## Supplementary Materials to Cornwell et al. *‘Identifying Structural Brain Markers of Resilience to Adversity in Young People Using Voxel-Based Morphometry’*

**Table S1**

*Number of Participants from each Study Site (N=298)*

|  |  |  |  |
| --- | --- | --- | --- |
| Site Number | Site Name |  | *n* |
| 1 | Frankfurt |  | 75 |
| 2 | Aachen |  | 85 |
| 4 | Southampton |  | 28 |
| 5 | Basel |  | 21 |
| 7 | Birmingham |  | 89 |

**Figure S1**

*A Flowchart of the Sample Selection Process*

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*Notes.* MRI, Magnetic Resonance Imaging; VBM, Voxel-Based Morphometry

**Table S2**

*Demographic and Clinical Characteristics of Participants with Structural MRI data who were Included Versus Excluded from the Voxel-Based Morphometry Analysis*

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Variable | Included (*n*=298) |  | Excluded (*n*=454) |  | Test Statistic |  | *p* |  |
| Female/Male, *n* (%) | 151 (51%) / 147 (49%) |  | 240 (53%) / 214 (47%) |  | χ2 = 0.35 |  | .56 |  |
| CD/HC, *n* (%) | 78 (26%) / 220 (74%) |  | 255 (56%) / 199 (44%) |  | χ2 = 65.60 |  | < .001 |  |
| Age (years), mean (SD) | 13.51 (2.57) |  | 14.58 (2.36) |  | *t* = -5.78 |  | < .001 |  |
| Resilience Score, mean (SD) | 0.00 (0.12) |  | N/A |  | N/A |  | N/A |  |
| Estimated IQ, mean (SD) | 103.63 (11.97) |  | 97.24 (13.50) |  | *t* = 6.58 |  | < .001 |  |
| Number of Traumatic Events, mean (SD) | 1.25 (1.34) |  | 1.84 (1.77) |  | *t* = -5.17 |  | < .001 |  |
| Number of Current CD Symptoms, mean (SD) | 1.13 (2.14) |  | 2.98 (3.15) |  | *t* = -9.45 |  | < .001 |  |

*Notes.* CD, Conduct Disorder; HC, Healthy Controls; IQ, Intelligent Quotient; Number of Traumatic Events and Number of Current CD Symptoms are measured by the Kiddie-Schedule for Affective Disorders and Schizophrenia - Present and Lifetime Version (K-SADS-PL); SD, Standard Deviation. Participants excluded from this analysis did not have resilience scores. 15 participants with neuroimaging data were not included in these analyses as they had missing demographic data due to miscellaneous reasons (i.e., withdrawing consent or being excluded at a later timepoint). Four participants included in the analysis had missing IQ data. In terms of participants excluded from the analysis, there was some missing data on the following variables: IQ (*n*=8), Number of Traumatic Events (*n*=19), Number of Current CD Symptoms (*n*=20).

**Supplement 1 – Imputation Procedures used for Missing Data**

Of relevance to this study were missing data on the Childhood Experience of Care and Abuse (CECA-Q; Bifulco et al., 2005); a questionnaire used to derive the resilience scores. Data from the full FemNAT-CD sample were used to impute missing values of items that loaded onto four CECA-Q subscales: ‘Father Antipathy’, ‘Father Neglect’, ‘Mother Antipathy’, and ‘Mother Neglect’. Using the PROC MI procedure in SAS version 9.4, imputation was performed at an item level (Eekhout et al., 2014) prior to calculating subscale scores. Imputation by fully conditional specification (FCS; Liu & De, 2015) was used and the logistic regression method was specified in the FCS statement. The following data were used in the CECA-Q imputation model: diagnostic group, site, age, sex, IQ, co-morbidity data (major depressive disorder, general anxiety disorder, attention-deficit/hyperactivity disorder, oppositional defiant disorder, and post-traumatic stress disorder), and seven items from the child-report Alabama Parenting Questionnaire (APQ; Essau et al., 2006).

**Table S3**

*A Summary of the Variables that Loaded onto each Factor, and their Associated Factor Loadings, in the Factor Analysis Run with Exposure to Adversity and Trauma Variables*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Factor | Cumulative % of Variance Explained | Factor Loadings | Variable | Variable Description |
| (F1) Emotional Support from Father Figure | 22.714 | 0.789 | CECA\_Q\_IMPUTED\_c3f2 | 'He was concerned about my worries.' |
| 0.746 | CECA\_Q\_IMPUTED\_c3f8 | 'He would usually have time to talk to me.' |
| 0.718 | CECA\_Q\_IMPUTED\_c3f11 | 'He was there if I needed him.' |
| 0.700 | CECA\_Q\_IMPUTED\_c3f14 | 'He cared for me when I was ill.' |
| 0.597 | CECA\_Q\_IMPUTED\_c3f5 | 'He tried to make me feel better when I was upset.' |
| -0.533 | CECA\_Q\_IMPUTED\_c3f10 | 'He often picked on me unfairly' |
| -0.531 | CECA\_Q\_IMPUTED\_c3f4 | 'He made me feel unwanted' |
| 0.325 | CECA\_Q\_IMPUTED\_c3f13 | 'He was concerned about my whereabouts.' |
| -0.312 | CECA\_Q\_IMPUTED\_c3f7 | 'He would leave me unsupervised before I was 10 years old' |
|  |  |  |  |  |
| (F2) Neglect | 30.776 | 0.764 | CECA\_Q\_IMPUTED\_c3f15 | 'He neglected my basic needs (e.g. food and clothes)' |
| 0.705 | CECA\_Q\_IMPUTED\_c2m15 | 'She neglected my basic needs (e.g. food and clothes)' |
| 0.318 | CECA\_Q\_IMPUTED\_c3f9 | 'At times he made me feel I was a nuisance' |
|  |  |  |  |  |
| (F3) Relationship to Mother Figure | 37.426 | -0.775 | CECA\_Q\_IMPUTED\_c2m12 | 'She was interested in who my friends were' |
| -0.725 | CECA\_Q\_IMPUTED\_c2m3 | 'She was interested in how I did at school' |
| -0.688 | CECA\_Q\_IMPUTED\_c2m11 | 'She was there if I needed her' |
| -0.650 | CECA\_Q\_IMPUTED\_c2m13 | 'She was concerned about my whereabouts' |
| -0.644 | CECA\_Q\_IMPUTED\_c2m14 | 'She cared for me when I was ill' |
| 0.481 | CECA\_Q\_IMPUTED\_c2m4 | 'She made me feel unwanted' |
| 0.463 | CECA\_Q\_IMPUTED\_c2m16 | 'She did not like me as much as my brothers and sisters' |
| -0.353 | CECA\_Q\_IMPUTED\_c2m2 | 'She was concerned about my worries' |
|  |  |  |  |  |
| (F4) Physical Abuse | 43.169 | 0.843 | CBE\_cbe3 | 'Has your child been harmed on purpose by an adult?' |
| 0.656 | CBE\_cbe4 | 'Has your child been harmed in the course of discipline for naughty behaviour (by a parent, partner, grandparent, teacher, child-minder, etc. Hit too hard, hit with something that could hurt like a belt, shut in the dark)?' |
| 0.542 | CS2\_PTSD\_47\_9 | Physical Abuse |
| 0.321 | CS2\_PTSD\_47\_8 | Witness to Domestic Violence |
|  |  |  |  |  |
| (F5) Interest and Concern from Father Figure about Social Relationships | 47.437 | 0.747 | CECA\_Q\_IMPUTED\_c3f12 | 'He was interested in who my friends were.' |
| 0.598 | CECA\_Q\_IMPUTED\_c3f13 | 'He was concerned about my whereabouts.' |
| 0.551 | CECA\_Q\_IMPUTED\_c3f3 | 'He was interested in how I did at school.' |
| 0.301 | CECA\_Q\_IMPUTED\_c2m10 | 'She often picked on me unfairly' |
|  |  |  |  |  |
| (F6) Emotional Support from Mother Figure | 51.210 | 0.526 | CECA\_Q\_IMPUTED\_c2m5 | 'She tried to make me feel better when I was upset' |
| 0.489 | CECA\_Q\_IMPUTED\_c2m8 | 'She would usually have time to talk to me' |
| -0.437 | CECA\_Q\_IMPUTED\_c2m1 | 'She was very difficult to please' |
| 0.436 | CECA\_Q\_IMPUTED\_c2m2 | 'She was concerned about my worries' |
| -0.366 | CECA\_Q\_IMPUTED\_c2m10 | 'She often picked on me unfairly' |
|  |  |  |  |  |
| (F7) Sexual Abuse | 54.360 | 0.987 | CS2\_PTSD\_47\_10 | Sexual Abuse |
| 0.691 | CBE\_cbe5 | 'Has there been any other situation where he/she has been harmed by someone (not accidents)? This could be sexual harm, such as if someone asked your child to touch their genitals or private parts, or touched the child there or if someone tried to have sex with your child?' |
|  |  |  |  |  |
| (F8) Exposed to a Violent Crime | 57.343 | 0.469 | CS2\_PTSD\_47\_6 | Victim of Violent Crime |
| 0.419 | CS2\_PTSD\_47\_5 | Witness of a Violent Crime |
|  |  |  |  |  |
| (F9) Lack of Parental Supervision | 59.958 | -0.685 | CECA\_Q\_IMPUTED\_c3f7 | 'He would leave me unsupervised before I was 10 years old' |
| -0.678 | CECA\_Q\_IMPUTED\_c2m7 | 'She would leave me unsupervised before I was 10 years old' |
|  |  |  |  |  |
| (F10) Emotional Abuse from Parents | 62.416 | 0.582 | CECA\_Q\_IMPUTED\_c3f16 | 'He did not like me as much as my brothers and sisters' |
| 0.529 | CECA\_Q\_IMPUTED\_c3f1 | 'He was very difficult to please' |
| 0.501 | CECA\_Q\_IMPUTED\_c3f6 | 'He was very critical of me' |
| 0.354 | CECA\_Q\_IMPUTED\_c3f9 | 'At times he made me feel I was a nuisance' |
| 0.342 | CECA\_Q\_IMPUTED\_c2m6 | 'She was very critical of me' |
| 0.340 | CECA\_Q\_IMPUTED\_c2m16 | 'She did not like me as much as my brothers and sisters' |
| 0.336 | CECA\_Q\_IMPUTED\_c3f4 | 'He made me feel unwanted' |
| 0.318 | CECA\_Q\_IMPUTED\_c2m9 | 'At times she made me feel I was a nuisance' |
|  |  |  |  |  |
| (F11) Other Trauma | 64.654 | 0.343 | CS2\_PTSD\_47\_7 | Confronted with Traumatic News |
| 0.321 | CECA\_Q\_IMPUTED\_c2m16 | 'She did not like me as much as my brothers and sisters' |
| 0.302 | CS2\_PTSD\_47\_2 | Other Accident |

*Notes.* Extraction method; principal axis factoring; Rotation method; direct oblimin. All loadings reported are above the cut-off of .3. The cumulative percentage of variance explained by each factor is also shown.

**Table S4**

*A Summary of the Variables that Loaded onto each Factor, and their Associated Factor Loadings, in the Factor Analysis Run with Variables that Measured Different Forms of Psychopathology*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Factor | Cumulative % of Variance Explained | Factor Loadings | Variable | Timing (If Applicable) | Variable Description |
| (F1) Current Externalizing Disorder Symptoms | 16.569 | 0.690 | CS2\_ADHD\_C\_14\_1 | Current | Difficulty Sustaining Attention on Tasks or Play Activities |
| 0.685 | CS2\_ADHD\_C\_14\_2 | Current | Easily Distracted |
| 0.622 | CS2\_ADHD\_C\_14\_4 | Current | Impulsivity |
| 0.583 | CS2\_ODD\_C\_15\_4 | Current | Disobeys Rules A Lot |
| 0.481 | CS2\_ADHD\_C\_14\_3 | Current | Difficulty Remaining Seated |
| 0.478 | CS2\_ODD\_C\_15\_3 | Current | Argues A Lot With Adults |
| 0.446 | CS2\_CD\_C\_17\_1 | Current | Lies |
| 0.443 | CS2\_ODD\_C\_15\_1 | Current | Loses Temper |
| 0.438 | CS2\_CD\_C\_17\_4 | Current | Bullies, Threatens, or Intimidates Others |
| 0.426 | CS2\_CD\_C\_17\_3 | Current | Initiates Physical Fights |
| 0.418 | CS2\_ODD\_C\_15\_2 | Current | DMDD Temper Outburst Score |
| 0.327 | CBCLSUB\_tscore\_6 | Current | Attention Problems |
|  |  |  |  |  |  |
| (F2) Past ODD Symptoms | 21.428 | -0.652 | CS2\_ODD\_P\_15\_1 | Past | Loses Temper |
| -0.550 | CS2\_ODD\_P\_15\_2 | Past | DMDD Temper Outburst Score |
| -0.368 | CS2\_ODD\_P\_15\_4 | Past | Disobeys Rules A Lot |
|  |  |  |  |  |  |
| (F3) Past Depressive Disorder Symptoms | 25.616 | 0.738 | CS2\_DD\_P\_1\_2 | Past | Irritability and Anger |
| 0.722 | CS2\_DD\_P\_1\_3 | Past | DMDD Irritability Scoring |
| 0.548 | CS2\_DD\_P\_1\_1 | Past | Depressed Mood |
| 0.440 | CS2\_DD\_P\_1\_4 | Past | Anhedonia, Lack of Interest, Apathy, Low Motivation, or Boredom |
| 0.364 | CS2\_DD\_P\_1\_5 | Past | Recurrent Thoughts of Death |
|  |  |  |  |  |  |
| (F4) Substance Use | 29.443 | 0.798 | CS2\_SU\_22\_2 |   | Use of Stimulants |
| 0.781 | CS2\_SU\_22\_7 |  | Use of Hallucinogens |
| 0.743 | CS2\_SU\_22\_4 |  | Use of Cocaine |
| 0.693 | CS2\_SU\_22\_9 |  | Use of Other Substances |
| 0.636 | CS2\_SU\_22\_6 |   | Use of PCP |
|  |  |  |  |  |  |
| (F5) Lifetime Bulimia Nervosa Symptoms | 32.084 | 0.827 | CS2\_BN\_C\_13\_1 | Current | Weight Loss Methods - Using Diet Pills |
| 0.548 | CS2\_BN\_C\_13\_5 | Current | Weight Loss Methods - Exercising A Lot |
| 0.400 | CS2\_BN\_C\_13\_4 | Current | Weight Loss Methods - Throwing Up |
| 0.388 | CS2\_BN\_P\_13\_8 | Past | Eating Binges or Attacks |
|  |  |  |  |  |  |
| (F6) Current Self-Harm and Suicidality | 34.490 | -0.825 | CS2\_DD\_C\_1\_7 | Current | Suicidal Acts - Seriousness |
| -0.818 | CS2\_DD\_C\_1\_8 | Current | Suicidal Acts - Medical Lethality |
| -0.689 | CS2\_DD\_C\_1\_6 | Current | Suicidal Ideation |
| -0.518 | CS2\_DD\_C\_1\_5 | Current | Recurrent Thoughts of Death |
| -0.341 | CS2\_DD\_C\_1\_9 | Current | Non-Suicidal Physical Self-Damaging Acts |
|  |  |  |  |  |  |
| (F7) Lifetime Autism Spectrum Disorder Symptoms | 36.667 | -0.569 | CS2\_ASD\_C\_19\_3 | Current | Highly Restricted, Fixated Interests That Are Abnormal in Intensity or Focus |
| -0.494 | CS2\_ASD\_P\_19\_3 | Past | Highly Restricted, Fixated Interests That Are Abnormal in Intensity or Focus |
| -0.341 | CS2\_ASD\_P\_19\_2 | Past | Insistence on Sameness, Inflexible Adherence to Routines, Ritualized Patterns of Verbal or Nonverbal Behaviour |
| -0.305 | CS2\_ASD\_P\_19\_4 | Past | Deficits in Nonverbal Communicative Behaviours Used for Social Interaction |
|  |  |  |  |  |  |
| (F8) Current Separation Anxiety Issues | 38.667 | 0.742 | CS2\_SAD\_C\_5\_5 | Current | Fears Being Alone at Home |
| 0.596 | CS2\_SAD\_C\_5\_4 | Current | Fears Sleeping Away from Home/Sleeping Alone |
| 0.433 | CS2\_SAD\_C\_5\_1 | Current | Fears Calamitous Event that Will Cause Separation |
| 0.349 | CS2\_SAD\_C\_5\_2 | Current | Fears Harm Befalling Attachment Figure |
|  |  |  |  |  |  |
| (F9) Lifetime Avoidant Disorder/Social Phobia | 40.573 | -0.623 | CS2\_ADSP\_P\_6\_2 | Past | Fear of Social Situations |
| -0.613 | CS2\_ADSP\_P\_6\_1 | Past | Shrinks from Contact |
| -0.543 | CS2\_ADSP\_C\_6\_2 | Current | Fear of Social Situations |
| -0.506 | CS2\_ADSP\_C\_6\_1 | Current | Shrinks from Contact |
|  |  |  |  |  |  |
| (F10) Past Agoraphobia Symptoms | 42.329 | 0.955 | CS2\_AP\_P\_7\_2 | Past | Agoraphobia/Specific Phobias - Avoidance |
| 0.790 | CS2\_AP\_P\_7\_1 | Past | Agoraphobia/Specific Phobias - Distress |
|  |  |  |  |  |  |
| (F11) Lifetime Racing Thoughts | 43.944 | -0.680 | CS2\_MA\_P\_2\_4 | Past | Racing Thoughts |
| -0.634 | CS2\_MA\_C\_2\_4 | Current | Racing Thoughts |
|  |  |  |  |  |  |
| (F12) Lifetime Obsessive-Compulsive Disorder Symptoms | 45.501 | 0.643 | CS2\_OCD\_P\_9\_2 | Past | Obsessions |
| 0.557 | CS2\_OCD\_C\_9\_2 | Current | Obsessions |
| 0.513 | CS2\_OCD\_P\_9\_1 | Past | Compulsions |
| 0.501 | CS2\_OCD\_C\_9\_1 | Current | Compulsions |
|  |  |  |  |  |  |
| (F13) Substance-Related Disorders | 46.990 | -0.743 | CS2\_CIG\_20\_1 |   | Cigarette Use - Ever Smoked |
| -0.741 | CS2\_SU\_22\_1 |  | Use of Cannabis |
| -0.467 | CS2\_ALC\_21\_2 |   | Drank Two Drinks in One Week Four or More Times |
|  |  |  |  |  |  |
| (F14) Past Use of Weight Loss Methods | 48.449 | 0.752 | CS2\_BN\_P\_13\_4 | Past | Weight Loss Methods - Throwing Up |
| 0.723 | CS2\_BN\_P\_13\_6 | Past | Weight Loss Methods - Taking Only Non-Caloric Fluids For a Week or More |
| 0.419 | CS2\_AN\_P\_12\_1 | Past | Fear of Becoming Obese |
|  |  |  |  |  |  |
| (F15) Lifetime Tic Disorder Symptoms | 49.867 | 0.714 | CS2\_TIC\_P\_18\_1 | Past | Motor Tics |
| 0.522 | CS2\_TIC\_P\_18\_2 | Past | Phonic Tics |
| 0.408 | CS2\_TIC\_C\_18\_1 | Current | Motor Tics |
|  |  |  |  |  |  |
| (F16) Lifetime Mania Symptoms | 51.247 | -0.670 | CS2\_MA\_P\_2\_2 | Past | Decreased Need for Sleep |
| -0.440 | CS2\_MA\_P\_2\_1 | Past | Elation, Expansive Mood |
| -0.418 | CS2\_MA\_C\_2\_2 | Current | Decreased Need for Sleep |
| -0.331 | CS2\_MA\_C\_2\_1 | Current | Elation, Expansive Mood |
|  |  |  |  |  |  |
| (F17) Current Use of Weight Loss Methods | 52.604 | 0.683 | CS2\_BN\_C\_13\_7 | Current | Weight Loss Methods - Combined Frequency Weight Loss Methods |
| 0.674 | CS2\_BN\_C\_13\_4 | Current | Weight Loss Methods - Throwing Up |
| 0.434 | CS2\_MA\_C\_2\_2 | Current | Decreased Need for Sleep |
|  |  |  |  |  |  |
| (F18) Past Self-Harm and Suicidal Ideation | 53.906 | -0.391 | CS2\_DD\_P\_1\_9 | Past | Non-Suicidal Physical Self-Damaging Acts |
| -0.337 | CS2\_DD\_P\_1\_5 | Past | Recurrent Thoughts of Death |
|  |  |  |  |  |  |
| (F19) Past ADHD Symptoms | 55.131 | -0.812 | CS2\_ADHD\_P\_14\_1 | Past | Difficulty Sustaining Attention on Tasks or Play Activities |
| -0.806 | CS2\_ADHD\_P\_14\_2 | Past | Easily Distracted |
| -0.671 | CS2\_ADHD\_P\_14\_3 | Past | Difficulty Remaining Seated |
| -0.571 | CS2\_ADHD\_P\_14\_4 | Past | Impulsivity |
|  |  |  |  |  |  |
| (F20) Current Eating Binges/Attacks | 56.332 | 0.366 | CS2\_BN\_C\_13\_8 | Current | Eating Binges or Attacks |
|  |  |  |  |  |  |
| (F21) Lifetime Stereotyped or Repetitive Behaviours | 57.521 | 0.772 | CS2\_ASD\_C\_19\_1 | Current | Stereotyped or Repetitive Speech, Motor Movements or Use of Objects |
| 0.727 | CS2\_ASD\_P\_19\_1 | Past | Stereotyped or Repetitive Speech, Motor Movements or Use of Objects |
|  |  |  |  |  |  |
| (F22) CBCL Subscales | 58.659 | 0.745 | CBCLSUB\_tscore\_2 |   | Withdrawn |
| 0.694 | CBCLSUB\_tscore\_1 |  | Anxious/Depressed |
| 0.644 | CBCLSUB\_tscore\_4 |  | Social Problems |
| 0.617 | CBCLSUB\_tscore\_5 |  | Thought Problems |
| 0.587 | CBCLSUB\_tscore\_6 |  | Attention Problems |
| 0.547 | CBCLSUB\_tscore\_8 |  | Aggressive Behaviour |
| 0.515 | CBCLSUB\_tscore\_3 |  | Somatic Complaints |
| 0.479 | CBCLSUB\_tscore\_7 |   | Rule-Breaking Behaviour |
|  |  |  |  |  |  |
| (F23) Lifetime School Reluctance/Refusal | 59.759 | 0.575 | CS2\_SAD\_C\_5\_3 | Current | School Reluctance/Refusal |
| 0.573 | CS2\_SAD\_P\_5\_3 | Past | School Reluctance/Refusal |
| 0.320 | CS2\_CD\_C\_17\_2 | Current | Truant |
|  |  |  |  |  |  |
| (F24) Lifetime Delusions | 60.808 | 0.540 | CS2\_PSYCH\_P\_3\_2 | Past | Delusions |
| 0.442 | CS2\_PSYCH\_C\_3\_2 | Current | Delusions |
| 0.357 | CS2\_MA\_C\_2\_3 | Current | Increased Goal Directed Activity |
|  |  |  |  |  |  |
| (F25) Past Separation Anxiety Issues | 61.834 | 0.549 | CS2\_SAD\_P\_5\_2 | Past | Fears Harm Befalling Attachment Figure |
| 0.502 | CS2\_SAD\_P\_5\_5 | Past | Fears Being Alone at Home |
| 0.485 | CS2\_SAD\_P\_5\_4 | Past | Fears Sleeping Away from Home/Sleeping Alone |
|  |  |  |  |  |  |
| (F26) Lifetime Use of Exercise for Weight Loss | 62.814 | -0.648 | CS2\_BN\_P\_13\_5 | Past | Weight Loss Methods - Exercising A Lot |
| -0.512 | CS2\_BN\_C\_13\_5 | Current | Weight Loss Methods - Exercising A Lot |
| -0.351 | CS2\_AN\_P\_12\_1 | Past | Fear of Becoming Obese |
|  |  |  |  |  |  |
| (F27) Lifetime Emaciation | 63.776 | 0.734 | CS2\_AN\_C\_12\_2 | Current | Emaciation |
| 0.653 | CS2\_AN\_P\_12\_2 | Past | Emaciation |
|  |  |  |  |  |  |
| (F28) Current Agoraphobia Symptoms | 64.737 | 0.923 | CS2\_AP\_C\_7\_2 | Current | Agoraphobia/Specific Phobias - Avoidance |
| 0.782 | CS2\_AP\_C\_7\_1 | Current | Agoraphobia/Specific Phobias - Distress |
|  |  |  |  |  |  |
| (F29) Lifetime Somatic Complaints | 65.660 | 0.652 | CS2\_OGAD\_C\_8\_2 | Current | Somatic Complaints |
| 0.497 | CS2\_OGAD\_P\_8\_2 | Past | Somatic Complaints |
|  |  |  |  |  |  |
| (F30) Lifetime Repetitive Behaviour | 66.580 | -0.678 | CS2\_ASD\_C\_19\_2 | Current | Insistence on Sameness, Inflexible Adherence to Routines, Ritualized Patterns of Verbal or Nonverbal Behaviour |
| -0.544 | CS2\_ASD\_P\_19\_2 | Past | Insistence on Sameness, Inflexible Adherence to Routines, Ritualized Patterns of Verbal or Nonverbal Behaviour |
|  |  |  |  |  |  |
| (F31) Past Suicidality | 67.467 | 0.858 | CS2\_DD\_P\_1\_8 | Past | Suicidal Acts - Medical Lethality |
| 0.856 | CS2\_DD\_P\_1\_7 | Past | Suicidal Acts - Seriousness |
| 0.506 | CS2\_DD\_P\_1\_6 | Past | Suicidal Ideation |
|  |  |  |  |  |  |
| (F32) Current Irritability | 68.327 | -0.614 | CS2\_DD\_C\_1\_3 | Current | DMDD Irritability Scoring |
| -0.582 | CS2\_DD\_C\_1\_2 | Current | Irritability and Anger |
|  |  |  |  |  |  |
| (F33) Current Depressive/Panic Disorder Symptoms | 69.149 | -0.539 | CS2\_DD\_C\_1\_4 | Current | Anhedonia, Lack of Interest, Apathy, Low Motivation, or Boredom |
| -0.342 | CS2\_PD\_C\_4\_1 | Current | Panic Attacks |
| -0.341 | CS2\_DD\_C\_1\_1 | Current | Depressed Mood |
|  |  |  |  |  |  |
| (F34) Past Conduct Problems | 69.947 | 0.543 | CS2\_CD\_P\_17\_1 | Past | Lies |
| 0.431 | CS2\_CD\_P\_17\_4 | Past | Bullies, Threatens, or Intimidates Others |
| 0.411 | CS2\_CD\_P\_17\_5 | Past | Nonaggressive Stealing |
| 0.394 | CS2\_ODD\_P\_15\_4 | Past | Disobeys Rules A Lot |
| 0.340 | CS2\_CD\_C\_17\_1 | Current | Lies |
| 0.308 | CS2\_ODD\_P\_15\_3 | Past | Argues A Lot With Adults |
| 0.306 | CS2\_CD\_P\_17\_2 | Past | Truant |
|  |  |  |  |  |  |
| (F35) Lifetime Social Communication Deficits | 70.738 | 0.500 | CS2\_ASD\_C\_19\_4 | Current | Deficits in Nonverbal Communicative Behaviours Used for Social Interaction |
| 0.494 | CS2\_TIC\_C\_18\_2 | Current | Phonic Tics |
| 0.434 | CS2\_ASD\_P\_19\_4 | Past | Deficits in Nonverbal Communicative Behaviours Used for Social Interaction |
|  |  |  |  |  |  |
| (F36) Lifetime Worry/Fear | 71.507 | -0.453 | CS2\_SAD\_P\_5\_1 | Past | Fears Calamitous Event that Will Cause Separation |
| -0.387 | CS2\_OGAD\_C\_8\_1 | Current | Unrealistic Worry About the Future |
| -0.372 | CS2\_OGAD\_P\_8\_1 | Past | Unrealistic Worry About the Future |
| -0.301 | CS2\_SAD\_P\_5\_2 | Past | Fears Harm Befalling Attachment Figure |

*Notes.* Extraction method; principal axis factoring; Rotation method; direct oblimin. All loadings shown are above the cut-off of .3. The cumulative percentage of variance explained by each factor is also shown. The timing (where applicable) column states whether the K-SADS-PL variables were measuring a current or past psychopathology symptom. DMDD, disruptive mood dysregulation disorder.

**Supplement 2 – List of Psychopathology Factors Removed**

The following neurodevelopmental psychopathology factors were removed prior to deriving the resilience scores, as they are thought to have a stronger genetic basis and therefore are less likely to have resulted from environmental influences such as exposure to adversity and/or trauma:

* Factor 7 - Lifetime Autism Spectrum Disorder Symptoms
* Factor 15 - Lifetime Tic Disorder Symptoms
* Factor 21 - Lifetime Stereotyped or Repetitive Behaviours
* Factor 24 - Lifetime Delusions
* Factor 30 - Lifetime Repetitive Behaviour
* Factor 35 - Lifetime Social Communication Deficits

It should be noted that some of the factors removed related to disorders that were exclusion criteria for the FemNAT-CD study (e.g., autism spectrum disorders and psychosis). Individuals with full diagnoses of these disorders were excluded from the study, but youth with subthreshold symptoms could still be included.

**Figure S2***A Scatterplot to Illustrate the Relationship Between Adversity Exposure and Psychopathology (R2 = .13)*

**Supplement 3 – Site Qualification Procedures**

Prior to commencing data collection, all sites underwent site qualification procedures to ensure comparability of MRI data acquisition. The first quality assurance (QA) check involved the use of an American College of Radiology (ACR) phantom (Chen, Wan, Wai, & Liu, 2004) which is designed to assess structural magnetic resonance imaging (MRI) sequences. The second QA check used a Functional Biomedical Infrastructure Research Network (FBIRN) phantom (Glover et al., 2012) to assess scanning stability during functional MRI sequences. Finally, a human volunteer was scanned using the \_\_\_\_\_\_\_\_\_ compliant imaging protocol. Once the QA checks had been performed, the three sets of data were reviewed by Dr. Ali Chowdhury (an MRI physicist at the University of Birmingham). The physicist was then able to make recommendations to each site regarding scanning parameters that required adjustment. Once a site had passed the site qualification procedures, MRI data collection could begin.

**Table S5**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Site 1 - Frankfurt |  | Site 2 - Aachen |  | Site 4 - Southampton |  | Site 5 - Basel |  | Site 7 - Birmingham |
| Scanner | Siemens Magnetom Tim Trio |  | Siemens Magnetom Prisma |  | Siemens Magnetom Tim Trio |  | Siemens Magnetom Prisma |  | Philips Achieva |
| Software version | Syngo MR A35 |  | Syngo MR D13D |  | Syngo MR B17 |  | Syngo MR D13D |  | Version 3.2.6.1 |
| Head coil | 8-channel |  | 20-channel |  | 32-channel |  | 20-channel |  | 32-channel |
| Number of slices | 192 |  | 192 |  | 192 |  | 192 |  | 192 |
| Voxel size | 1 x 1 x 1 mm |  | 1 x 1 x 1 mm |  | 1 x 1 x 1 mm |  | 1 x 1 x 1 mm |  | 1 x 1 x 1 mm |
| Repetition time (TR) | 1900ms |  | 1900ms |  | 1900ms |  | 1900ms |  | 1900ms |
| Echo time (TE) | 2.74ms |  | 3.42ms |  | 4.1ms |  | 3.42ms |  | 3.7ms |
| Inversion time (TI) | 900ms |  | 900ms |  | 900ms |  | 900ms |  | 900ms |
| Field of view | 256mm |  | 256mm |  | 256mm |  | 256mm |  | 256mm |
| Flip angle | 9 |  | 9 |  | 9 |  | 9 |  | 9 |

*Scanner Type and Acquisition Parameters, by Study Site*

**Supplement 4 – Quality Control Procedures**

The four steps in the workflow rating system were: image sharpness, presence/absence of ringing artefacts, and contrast-to-noise ratio of subcortical structures and grey- and white-matter (Backhausen et al., 2016). Each scan was given an overall rating of pass, check, or fail based on its average rating across steps. Each scan was rated independently by two trained raters, and any discrepancies were resolved by a third rater.

**Supplement 5 – Factor Analysis Assumptions**

In terms of the assumptions of this principal axis factor analysis, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was substantially above the minimum criterion of .5 for both factor analyses (exposure to adversity variables: KMO = .885; psychopathology variables: KMO = .856) and so we can assume that our sample size was adequate (Hutcheson & Sofroniou, 1999). Bartlett’s test of sphericity was also significant (*p*  .001) in both factor analyses, indicating an adequate correlation structure for a factor analysis. Upon assessing the correlation matrix from both factor analyses, none of the variables had shared correlation coefficients that exceeded .9, indicating that there were no issues with multicollinearity between variables (Field, 2013).

**Figure S3***Distribution of Resilience Scores in (a) Females and (b) Males*

a


b



**Table S6**

*Demographic and Clinical Characteristics of the Participants Included in the Voxel-Based Morphometry Analysis by Sex and Diagnostic Group (N=298)*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Female (*n*=151) | Male (*n*=147) |  |  |  |
| CD (*n*=22) | HC (*n*=129) | CD (*n*=56) | HC (*n*=91) |  |  |  |
| Characteristic | *M (SD)* | *M (SD)* | *M (SD)* | *M (SD)* | *t*sex (*p*) | *t*group (*p*) | *F*sex-x-group (*p*) |
| Age (years) | 14.14 (2.17) | 13.85 (2.67) | 12.71 (2.38) | 13.29 (2.50) | **2.92 (.004)** | -1.53 (.13) | 3.45 (.017) |
| Resilience Score | -0.04 (0.16) | 0.00 (0.10) | -0.04 (0.18) | 0.04 (0.07) | -1.00 (.32) | **-2.87 (.005)** | **6.59 (< .001)** |
| Estimated IQ | 100.05 (14.39) | 105.43 (10.40) | 97.47 (12.49) | 105.73 (11.79) | 1.44 (.15) | **-4.43 (< .001)** | **7.91 (< .001)** |
| CD Symptoms | 3.86 (2.32) | 0.06 (0.26) | 4.31 (2.16) | 0.07 (0.29) | **-4.41 (< .001)** | **16.53 (< .001)** | **249.81 (< .001)** |

*Notes.* CD, Conduct Disorder; HC, Healthy Controls; IQ, Intelligent Quotient; *M*, Mean; *SD*, Standard Deviation. Sex and group differences were computed using independent samples t-tests. Sex-by-group interactions were computed using univariate analyses of variance.

**Table S7**

*Coordinates and Cluster Sizes for the Main Effects of Sex in the Whole-Brain Analysis (N=298)*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  | MNI Coordinates |
| Contrast | Region | BA | Hemisphere | T-value | Cluster Size (*k*) | x | y | z |
| *Males > Females* | Fusiform Gyrus | 20 | Left | 6.07\* | 3396 | -48 | 0 | -30 |
| Inferior Temporal Gyrus | 20 | Left | 5.75\* | Same as above | -47 | -5 | -51 |
| Fusiform Gyrus | 20 | Left | 4.86 | Same as above | -60 | 2 | -33 |
| Inferior Occipital Gyrus | 18 | Left | 6.00\* | 790 | -44 | -84 | -21 |
| Fusiform Gyrus | 18 | Left | 3.67 | Same as above | -23 | -98 | -24 |
| Inferior Temporal Gyrus | 20 | Right | 4.96\* | 1263 | 44 | -6 | -51 |
| Inferior Temporal Gyrus | 20 | Right | 4.77 | Same as above | 47 | 5 | -50 |
| Parahippocampal Gyrus | 36 | Right | 4.39 | Same as above | 35 | -15 | -32 |
| Cerebellum | - | Right | 4.90\* | 1057 | 38 | -77 | -56 |
| Cerebellum | - | Right | 4.00 | Same as above | 41 | -84 | -42 |
| Cerebellum | - | Right | 3.98 | Same as above | 26 | -66 | -47 |
| Middle Occipital Gyrus | 18 | Right | 4.81 | 392 | 48 | -78 | -20 |
| Fusiform Gyrus | 37 | Right | 4.30 | Same as above | 57 | -63 | -21 |
| Superior Temporal Gyrus | 13 | Right | 4.68 | 133 | 47 | -24 | 5 |
| Cerebellum | - | Left | 4.55 | 381 | -36 | -83 | -50 |
| Amygdala | - | Right | 4.35 | 114 | 35 | -2 | -26 |
| Superior Temporal Gyrus | 38 | Right | 4.32 | 98 | 51 | 21 | -35 |
| Postcentral Gyrus | 3 | Left | 4.27 | 60 | -68 | -21 | 41 |
| Culmen | - | Left | 4.17 | 117 | -21 | -60 | -33 |
| Cerebellar Tonsil | - | Left | 4.13 | 214 | -54 | -54 | -51 |
| Superior Temporal Gyrus | 39 | Right | 4.12 | 162 | 44 | -50 | 5 |
| Middle Temporal Gyrus | 21 | Right | 4.10 | 61 | 50 | 5 | -32 |
| Transverse Temporal Gyrus | 41 | Left | 4.03 | 647 | -33 | -32 | 8 |
| Transverse Temporal Gyrus | 41 | Left | 3.97 | Same as above | -38 | -39 | 14 |
| Insula | 13 | Left | 3.90 | Same as above | -41 | -29 | 15 |
| Cerebellum | - | Right | 3.95 | 113 | 54 | -60 | -50 |
| Inferior Parietal Lobule | 40 | Left | 3.94 | 64 | -60 | -56 | 45 |
| Medial Temporal Gyrus | 21 | Right | 3.91 | 193 | 44 | -5 | -20 |
| Medial Temporal Gyrus | 20 | Right | 3.83 | Same as above | 48 | -11 | -23 |
| Cerebellum | - | Left | 3.88 | 43 | -24 | -63 | -45 |
| Fusiform Gyrus | 37 | Left | 3.84 | 69 | -39 | -42 | -15 |
| Superior Temporal Gyrus | 38 | Right | 3.80 | 55 | 42 | 20 | -45 |
| Fusiform Gyrus | 37 | Right | 3.76 | 50 | 41 | -53 | -15 |
| Culmen | - | Right | 3.72 | 87 | 24 | -59 | -35 |
| Inferior Occipital Gyrus | 18 | Right | 3.69 | 46 | 32 | -93 | -20 |
| Postcentral Gyrus | 2 | Right | 3.66 | 71 | 47 | -27 | 33 |
| Superior Temporal Gyrus | 22 | Left | 3.66 | 93 | -59 | -9 | -2 |
| Middle Frontal Gyrus | 8 | Right | 3.61 | 59 | 32 | 33 | 51 |
| Middle Frontal Gyrus | 9 | Right | 3.60 | Same as above | 33 | 30 | 39 |
| Precuneus | 31 | Left | 3.60 | 80 | -12 | -60 | 30 |
| Claustrum | - | Left | 3.59 | 119 | -30 | 2 | 17 |
| Superior Frontal Gyrus | 10 | Left | 3.58 | 50 | -23 | 54 | 3 |
| *Females > Males* | Caudate Body | - | Right | 7.16\* | 8222 | 6 | 14 | 14 |
| Caudate Body | - | Left | 6.30\* | Same as above | -5 | 12 | 14 |
| Caudate Body | - | Right | 5.58\* | Same as above | 5 | 6 | 9 |
| Caudate Tail | - | Left | 5.06\* | 810 | -24 | -39 | 9 |
| Hippocampus | - | Left | 4.16 | Same as above | -26 | -36 | -3 |
| Hippocampus | - | Right | 5.00\* | 948 | 29 | -32 | -6 |
| Hippocampus | - | Right | 4.33 | Same as above | 32 | -38 | -2 |
| Parahippocampal Gyrus | 27 | Right | 3.89 | Same as above | 21 | -35 | -11 |
| Cerebellum | - | Left | 4.64 | 506 | -6 | -75 | -51 |
| Cerebellum | - | Right | 4.25 | Same as above | 5 | -77 | -50 |
| Paracentral Lobule | 31 | Left | 4.32 | 201 | -2 | -18 | 50 |
| Paracentral Lobule | 31 | Right | 3.59 | Same as above | 2 | -33 | 48 |
| Cerebellar Tonsil | - | Right | 4.32 | 195 | 11 | -32 | -48 |
| Cerebellar Tonsil | - | Right | 4.01 | Same as above | 17 | -35 | -44 |
| Postcentral Gyrus | 3 | Left | 4.23 | 284 | -39 | -24 | 50 |
| Precentral Gyrus | 6 | Left | 3.84 | Same as above | -27 | -24 | 65 |
| Precentral Gyrus | 4 | Left | 3.66 | Same as above | -33 | -23 | 56 |
| Cingulate Gyrus | 24 | Right | 4.21 | 127 | 3 | -5 | 45 |
| Cingulate Gyrus | 24 | Right | 3.68 | Same as above | 11 | -8 | 48 |
| Cerebellar Tonsil | - | Right | 3.94 | 75 | 42 | -39 | -48 |
| Medial Globus Pallidus | - | Right | 3.92 | 202 | 12 | 3 | -14 |
| Hypothalamus | - | Left | 3.31 | Same as above | 2 | 0 | -11 |
| Precentral Gyrus | 6 | Left | 3.90 | 122 | -12 | -27 | 71 |
| Postcentral Gyrus | 3 | Left | 3.39 | Same as above | -11 | -38 | 75 |
| Inferior Frontal Gyrus | 47 | Right | 3.85 | 81 | 18 | 21 | -24 |
| Postcentral Gyrus | 2 | Right | 3.84 | 90 | 35 | -42 | 66 |
| Middle Frontal Gyrus | 11 | Right | 3.83 | 76 | 41 | 38 | -21 |
| Culmen | - | Right | 3.77 | 175 | 15 | -21 | -32 |
| Midbrain | - | Right | 3.77 | Same as above | 8 | -15 | -24 |
| Parahippocampal Gyrus | 35 | Right | 3.70 | Same as above | 17 | -21 | -23 |
| Parahippocampal Gyrus | 35 | Left | 3.74 | 53 | -15 | -21 | -24 |
| Superior Temporal Gyrus | 22 | Right | 3.62 | 58 | 53 | 14 | -3 |
| Rectal Gyrus | 11 | Left | 3.59 | 48 | -6 | 26 | -26 |
| Superior Temporal Gyrus | 39 | Left | 3.56 | 180 | -35 | -53 | 26 |
| Superior Temporal Gyrus | 39 | Left | 3.42 | Same as above | -44 | -54 | 20 |
| Cerebellum | - | Left | 3.52 | 70 | -6 | -47 | -36 |
| Cerebellar Tonsil | - | Left | 3.45 | Same as above | -9 | -45 | -44 |

*Notes.* BA, Brodmann’s Area; MNI, Montreal Neurological Institute.\*whole-brain family-wise error corrected. All other findings shown were significant at a threshold of *p* ≤ .001, with a cluster extent threshold of *k*=41 voxels.

**Table S8**

*Coordinates and Cluster Sizes for the Correlations Between Resilience Scores and Gray Matter Volume, and Sex-by-Resilience Score Interactions in the Sensitivity Analysis Run with Healthy Controls Only (n=220)*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  | MNI Coordinates |
| Contrast | Region | BA | Hemisphere | T-value | Cluster Size (*k)* | x | y | z |
| *Correlations with Resilience Score* |  |  |  |  |  |  |  |  |
| Positive Correlations |  |  |  |  |  |  |  |  |
|  | Postcentral Gyrus | 43 | Left | 3.93 | 242 | -56 | -12 | 14 |
|  | Insula | 13 | Left | 3.32 | Same as above | -45 | -9 | 17 |
|  | Postcentral Gyrus | 40 | Left | 3.22 | Same as above | -63 | -18 | 15 |
|  | Middle Frontal Gyrus | 8 | Left | 3.81 | 208 | -38 | 30 | 44 |
|  | Middle Frontal Gyrus | 8 | Left | 3.25 | Same as above | -32 | 23 | 33 |
|  | Precuneus | 7 | Left | 3.79 | 72 | -5 | -72 | 41 |
|  | Postcentral Gyrus | 2 | Left | 3.59 | 66 | -44 | -30 | 68 |
| Negative Correlations |  |  |  |  |  |  |  |  |
|  | Precentral Gyrus | 4 | Left | 3.89 | 44 | -29 | -17 | 62 |
| *Sex-by-Resilience Score Interactions* |  |  |  |  |  |  |  |  |
| Males Positive, Females Negative |  |  |  |  |  |  |  |  |
|  | Angular Gyrus | 39 | Left | 3.92 | 54 | -38 | -57 | 41 |
|  | Insula | 13 | Left | 3.86 | 102 | -36 | 11 | 14 |
|  | Inferior Parietal Lobule | 40 | Right | 3.77 | 41 | 39 | -41 | 57 |
| Females Positive, Males Negative |  |  |  |  |  |  |  |  |
|  | Cerebellum | - | Left | 3.89 | 97 | -35 | -83 | -15 |
|  | Superior Temporal Gyrus | 22 | Left | 3.33 | 40 | -39 | -53 | 24 |

*Notes.* BA, Brodmann’s Area; MNI, Montreal Neurological Institute. All correlations and sex-by resilience score interactions shown were significant at a threshold of *p* ≤ .001, with a cluster extent threshold of *k*=40 voxels.

**Table S9**

*Coordinates and Cluster Sizes for the Correlations Between Resilience Scores and Gray Matter Volume, and Sex-by-Resilience Score Interactions in the Youth who were Classified as Mid, Late, or Post-Pubertal on the Pubertal Development Scale (n=225)*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  | MNI Coordinates |
| Contrast | Region | BA | Hemisphere | T-value | Cluster Size (*k)* | x | y | z |
| *Correlations with Resilience Score* |  |  |  |  |  |  |  |  |
| Positive Correlations |  |  |  |  |  |  |  |  |
|  | Inferior Frontal Gyrus | 44 | Right | 3.88 | 171 | 62 | 11 | 11 |
|  | Middle Occipital Gyrus | 19 | Right | 3.70 | 121 | 44 | -87 | 9 |
|  | Postcentral Gyrus | 3 | Right | 3.68 | 117 | 57 | -17 | 53 |
|  | Inferior Parietal Lobule | 40 | Left | 3.43 | 65 | -48 | -35 | 45 |
|  | Middle Occipital Gyrus | 19 | Left | 3.41 | 44 | -47 | -87 | 8 |
| Negative Correlations |  |  |  |  |  |  |  |  |
|  | Caudate | - | Left | 3.87 | 513 | -17 | 17 | 6 |
|  | Caudate | - | Left | 3.51 | Same as above | -14 | 0 | 17 |
|  | Caudate | - | Left | 3.41 | Same as above | -12 | 11 | 0 |
|  | Caudate | - | Right | 3.84 | 253 | 14 | 17 | 6 |
|  | Caudate | - | Right | 3.49 | Same as above | 21 | 20 | 6 |
|  | Pars Orbitalis | 47 | Left | 3.66 | 41 | -42 | 42 | -21 |
| *Sex-by-Resilience Score Interactions* |  |  |  |  |  |  |  |  |
| Females Positive, Males Negative |  |  |  |  |  |  |  |  |
|  | Premotor Cortex | 6 | Left | 4.05 | 79 | -30 | -15 | 45 |
|  | Postcentral Gyrus | 3 | Left | 3.16 | Same as above | -30 | -23 | 41 |
|  | Lingual Gyrus | 18 | Right | 3.90 | 42 | 9 | -66 | 2 |
|  | Cerebellar Tonsil | - | Left | 3.70 | 125 | -14 | -44 | -59 |
|  | Cerebellar Tonsil | - | Right | 3.49 | 84 | 12 | -45 | -54 |

*Notes.* BA, Brodmann’s Area; MNI, Montreal Neurological Institute. All correlations and sex-by resilience score interactions shown were significant at a threshold of *p* ≤ .001, with a cluster extent threshold of *k*=40 voxels.

**Figure S4**

*Negative Correlations Between Resilience Scores and Gray Matter Volume in the (a) Left (rs=-.23) and (b) Right Caudate Nucleus (rs=-.26) in the Youth who were Classified as Mid, Late, or Post-Pubertal on the Pubertal Development Scale (n=225)*

a

b

**Supplementary References**

Backhausen, L. L., Herting, M. M., Buse, J., Roessner, V., Smolka, M. N., & Vetter, N. C. (2016). Quality control of structural MRI images applied using FreeSurfer—A hands-on workflow to rate motion artifacts. *Frontiers in Neuroscience, 10*, Article 558. https://doi.org/10.3389/fnins.2016.00558

Bifulco, A., Bernazzani, O., Moran, P., & Jacobs, C. (2005). The childhood experience of care and abuse questionnaire (CECA. Q): Validation in a community series. *British Journal of Clinical Psychology, 44*(4), 563–581. https://doi.org/10.1348/014466505X35344

Chen, C.-C., Wan, Y.-L., Wai, Y.-Y., & Liu, H.-L. (2004). Quality assurance of clinical MRI scanners using ACR MRI phantom: Preliminary results. *Journal of Digital Imaging, 17*(4), 279–284. https://doi.org/10.1007/s10278-004-1023-5

Eekhout, I., de Vet, H. C., Twisk, J. W., Brand, J. P., de Boer, M. R., & Heymans, M. W. (2014). Missing data in a multi-item instrument were best handled by multiple imputation at the item score level. *Journal of Clinical Epidemiology, 67*(3), 335–342. https://doi.org/10.1016/j.jclinepi.2013.09.009

Essau, C. A., Sasagawa, S., & Frick, P. J. (2006). Psychometric properties of the Alabama parenting questionnaire. *Journal of Child and Family Studies, 15*(5), 595–614. https://doi.org/10.1007/s10826-006-9036-y

Field, A. (2013). *Discovering statistics using IBM SPSS statistics, 4th Edition*. Sage.

Glover, G. H., Mueller, B. A., Turner, J. A., Van Erp, T. G., Liu, T. T., Greve, D. N., Voyvodic, J. T., Rasmussen, J., Brown, G. G., & Keator, D. B. (2012). Function biomedical informatics research network recommendations for prospective multicenter functional MRI studies. *Journal of Magnetic Resonance Imaging, 36*(1), 39–54. https://doi.org/10.1002/jmri.23572

Hutcheson, G. D., & Sofroniou, N. (1999). *The multivariate social scientist: Introductory statistics using generalized linear models*. Sage.

Liu, Y., & De, A. (2015). Multiple imputation by fully conditional specification for dealing with missing data in a large epidemiologic study. *International Journal of Statistics in Medical Research, 4*(3), 287–295. https://doi.org/10.6000/1929-6029.2015.04.03.7