, -42.8]	-39.7 [-70.3, -14.2]	5.7 [-14.2, 24.5]	51.4 [21.6, 82]	97.3 [48.9, 147]
	Inferior-Posterior	-109.8 [-165.5, -63.6]	-58.7 [-92.5, -30.5]	-7.4 [-30, 15.4]	44.9 [9.5, 80.6]	97 [40, 154.1]
	Posterior-Inferior	-73.4 [-152.5, -5.7]	-12.3 [-58.4, 26.9]	48.9 [21.4, 74.1]	110.4 [67.1, 155.2]	171.7 [98.5, 248.8]
	Posterior-Superior	57.3 [-30.9, 130.8]	107.9 [57.9, 152.5]	160.4 [131.6, 187.7]	212.9 [166.9, 259.8]	265.5 [186.9, 348.2]
	Superior-Posterior	135.5 [58, 197.5]	174.8 [129.8, 212.2]	214.4 [189.6, 238.7]	255.6 [213.6, 297.3]	295.8 [226.7, 368.6]
Male	Superior-Anterior	42.7 [-1.4, 89.8]	81 [49.1, 109.5]	118.7 [90.2, 143.9]	156 [116, 193.5]	193.9 [135.4, 249.6]
	Anterior-Superior	-40.6 [-89.4, 2.6]	8.6 [-24.2, 37.6]	57.7 [28.1, 86.6]	107.8 [64.1, 152.2]	157.7 [93.8, 223.9]
	Anterior-Inferior	-80.8 [-124.5, -39.6]	-25.4 [-53.2, 3.6]	31.3 [6.3, 57.1]	87.9 [50, 126.6]	143.9 [88.5, 202]
	Inferior-Anterior	-110.4 [-145.8, -78.5]	-56.8 [-78.7, -35.2]	-2.7 [-22.3, 18.9]	52.1 [20.5, 84.9]	106.3 [60.4, 155.4]
	Inferior-Posterior	-127.4 [-166.4, -92.6]	-68.9 [-93.5, -44.3]	-9.6 [-31.8, 15.9]	51 [15.2, 87.8]	110.7 [57.6, 163.9]
	Posterior-Inferior	-84.6 [-136.3, -35]	-24.8 [-59.6, 6.7]	34.9 [5.4, 63.8]	94.8 [50.4, 139.2]	155 [90.2, 221.5]
	Posterior-Superior	19.7 [-39.3, 74.6]	69.2 [28.6, 104.8]	119.5 [83.8, 149.5]	168.3 [118.3, 217.3]	218.2 [146.3, 291.7]
	Superior-Posterior	104.3 [53.2, 154.8]	133.5 [93.5, 166]	162.4 [125.1, 190]	190.4 [142.2, 231.4]	218.6 [153, 278.3]

Table A3: Difference and 89th percentile interval of BMD in ST between OA and CTRL, for male and female at BMIs 17, 25, and 33 kg/m^2, while keeping age at 65 years.

Sex	Location	17 kg/m2	22 kg/m2	27 kg/m2	32 kg/m2
Female	Superior-Anterior	169.1 [138, 200.2]	170.5 [146.7, 194.2]	171.7 [149.1, 194.3]	173.3 [144.9, 201.2]
	Anterior-Superior	199.8 [157.8, 238.9]	206.3 [175.8, 235.6]	212.8 [185, 240.7]	219.1 [184.7, 255.4]
	Anterior-Inferior	214 [171.3, 252.9]	224.8 [196.3, 253]	235.8 [211.8, 262]	247.2 [215.8, 282.6]
	Inferior-Anterior	280.5 [243, 315.3]	288.3 [262.3, 313.8]	296.2 [273.1, 320.2]	303.8 [274.1, 335.8]
	Inferior-Posterior	283 [253.3, 313.8]	282.1 [259.5, 306.9]	281.8 [259.7, 304.3]	280.9 [253.4, 308.3]
	Posterior-Inferior	334.6 [298.3, 375.3]	328.8 [301.4, 358.1]	322.9 [297.5, 348.8]	317.1 [283.2, 349.2]
	Posterior-Superior	327.1 [288.7, 369.6]	322.8 [293.2, 351.7]	317.8 [290.2, 343.1]	312.5 [277.7, 344.7]
	Superior-Posterior	251.7 [216.6, 287.9]	245.2 [218.3, 270.2]	238.2 [213.6, 262.1]	231.5 [198.9, 262.7]
Male	Superior-Anterior	129 [88.5, 167.7]	128.5 [92.4, 162.4]	127.9 [93.6, 159.5]	127.5 [90.9, 161.5]
	Anterior-Superior	170.8 [123.2, 215.9]	160.9 [120, 200]	151.4 [112.6, 188]	141.2 [100.1, 180.7]
	Anterior-Inferior	168.3 [121.6, 215.7]	162.5 [120.1, 203.8]	156.4 [115.4, 195]	149.7 [106.9, 189.2]
	Inferior-Anterior	239.4 [197, 280.9]	234.5 [195.7, 272.2]	230 [191.7, 266.4]	224.5 [184.8, 263.5]
	Inferior-Posterior	251.6 [215.5, 289.9]	251.2 [218, 284.9]	250.7 [218.6, 282.9]	249.8 [216.3, 283.2]
	Posterior-Inferior	297.4 [250.3, 344.6]	293.2 [250.8, 335.1]	289.4 [247.8, 330.2]	284.7 [242.1, 328]
	Posterior-Superior	297.6 [251.1, 345.9]	292.8 [250.9, 336.4]	288 [248.3, 330.9]	283.5 [241.2, 328.8]
	Superior-Posterior	223.1 [179.5, 267.3]	217.3 [178.9, 256.5]	211.8 [174.3, 249.1]	206.5 [166.6, 245.9]

Table A4: Difference and 89th percentile interval of BMD in ST between CTA and CTRL, for male and female at BMIs 17, 25, and 33 kg/m², while keeping age at 65 years.

Sex	Location	17 kg/m2	22 kg/m2	27 kg/m2	32 kg/m2
Female	Superior-Anterior	130.8 [88.9, 165.9]	132 [100.5, 159.7]	133.8 [104.9, 160.9]	134.7 [100.3, 172.4]
	Anterior-Superior	78.4 [36.1, 118.7]	75.6 [42.8, 105.5]	72.9 [40.3, 101.1]	70.1 [29.5, 106.9]
	Anterior-Inferior	19.3 [-23.2, 54.6]	17.8 [-14.3, 44.4]	16 [-14.3, 42.3]	13.4 [-21.1, 48.5]
	Inferior-Anterior	-14.7 [-45.9, 13.5]	-15.9 [-40.6, 5.8]	-17.2 [-40.4, 2.8]	-18.8 [-46.4, 6.9]
	Inferior-Posterior	-34.4 [-66.9, -3.9]	-33.5 [-59.9, -8.8]	-32.5 [-58.3, -8.8]	-32 [-63.2, -1.1]
	Posterior-Inferior	11 [-41.6, 48.8]	14.8 [-20.2, 45.6]	20.7 [-13, 50.7]	25.3 [-15.5, 71.9]
	Posterior-Superior	130.4 [75.9, 173.3]	132.8 [93.8, 166.1]	135.5 [100.2, 169.6]	137.2 [94.2, 188]
	Superior-Posterior	190.4 [136.1, 230.5]	192.6 [157.1, 223.8]	195.6 [164.6, 226.2]	197.4 [159, 246]
Male	Superior-Anterior	109.8 [70.5, 158.9]	104.3 [73, 133.6]	96.9 [68.7, 121.9]	91.3 [46.9, 122.9]
	Anterior-Superior	57.5 [16.5, 112.3]	43.1 [12.2, 76.3]	26.6 [-2.5, 53.4]	11 [-36.2, 45.6]
	Anterior-Inferior	19.8 [-17.8, 64.6]	9.8 [-17.2, 39.4]	-1.1 [-26.3, 23.8]	-11.1 [-49.5, 21.2]
	Inferior-Anterior	-19.9 [-49, 12.5]	-25.8 [-46.6, -3.2]	-32.3 [-50.2, -11.5]	-37.9 [-63.7, -11.9]
	Inferior-Posterior	-36.4 [-68.5, -0.2]	-38.1 [-60.9, -12.3]	-39.9 [-60.4, -16.6]	-41.7 [-69.9, -11.9]
	Posterior-Inferior	15.4 [-26.2, 62.9]	9.4 [-22.2, 41.5]	2.5 [-27.3, 31.1]	-4.1 [-48.3, 34.3]
	Posterior-Superior	106.2 [56.4, 161.5]	99 [60.4, 135.7]	91.1 [54.6, 123.2]	83.4 [31.9, 125.4]
	Superior-Posterior	165.8 [119.1, 221.3]	155.5 [116.7, 189.1]	143.3 [104.8, 171.1]	131.4 [79.2, 168.2]

Table A5: ST BMD and 89th percentile interval for CTRL, male and female at ages 50, 60, 70, 80, and 90 years, while keeping BMI at 25 kg/m^2.

Sex	Location	50 years	60 years	70 years	80 years	90 years
Female	Superior-Anterior	268.2 [241.9, 295.3]	246 [226.7, 265.3]	223.4 [203.7, 242.7]	200.9 [174.3, 227.3]	178.4 [141.5, 214.4]
	Anterior-Superior	293.5 [262.9, 324.6]	264.2 [241, 287.5]	234.4 [210.7, 258.4]	204.6 [171, 236.5]	174.5 [128.5, 218.6]
	Anterior-Inferior	307.2 [281.4, 334.5]	274.3 [255.1, 294.3]	241.3 [221.3, 260.9]	208.2 [180.7, 234.2]	174.9 [137, 210.5]
	Inferior-Anterior	279.5 [256.4, 302.7]	247.6 [230.8, 264.2]	215.6 [198.5, 232.3]	183.5 [158.8, 207.5]	151.4 [117.2, 184.7]
	Inferior-Posterior	288 [261, 315.6]	253 [232.8, 272.5]	217.4 [197.2, 237]	181.5 [154.1, 209.4]	146 [107.9, 184]
	Posterior-Inferior	346.9 [319.7, 375.3]	312.8 [292.8, 332.8]	278.5 [257.7, 298.4]	244.1 [215.4, 271.8]	209.6 [169.3, 249]
	Posterior-Superior	353.4 [322.5, 382.9]	325.2 [303.2, 347.1]	297.2 [275.7, 319]	268.8 [239.3, 299.2]	241.1 [200.2, 281.9]
	Superior-Posterior	320.9 [297.6, 344.9]	301.7 [284.1, 320.1]	282.4 [264.7, 300.2]	263.1 [238.5, 287.9]	243.6 [208.7, 277.9]
Male	Superior-Anterior	338.3 [315.4, 360.7]	299.4 [284.7, 313.6]	259.9 [242.3, 277]	220.5 [191.8, 248]	180.8 [139.6, 221.5]
	Anterior-Superior	375.8 [347.2, 404.5]	327.9 [309.3, 345.9]	279 [257.7, 301.1]	230.3 [195.8, 265.6]	182.1 [130.6, 233.1]
	Anterior-Inferior	373.1 [349.9, 397.2]	316.9 [302, 331.8]	260.3 [242, 278.7]	203.8 [173.8, 233.3]	146.8 [103.1, 189.5]
	Inferior-Anterior	336.1 [316.2, 356.3]	282.9 [270.2, 295.7]	229.4 [213.4, 244.9]	175.6 [149.5, 201.5]	122.3 [83.9, 159.8]
	Inferior-Posterior	341.7 [317.5, 365.2]	282.9 [267.6, 297.7]	223.5 [205.1, 242.1]	164.6 [134.1, 194.7]	105 [60.8, 149.2]
	Posterior-Inferior	414 [388.4, 439.3]	354.4 [338.1, 370]	294.5 [275.6, 313.2]	234.4 [203.6, 265.4]	174 [129.5, 219.8]
	Posterior-Superior	436.7 [410.5, 464]	387.6 [370.2, 404.4]	337.4 [317.3, 357.7]	286.9 [254.6, 320.1]	236.9 [190.5, 285.3]
	Superior-Posterior	391.5 [370, 413.3]	361.5 [348.1, 375]	331.2 [314.6, 347.9]	301.2 [273.8, 328.8]	271 [230.4, 311]

Table A6: ST BMD and 89th percentile interval for OA, for male and female at ages 50, 60, 70, 80, and 90 years, while keeping BMI at 25 kg/m^2.

Sex	Location	50 years	60 years	70 years	80 years	90 years
Female	Superior-Anterior	428 [387.9, 469.9]	413.5 [389.2, 437.2]	398.7 [384.7, 411.3]	383.6 [361.6, 405]	369.2 [329.5, 405.5]
	Anterior-Superior	494.8 [450.4, 546.8]	471 [444.3, 500.5]	446.8 [431.6, 461.1]	422.2 [396.6, 445.3]	398.3 [351.3, 438.2]
	Anterior-Inferior	520.5 [475, 569.9]	499.7 [472.7, 529.1]	478.6 [463.6, 495.3]	457.6 [432.3, 482.8]	436.9 [390.8, 479.6]
	Inferior-Anterior	553.9 [507.9, 602.4]	534.5 [507.1, 563.2]	514.6 [500.7, 530.4]	495.5 [470, 520.2]	476 [430.7, 519.9]
	Inferior-Posterior	542.7 [506.7, 584]	525.7 [504.4, 548.9]	508 [496.6, 520.1]	490 [469.8, 510]	472.7 [436.2, 507.5]
	Posterior-Inferior	645.7 [594.8, 697.2]	629 [599.9, 659.1]	612.5 [597.4, 628.7]	595.8 [570.5, 622.8]	578.6 [533.9, 627.3]
	Posterior-Superior	647 [596, 696.6]	636.4 [606.1, 665.7]	625.4 [608, 641.3]	614.3 [586.7, 640.7]	603.3 [555.6, 649.8]
	Superior-Posterior	535.6 [483.8, 579.4]	534 [503.4, 560.4]	532.9 [515.8, 547.1]	531.3 [507, 556.5]	529.3 [488.6, 576.2]
Male	Superior-Anterior	382.4 [328.7, 431.1]	398.8 [361.6, 433.5]	415.7 [383, 446.4]	432.4 [389.8, 475.1]	448.7 [390.4, 509.8]
	Anterior-Superior	441.7 [384.2, 499.5]	452.2 [412.5, 493]	463.2 [429.9, 495.9]	473.9 [429.2, 518.2]	484.9 [420, 549.3]
	Anterior-Inferior	398.5 [333, 458.9]	430.7 [384.9, 472.4]	463.7 [423.2, 499.7]	495.3 [444.1, 547]	526.6 [456.5, 604.4]
	Inferior-Anterior	423.7 [350.1, 486.3]	465.7 [420.7, 506.6]	509.5 [473.8, 542.8]	552.9 [503.8, 604.8]	595.8 [523.9, 678.1]
	Inferior-Posterior	463.2 [411.9, 510.6]	489.8 [456.1, 523.2]	517.7 [489.4, 545.5]	544.6 [506.9, 584.8]	572 [517.7, 631.9]
	Posterior-Inferior	572.8 [507.2, 637.4]	600.5 [555.3, 644.9]	629 [590.2, 667.6]	656.9 [606.6, 709]	684.7 [613.7, 759.4]
	Posterior-Superior	614.3 [548, 678.6]	638.9 [594.5, 685.9]	664 [627.1, 705.2]	690 [640, 744.9]	714.8 [644.1, 792.4]
	Superior-Posterior	524.7 [461.2, 582.2]	548.1 [505.6, 589.1]	572.5 [537.4, 609.6]	597.1 [551.4, 647.1]	621.3 [556.8, 694.5]

Table A7: ST BMD and 89th percentile interval for CTA, for male and female at ages 50, 60, 70, 80, and 90 years, while keeping BMI at 25 kg/m^2.

Sex	Location	50 years	60 years	70 years	80 years	90 years
Female	Superior-Anterior	333 [268.3, 383.4]	356.4 [318, 385.8]	380 [360.4, 396.4]	403.7 [376, 435]	426.7 [379.4, 485.2]
	Anterior-Superior	292.2 [225.3, 341.3]	313.6 [273.3, 341.8]	334.7 [314.2, 350.1]	356.4 [328, 387.2]	377.5 [329.8, 436.6]
	Anterior-Inferior	240.3 [174.1, 287.6]	263.4 [223.1, 291]	286.8 [266.5, 301]	309.5 [284.4, 337.8]	332.7 [288.3, 385.7]
	Inferior-Anterior	194.5 [148.9, 230.9]	208.2 [180.1, 229.2]	222 [206.4, 232.3]	234.8 [215.7, 255.3]	248.5 [214.8, 285.2]
	Inferior-Posterior	177.7 [129.1, 219.5]	194.1 [163.8, 218.3]	210.6 [194.6, 222.9]	226.6 [205, 248.8]	242.4 [203.9, 285]
	Posterior-Inferior	274 [198.6, 337.1]	301 [257.3, 337.3]	327.6 [304.6, 345.9]	353.9 [321.9, 388.9]	380.5 [323.1, 445.3]
	Posterior-Superior	410.1 [325.2, 478.1]	433.9 [385.3, 473.4]	457.7 [433.7, 479.5]	481.9 [444.3, 520.6]	505.7 [440.2, 576.3]
	Superior-Posterior	456.5 [384.6, 515.8]	476.3 [434, 512.5]	497 [475.8, 516.3]	517.9 [485.8, 550.9]	538.1 [482.5, 602]
Male	Superior-Anterior	381 [339.8, 427.8]	380.2 [348.3, 408.8]	379.2 [352, 398.6]	377.3 [345.2, 402.7]	376.2 [331, 411.7]
	Anterior-Superior	335.7 [292.1, 372.7]	336.1 [305.9, 363.8]	337.2 [314.1, 358.5]	338 [311.6, 366.3]	338.7 [303.3, 380.7]
	Anterior-Inferior	291.7 [253, 331.4]	291.6 [264.6, 319.7]	291.2 [271.6, 313.4]	291.3 [267, 317.7]	291.2 [254.6, 328.6]
	Inferior-Anterior	225.7 [194.3, 254.1]	225.8 [206, 247.1]	226.2 [213, 243.6]	227.1 [210.7, 249.1]	227.5 [203.2, 258.9]
	Inferior-Posterior	213.3 [180.8, 245.6]	213.7 [192.2, 237.2]	213.9 [198.5, 233]	214.5 [194.7, 238.7]	215.1 [186.7, 250.1]
	Posterior-Inferior	329.3 [280.6, 378.3]	329.1 [294.8, 362.8]	329.5 [303.3, 354.1]	329.4 [297, 361.7]	329.6 [283.1, 377.1]
	Posterior-Superior	456.3 [399.2, 508.9]	456.7 [415.5, 491.9]	456.9 [424.5, 483.3]	456.4 [417.2, 491.2]	456.8 [401, 508.4]
	Superior-Posterior	495 [446.6, 546.7]	494.8 [455.3, 528.6]	494.1 [459.3, 518.4]	492 [452.9, 522.4]	491 [436.7, 531.8]