**Methods for Inverse Probability Weighting (IPW)**

First, we compared the demographic characteristics for twins with observed outcomes compared to twins with missing outcomes to determine whether IPW was necessary. This was done variable-by-variable to ensure the IPW model was appropriate for each regression. Due to the number of variables used in these analyses, we have only presented the demographic characteristics for twins with observed or missing BMI at 18 months. The demographic characteristics differed between twins with fully-observed outcome measures and those with missing outcome measures (Supplementary Table S1).

**Supplementary Table S1:** Descriptive statistics mean (standard deviation) or frequency [percent] for twins with missing or observed BMI at 18 months in the PETS.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Observed BMI at 18 months (n=441) | Missing BMI at 18 months (n=59) | p-value for difference |
| Maternal Age at Delivery (years) | 33.05 (5.03) | 30.03 (4.77) | <0.001 |
| Mother Smoked (at all) During Pregnancy  | 64 [14.5] | 8 [13.6]  | 0.845 |
| Mother Drank Alcohol (at all) During Pregnancy  | 148 [33.6] | 8 [13.6]  | 0.003 |
| Gestational Age (weeks) | 35.97 (2.19) | 35.00 (2.98) | 0.002 |
| Caesarean Delivery | 280 [63.5] | 45 [76.3] | 0.024 |
| Breastfed (any) | 387 [87.8] | 9 [15.3] | 0.073 |
| Monozygotic Twins | 183 [41.5] | 25 [42.4] | 0.898 |
| Monochorionic Twins | 121 [27.4] | 17 [28.8] | 0.824 |
| Sex (Male) | 210 [47.6] | 34 [57.6] | 0.151 |
| Birthweight (grams) | 2496.36 (521.57) | 2262.37 (626.46) | 0.002 |
| Small for gestational age (based on twin charts) | 27 [6.1] | 7 [11.9] | 0.106 |
| SBP (mmHg) at age six | 101.49 (8.00) | 102.68 (10.21) | 0.301 |

 We then fitted logistic regression models with robust standard errors to predict the probability of outcome measures being observed or missing. We then used this probability to calculated stabilised weights. Stabilised weights were used in these analyses to reduce the influence of non-zero probability. After calculating the stabilised weights, we used the standardised differences between the unweighted and weighted models to determine whether weighting the observations balanced the data. Standardised differences were smaller for weighted observations compared to unweighted observations, indicating that IPW led to balanced data (Supplementary Table S2).

**Supplementary Table S2:** **Comparison of the standardised differences between the unweighted and weighted models for continuous demographic variables** for twins with missing or observed BMI at 18 months in the PETS**.**

|  |  |  |
| --- | --- | --- |
|  | Unweighted | Weighted |
|  | Observed | Missing | Standardised Difference | Observed | Missing | Standardised Difference |
| Maternal Age at Delivery (years) | 33.05 (5.03) | 30.03 (4.77) | 1.36 | 38.64 (10.84) | 35.00 (5.06) | 1.29 |
| Gestational Age (weeks) | 35.97 (2.19) | 35.00 (2.98) | 0.60 | 35.34 (0.27) | 35.37 (0.21) | -0.07 |
| Birthweight (grams) | 2496.36 (521.57) | 2262.37 (626.46) | 9.77 | 2425.26 (60.17) | 2429.71 (47.66) | -0.61 |
| SBP (mmHg) at age six | 101.49 (8.00) | 102.68 (10.21) | -0.39 | 101.74 (8.73) | 101.45 (7.73) | 0.10 |

 Finally, after determining that IPW was necessary and led to balanced data, we used the stabilised weight, calculated earlier, to fit weighted generalised estimating equations regressions. In Supplementary Tables S3-5 we present the results from the unweighted adjusted regressions (see also main text), results from models with highly influential observations removed, and the results from the weighted regressions. At 18 months, we found slight differences for fully-observed versus IPW associations of birthweight with between-pair abdominal circumference and twins-as-individuals arm circumference. At six years, there were differences for the associations of birthweight with six-year twins-as-individuals BMI, twins-as-individuals height, between-pair weight z-score, and within-pair head circumference. All other results led to similar inferences between the fully-observed and IPW models.

**Supplementary Table S3:** Results from the original adjusted regression models, with influential observations removed (sensitivity), and inverse probability weighted results, for models assessing associations of overall, within-pair and between-pair birthweight-for-gestational-age z-scores with 18-month anthropometric measures.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Original Adjusteda β (95%CI), q-valueb (see main text)** | **Sensitivity β (95%CI), p-value**  | **IPW β (95%CI), p-value** |
| **BMI (kg/m2) n=285** |
| Twins-as-individuals | 0.29 (0.14, 0.45), <0.001 | 0.24 (0.11, 0.356, <0.001 | 0.20 (0.02, 0.39), 0.031 |
| Between-pair | 0.08 (-0.16, 0.33), 0.593 | 0.01 (-0.20, 0.23), 0.896 | 0.11 (-0.14, 0.36), 0.375 |
| Within-pair | 0.37 (0.20, 0.55), <0.001 | 0.34 (0.20, 0.49), <0.001 | 0.38 (0.20, 0.56), <0.001 |
| **BMI (z-score) n=285** |
| Twins-as-individuals | 0.23 (0.11, 0.35), <0.001 | 0.17 (0.08, 0.26), <0.001 | 0.17 (0.02, 0.31), 0.022 |
| Between-pair | 0.07 (-0.11, 0.27), 0.526 | 0.02 (-0.13, 0.17), 0.799 | 0.10 (-0.09, 0.29), 0.323 |
| Within-pair | 0.29 (0.16, 0.42), <0.001 | 0.20 (0.10, 0.30), <0.001 | 0.30 (0.17, 0.43), <0.001 |
| **Height (cm) n=286** |
| Twins-as-individuals | 0.47 (0.10, 0.84), 0.025 | 0.44 (0.18, 0.71), 0.001 | 0.58 (0.22, 0.94), 0.002 |
| Between-pair | 0.70 (0.26, 1.14), 0.005 | 0.59 (0.21, 0.97), 0.002 | 0.68 (0.25, 1.11), 0.002 |
| Within-pair | 0.38 (-0.05, 0.82), 0.129 | **0.35 (0.01, 0.68), 0.043** | 0.39 (-0.05, 0.84), 0.084 |
| **Height (z-score) n=286** |
| Twins-as-individuals | 0.16 (0.02, 0.29), 0.043 | 0.18 (0.07, 0.28), 0.001 | 0.19 (0.05, 0.33), 0.009 |
| Between-pair | 0.21 (0.04, 0.39), 0.032 | 0.23 (0.09, 0.38), 0.002 | 0.21 (0.04, 0.38), 0.017 |
| Within-pair | 0.13 (-0.02, 0.29), 0.133 | 0.12 (-0.00, 0.25), 0.051 | 0.14 (-0.02, 0.30), 0.086 |
| **Weight (kg) n=285** |
| Twins-as-individuals | 0.32 (0.18, 0.46), <0.001 | 0.24 (0.12, 0.36), <0.001 | 0.29 (0.14, 0.45), <0.001 |
| Between-pair | 0.25 (0.05, 0.44), 0.027 | 0.25 (0.08, 0.42), 0.004 | 0.26 (0.07, 0.46), 0.009 |
| Within-pair | 0.34 (0.18, 0.51), <0.001 | 0.42 (0.28, 0.56), <0.001 | 0.35 (0.19, 0.52), <0.001 |
| **Weight (z-score) n=285** |
| Twins-as-individuals | 0.27 (0.15, 0.40), <0.001 | 0.33 (0.23, 0.43), <0.001 | 0.24 (0.11, 0.37), 0.001 |
| Between-pair | 0.19 (0.02, 0.36), 0.050 | 0.21 (0.06, 0.36), 0.006 | 0.20 (0.03, 0.38), 0.022 |
| Within-pair | 0.30 (0.15, 0.45), <0.001 | 0.38 (0.26, 0.50), <0.001 | 0.31 (0.16, 0.46), <0.001 |
| **Head Circumference (cm) n=286** |
| Twins-as-individuals | 0.28 (0.11, 0.46), 0.005 | 0.28 (0.14, 0.42), <0.001 | 0.30 (0.13, 0.48), 0.001 |
| Between-pair | 0.35 (0.12, 0.58), 0.007 | 0.34 (0.16, 0.52), <0.001 | 0.33 (0.11, 0.56), 0.004 |
| Within-pair | 0.25 (0.01, 0.48), 0.060 | 0.25 (0.06, 0.45), 0.011 | 0.25 (0.01, 0.48), 0.040 |
| **Head Circumference (z-score) n=286** |
| Twins-as-individuals | 0.23 (0.08, 0.37), 0.005 | 0.23 (0.11, 0.34), <0.001 | 0.24 (0.10, 0.38), 0.001 |
| Between-pair | 0.27 (0.08, 0.46), 0.011 | 0.24 (0.09, 0.38), 0.002 | 0.26 (0.07, 0.44), 0.006 |
| Within-pair | 0.21 (0.02, 0.40), 0.053 | 0.23 (0.07, 0.39), 0.006 | 0.21 (0.02, 0.40), 0.035 |
| **Abdominal Circumference (log cm) n=278** |
| Twins-as-individuals | 0.016 (0.007, 0.024), <0.001 | 0.014 (0.008, 0.021), <0.001 | 0.02 (0.01, 0.03), 0.003 |
| Between-pair | 0.012 (0.002, 0.022), 0.021 | **0.010 (-0.002, 0.021), 0.101** | **0.012 (-0.002, 0.025), 0.096** |
| Within-pair | 0.022 (0.009, 0.036), 0.002 | 0.016 (0.009, 0.024), <0.001 | 0.02 (0.01, 0.03), <0.001 |
| **Upper Arm Circumference (cm) n=280** |
| Twins-as-individuals | 0.16 (0.03, 0.29), 0.033 | 0.15 (0.03, 0.28), 0.015 | **0.12 (-0.02, 0.27), 0.097** |
| Between-pair | 0.06 (-0.13, 0.25), 0.593 | 0.05 (-0.12, 0.22), 0.561 | 0.07 (-0.11, 0.26), 0.432 |
| Within-pair | 0.21 (0.05, 0.37), 0.022 | 0.26 (0.09, 0.43), 0.003 | 0.21 (0.05, 0.38), 0.012 |
| **Triceps Skinfold Thickness (cm) n=274** |
| Twins-as-individuals | -0.11 (-0.36, 0.16), 0.520 | -0.13 (-0.31, 0.06), 0.186 | -0.11 (-0.40, 0.18), 0.445 |
| Between-pair | -0.11 (-0.52, 0.30), 0.630 | -0.10 (-0.41, 0.22), 0.545 | -0.12 (-0.51, 0.27), 0.549 |
| Within-pair | -0.11 (-0.43, 0.22), 0.593 | -0.11 (-0.32, 0.11), 0.330 | -0.10 (-0.43, 0.23), 0.549 |
| **Sub-scapula Skinfold Thickness (cm) n=272** |
| Twins-as-individuals | 0.09 (-0.09, 0.27), 0.440 | 0.01 (-0.12, 0.15), 0.863 | -0.004 (-0.22, 0.21), 0.971 |
| Between-pair | -0.07 (-0.36, 0.22), 0.681 | -0.09 (-0.34, 0.17), 0.502 | -0.08 (-0.37, 0.22), 0.601 |
| Within-pair | 0.15 (-0.06, 0.37), 0.223 | 0.06 (-0.11, 0.23), 0.504 | 0.13 (-0.09, 0.36), 0.236 |

a Adjusted for maternal pre-pregnancy BMI, gestational age at delivery, number of prior pregnancies, total maternal gestational weight gain, smoking during pregnancy, twin sex, chorionicity and zygosity. b Simes adjusted q-value. IPW=inverse probability weight; 95%CI=95% confidence interval; BMI=body mass index. Bold results are those which differed between the original regression compared to the sensitivity analyses.

**Supplementary Table S4:** Results from the original adjusted regression models, with influential observations removed (sensitivity), and inverse probability weighted results, for models assessing associations of overall, within-pair and between-pair birthweight-for-gestational-age z-scores with six-year outcomes.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Original Adjusteda β (95%CI), q-valueb** | **Sensitivity β (95%CI), p-value**  | **IPW β (95%CI), p-value** |
| **BMI (inverse square (1/(kg/m2)2) n=216** |
| Twins-as-individuals | -1.37x10-4 (-2.47x10-4, -2.70x10-5), 0.015 | **-5.55x10-5 (-1.53x10-4, 4.23x10-5), 0.266** | **-9.01x10-5 (-2.27x10-4, 4.64x10-5), 0.193** |
| Between-pair | -5.69x10-5 (-2.40x10-4, 1.26x10-4), 0.543 | 5.58x10-5 (-8.39x10-5, 1.95x10-4), 0.434 | -5.95x10-5 (-2.47x10-4, 1.28x10-4), 0.531 |
| Within-pair | -1.71x10-4 (-2.40x10-4, -3.99x10-5), 0.011 | -1.43x10-4 (-2.75x10-4, -1.04x10-5), 0.035 | -1.55x10-5 (-2.98x10-4, -1.13x10-5), 0.035 |
| **BMI (z-score) n=216** |
| Twins-as-individuals | 0.18 (0.04, 0.31), 0.025 | **-0.02 (-0.19, 0.16), 0.860** | **0.09 (-0.08, 0.26), 0.310** |
| Between-pair | 0.01 (-0.22, 0.24), 0.947 | -0.12 (-0.40, 0.15), 0.387 | 0.02 (-0.21, 0.26), 0.855 |
| Within-pair | 0.25 (0.09, 0.40), 0.005 | **0.07 (-0.14, 0.27), 0.534** | 0.24 (0.08, 0.40), 0.004 |
| **Height (Inverse cube (1/cm3)) n=216** |
| Twins-as-individuals | -8.54x10-9 (-2.25x10-8, 5.42x10-9), 0.231 | 0.04 (-0.17, 0.24), 0.718 | **-2.09x10-8 (-3.63x10-8, -5.58x10-9), 0.008** |
| Between-pair | -3.08x10-8 (-4.84x10-8, -1.32x10-8), 0.001 | **-0.08 (-0.38, 0.22), 0.599** | -3.11x10-8 (-4.98x10-8, -1.24x10-8), 0.001 |
| Within-pair | -4.06x10-9 (-1.64x10-8, 1.56x10-8), 0.960 | 0.13 (-0.10, 0.37), 0.268 | 4.35x10-10 (-1.62x10-8, 1.70x10-8), 0.959 |
| **Height (z-score) n=206** |
| Twins-as-individuals | 0.15 (0.03, 0.28), 0.029 | 0.22 (0.06, 0.38), 0.008 | 0.22 (0.05, 0.40), 0.015 |
| Between-pair | 0.28 (0.07, 0.49), 0.018 | 0.31 (0.11, 0.51), 0.003 | 0.32 (0.11, 0.53), 0.003 |
| Within-pair | 0.004 (-0.23, 0.24), 0.978 | 0.03 (-0.15, 0.21), 0.750 | 0.01 (-0.24, 0.25), 0.942 |
| **Weight (inverse (1/kg)) n=216** |
| Twins-as-individuals | -1.18x10-3 (-2.10x10-3, -2.49x10-4), 0.013 | **0.03 (-0.18, 0.24), 0.767** | -1.49x10-3 (-2.61x10-3, -3.69x10-4), 0.010 |
| Between-pair | -1.79x10-3 (-3.22x10-3, -3.66x10-4), 0.014 | **-0.07 (-0.38, 0.24), 0.667** | -1.81x10-3 (-3.27x10-3, -3.42x10-4), 0.016 |
| Within-pair | -9.47x10-4 (-2.02x10-3, 1.23x10-4), 0.083 | 0.10 (-0.14, 0.35), 0.409 | -8.15x10-4 (-1.91x10-3, 2.77x10-4), 0.142 |
| **Weight (z-score) n=200** |
| Twins-as-individuals | 0.17 (0.02, 0.32), 0.043 | 0.19 (0.06, 0.33), 0.005 | 0.19 (0.02, 0.36), 0.027 |
| Between-pair | 0.62 (0.24, 0.99), 0.003 | 0.21 (0.04, 0.38), 0.016 | **0.20 (-0.02, 0.41), 0.069** |
| Within-pair | 0.28 (-0.02, 0.59), 0.110 | 0.17 (0.002, 0.34), 0.048 | 0.17 (-0.02, 0.36), 0.078 |
| **Head Circumference (cm) n=216** |
| Twins-as-individuals | 0.40 (0.15, 0.66), 0.005 | 0.41 (0.24, 0.58), <0.001 | 0.46 (0.18, 0.75), 0.002 |
| Between-pair | 0.41 (0.14, 0.68), 0.007 | 0.39 (0.22, 0.57), <0.001 | 0.56 (0.19, 0.93), 0.003 |
| Within-pair | 0.22 (-0.01, 0.46), 0.100 | 0.25 (-0.02, 0.52), 0.065 | 0.26 (-0.08, 0.59), 0.128 |
| **Head Circumference (z-score) n=204** |
| Twins-as-individuals | 0.30 (0.11, 0.49), 0.005 | 0.26 (0.15, 0.38), <0.001 | 0.33 (0.12, 0.54), 0.002 |
| Between-pair | 0.19 (0.02, 0.36), 0.053 | 0.25 (0.05, 0.44), 0.012 | 0.37 (0.11, 0.63), 0.006 |
| Within-pair | 0.21 (0.09, 0.34), 0.003 | 0.25 (0.10, 0.39), 0.001 | **0.24 (-0.04, 0.53), 0.090** |
| **Abdominal Circumference (Inverse cube (1/cm3)) n=216** |
| Twins-as-individuals | -1.34x10-7 (-3.14x10-7, 4.55x10-8), 0.143 | 0.03 (-0.18, 0.24), 0.806 | -1.27x10-7 (-3.33x10-7, 7.83x10-8), 0.222 |
| Between-pair | -1.35x10-7 (-4.03x10-7, 1.32x10-7), 0.320 | -0.08 (-0.38, 0.23), 0.630 | -1.37x10-7 (-4.05x10-7, 1.30x10-7), 0.310 |
| Within-pair | -1.34x10-7 (-3.46x10-7, 7.89x10-8), 0.218 | 0.11 (-0.14, 0.35), 0.397 | -1.05x10-7 (-3.24x10-7, 1.14x10-7), 0.342 |
| **Upper Arm Circumference (Inverse cube (1/cm3)) n=216** |
| Twins-as-individuals | -4.69x10-6 (-9.81x10-6, 4.39x10-7), 0.073 | 0.03 (-0.19, 0.24), 0.802 | -4.52x10-6(-1.12x10-5, 2.16x10-6), 0.183 |
| Between-pair | -4.47x10-6 (-1.36x10-5, 4.68x10-6), 0.339 | -0.09, -0.39, 0.22), 0.580 | -4.70x10-6 (-1.41x10-5, 4.65x10-6), 0.321 |
| Within-pair | -4.79x10-6 (-1.11x10-5, 1.38x10-6), 0.128 | 0.11 (-0.14, 0.36), 0.580 | -4.13x10-6 (-1.09x10-5, 2.63x10-6), 0.229 |
| **Triceps Skinfold Thickness (log cm) n=214** |
| Twins-as-individuals | 0.02 (-0.01, 0.05), 0.250 | 0.04 (-0.17, 0.25), 0.697 | 0.01 (-0.03, 0.05), 0.552 |
| Between-pair | 0.01 (-0.04, 0.06), 0.749 | -0.06 (-0.36, 0.25), 0.718 | 0.01 (-0.04, 0.06), 0.774 |
| Within-pair | 0.02 (-0.02, 0.06), 0.269 | 0.12 (-0.36, 0.25), 0.317 | 0.02 (-0.02, 0.06), 0.384 |
| **Sub-scapula Skinfold Thickness (Inverse square (1/cm2)) n=211** |
| Twins-as-individuals | 0.001 (-0.005, 0.007), 0.693 | 0.002 (0.000, 0.003), 0.055 | -1.92x10-4 (-2.26x10-3, 1.88x10-3), 0.855 |
| Between-pair | -0.0001 (-0.0087, 0.0084), 0.978 | 0.001 (-0.002, 0.003), 0.526 | -0.001 (-0.004, 0.002), 0.547 |
| Within-pair | 0.002 (-0.005, 0.010), 0.593 | 0.002 (-0.000, 0.004), 0.055 | 0.001 (-0.001, 0.004), 0.376 |
| **Systolic Blood Pressure (mmHg) n=213** |
| Twins-as-individuals | 0.15 (-0.81, 1.11), 0.796 | 0.09 (-0.93, 1.12), 0.857 | 0.06 (-0.97, 1.10), 0.906 |
| Between-pair | 0.77 (-0.60, 2.15), 0.359 | 0.27 (-1.05, 1.59), 0.689 | 0.30 (-1.13, 1.74), 0.677 |
| Within-pair | -0.30 (-1.81, 1.21), 0.741 | -0.26 (-1.66, 1.14), 0.721 | -0.45 (-2.04, 1.13), 0.573 |
| **Diastolic Blood Pressure (mmHg) n=213** |
| Twins-as-individuals | 0.22 (-0.34, 0.77), 0.529 | 0.24 (-0.23, 0.72), 0.315 | 0.15 (-0.57, 0.86), 0.685 |
| Between-pair | 0.42 (-0.61, 1.46), 0.520 | 0.41 (-0.41, 1.24), 0.324 | 0.20 (-0.88, 1.28), 0.713 |
| Within-pair | 0.10 (-0.64, 0.84), 0.820 | 0.14 (-0.45, 0.74), 0.631 | 0.03 (-0.73, 0.79), 0.935 |

a Adjusted for maternal pre-pregnancy BMI, gestational age at delivery, number of prior pregnancies, total maternal gestational weight gain, smoking during pregnancy, twin sex, chorionicity and zygosity. b Simes adjusted q-value. IPW=inverse probability weight; 95%CI=95% confidence interval; BMI=body mass index. Bold results are those which differed between the original regression compared to the sensitivity analyses.

**Supplementary Table S5:** Results from the original adjusted regression models, with influential observations removed (sensitivity), and inverse probability weighted results, for models assessing associations of overall, within-pair and between-pair birthweight-for-gestational-age z-scores with postnatal growth.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Original Adjusteda β (95%CI), q-valueb** | **P-valuec** | **Sensitivity β (95%CI), p-value**  | **IPW β (95%CI), p-value** |
| ***Growth between birth and 18 months*** |
| **BMI (change in z-score) n=260** |
| Twins-as-individuals | -0.63 (-0.78, -0.50), <0.001 | p=0.180 | -0.62 (-0.74, -0.51), <0.001 | -0.65 (-0.82, -0.47), <0.001 |
| Between-pair | -0.74 (-0.94, -0.54), <0.001 | -0.74 (-0.91, -0.57), <0.001 | -0.71 (-0.93, -0.49), <0.001 |
| Within-pair | -0.58 (-0.74, -0.42), <0.001 | -0.50 (-0.64, -0.35), <0.001 | -0.52 (-0.70, -0.49), <0.001 |
| **Height (change in z-score) n=262** |
| Twins-as-individuals | -0.56 (-0.70, -0.43), <0.001 | p=0.677 | -0.61 (-0.73, -0.48), <0.001 | -0.57 (-0.75, -0.39), <0.001 |
| Between-pair | -0.55 (-0.78, -0.33), <0.001 | -0.59 (-0.77, -0.42), <0.001 | -0.56 (-0.80, -0.32), <0.001 |
| Within-pair | -0.57 (-0.72, -0.41), <0.001 | -0.60 (-0.77, -0.44), <0.001 | -0.60 (-0.76, -0.44), <0.001 |
| **Weight (change in z-score) n=283** |
| Twins-as-individuals | -0.74 (-0.86, -0.61), <0.001 | p=0.328 | -0.70 (-0.80, -0.60), <0.001 | -0.76 (-0.89, -0.63), <0.001 |
| Between-pair | -0.83 (-1.00, -0.65), <0.001 | -0.81 (-0.95, -0.68), <0.001 | -0.80 (-0.97, -0.62), <0.001 |
| Within-pair | -0.71 (-0.85, -0.56), <0.001 | -0.64 (-0.76, -0.51), <0.001 | -0.69 (-0.84, -0.54), <0.001 |
| **Head Circumference (change in z-score) n=281** |
| Twins-as-individuals | -0.42 (-0.55, -0.29), <0.001 | p=0.213 | -0.43 (-0.54, -0.32), <0.001 | -0.47 (-0.60, -0.33) <0.001 |
| Between-pair | -0.53 (-0.71, -0.34), <0.001 | -0.48 (-0.64, -0.33), <0.001 | -0.52 (-0.72, -0.33), <0.001 |
| Within-pair | -0.36 (-0.53, -0.20), <0.001 | -0.29 (-0.44, -0.14), <0.001 | -0.36 (-0.52, -0.19), <0.001 |
| ***Growth between birth and six years*** |
| **BMI (change in z-score) n=163** |
| Twins-as-individuals | -0.62 (-0.80, -0.45), <0.001 | p=0.623 | -0.70 (-0.85, -0.55), <0.001 | -0.67 (-0.89, -0.45), <0.001 |
| Between-pair | -0.65 (-0.93, -0.37), <0.001 | -0.81 (-1.02, -0.95), <0.001 | -0.69 (-0.98, -0.41), <0.001 |
| Within-pair | -0.61 (-0.81, -0.41), <0.001 | -0.78 (-1.00, 0.55), <0.001 | -0.62 (-0.84, -0.39), <0.001 |
| **Height (change in z-score) n=186** |
| Twins-as-individuals | -0.51 (-0.69, -0.33), <0.001 | p=0.176 | -0.64 (-0.80, -0.48), <0.001 | -0.45 (-0.66, -0.25), <0.001 |
| Between-pair | -0.37 (-0.67, -0.17), <0.001 | -0.50 (-0.72, -0.28), <0.001 | -0.38 (-0.61, -0.15), 0.001 |
| Within-pair | -0.62 (-0.84, -0.39), <0.001 | -0.72 (-0.91, -0.53), <0.001 | -0.63 (-0.86, -0.40), <0.001 |
| **Weight (change in z-score) n=200** |
| Twins-as-individuals | -0.82 (-0.98, -0.67), <0.001 | p=0.072 | -0.81 (-0.94, -0.67), <0.001 | -0.81 (-0.98, -0.64), <0.001 |
| Between-pair | -0.77 (-1.02, -0.56), <0.001 | 0.80 (-0.97, -0.64), <0.001 | -0.80 (-1.02, -0.59), <0.001 |
| Within-pair | -0.84 (-1.03, -0.66), <0.001 | -0.87 (-1.02, -0.72), <0.001 | -0.83 (-1.02, -0.64), <0.001 |
| **Head Circumference (change in z-score) n=195** |
| Twins-as-individuals | -0.31 (-0.47, -0.15), <0.001 | p=0.996 | -0.35 (-0.47, -0.23), <0.001 | -0.33 (-0.51, -0.15), <0.001 |
| Between-pair | -0.29 (-0.52, -0.05), 0.031 | -0.39 (-0.56, -0.21), <0.001 | -0.34 (-0.57, -0.11), 0.004 |
| Within-pair | -0.33 (-0.52, -0.13), 0.003 | -0.34 (-0.51, -0.18), <0.001 | -0.30 (-0.53, -0.08), 0.009 |

a Adjusted for maternal pre-pregnancy BMI, gestational age at delivery, number of prior pregnancies, total maternal gestational weight gain, smoking during pregnancy, twin sex, chorionicity and zygosity. b Simes adjusted q-value. c P-value comparing within-between model to twins-as-individual model. IPW=inverse probability weight ; 95%CI=95% confidence interval; BMI=body mass index.

**Association of Low Birthweight due to Preterm Birth, Small-for-Gestational-Age (SGA), or Both with 18-Month Anthropometrics**

Birthweight was categorised according to risk of neonatal and long-term health complications – term-appropriate-for-gestational-age (AGA), term-SGA, preterm-AGA, and preterm-SGA.

Being in the highest risk birthweight category (preterm-SGA) was associated with lower height (β=-2.20 cm, 95%CI=-3.93, -0.48 cm) and weight (β=-1.11 kg, 95%CI=-2.13, -0.10 kg) compared to the lowest risk category (term-AGA; Supplementary Table S6). Height and weight of infants born term-SGA were slightly smaller compared to term-AGA infants, but there appeared to be no difference for preterm-AGA twins compared to term-AGA twins.

**Supplementary Table S6:** Results of the regression models assessing associations of birthweight risk categories with 18-month anthropometrics.

|  |  |  |
| --- | --- | --- |
|  | **Unadjusted β (95%CI), p-value** | **Adjusteda β (95%CI), q-valueb** |
| **BMI (kg/m2) n=285** |
| Term and AGA | REFERENCE | REFERENCE |
| Term but SGA | -0.67 (-2.29, -0.05), 0.035 | -0.60 (-1.22, 0.03), 0.107 |
| Preterm but AGA | -0.24 (-0.60, 0.13), 0.210 | -0.21 (-1.02, 0.59), 0.622 |
| Preterm and SGA | -1.41 (-1.88, -0.95), <0.001 | -0.94 (-2.13, 0.24), 0.120 |
| **BMI (z-score) n=285** |
| Term and AGA | REFERENCE | REFERENCE |
| Term but SGA | -0.56 (-1.05, -0.06), 0.027 | -0.56 (-1.10, -0.03), 0.040 |
| Preterm but AGA | -0.17 (-0.45, 0.11), 0.229 | -0.14 (-0.77, 0.49), 0.676 |
| Preterm and SGA | -.17 (-1.54, -0.79), <0.001 | -0.74 (-1.23, 0.25), 0.099 |
| **Height (cm) n=286** |
| Term and AGA | REFERENCE | REFERENCE |
| Term but SGA | -1.65 (-2.62, -0.67), 0.001 | -1.16 (-2.25, -0.07), 0.037 |
| Preterm but AGA | -1.31 (-2.05, -0.58), <0.001 | 0.03 (-1.75, 1.81), 0.976 |
| Preterm and SGA | -3.45 (-4.52, -2.37), <0.001 | -2.20 (-3.93, -0.48), 0.012 |
| **Height (z-score) n=286** |
| Term and AGA | REFERENCE | REFERENCE |
| Term but SGA | -0.43 (-0.79, -0.07), 0.018 | -0.33 (-0.75, 0.10), 0.128 |
| Preterm but AGA | -0.51 (-0.75, -0.26), <0.001 | -0.06 (-0.66, 0.55), 0.856 |
| Preterm and SGA | -1.18 (-1.56, -0.81), <0.001 | -0.76 (-1.32, -0.20), 0.007 |
| **Weight (kg) n=285** |
| Term and AGA | REFERENCE | REFERENCE |
| Term but SGA | -0.89 (-1.50, -0.28), 0.004 | -0.70 (-1.30, -0.10), 0.022 |
| Preterm but AGA | -0.51 (-0.83, -0.20), 0.001 | -0.11 (-0.85, 0.63), 0.783 |
| Preterm and SGA | -1.80 (-2.24, -1.36), <0.001 | -1.11 (-2.13, -0.10), 0.032 |
| **Weight (z-score) n=285** |
| Term and AGA | REFERENCE | REFERENCE |
| Term but SGA | -0.66 (-1.18, -0.14), 0.013 | -0.60 (-1.18, -0.03), 0.091 |
| Preterm but AGA | -0.44 (-0.70, -0.19), 0.001 | -0.15 (-0.79, 0.48), 0.656 |
| Preterm and SGA | -1.61 (-2.04, -1.19), <0.001 | -1.03 (-1.90, -0.16), 0.020 |

a Adjusted for maternal pre-pregnancy BMI, gestational age at delivery, number of prior pregnancies, total maternal gestational weight gain, smoking during pregnancy, twin sex, chorionicity and zygosity. b Simes adjust q-value to account for multiple testing. 95%CI=95% confidence interval; BMI=body mass index; AGA=appropriate for gestational age; SGA=small for gestational age.