Supplementary Material

Persistence of anxiety/depression symptoms in early adolescence: A prospective study of daily life stress, rumination, and daytime sleepiness in a genetically informative cohort

Authors: Narelle K. Hansell, Lachlan T. Strike, Greig I. de Zubicaray, Paul M. Thompson, Katie L. McMahon, Margaret J. Wright

Table of Contents

Supplementary Table S1. Linear regression analyses of potential fixed effect covariates at baseline (Time 1 (T1)) with family and zygosity included as random effects

| Fixed Effects (examined individualy*) | Outcome Variable: Anxiety/Depression T1 | | | | | | | |
| | Full Sample | | | | Longitudinal Subsample Only | | | |
	β	SE	*p*-value	R^2 *(marginal)*	β	SE	*p*-value	R^2 *(marginal)*
Sex (coded girls 0, boys 1)	.150	.105	.153	.006	**.269**	**.120**	**.026**	**.018**
Age at T1	**-.163**	**.040**	**6.67e-05**	**.048**	**-.141**	**.049**	**.0043**	**.035**
Puberty at T1	.006	.084	.947	1.1e-05	.062	.100	.537	.001
Neighbourhood SES at T1	**-.057**	**.025**	**.021**	**.017**	-.056	.030	.064	.015
Age T1 x SES T1	-.002	.017	.885	.000				

| | Outcome Variable: Perceived Stress T1 | | | | | | | |
| | Full Sample | | | | Longitudinal Subsample Only | | | |
	β	SE	*p*-value	R^2 *(marginal)*	β	SE	*p*-value	R^2 *(marginal)*
Sex	.163	.104	.118	.007	.171	.121	.160	.007
Age at T1	**-.092**	**.040**	**.023**	**.016**	-.086	.049	.085	.013
Puberty at T1	.058	.084	.485	.001	.156	.100	.117	.008
Neighbourhood SES at T1	**-.059**	**.024**	**.015**	**.019**	-.047	.030	.124	.01
Age T1 x SES T1	.005	.017	.750	.000				

| | Outcome Variable: Rumination T1 | | | | | | | |
| | Full Sample | | | | Longitudinal Subsample Only | | | |
	β	SE	*p*-value	R^2 *(marginal)*	β	SE	*p*-value	R^2 *(marginal)*
Sex	**-.238**	**.104**	**.022**	**.014**	-.200	.122	.101	.010
Age at T1	**-.112**	**.041**	**.0065**	**.023**	**-.100**	**.048**	**.040**	**.018**
Puberty at T1	-.009	.085	.916	2.8e-05	-.035	.101	.733	4.1e-04
Neighbourhood SES at T1	-.013	.025	.585	9.4e-04	.000	.030	.989	8.8e-07
Sex x Age T1	-.107	.075	.156	.005				

| | Outcome Variable: Daytime Sleepiness T1 | | | | | | | |
| | Full Sample | | | | Longitudinal Subsample Only | | | |
	β	SE	*p*-value	R^2 *(marginal)*	β	SE	*p*-value	R^2 *(marginal)*
Sex	-.039	.105	.707	3.9e-04	.020	.123	.163	1.0e-04
Age at T1	-.032	.039	.410	.002	-.020	.047	.673	6.9e-04
Puberty at T1	.068	.083	.414	.002	.068	.100	.498	.002
Neighbourhood SES at T1	-.036	.023	.124	.007	-.001	.029	.826	1.9e-04

*except for interactions (e.g. Age T1 x SES T1 includes Age and SES as well as the interaction – the R² represents the ΔR² when the interaction term is added).
NOTE: Family and zygosity were included in the model as random effects. Nominally significant fixed effects are highlighted in **bold.**

Supplementary Table S2. Linear Regression analyses of potential fixed effect covariates at follow-up (Time 2 (T2)) with family and zygosity included as random effects

	Outcome Variable: Anxiety/Depression T2			
Fixed Effects (examined individually*)	β	SE	*p*-value	R^2 *(marginal)*
Sex (coded girls 0, boys 1)	**-.279**	**.119**	**.020**	**.019**
Age at T2	.015	.045	.735	5.5e-04
Puberty at T2	**.322**	**.086**	**.00023**	**.049**
Neighbourhood SES at T2	-.004	.031	.896	8.3e-05
Baseline/Follow-up Interval	-.135	.233	.563	.002
Pre/Post Lockdown	.118	.149	.430	.003
Sex x Puberty T2	-.114	.169	.501	.000

	Outcome Variable: Perceived Stress T2			
	β	SE	*p*-value	R^2 *(marginal)*
Sex (coded girls 0, boys 1)	-.037	.120	.760	3.4e-04
Age at T2	.053	.044	.233	.007
Puberty at T2	**.207**	**.087**	**.018**	**.021**
Neighbourhood SES at T2	.011	.030	.706	6.6e-04
Baseline/Follow-up Interval	.026	.229	.911	5.9e-05
Pre/Post Lockdown	.042	.147	.774	3.9e-04

	Outcome Variable: Rumination T2			
	β	SE	*p*-value	R^2 *(marginal)*
Sex (coded girls 0, boys 1)	**-.421**	**.120**	**.00058**	**.044**
Age at T2	.070	.044	.113	.011
Puberty at T2	**.358**	**.086**	**4.89e-05**	**.061**
Neighbourhood SES at T2	.044	.030	.145	.010
Baseline/Follow-up Interval	.056	.228	.806	2.7e-04
Pre/Post Lockdown	-.080	.146	.585	.001
Sex x Puberty T2	-.211	.173	.223	.004

	Outcome Variable: Daytime Sleepiness T2			
	β	SE	*p*-value	R^2 *(marginal)*
Sex (coded girls 0, boys 1)	-.220	.121	.071	.012
Age at T2	.080	.045	.076	.015
Puberty at T2	**.270**	**.087**	**.002**	**.035**
Neighbourhood SES at T2	.013	.031	.675	8.4e-04
Baseline/Follow-up Interval	.239	.232	.304	.005
Pre/Post Lockdown	-.130	.149	.383	.004

*except for interactions (e.g. Sex x Puberty T2 includes Sex and Puberty T2 as well as the interaction – the R^2 represents the ΔR^2 when the interaction term is added).

NOTE: Family and zygosity were included in the model as random effects. Nominally significant fixed effects are highlighted in **bold.**

Supplementary Table S3. Correlation coefficients for measures collected at baseline (Time 1 (T1)) and follow-up (Time 2 (T2)).

	Pearson Correlation Coefficient							
	Anx/Dep Time 1	Stress Time 1	Rumination Time 1	Sleepiness Time 1	Anx/Dep Time 2	Stress Time 2	Rumination Time 2	Sleepiness Time 2
Perceived Stress T1	.574**							
Rumination T1	.532**	.593**						
Daytime Sleepiness T1	.504**	.473**	.383**					
Anxiety/Depression T2	.416**	.363**	.331**	.336**				
Perceived Stress T2	.247**	.477**	.388**	.277**	.594**			
Rumination T2	.275**	.270**	.404**	.268**	.553**	.628**		
Daytime Sleepiness T2	.211**	.305**	.297**	.491**	.588**	.608**	.482**	
	Spearman's Rank Correlation Coefficient							
	Anx/Dep Time 1	Stress Time 1	Rumination Time 1	Sleepiness Time 1	Anx/Dep Time 2	Stress Time 2	Rumination Time 2	Sleepiness Time 2
Sex	0.048	0.075	-.127**	-.032	-.079	0.003	-.199**	-.114*
Age at T1	-.238**	-.128**	-.172**	-.036	0.049	0.103	.127*	.115*
Puberty at T1	-.025	0.007	-.003	0.055	.149**	.120*	.124*	.132*
Neighbourhood SES at T1	-.055	-.082	0.000	-.040	-.018	0.006	0.081	-.002
Age at T2	-.204**	0.135*	-.165**	0.033	0.044	0.101	.123*	.114*
Puberty at T2	-.056	-.053	-.020	0.058	.199**	.136*	.233**	.203**
Neighbourhood SES at T2	-.075	-.054	0.042	0.013	-.011	0.010	0.080	-.001
Baseline/Follow-up Interval	-.172**	-.161**	-.163**	-.083	-.003	0.031	0.030	0.080
Pre/Post Lockdown	0.183**	0.154**	0.179**	0.078	0.058	0.020	-.030	-.048

** Significant at the 0.01 level (2-tailed)

* Significant at the 0.05 level (2-tailed)

NOTE: Anxiety/depression, perceived stress, and rumination have been square root transformed to address minor positive skew with minor outliers winsorised to ±3.3SD. Transformations and correlations were conducted using IBM SPSS Statistics Version 27. Sample size ranged from 416 to 422 for Time 1 data correlations and from 303 to 304 for correlations including Time 2 data. All traits show moderate stability over time (r ranging 0.40 to 0.48). Perceived stress, rumination, and daytime sleepiness have moderate concurrent associations with anxiety/depression ((r ranging 0.50 to 0.57 at T1, and 0.55 to 0.60 at T2). Age is associated with anxiety/depression, perceived stress, and rumination at baseline, but puberty is more influential at follow-up. Note that associations between interval and lockdown with traits at Time 1 reflect associations with age at Time 1. That is, age at Time 1 correlates 0.59 with interval (i.e. younger participants had a shorter interval – an artificial construct driven by the practicalities of maximising sample size within our preferred age range). Age at Time 1 correlates -0.56 with lockdown (post-lockdown participants were younger overall than pre-lockdown participants). These analyses do not include correction for twin relatedness.

Supplementary Table S4. Cross-sectional linear regression models with anxiety/depression symptoms at **Time 1** (T1) as the output variable: associations with perceived stress, rumination, and daytime sleepiness

Fixed Effects	Anxiety/Depression at Time 1 as Output Variable					
	Model 1		**Model 2**		**Model 3**	
	β (SE)	p-value	β (SE)	p-value	β (SE)	p-value
Perceived Stress T1	.568 (.040)	<2e-16				
Rumination T1			.521 (.041)	<2e-16		
Daytime Sleepiness T1					0.481 (.042)	<2e-16
	R^2	AIC	R^2	AIC	R^2	AIC
	.320	1016.3	.236	1056.8	.236	1056.8
	Model 4		**Model 5**		**Model 6**	
	β (SE)	p-value	β (SE)	p-value	β (SE)	p-value
Perceived Stress T1	.388 (.048)	8.09e-15	.428 (.044)	<2e-16		
Rumination T1	.302 (.070)	3.60e-10			.398 (.041)	<2e-16
Daytime Sleepiness T1			.297 (.043)	2.11e-11	.343 (.041)	1.09e-15
	R^2	AIC	R^2	AIC	R^2	AIC
	.380	976.3	.390	.967.8	.382	.972.0
	Model 7		**Model 8**		**Model 9**	
	β (SE)	p-value	β (SE)	p-value	β (SE)	p-value
Perceived Stress T1	.289 (.049)	6.06e-09	.283(.048)	8.13e-09	**.273 (.048)**	**2.97e-08**
Rumination T1	.262 (.045)	1.42e-08	.250 (.045)	5.35e-08	**.254 (.045)**	**3.07e-08**
Daytime Sleepiness T1	.264 (.042)	7.65e-10	.266 (.041)	3.87e-10	**.263 (.041)**	**4.91e-10**
Age at T1			-.095 (.031)	.002	**-.094 (.030)**	**.0021**
Neighbourhood SES T1					**-.027 (.018)**	**.129**
	R^2	AIC	R^2	AIC	**R^2**	**AIC**
	.435	937.8	.453	930.3	**.458**	**930.0**

Family and zygosity are included as random effects. Analyses are on the full baseline sample. Model 9 is the best-fitting model, although the AIC fit is almost identical to that of Model 8.

Supplementary Table S5. Cross-sectional linear regression models with anxiety/depression symptoms at **Time 2** (T2) as the output variable: associations with perceived stress, rumination, and daytime sleepiness

Fixed Effects	Anxiety/Depression at Time 2 as Output Variable					
	Model 1		Model 2		Model 3	
	β (SE)	*p*-value	β (SE)	*p*-value	β (SE)	*p*-value
Perceived Stress T2	.562 (.047)	<2e-16				
Rumination T2			.515 (.048)	<2e-16		
Daytime Sleepiness T2					0.563 (.047)	<2e-16
	R^2	AIC	R^2	AIC	R^2	AIC
	.326	726.7	.276	741.0	.326	725.2
	Model 4		Model 5		Model 6	
	β (SE)	*p*-value	β (SE)	*p*-value	β (SE)	*p*-value
Perceived Stress T2	.381 (.057)	1.22e-10	.354 (.055)	3.55e-10		
Rumination T2	.295 (.056)	3.12e-07			.340 (.049)	1.69e-11
Daytime Sleepiness T2			.359 (.055)	2.32e-10	.408 (.049)	4.35e-15
	R^2	AIC	R^2	AIC	R^2	AIC
	.384	702.5	.419	.688.6	.427	681.9
	Model 7		Model 8		Model 9	
	β (SE)	*p*-value	β (SE)	*p*-value	β (SE)	*p*-value
Perceived Stress T2	.224 (.060)	.00023	**.224 (.060)**	**.00024**	.228 (.061)	.00023
Rumination T2	.246 (.054)	7.71e-06	**.233 (.055)**	**2.95e-05**	.229 (.056)	5.35e-05
Daytime Sleepiness T2	.321 (.054)	5.70e-09	**.313 (.054)**	**1.89e-08**	.311 (.054)	2.62e-08
Puberty T2			**.082 (.067)**	**.220**	.076 (.069)	.273
Sex					-.038 (.689)	.689
	R^2	AIC	**R^2**	**AIC**	R^2	AIC
	.457	670.6	**.459**	**664.8**	.459	666.6

NOTE: Family and zygosity are included as random effects. Model 8 is the best-fitting model.

Supplementary Table S6 (a). Linear regression analyses exploring bidirectional influences between *perceived stress* and *anxiety/depression* across times 1 and 2

	Output Variable: Anxiety/Depression T2					
Fixed Effects	**Model 1**		**Model 2**		**Model 3**	
	β (SE)	*p*-value	β (SE)	*p*-value	β (SE)	*p*-value
Perceived Stress T1	.327 (.054)	3.57e-09*	.335 (.052)	6.38e-10*	.340 (.052)	3.28e-10*
Puberty T2			.326 (.081)	7.15e-05*	.277 (.084)	.0012*
Sex					-.226 (.116)	.052
	R^2	AIC	R^2	AIC	R^2	AIC
	.107	799.6	.158	776.8	.167	775.1
	Output Variable: Perceived Stress T2					
	Model 4		**Model 5**			
	β (SE)	*p*-value	β (SE)	*p*-value		
Anxiety/Depression T1	.220 (.055)	7.63e-05*	.232 (.055)	2.89e-05*		
Puberty T2			.233 (.085)	.00062*		
	R^2	AIC	R^2	AIC		
	.049	824.3	.077	812.1		

NOTE: Family and zygosity were included as random effects in all models. Puberty and sex were significant covariates for anxiety/depression at follow-up, while puberty was a significant covariate for perceived stress at follow-up (Supp Table S2). Models are shown with and without sex and/or puberty as fixed effects. Sex (coded girls 0, boys 1) is not significant when perceived stress and puberty are included in the model (Model 3). Note that inclusion of covariates does not reduce the effect size of the predicting variable, rather, it causes a slight increase in the effect size.
*p-values less than the experiment-wide significance threshold (*p*<0.0085).

Supplementary Table S6 (b). Linear regression analyses exploring bidirectional influences between *rumination* and *anxiety/depression* across times 1 and 2

	Output Variable: Anxiety/Depression T2					
Fixed Effects	**Model 1**		**Model 2**		**Model 3**	
	β (SE)	*p*-value	β (SE)	*p*-value	β (SE)	*p*-value
Rumination T1	.286 (.056)	6.24e-07*	.285 (.055)	3.86e-07*	.278 (.055)	8.32e-07*
Puberty T2			.315 (.083)	.00018*	.293 (.087)	.00085*
Sex					-.101 (.120)	.398
	R^2	AIC	R^2	AIC	R^2	AIC
	.076	810.5	.123	790.2	.125	791.5
	Output Variable: Rumination T2					
	Model 4		**Model 5**			
	β (SE)	*p*-value	β (SE)	*p*-value		
Anxiety/Depression T1	.254 (.055)	6e-06*	.274 (.054)	5.62e-07*		
Puberty T2			.387 (.083)	4.62e-06*		
	R^2	AIC	R^2	AIC		
	.065	830.0	.139	802.3		

NOTE: Family and zygosity were included as random effects in all models. Puberty and sex were significant covariates for anxiety/depression at follow-up, while puberty was a significant covariate for perceived stress at follow-up (Supp Table S2). Models are shown with and without sex and/or puberty as fixed effects. Sex (coded girls 0, boys 1) is not significant when perceived stress and puberty are included in the model (Model 3).
*p-values less than the experiment-wide significance threshold (*p*<0.0085).

Supplementary Table S6 (c). Linear regression analyses exploring bidirectional influences between *daytime sleepiness* and *anxiety/depression* across times 1 and 2

	Output Variable: Anxiety/Depression T2					
Fixed Effects	**Model 1**		**Model 2**		**Model 3**	
	β (SE)	*p*-value	β (SE)	*p*-value	β (SE)	*p*-value
Daytime Sleepiness T1	.278 (.055)	2.1e-07*	.267 (.051)	3.79e-07*	.270 (.051)	2.63e-07*
Puberty T2			.273 (.081)	.00084*	.235 (.085)	.0060*
Sex					-.178 (.116)	.125
	R^2	AIC	R^2	AIC	R^2	AIC
	.078	796.8	.117	777.5	.124	777.1
	Output Variable: Daytime Sleepiness T2					
	Model 4		**Model 5**			
	β (SE)	*p*-value	β (SE)	*p*-value		
Anxiety/Depression T1	.166 (.055)	.0027*	.183 (.055)	.00089*		
Puberty T2			.299 (.086)	.00053*		
	R^2	AIC	R^2	AIC		
	.028	828.2	.074	813.1		

NOTE: Family and zygosity were included as random effects in Models 1 and 3-5. Model 2 was overfitted if both Family and Zygosity were included and so was run with only Family included as a Random Effect. Puberty and sex were significant covariates for anxiety/depression at follow-up, while puberty was a significant covariate for daytime sleepiness at follow-up (Supp Table S2). Models are shown with and without sex and/or puberty as fixed effects. Sex (coded girls 0, boys 1) is not significant when daytime sleepiness and puberty are included in the model (Model 3).
*p-values less than the experiment-wide significance threshold (*p*<0.0085).

Supplementary Table S6 (d). Linear regression analyses exploring bidirectional influences between *perceived stress* and *rumination* across times 1 and 2

Fixed Effects	Output Variable: Rumination T2					
	Model 1		**Model 2**		**Model 3**	
	β (SE)	*p*-value	β (SE)	*p*-value	β (SE)	*p*-value
Perceived Stress T1	.262 (.056)	4.51e-06*	.280 (.055)	5.44e-07*	.289 (.054)	1.85e-07*
Puberty T2			.365 (.083)	1.74e-05*	.295 (.086)	.00073*
Sex					-.338 (.120)	.0052*
	R²	AIC	R²	AIC	R²	AIC
	.067	827.5	.135	800.9	.160	795.1
	Output Variable: Perceived Stress T2					
	Model 4		**Model 5**			
	β (SE)	*p*-value	β (SE)	*p*-value		
Rumination T1	.356 (.053)	3.8e-10*	.362 (.054)	1.56e-10*		
Puberty T2			.200 (.081)	.014		
	R²	AIC	R²	AIC		
	.119	795.5	.143	784.3		

NOTE: Family and zygosity were included as random effects in all models. Puberty and sex (coded girls 0, boys 1) were significant covariates for rumination at follow-up, while puberty was a significant covariate for perceived stress at follow-up (Supp Table S2). Models are shown with and without sex and/or puberty as fixed effects.
*p-values less than the experiment-wide significance threshold ($p<0.0085$).

Supplementary Table S6 (e). Linear regression analyses exploring bidirectional influences between *perceived stress* and *daytime sleepiness* across times 1 and 2

Fixed Effects	Output Variable: Daytime Sleepiness T2			
	Model 1		**Model 2**	
	β (SE)	*p*-value	β (SE)	*p*-value
Perceived Stress T1	.297 (.053)	5.66e-08*	.302 (.053)	3.07e-08*
Puberty T2			.252 (.083)	.0018*
	R²	AIC	R²	AIC
	.088	798.5	.122	785.6
	Output Variable: Perceived Stress T2			
	Model 3		**Model 4**	
	β (SE)	*p*-value	β (SE)	*p*-value
Daytime Sleepiness T1	.235 (.055)	2.3e-05*	.235 (.055)	2.42e-05*
Puberty T2			.179 (.085)	.035
	R²	AIC	R²	AIC
	.055	819.9	.074	810.1

NOTE: Family and zygosity were included as random effects in all models. Puberty was the only significant covariate identified for perceived stress and daytime sleepiness at follow-up (Supp Table S2). Models are shown with and without puberty as a fixed effect.
*p-values less than the experiment-wide significance threshold ($p<0.0085$).

Supplementary Table S6 (f). Linear regression analyses exploring bidirectional influences between *rumination* and *daytime sleepiness* across times 1 and 2

Fixed Effects	Output Variable: Daytime Sleepiness T2					
	Model 1		**Model 2**			
	β (SE)	*p*-value	β (SE)	*p*-value		
Rumination T1	.266 (.055)	2.63e-06*	.271 (.055)	1.4e-06*		
Puberty T2			.262 (.083)	.0017*		
	R²	AIC	R²	AIC		
	.066	804.7	.103	791.8		
	Output Variable: Rumination T2					
	Model 3		**Model 4**		**Model 5**	
	β (SE)	*p*-value	β (SE)	*p*-value	β (SE)	*p*-value
Daytime Sleepiness T1	.272 (.055)	1.43e-06*	.265 (.054)	1.88e-06*	.267 (.054)	1.22e-06*
Puberty T2			.323 (.084)	.00016*	.261 (.087)	.0030*
Sex					-.306 (.121)	.013
	R²	AIC	R²	AIC	R²	AIC
	.069	825.3	.124	803.2	.146	798.9

NOTE: Family and zygosity were included as random effects in all models. Puberty and sex (coded girls 0, boys 1) were significant covariates for rumination at follow-up, while puberty was a significant covariate for daytime sleepiness at follow-up (Supp Table S2). Models are shown with and without sex and/or puberty as fixed effects
*p-values less than the experiment-wide significance threshold ($p<0.0085$).

Supplementary Table S7. 8-Variable Cholesky decomposition parameter estimates for additive genetic (A), common (shared) environmental (C), and unique (non-shared) environmental (E) influences (95% confidence intervals shown for significant estimates)

	A1	A2	A3	A4	A5	A6	A7	A8	Total A (Heritability)
				Additive Genetic Factor Estimates (shown as % of total variance)					
Anx/Dep T1	23 (.04, 51)								23 (.04, 51)
Stress T1	09	12							20 (.04, 47)
Rumination T1	01	02	08						10
Sleepiness T1	10	00	01	18					29 (04, 48)
Anx/Dep T2	02	00	00	04	10				16
Stress T2	01	00	00	04	06	03			15
Rumination T2	00	09	09	01	08	10	00		28 (0.8, 58)
Sleepiness T2	00	00	01	22	02	18	00	00	44 (07, 66)

	C1	C2	C3	C4	C5	C6	C7	C8	Total C
				Common Environment Factor Estimates (shown as % of total variance)					
Anx/Dep T1	18								18
Stress T1	07	12							20 (.04, 40)
Rumination T1	11	11	01						23 (0.8, 40)
Sleepiness T1	04	02	00	00					06
Anx/Dep T2	27	02	06	00	00				35 (04, 56)
Stress T2	19	12	00	00	00	00			31 (01, 51)
Rumination T2	15	06	00	00	00	00	00		20 (0.3, 43)
Sleepiness T2	12	02	00	00	00	00	00	00	14

	E1	E2	E3	E4	E5	E6	E7	E8	Total E
				Unique Environment Factor Estimates (shown as % of total variance)					
Anx/Dep T1	59 (45, 74)								59 (45, 74)
Stress T1	13 (06, 24)	47 (36, 59)							60 (47, 75)
Rumination T1	18 (09, 30)	06 (02, 12)	43 (33, 54)						67 (52, 81)
Sleepiness T1	12 (05, 22)	03 (0.3, 09)	00	50 (39, 62)					65 (50, 80)
Anx/Dep T2	04 (0.4, 11)	01	00	00	43 (32, 57)				49 (36, 64)
Stress T2	03 (0.1, 10)	08 (02, 18)	00	00	04 (0.6, 12)	39 (28, 51)			54 (39, 71)
Rumination T2	03 (0.1, 11)	02	00	02	07 (02, 17)	07 (02, 15)	31 (21, 44)		52 (36, 72)
Sleepiness T2	01	06 (11, 37)	00	03 (0.4, 09)	07 (02, 14)	02 (0.1, 06)	00	24 (17, 34)	42 (30, 58)

Supplementary Table S8. Additive genetic (A), common environmental (C), unique environmental (E) and familial (A + C) contributions to phenotypic associations between Time 1 (T1) predictors and anxiety/depression symptoms at Time 2 (T2)

	Phenotypic r = A + C + E (95% CI)	A, C, E additive components of phenotypic r			A, C, E as % of phenotypic r		
		$A = a_{11}*a_{21}$ (95% CI)	$C = c_{11}*c_{21}$ (95% CI)	$E = e_{11}*e_{21}$ (95% CI)	A	C	E
AnxDep T1 – AnxDep T2	**0.41 (.31, .51)**	0.10 (-.12, .40)	0.16 (-.08, .37)	**0.15 (.04, .28)**	24%	39%	37%
Stress T1 – AnxDep T2	**0.36 (.26, .46)**	0.09 (-.16, .40)	0.13 (-.13, .36)	**0.14 (.03, .27)**	25%	36%	39%
Rumination T1 – AnxDep T2	**0.33 (.21, .43)**	-0.08 (-.16, .19)	**0.30 (.09, .39)**	0.11 (-.01, .22)	16%	61%	23%
Sleepiness T1 – AnxDep T2	**0.32 (.21, .43)**	0.17 (-.09, .38)	0.08 (-.09, .30)	0.07 (-.04, .20)	53%	25%	22%
	Phenotypic r = (A + C) + E (95% CI)	(A + C) and E additive components of phenotypic r			(A + C) and E as % of phenotypic r		
		A + C (95% CI)		E (95% CI)	A + C		E
AnxDep T1 – AnxDep T2	**0.41 (.31, .51)**	**0.26 (.12, .39)**		**0.15 (.04, .28)**	63%		37%
Stress T1 – AnxDep T2	**0.36 (.26, .46)**	**0.22 (.08, .35)**		**0.14 (.03, .27)**	61%		39%
Rumination T1 – AnxDep T2	**0.33 (.21, .43)**	**0.22 (.09, .35)**		0.11 (-.01, .22)	77%		23%
Sleepiness T1 – AnxDep T2	**0.32 (.21, .43)**	**0.25 (.11, .38)**		0.07 (-.04, .20)	78%		22%
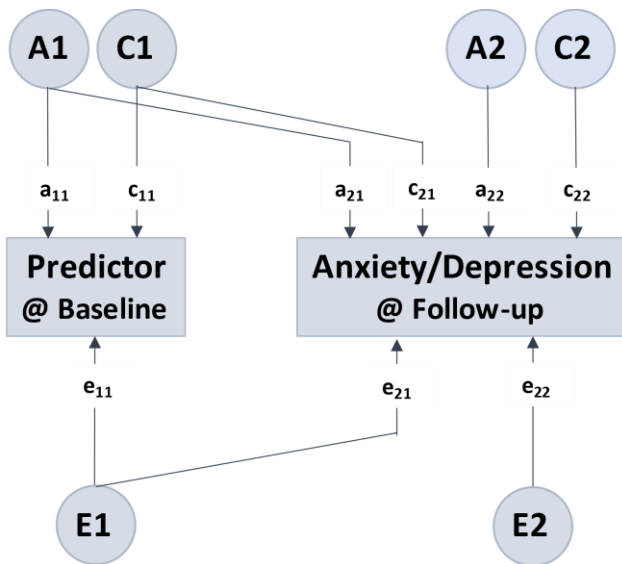
Supplementary Figure S1. Path diagram of bivariate Cholesky decomposition (shown for only one twin). Factors A1, C1 and E1 represent the total additive genetic (A), common/shared environmental (C), and unique/non-shared environmental (E) influences on the predictor variable at baseline. a_{21}, c_{21}, and e_{21} indicate the extent to which A1, C1 and E1 account for variance in anxiety/depression symptoms at follow-up. Factors A2, C2, and E2 represent independent A, C, and E influences on anxiety/depression symptoms at follow-up. The phenotypic correlation between the predictor at baseline and anxiety/depression at follow-up is equivalent to $a_{11}*a_{21} + c_{11}*c_{21} + e_{11}*e_{21}$.
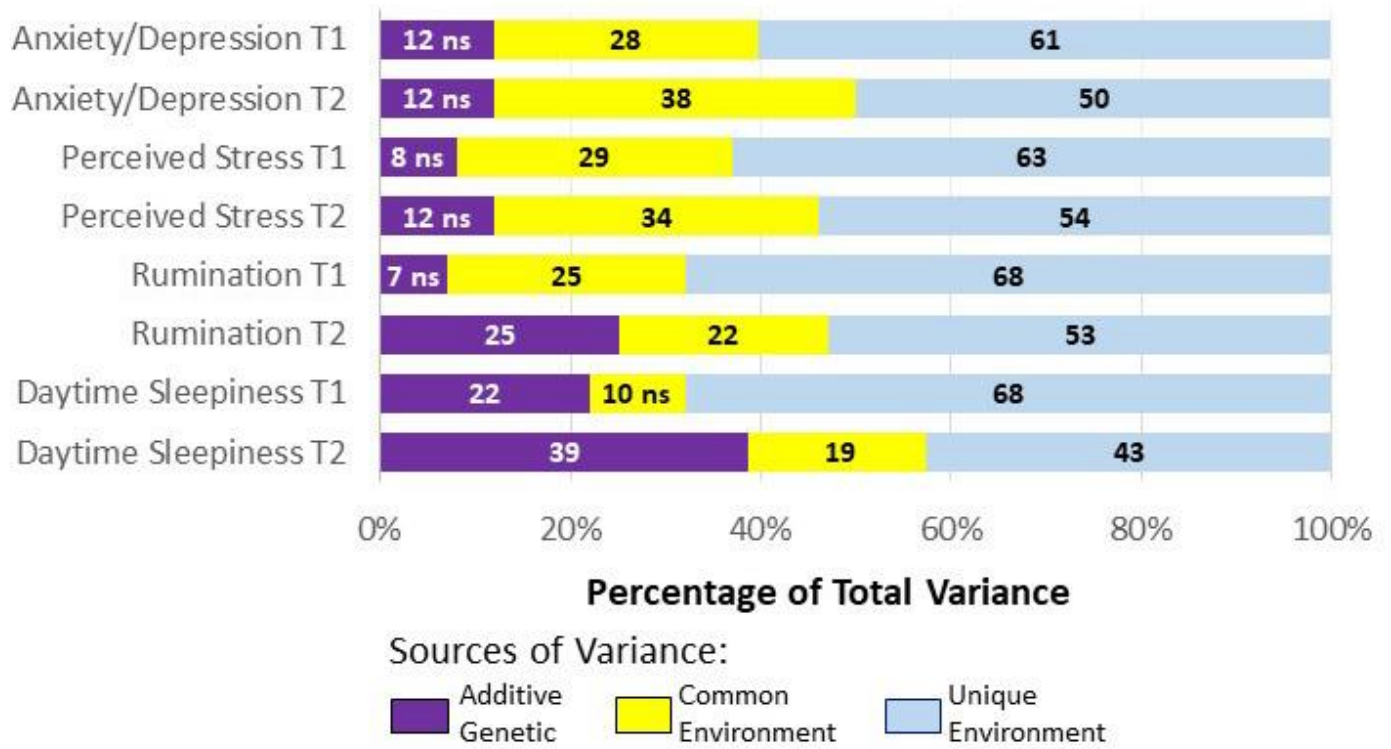
Supplementary Figure S2. Proportion of total variance influenced by additive genetic (A), common/shared environmental (C), and unique/non-shared environmental sources (E), as derived from multivariate Cholesky decomposition – **restricted to Time 2 sample for both timepoints**.