Table S1: Factor loadings from principal components analysis at age 7

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | 1 | 2 | 3 | 4 | 5 |
| 1. Is afraid of medical procedures such as going to the doctor or dentist |  |  |  | .43 |  |
| 1. Does something over and over again |  |  |  |  | .54 |
| 1. Is afraid of animals or insects |  |  |  | .50 |  |
| 1. Resists sleeping alone |  |  |  | .55 |  |
| 1. Many fears, easily scared |  |  |  | .72 |  |
| 1. Does not enjoy him/herself |  |  |  |  | .53 |
| 1. Often critical of him/herself | .76 |  |  |  |  |
| 1. Tends to check that things are done exactly right |  |  | .74 |  |  |
| 1. Complains or whines |  |  |  |  | .58 |
| 1. Is afraid of small closed spaces, heights, water, or the dark |  |  |  | .70 |  |
| 1. Many worries, often seems worried | .61 |  |  |  |  |
| 1. Fussy about keeping hands clean |  |  | .68 |  |  |
| 1. Often unhappy, downhearted or tearful |  |  |  |  | .66 |
| 1. Has low self-confidence | .61 |  |  |  |  |
| 1. Fussy or overparticular |  |  | .73 |  |  |
| 1. Tends to blame him/herself | .73 |  |  |  |  |
| 1. Is often extremely upset or distressed when parent leaves |  |  |  |  | .36 |
| 1. Is afraid in social situations |  | -.73 |  |  |  |
| 1. Tends to be shy or timid |  | -.80 |  |  |  |
| 1. Takes a long time to warm to strangers |  | -.72 |  |  |  |
| 1. Seems keyed up, on edge, tense |  |  |  |  | .58 |
| 1. Asks for reassurance that s/he is OK | .54 |  |  |  |  |
| 1. Nervous or clingy in new situations, often loses confidence |  | -.76 |  |  |  |
| 1. Anxious that bad things will happen | .56 |  |  |  |  |
| 1. Complains of stomach-aches, headaches or sickness |  |  |  | .23 |  |
| 1. Has tics or twitches |  |  |  |  | .07 |

Notes: Only the highest factor loadings are presented here. Factor 3 represents the OCB sub-scale

Table S2: Factor loadings from principal components analysis at age 16

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | 1 | 2 | 3 | 4 |
| 1. Is afraid of medical procedures such as going to the doctor or dentist |  |  |  | .56 |
| 1. Does something over and over again |  |  | .66 |  |
| 1. Is afraid of animals or insects |  |  |  | .70 |
| 1. Does not enjoy him/herself | .56 |  |  |  |
| 1. Often critical of him/herself | .75 |  |  |  |
| 1. Tends to check that things are done exactly right |  |  | .74 |  |
| 1. Complains or whines | .56 |  |  |  |
| 1. Is afraid of small closed spaces, heights, water, or the dark |  |  |  | .69 |
| 1. Has low self-confidence | .72 |  |  |  |
| 1. Fussy or overparticular |  |  | .72 |  |
| 1. Tends to blame him/herself | .69 |  |  |  |
| 1. Is often extremely upset or distressed when parent leaves | .45 |  |  |  |
| 1. Is afraid in social situations |  | -.81 |  |  |
| 1. Tends to be shy or timid |  | -.84 |  |  |
| 1. Takes a long time to warm to strangers |  | -.79 |  |  |
| 1. Seems keyed up, on edge, tense | .66 |  |  |  |
| 1. Asks for reassurance that s/he is OK |  |  | .54 |  |
| 1. Anxious that bad things will happen | .56 |  |  |  |
| 1. Has tics or twitches |  |  | .25 |  |

Notes: Only the highest factor loadings are presented here. Factor 3 represents the OCB sub-scale. Consistent with Hallett et al (2009), only items with a factor loading >.3 were used to create the OCB sub-scale.

Table S3: Twin correlations within–age and across-age

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  | Twin 2 | | | |
|  |  |  | Age 4 | Age 7 | Age 9 | Age 16 |
| MZ |  |  |  |  |  |  |
|  | Twin 1 | Age 4 | .58 (.56-.60) | .35 (.32-.38) | .23 (.19-.27) | .20 (.17-.23) |
|  |  | Age 7 | - | .65 (.64-.67) | .28 (.25-.33) | .31 (.28-.34) |
|  |  | Age 9 | - | - | .72 (.70-.74) | .30 (.25-.35) |
|  |  | Age 16 | - | - | - | .59 (.57-.61) |
|  |  |  |  |  |  |  |
| DZ |  |  |  |  |  |  |
|  | Twin 1 | Age 4 | .21 (.19-.23) | .10 (.08-.12) | .10 (.07-.13) | .10 (.07-.13) |
|  |  | Age 7 | - | .28 (.26-.30) | .13 (.10-.19) | .13 (.10-.16) |
|  |  | Age 9 | - | - | .41 (.28-.32) | .13 (.09-.17) |
|  |  | Age 16 | - | - | - | .40 (.38-.42) |

Table S4: Model comparisons for Cholesky decomposition

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | -2LL | df | chi-sq | diff df | p-val | AIC |
| Saturated model | 115542.80 | 45095 |  |  |  | 25352.80 |
| ACE sex differences | 116378.30 | 45247 | 835.50 | 152 | <.05 | 25884.28 |
| **ACE no sex differences** | **117063.60** | **45277** | **1520.80** | **182** | **<.05** | **26509.63** |
| ADE sex differences | 116476.90 | 45247 | 934.10 | 152 | <.05 | 25982.94 |
| ADE no sex differences | 120364.00 | 45277 | 4821.20 | 182 | <.05 | 29810.05 |

Notes: -2LL = minus twice the log likelihood; AIC = Akaike’s information criterion; A = additive genetic influence; D = dominant genetic influence; C= shared environmental influences; E = non-shared environmental influences. Bold typeface indicates the selected model.

Table S5: Proportion of phenotypic variance and covariance accounted for by A, C and E (males below diagonal, females above diagonal)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Proportion of phenotypic variance and covariance accounted for by A | | | | |
|  | Age 4 | Age 7 | Age 9 | Age 16 |
| Age 4 | .56 (.51-.60) / .60 (.56-.63) | .81 (.72-.86) | .79 (.71-.89) | .94 (.70-1.00) |
| Age 7 | .66 (.59-.73) | .54 (.50-.58 ) /.62 (.54-.66) | .70 (.68-.82) | .55 (.33-.76) |
| Age 9 | .73 (.58-.87) | .64 (.57-.81) | .45 (.35-.55) / .56 (.48-.64) | .67 (.56-1.00) |
| Age 16 | .65 (.42-.87) | .55 (.37-.73) | .61 (.36-.87) | .22 (.13-.32) / .30 (.21-.39) |
| Proportion of phenotypic variance and covariance accounted for by C | | | | |
|  | Age 4 | Age 7 | Age 9 | Age 16 |
| Age 4 | .01 (.00-.04) / .00 (.00-.04) | .00 (.00-.08) | .00 (.00-.04) | .00 (.00-.19) |
| Age 7 | .01 (.00-.05) | .02 (.00-.04) / .04 (.00-.10) | .00 (.00-.01) | .20 (.10-.38) |
| Age 9 | .04 (.00-.15) | .00 (.00-.04) | .17 (.10-.25) / .15 (.08-.23) | .00 (.00-.19) |
| Age 16 | .17 (.02-.34) | .17 (.05-.25) | .05 (.00-.25) | .26 (.19-.34) / .31 (.24-.39) |
| Proportion of phenotypic variance and covariance accounted for by E | | | | |
|  | Age 4 | Age 7 | Age 9 | Age 16 |
| Age 4 | .43 (.39-.47) / .39 (.37-.43) | .19 (.14-.24) | .22 (.14-.30) | .06 (.00-.19) |
| Age 7 | .32 (.26-.39) | .44 (.41-.48) / .35 (.32-.37) | .29 (.23-.35) | .25 (.17-.34) |
| Age 9 | .23 (.13-.33) | .36 (.29-.44) | .38 (.34-.43) / .29 (.26-.33) | .33 (.23-.44) |
| Age 16 | .18 (.05-.32) | .27 (.17-.38) | .34 (.22-.47) | .51 (.47-.56) / .39 (.36-.43) |

Notes: A = additive genetic parameters; C = shared environment parameters; E = non-shared environment parameters; 95% Confidence Intervals (CIs) are presented in brackets

Table S6: ACE Cholesky decomposition results (males/females)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **A1** | **A2** | **A3** | **A4** |
| Age 4 | .56 (.51-.60) / .60 (.56-.63) |  |  |  |
| Age 7 | .16 (.12-.20) / .20 (.17-.24) | .38 (.33-.43) / .42 (.34-.47) |  |  |
| Age 9 | .11 (.07-.16) / .11 (.08-.15) | .08 (.03-.13) / .09 (.04-.15) | .27 (.17-.36) / .35 (.27-.43) |  |
| Age 16 | .05 (.02-.09) / .06 (.03-.10) | .02 (.00-.06) / .00 (.00-.03) | .04 (.00-.12) / .05 (.00-.13) | .11 (.03-.20) / .19 (.08-.28) |
|  | **C1** | **C2** | **C3** | **C4** |
| Age 4 | .01 (.00-.04) / .00 (.00-.04) |  |  |  |
| Age 7 | .00 (.00-.03) / .00 (.00-.05) | .01 (.00-.04) / .00 (.00-.04) |  |  |
| Age 9 | .02 (.00-.17) / .01 (.00-.14) | .06 (.00-.23) / .06 (.00-.22) | .09 (.00-.23) / .08 (.00-.22) |  |
| Age 16 | .17 (.00-.33) / .18 (.00-.38) | .08 (.00-.26) / .12 (.00-.33) | .01 (.00-.01) / .02 (.01-.23) | .00 (.00-.17) / .00 (.00-.22) |
|  | **E1** | **E2** | **E3** | **E4** |
| Age 4 | .43 (.39-.47) / .39 (.36-.43) |  |  |  |
| Age 7 | .05 (.03-.07) / .02 (.01-.03) | .39 (.36-.42) / .33 (.30-.35) |  |  |
| Age 9 | .02 (.01-.03) / .01 (.00-.02) | .05 (.03-.07) / .04 (.02-.05) | .32 (.28-.36) / .24 (.21-.27) |  |
| Age 16 | .00 (.00-.01) / .00 (.00-.00) | .01 (.00-.03) / .01 (.00-.02) | .03 (.00-.05) / .03 (.01-.05) | .47 (.42-.52) /.35 (.32-38) |

Notes: A = additive genetic parameters; C = shared environment parameters; E = non-shared environment parameters; 95% Confidence Intervals (CIs) are presented in brackets

Table S7: Cholesky decomposition results using a stable OCB index

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | A1 | A2 | A3 | A4 |
| Age 4 | .56 (.53-.59) |  |  |  |
| Age 7 | .18 (.15-.22) | .39 (.33-.45) |  |  |
| Age 9 | .12 (.08-.16) | .12 (.06-.18) | .31 (.23-.39) |  |
| Age 16 | .06 (.04-.10) | .03 (.01-.08) | .03 (.00-.11) | .22 (.13-.30) |
|  | C1 | C2 | C3 | C4 |
| Age 4 | .00 (.00-.02) |  |  |  |
| Age 7 | .02 (.00-.07) | .01 (.00-.07) |  |  |
| Age 9 | .07 (.00-.15) | .00 (.00-.12) | .00 (.00-.12) |  |
| Age 16 | .01 (.00-.23) | .13 (.00-.25) | .05 (.00-.23) | .00 (.00-.22) |
|  | E1 | E2 | E3 | E4 |
| Age 4 | .43 (.41-.46) |  |  |  |
| Age 7 | .03 (.02-.03) | .37 (.35-.39) |  |  |
| Age 9 | .02 (.01-.02) | .04 (.03-.06) | .33 (.30-.35) |  |
| Age 16 | .00 (.00-.01) | .02 (.01-.03) | .03 (.02-.05) | .40 (.38-.44) |