Table 1 Means (SD) of raw scores for overall pre-sleep arousal, cognitive arousal, somatic pre-sleep arousal and symptoms of insomnia

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | Means (SD) |  |
|  |  Total |  Males |  Females |
| Overall pre-sleep arousal | 28.39 (9.64) | 27.32 (8.96)\*  | 28.94 (9.94)\* |
| Cognitive pre-sleep arousal  | 17.09 (6.76) | 16.60 (6.32)  | 17.34 (6.98) |
| Somatic pre-sleep arousal  | 11.30 (3.84) | 10.72 (3.54)\* | 11.60 (3.96)\* |
| Insomnia symptoms | 6.48 (5.22)  | 5.65 (4.89)\* | 6.92 (5.33)\* |
|  |  MZ |  DZ |  Siblings |
| Overall pre-sleep arousal | 28.29 (9.08) | 28.78 (10.42) | 27.98 (8.91) |
| Cognitive pre-sleep arousal  | 16.96 (6.42) | 17.31 (7.28) | 16.97 (6.25) |
| Somatic pre-sleep arousal  | 11.33 (3.70) | 11.47 (4.05) | 11.01 (3.67) |
| Insomnia symptoms | 6.09 (4.97) | 6.68 (5.38) | 6.61 (5.19) |

Note: \* sex differences were found. Means and SD were obtained from SPSS and are based on the raw data (untransformed, including outliers, etc.); MZ = monozygotic twins; DZ = dizygotic twins; siblings = non-twin sibling pairs; Overall pre-sleep arousal = overall pre-sleep arousal (PSAS), higher scores indicating higher overall pre-sleep arousal; Cognitive pre-sleep arousal = cognitive pre-sleep arousal (PSAS subscale), higher scores indicating higher cognitive pre-sleep arousal; Somatic pre-sleep arousal = somatic pre-sleep arousal (PSAS subscale), higher scores indicating higher somatic pre-sleep arousal; Insomnia symptoms = insomnia symptoms (ISQ), higher scores indicating more insomnia symptoms.

Table 2 Phenotypic correlations for overall pre-sleep arousal, cognitive pre-sleep arousal, somatic pre-sleep arousal and symptoms of insomnia

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Overall pre-sleep arousal  | Cognitive pre-sleep arousal | Somatic pre-sleep arousal | Insomnia symptoms  |
| Overall pre-sleep arousal  | 1 |  |  |  |
| Cognitive pre-sleep arousal  | .95\*\* | 1 |  |  |
| Somatic pre-sleep arousal  | .81\*\* | .60\*\* | 1 |  |
| Insomnia symptoms | .61\*\* | .62\*\* | .44\*\* | 1 |

Note: \* *p* < .05; \*\* *p* < .01. Correlations were calculated on age and sex regressed variables, and after outliers (+/ - 3 SD away from the mean) and data was transformed if necessary, using twin 1 only to control for non-independence of observations. Overall pre-sleep arousal = overall pre-sleep arousal (PSAS), higher scores indicating higher overall pre-sleep arousal; Cognitive pre-sleep arousal = cognitive pre-sleep arousal (PSAS subscale), higher scores indicating higher cognitive pre-sleep arousal; Somatic pre-sleep arousal = somatic pre-sleep arousal (PSAS subscale), higher scores indicating higher somatic pre-sleep arousal; Insomnia symptoms = insomnia symptoms (ISQ), higher scores indicating more insomnia symptoms.

Table 3 Twin/sibling correlations for overall pre-sleep arousal, cognitive arousal, somatic pre-sleep arousal and insomnia symptoms

|  |  |
| --- | --- |
|  | Correlations |
|  |  MZ |  DZ |  Sibling |
| *Within-trait* |  |  |  |
| Overall pre-sleep arousal | .42\* (.24 - .57) | .26\* (.10 - .40) | .13 (-.10 - .34) |
| Cognitive pre-sleep arousal | .30\* (.10 - .47) | .25\* (.09 - .39) | .11 (-.11 - .33) |
| Somatic pre-sleep arousal | .44\* (.28 - .58) | .20\* (.03 - .35) | .11 (-.12 - .32) |
| Insomnia symptoms | .37\* (.19 - .53) | .21\* (.05 - .36) | .12 (-.13 - .34) |
| *Cross-traits-cross-twins* |  |  |  |
| Cogn. pre-sleep arousal - Som. pre-sleep arousal | .41\* (.27 - .52) | .09 (-.03 - .21) | .13 (-.12 - .32) |
| Cogn. pre-sleep arousal - Insomnia symptoms | .33\* (.18 - .46) | .18\* (.05 - .29) | .19 (-.04 - .38) |
| Som. pre-sleep arousal - Insomnia symptoms | .38\* (.26 - .48) | .08 (-.05 - .20) | .09 (-.12 - .28) |

Note: \* significant correlations (95% CI not spanning 0). The 95% confidence intervals are presented in brackets. MZ = monozygotic twins; DZ = dizygotic twins; Sibling = sibling pairs; Overall pre-sleep arousal = overall pre-sleep arousal (PSAS), higher scores indicating higher overall pre-sleep arousal; Cogn. pre-sleep arousal = cognitive pre-sleep arousal (PSAS subscale), higher scores indicating higher cognitive pre-sleep arousal; Som. pre-sleep arousal = somatic pre-sleep arousal (PSAS subscale), higher scores indicating higher somatic pre-sleep arousal; Insomnia symptoms = insomnia symptoms (ISQ), higher scores indicating more insomnia symptoms.

Table 4 Fit statistics of all univariate genetic model fitting analyses and estimates for A, C and E

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Variable*/Model | ep | -2LL | df | AIC | ∆ -2LL | ∆ df | *p* | *Parameter Estimates* |
|  A (CI) |  C (CI) |  E (CI) |
| *Overall pre-sleep arousal*  |  |  |  |  |  |  |  |  |
| Saturated | 15 | 6006.78 | 821 | 4364.78 | - | - | - |  |  |  |
| ACE | 4 | 6028.64 | 832 | 4364.64 | 21.85 | 11 | .03 | .47 (.19 - .60) |  0 (0 - .17) | .53(.40 - .70) |
| E | 2 | 6054.39 | 834 | 4386.39 | 25.75 | 2 | < .01 |  |  |  |
| Cognitive pre-sleep arousal |  |  |  |  |  |  |  |  |
| Saturated | 15 | 5529.05 | 825 | 3879.05 | - | - | - |  |  |  |
| ACE | 4 | 5547.11 | 836 | 3875.13  | 18.08 | 11 | .08 | .13 (0 - .44) | .13 (0 - .31) | .74 (.56 - .90) |
| E | 2 | 5559.70 | 838 | 3883.70 | 12.57 | 2 | < .01 |  |  |  |
| Somatic pre-sleep arousal |  |  |  |  |  |  |  |  |
| Saturated | 15 | 2497.20 | 822 | 853.20 | - | - | - |  |  |  |
| ACE | 4 | 2505.77 | 833 | 839.77 | 8.56 | 11 | .66 | .49 (.24 - .61) | 0 (0 - .15) | .51(.39 - .67) |
| E | 2 | 2536.12 | 835 | 866.12 | 30.35 | 2 | < .01 |  |  |  |
| *Insomnia Symptoms* |  |  |  |  |  |  |  |  |  |  |
| Saturated | 15 | 5096.90 | 824 | 3448.90 | - | - | - |  |  |  |
| ACE | 4 | 5112.43 | 835 | 3442.43 | 15.53 | 11 | .16 | .36 (0 - .53) | .03 (0 - .32) | .61 (.47 - .80) |
| E | 2 | 5135.58 | 837 | 3461.58 | 23.15 | 2 | < .01 |  |  |  |

Note:All analyses focus on the transformed data, outliers deleted with age and sex regressed out. ep = estimated parameters; -2LL = -2\*(log likelihood); df = degrees of freedom; ∆χ2 = change in chi-square statistic; ∆*df* = change in degrees of freedom; AIC = Akaike’s Information Criterion statistic; Saturated = full model, A = additive genetic, C = shared environmental, E = non-shared environmental. The fit of the ACE model is relative to saturated model, the fit of the E model relative to ACE model.

Table 5 Fit statistics for the multivariate genetic model fitting analyses

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | ep | -2LL | df | AIC | ∆ -2LL | ∆ df | *p* |
|  *Model: Overall pre-sleep arousal and symptoms of insomnia* |
| Saturated  | 42 | 10739.18 | 1633 | 7473.18 | - | - | - |
| ACE  | 11 | 10781.59 | 1664 | 7453.59 | 42.41 | 31 | 0.08 |
| *Model: Cognitive pre-sleep arousal, somatic pre-sleep arousal and symptoms of insomnia* |
| Saturated  | 81 | 12357.87 | 2435 | 7487.87 | - | - | - |
| **ACE Correlated Factors Solution** | **21** | **12427.52** | **2495** | **7437.52** | **69.65** | **60** | **0.18** |
| **ACE Independent Pathway** | **21** | **12427.52** | **2495** | **7437.52** | **69.65** | **60** | **0.18** |
| ACE Common Pathway  | 18 | 12437.32 | 2499 | 7439.32 | 9.80 | 4 | 0.04 |

Note:All analyses focus on the transformed data, outliers deleted with age and sex regressed out. ep = estimated parameters; -2LL = -2\* (log likelihood); df = degrees of freedom; ∆χ2 = change in chi-square statistic; ∆*df* = change in degrees of freedom; AIC = Akaike’s Information Criterion statistic; Saturated = full model; A = additive genetic, C = shared environmental; E = non-shared environmental. The fit statistics of the ACE correlated factors model, the ACE independent pathway model are relative to the saturated model. The fit statistic of the ACE common pathway model is relative to the ACE model correlated factors model.