

SENSITIVITY ANALYSES

Table 1: Phenotypic correlations for overall dysfunctional beliefs about sleep, its subscales, and symptoms of insomnia

	Overall DBAS	DBAS Factor I	DBAS Factor II	DBAS Factor III	Insomnia Symptoms
Overall DBAS	1				
DBAS Factor I	.83**	1			
DBAS Factor II	.73**	.31**	1		
DBAS Factor III	.68**	.33**	.48**	1	
Insomnia Symptoms	.37**	.19**	.40**	.33**	1

Note: * $p < .05$; ** $p < .01$. Correlations were calculated on **raw data**, using twin 1 only to control for non-independence of observations. Overall DBAS = overall dysfunctional beliefs about sleep (DBAS); DBAS Factor I = beliefs about the immediate negative consequences of insomnia (DBAS subscale); DBAS Factor II = beliefs about the long-term negative consequences of insomnia (DBAS subscale); DBAS Factor III = beliefs about the need for control over insomnia (DBAS subscale), higher scores indicating more dysfunctional beliefs about sleep; Insomnia Symptoms = insomnia symptoms (ISQ), higher scores indicating more insomnia symptoms.

Table 2: Twin/sibling correlations for overall dysfunctional beliefs about sleep, its subscales, and symptoms of insomnia

	Correlations		
	MZ	DZ	Sibling
<i>Within-trait</i>			
Overall DBAS	.14 (-.05 - .33)	.16 (-.01 - .31)	-.05 (-.28 - .19)
DBAS factor I	.20 (.01 - .38)	.18 (.01 - .34)	-.16 (-.37 - .07)
DBAS factor II	.10 (-.10 - .30)	.20 (.03 - .35)	-.05 (-.31 - .22)
DBAS factor III	.17 (-.04 - .36)	.07 (-.10 - .23)	.10 (-.14 - .33)
Insomnia symptoms	.37 (.19 - .53)	.25 (.09 - .40)	.11 (-.13 - .34)
<i>Cross-traits-cross-twins</i>			
Overall DBAS – Insomnia symptoms	.14 (-.01 - .27)	.09 (-.03 - .20)	-.08 (-.28 - .13)
DBAS factor I - Insomnia symptoms	.11 (-.03 - .23)	.02 (-.09 - .12)	-.17 (-.34 - .03)
DBAS factor II - Insomnia symptoms	.07 (-.09 - .22)	.14 (.03 - .25)	0 (-.21 - .21)
DBAS factor III - Insomnia symptoms	.19 (.04 - .31)	.06 (-.06 - .18)	.02 (-.16 - .20)
DBAS factor I – DBAS factor II	-.01 (-.16 - .14)	.07 (-.04 - .18)	-.01 (-.24 - .23)
DBAS factor I - DBAS factor III	.05 (-.10 - .18)	-.01 (-.12 - .11)	-.03 (-.22 - .17)
DBAS factor II - DBAS factor III	.06 (-.10 - .22)	.05 (-.08 - .17)	-.03 (-.18 - .24)

Note: All analyses focus on **raw data**. The 95% confidence intervals are presented in brackets. MZ = monozygotic twins; DZ = dizygotic twins; Sibling = sibling pairs; Overall DBAS = overall dysfunctional beliefs about sleep (DBAS); DBAS factor I = beliefs about the immediate negative consequences of insomnia (DBAS subscale); DBAS factor II = beliefs about the long-term negative consequences of insomnia (DBAS subscale); DBAS factor III = beliefs about the need for control over insomnia (DBAS subscale) - higher scores indicating more dysfunctional beliefs about sleep; Insomnia Symptoms = insomnia symptoms (ISQ), higher scores indicating more insomnia symptoms.

Online Appendix Sensitivity Analyses

Table 3: Fit statistics of all univariate genetic model fitting analyses

Variable/ Model	ep	-2LL	df	AIC	Δ -2LL	Δ df	p	Parameter Estimates		
								A (CI)	C (CI)	E (CI)
<i>Overall DBAS</i>										
Saturated	15	6949.14	826	5297.14	-	-	-			
ACE	4	6965.23	837	5291.23	16.09	11	.14	.09 (0 – .32)	.06 (0 – .23)	.85 (.68 – .99)
E	2	6969.97	839	5291.97	4.74	2	.09			
<i>DBAS Factor I</i>										
Saturated	15	6113.35	826	4461.35	-	-	-			
ACE	4	6140.75	837	4466.75	27.39	11	< .01	<u>.22 (0 – .37)</u>	0 (0 – .22)	.78 (.63 – .97)
E	2	6147.41	839	4469.41	6.67	2	<u>.03</u>			
<i>DBAS Factor II</i>										
Saturated	15	5398.37	826	3746.37	-	-	-			
ACE	4	5420.97	837	3746.97	22.60	11	.02	0 (0 – .28)	.13 (0 – .24)	.87 (.76 – .99)
E	2	5425.47	839	3747.47	4.50	2	.11			
<i>DBAS Factor III</i>										
Saturated	15	4875.22	826	3223.22	-	-	-			
ACE	4	4877.81	837	3203.81	6.59	11	.83	.17 (0 – .32)	0 (0 – .21)	.83 (.68 – 1)
E	2	4885.90	839	3207.90	4.34	2	.13			
<i>Insomnia Symptoms</i>										

Online Appendix Sensitivity Analyses

Saturated	15	5121.17	825	3448.90	-	-	-			
ACE	4	5141.58	836	3469.58	20.40	11	.04	.38 (0 - .53)	0 (0 - .27)	.62 (.48 - .77)
E	2	5161.75	838	3485.74	20.17	2	< .01			

Note: All analyses focus on **raw data**. ep = estimated parameters; $-2LL = -2 * (\log \text{likelihood})$; df = degrees of freedom; $\Delta\chi^2$ = change in chi-square statistic; Δdf = change in degrees of freedom; AIC = Akaike's Information Criterion statistic; Saturated = full model. The fit of the ACE model is relative to saturated model, the fit of the E model relative to ACE model. A = additive genetic, C = shared environmental; E = non-shared environmental. The 95% confidence intervals are presented in brackets. Overall DBAS = overall dysfunctional beliefs about sleep (DBAS); DBAS factor I = beliefs about the immediate negative consequences of insomnia (DBAS subscale); DBAS factor II = beliefs about the long-term negative consequences of insomnia (DBAS subscale); DBAS factor III = beliefs about the need for control over insomnia (DBAS subscale) – higher scores indicating more dysfunctional beliefs about sleep; Insomnia symptoms = insomnia symptoms (ISQ) – higher scores indicating more insomnia symptoms. Differences in significance compared to the analyses presented in the publication are underlined.

Online Appendix Sensitivity Analyses

Table 4: Fit statistics for the multivariate genetic model fitting analyses

	ep	-2LL	Df	AIC	Δ -2LL	Δ df	<i>p</i>
<i>Model 1: Overall DBAS and symptoms of insomnia</i>							
Saturated	42	11928.77	1639	8650.77	-	-	-
ACE	11	11971.89	1670	8631.89	43.12	31	0.07
<i>Model 2: DBAS factor I, DBAS factor II, DBAS factor III and symptoms of insomnia</i>							
Saturated	132	20905.49	3231	14443.49	-	-	-
Correlated Factors Solution	34	21054.48	3329	14396.48	149.00	98	< 0.01*

Note: * significant correlations at a level of $p < .05$. All analyses focus on **raw data**. ep = estimated parameters; -2LL = $-2 \times (\log \text{likelihood})$; df = degrees of freedom; $\Delta\chi^2$ and Δdf = change in chi-square statistic and corresponding degrees of freedom (computed as the difference in likelihood and df between each model and the saturated model); AIC = Akaike's Information Criterion statistic (calculated as $\chi^2 - 2df$); Saturated = full model; A = additive genetic, C = shared environmental; E = non-shared environmental. The fit statistics of the ACE is relative to the Saturated Model for Model 1. The fit statistics of the Correlated Factors Solution is relative to the Saturated Model for Model 2.

Phenotypes: Overall DBAS = overall dysfunctional beliefs about sleep (DBAS); DBAS Factor I = beliefs about the immediate negative consequences of insomnia (DBAS subscale); DBAS Factor II = beliefs about the long-term negative consequences of insomnia (DBAS subscale); DBAS Factor III = beliefs about the need for control over insomnia (DBAS subscale) - higher scores indicating more dysfunctional beliefs about sleep; Insomnia Symptoms = insomnia symptoms (ISQ), higher scores indicating more insomnia symptoms.

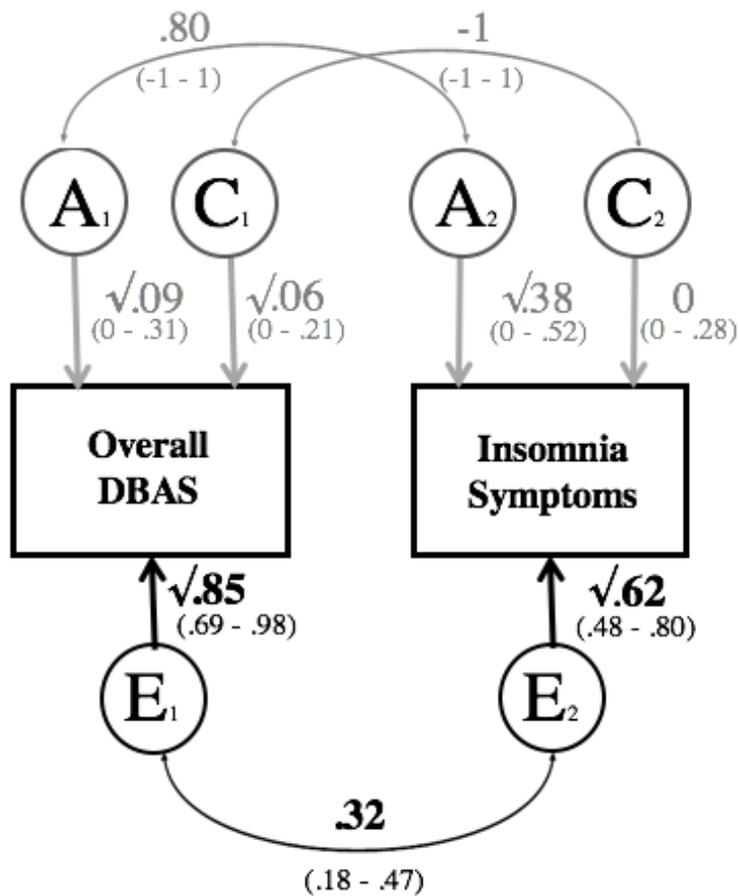


Figure 1: Path diagram of the bivariate analysis, including overall dysfunctional beliefs about sleep and insomnia symptoms

Note: All analyses focus on **raw data**. A = additive genetic, C = shared environmental; E = non-shared environmental. Significant paths are shown in black, see brackets for 95% confidence intervals. Paths with confidence intervals spanning 0 are depicted in grey. $r_{Ph} = .37$ (95%CI = .31 - .42). Overall DBAS = overall dysfunctional beliefs about sleep (DBAS), higher score indicating more dysfunctional beliefs about sleep; Insomnia Symptoms = insomnia symptoms (ISQ), higher score indicating more insomnia symptoms.

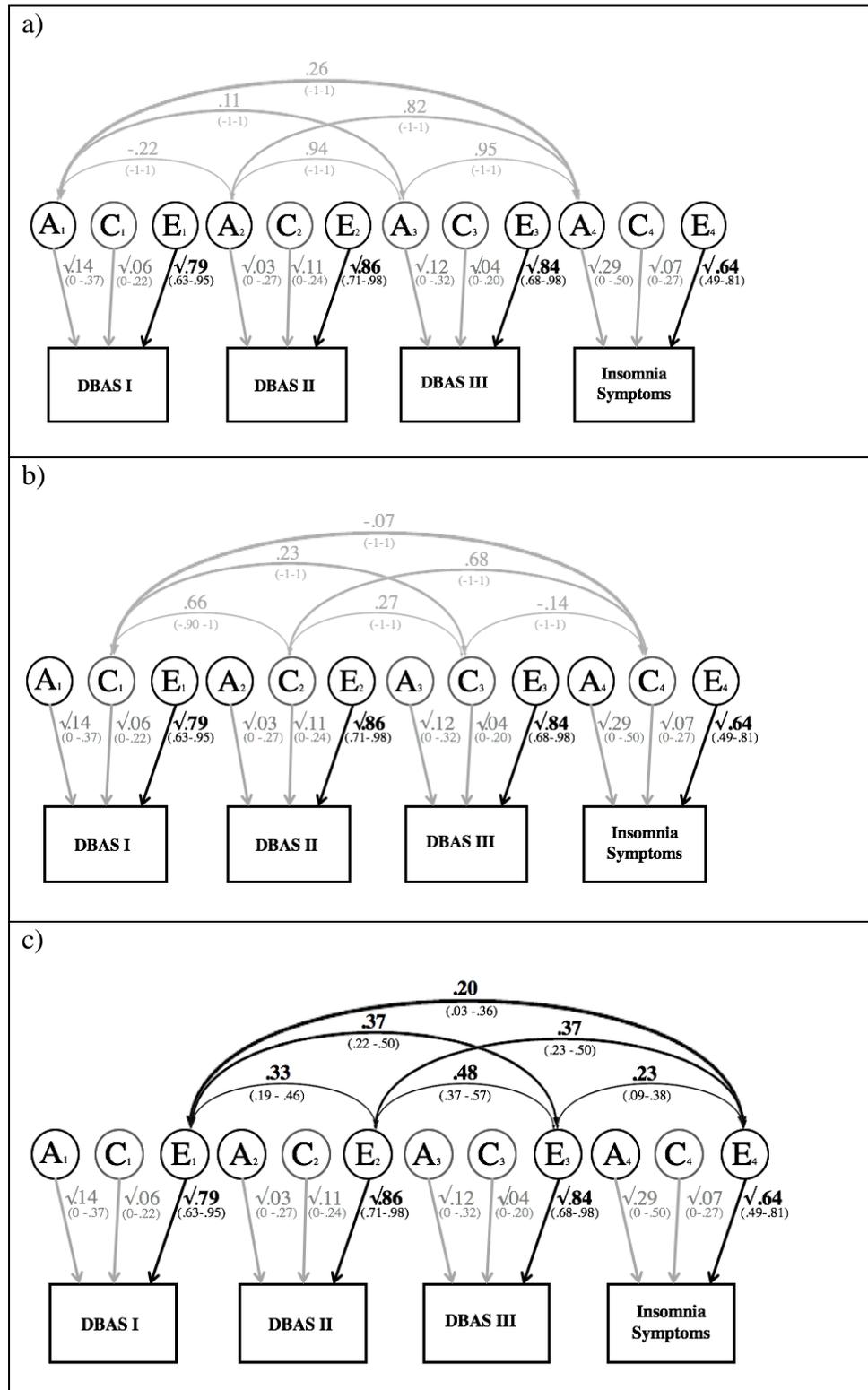


Figure 2: Path diagram of the correlated factors solution, including DBAS I, DBAS II, DBAS III and insomnia symptoms

Note: All analyses focus on **raw data**. A = additive genetic, C = shared environmental; E = non-shared environmental. Significant paths are shown in black. Paths with confidence intervals spanning 0 are depicted in grey; part a. shows the genetic correlations; part b. shows the shared-environmental correlations; part c. shows the non-shared environmental correlation. DBAS Factor I = beliefs about the immediate negative consequences of insomnia (DBAS subscale); DBAS Factor II = beliefs about the long-term negative consequences of insomnia (DBAS subscale); DBAS Factor III = beliefs about the need for control over insomnia (DBAS subscale).