Online supplement

A1 Sample descriptives and comparative analyses

Following the procedure outlined in the method section (see Participants) we collected N = 73 adoption families and N = 267 biological families. However, the analyses were restricted to the sample of parents with at least a secondary education (99% of the original collected sample). This was done because (1) only a small number of parents (4 mothers and 3 fathers) did not have a secondary degree, making analyses in this group unreliable, and (2) these mothers and fathers without a secondary degree belonged exclusively to the biological group, so it was impossible to compare this group with the adoption group. In point of fact, during later exploratory analyses it was found that especially the 4 mothers with no secondary education had higher levels of depressive and functional somatic symptoms (FSS) compared to the other educational levels, which strongly influenced mean level differences of the entire sample (i.e., it exacerbated the effect of education, gender, and differences between the adoption and biological group on depressive symptoms and FSS). Because one family had two parents with no secondary degree, this family was excluded (at least one pair of parent – child data per family is needed for the behavioral genetic analyses). The final included sample was N = 73 adoption families and N = 266 biological families. In this sample there was few missing data, i.e., 72 adoption families and 259 biological families had non-missing data for all assessed measures, the other families had at least one pair of parent – child data for each measure. The sample descriptives can be found in Table 1 and Table 2.

Table 1
Sample descriptives of parents

		Mothers		Fathers	
		Biological	Adoption	Biological	Adoption
Age	M (SD)	45.75 (4.22)	49.06 (4.62)	47.76 (4.73)	50.45 (5.01)
Education	Secondary	29%	21%	39%	23%
	College	49%	47%	37%	44%
	University	22%	32%	24%	33%

Note. Mean age is expressed in years.

Table 2
Sample descriptives of adolescents

		Adolescents	
		Biological	Adoption
Gender	% female	51%	63%
Age	M (SD)	15.13 (1.97)	14.78 (1.96)
Education	General	61%	60%
	Vocational	9%	6%
	Art	1%	4%
	Technical	29%	30%

Note. Mean age is expressed in years.

Table 3
Detailed education orientation for adolescents per gender

	Adolescents	
Education	Male	Female
General	52%	69%
Vocational	10%	6%
Technical	1%	2%
Art	37%	23%

Comparative analyses of demographic variables between adoption and biological group

Adolescent gender (χ^2-test)
There were no differences in distribution of adolescent gender between the adoption and biological group ($\chi^2 = 3.55$, $p = .059$).

Age (ANOVA and *t*-test)
There were significant age differences between parents of the adoption and biological group ($F_{1,661} = 49.17$, $p < .001$), with parents of the adoption group being older than parents of the biological group. There was also a main effect of gender on age, with fathers being generally older than mothers ($F_{1,661} = 15.84$, $p < .001$), there was however no interaction effect between group status (adoption versus biological) and gender of the parent on age ($F_{1,661} = 0.54$, $p = .462$). Both mothers of the adoption group were older than mothers of the biological group ($t = 5.79$, $p < .001$) and, in a similar way, fathers of the adoption group were older than fathers of the biological group ($t = 4.22$, $p < .001$). The finding that adoption parents are generally older than biological parents is not unexpected, given the process of having to adopt a child [1, 2]. The effects of these age differences between the adoption and biological group and mothers versus fathers on the measures is investigated below.

There were no differences in age between biological and adoption adolescents ($F_{1,332} = 1.40$, $p = .238$), between male or female adolescents ($F_{1,332} = 0.00$, $p = .949$), or the interaction between age and group status ($F_{1,332} = 0.11$, $p = .737$).

Education (Ordinal logistic regression)
There were no significant differences in educational level between biological and adoption parents (Wald χ^2 (1) = 3.21, $p = .073$) or between mother and fathers (Wald χ^2 (1) = 1.59, $p = .208$). There was also no interaction between group status and gender of the parent on educational level (Wald χ^2 (1) = 0.25, $p = .619$).

There were also no differences in educational orientation between biological and adoption adolescents (Wald χ^2 (1) = 0.52, $p = .472$). However, female and male adolescents did differ in educational orientation (Wald χ^2 (1) = 7.09, $p = .008$), with female adolescents represented more in the general education and male adolescents represented more in the arts (Table 3). There was, however, no interaction between group status and gender on educational orientation (Wald χ^2 (1) = 0.54, $p = .461$). The effects of the educational differences between male and female adolescents on the measures is investigated below.

A2 Construction of depression scales without somatic items

Beck Depression Inventory-II (BDI)

A Scree Plot indicated a 2 factor solution with 36% of explained variance. Factor analyses result for BDI-IIc (Beck Depression Inventory-II without somatic items) are presented in Table 4. Based on these findings and on extant literature [3-6], item 11 (Agitation), item 15 (Loss of energy), item 16 (Changes in sleeping pattern), item 17 (Irritability), item 18 (Changes in appetite), item 19(Concentration difficulty), item 20 (Tiredness or fatigue), and item 21 (Loss of interest in sex) were excluded from the BDI-IIc scale score (i.e., BDI-II without somatic items).

Table 4

Rotated factor matrix for Beck Depression Inventory-II (BDI)

	Factor	
Item	1	2
1	.61	.28
2	.56	.27
3	.58	.13
4	.39	.45
5	.43	.21
6	.46	.15
7	.62	.38
8	.39	.32
9	.65	.09
10	.30	.27
11	.18	**.56**
12	.41	.40
13	.33	.39
14	.79	.14
15	.23	**.62**
16	.02	**.58**
17	.20	**.54**
18	.25	**.38**
19	.38	**.53**
20	.15	**.75**
21	.34	**.41**

Note. Data for mothers and fathers combined. Extraction Method: Principal Axis Factoring. Rotation Method: Varimax with Kaiser Normalization. Rotation converged in 3 iterations. Numbers in bold were identified as measuring somatic items.

Children's Depression Inventory (CDI)

There is no consensus in literature about the factor structure of the CDI and identification of a separate somatic items subscale [7, 8]. Similarly, in the current study, a Scree Plot and Principal Axis Factoring identified either one large common factor explaining 18% of variance or 9 factors with 38% of explained variance (Figure 1). Neither of these solutions resulted in a set of items that could primarily be identified as a somatic subscale. Therefore, we selected items based on research using the CDI in adolescent samples suffering from pain symptoms [9, 10] and a community sample [11]. The following 4 items were excluded in the CDIc scale score (i.e., CDI without somatic items): item 16 (Sleep disturbance), item 17 (Fatigue), item 18 (Loss of appetite), and item 19 (Negative somatic preoccupation).

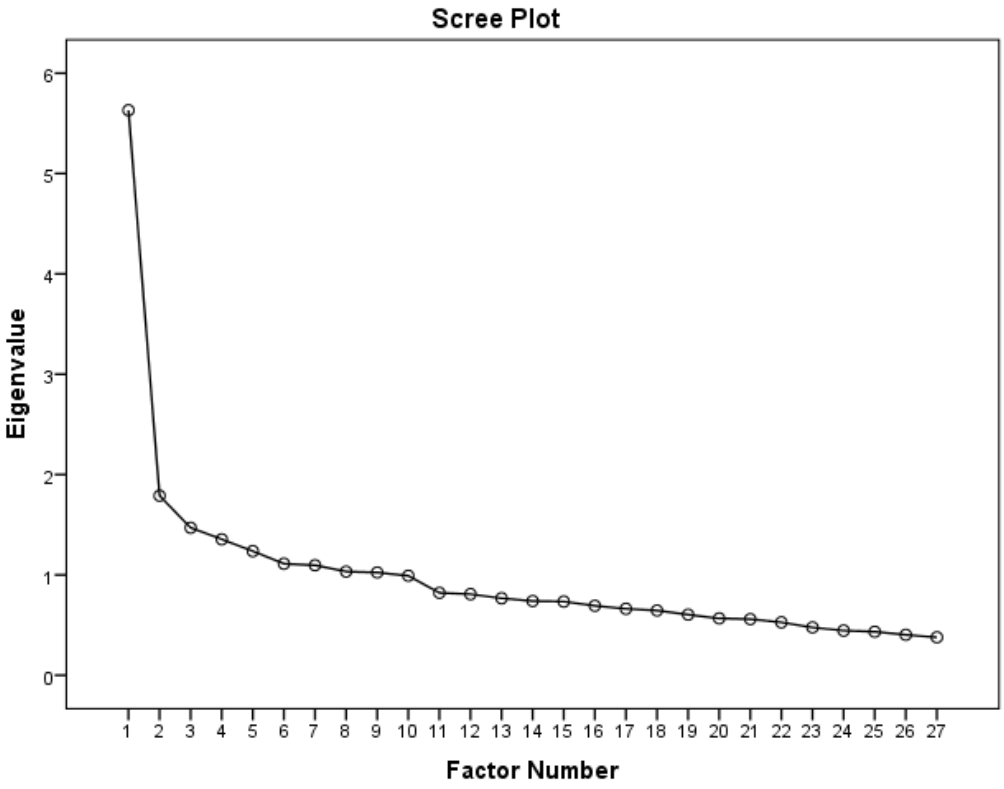

Fig. 1 Scree plot for the CDI.

A3 Somatic Symptoms Questionnaire

The Somatic Symptoms Questionnaire [12] assesses five types of FSS using 33 items: (1) fatigue related complaints,(2) pain symptoms, (3) respiratory complaints, (4) gastrointestinal problems, and (5) tension-related problems. It is developed from clinical experience with patients suffering from Chronic Fatigue Syndrome [13-15] and based on the Psychosomatic Symptom Checklist [16], the Physical Symptom Checklist [17, 18], and the Children's Somatization Inventory [19]. Participants rate each complaint on 5-point scales for frequency (never to daily) and intensity (not intense to very intense). The final functional somatic score is a summation of frequencies (or average as is done in the current study) and optionally (e.g., in clinical samples) the frequencies per item can be corrected by the intensity score (i.e., the frequency item score is multiplied by the intensity score and then summed/averaged).

Fatigue related complaints

Item 9: 'Feeling tired'; Item 10: 'Feeling not rested enough'; Item 11: 'Quickly tired during activity'; Item 12: 'Feeling feverish (e.g., feeling alternately hot and cold)' ; Item 13: 'Sensitive neck muscles or axillary nodes'; Item 29: 'Feeling weak'.

Pain symptoms

Item 1: 'Headache', Item 2: 'Neck- or back pain', Item 3: 'Joint- or muscle pain in my arms' ; Item 4: 'Joint- or muscle pain in my legs'; Item 5: 'Stomach ache'; Item 6: 'Painful eyes'; Item 7: 'Sore throat'; Item 8: 'Facial pain'.

Respiratory complaints

Item 19: 'Difficulty breathing without doing an activity'; Item 20: 'Allergic reactions'; Item 21: 'Pain or tightness in chest'.

Gastrointestinal problems

Item 14: 'Gastric acid', Item 15: 'Nausea'; Item 16: 'Diarrhea'; Item 17: 'Constipation (Obstipation)'; Item 18: 'Irritable bowels'.

Tension-related problems

Item 22: 'Dry mouth'; Item 23: 'Difficulties with swallowing or experiencing a lump in your throat'; Item 24: 'Muscle cramps'; Item 25: 'Fainting or dizziness'; Item 26: 'Heart palpitations'; Item 27: 'Tingling (e.g., in your hands)'; Item 28: 'Loss of voice'; Item 30: 'Pain when light pressure or touch is applied'; Item 31: 'Excessive sweating'; Item 32: 'Having to urinate frequently'; Item 33: 'Difficulty urinating'.

A4 Preliminary analyses with demographic variables

A series of ANOVA's were performed to investigate the influence of the demographic variables on the measures. Intercept, main and two-way interaction effects of the demographic variables were entered in one model. If significant relations were found with a control variable, a regression was used to partial out the variance associated with the control variable by saving the unstandardized residuals.

For each measure we also investigated whether the pattern of mean levels within the family (i.e., mother, father, and adolescent) differed between the adoption and biological group using a Repeated Measures ANOVA with family membership as the within level factor.

Table 5

ANOVA results for parental depressive symptoms' score (Beck Depression Inventory-II without somatic items)

Factors	df	F	*p*-value
Gender	1	4.51	.034
Group status	1	0.61	.434
Educational level	2	1.72	.179
Age	1	0.49	.484
Group status x gender	1	2.50	.114
Group status x educational level	2	1.31	.271
Group status x age	1	0.63	.426
Gender x educational level	2	0.93	.396
Gender x age	1	4.48	.035

Note. Group status is adoption vs. biological group. df of error = 646.

Table 6

ANOVA results for adolescent depressive symptoms' score (Children's Depression Inventory without somatic items)

Factors	df	F	*p*-value
Gender	1	0.37	.544
Group status	1	0.15	.704
Educational level	3	2.05	.108
Age	1	0.35	.554
Group status x gender	1	1.21	.273
Group status x educational level	2	1.16	.328
Group status x age	1	0.20	.655
Gender x educational level	3	0.42	.737
Gender x age	1	0.91	.342

Note. Group status is adoption vs. biological group. df of error = 225.

Table 7

ANOVA results for parental FSS score (Somatic Symptoms Questionnaire)

Factors	df	F	*p*-value
Gender	1	0.93	.336
Group status	1	0.12	.730
Educational level	2	0.19	.830
Age	1	5.30	.022
Group status x gender	1	0.42	.519
Group status x educational level	2	1.79	.168
Group status x age	1	0.06	.814
Gender x educational level	2	2.22	.110
Gender x age	1	0.41	.524

Note. Group status is adoption vs. biological group. df of error = 646.

Table 8

ANOVA results for adolescent FSS score (Somatic Symptoms Questionnaire)

Factors	df	F	*p*-value
Gender	1	0.29	.591
Group status	1	0.08	.784
Educational level	3	0.57	.638
Age	1	4.55	.034
Group status x gender	1	0.00	.998
Group status x educational level	2	1.67	.174
Group status x age	1	0.20	.654
Gender x educational level	3	1.17	.323
Gender x age	1	0.14	.710

Note. Group status is adoption vs. biological group. df of error = 225.

Table 9

ANOVA results for parental self-criticism score (Depressive Experiences Questionnaire)

Factors	df	F	*p*-value
Gender	1	4.80	.029
Group status	1	0.93	.335
Educational level	2	1.26	.284
Age	1	0.08	.777
Group status x gender	1	0.28	.598
Group status x educational level	2	0.84	.432
Group status x age	1	1.24	.266
Gender x educational level	2	2.45	.087
Gender x age	1	4.48	.035

Note. Group status is adoption vs. biological group. df of error = 645.

Table 10

ANOVA results for adolescent self-criticism score (Depressive Experiences Questionnaire)

Factors	df	F	*p*-value
Gender	1	0.05	.830
Group status	1	0.04	.846
Educational level	3	0.71	.546
Age	1	3.43	.065
Group status x gender	1	1.09	.297
Group status x educational level	2	0.37	.772
Group status x age	1	0.07	.789
Gender x educational level	3	1.09	.356
Gender x age	1	0.01	.908

Note. Group status is adoption vs. biological group. df of error = 224.

Depressive symptoms without somatic items

Parents

Significant effects were found for gender and the interaction between gender and age on parental depressive symptoms score without somatic items ($F_{1,646}$ = 4.51, p = .034 and $F_{1,646}$ = 4.48, p = .035, respectively, Table 7). A regression of depressive symptoms score (without somatic items) on gender and the interaction gender-age was performed. This effectively removed the effect of gender and the interaction gender-age on parental depressive symptoms score (without somatic items) ($F_{1,646}$ = 3.23, p = .073 and $F_{1,646}$ = 3.00, p = .84, respectively).

Adolescents

Gender, group status, educational level, age, and their interactions had no significant effect on adolescent depressive symptoms score without somatic items (Table 8).

Family

The pattern of mean levels of depressive symptoms without somatic items within one family did not differ between the biological and adoption group ($F_{1.956,629.987}$ = 1.25, p = .287).

FSS

Parents

Significant effects were found for age on parental FSS scores ($F_{1,646}$ = 5.30, p = .022, Table 9). Explorative analyses showed that the correlation between age and FSS in the parent sample was r = -.12 (p = .002, N = 663). A regression of FSS scores on age was performed. This effectively removed the effect of parent age on parent FSS ($F_{1,646}$ = 0.05, p = .816, r = .00).

Adolescents

Significant effects were found for age on FSS ($F_{1,225}$ = 4.55, p = .034, Table 10). Explorative analyses showed that the correlation between age and FSS in the adolescent sample was r = .20 (p < .001, N = 340). A regression of FSS scores on age was performed. This effectively removed the effect of adolescent age on adolescent FSS ($F_{1,225}$ = 0.00, p = .967, r = .00).

Family

The pattern of mean levels of FSS within one family did not differ between the biological and adoption group ($F_{1.951,626.226}$ = 2.34, p = .099).

Self-criticism

Parents

Significant effects were found for gender and the interaction between gender and age on parental self-criticism score ($F_{1,645}$ = 4.80, p = .029 and $F_{1,645}$ = 4.48, p = .035, respectively, Table 11). A regression of self-criticism on gender and the interaction gender-age was performed. This effectively removed the effect of gender and the interaction gender-age on parental self-criticism ($F_{1,645}$ = 3.21, p = .074 and $F_{1,645}$ = 3.46, p = .064, respectively).

Adolescents

Gender, group status, educational level, age, and their interactions had no significant effect on adolescent self-criticism score (Table 12).

Family

The pattern of mean levels of self-criticism within one family did not differ between the biological and adoption group ($F_{2,642}$ = 0.07, p = .929).

A5 Correlations

Table 11

Correlations for mother variables

Measure	1	2	3
1. Depressive symptoms	-		
2. FSS	.35***	-	
3. Self-criticism	.53***	.30***	-

Note. Depressive symptoms are measured without items measuring somatic symptoms.
*** $p < .001$

Table 12

Correlations for father variables

Measure	1	2	3
1. Depressive symptoms	-		
2. FSS	.44***	-	
3. Self-criticism	.54***	.34***	-

Note. Depressive symptoms are measured without items measuring somatic symptoms.
*** $p < .001$

Table 13

Correlations for adolescent variables

Measure	1	2	3
1. Depressive symptoms	-		
2. FSS	.46***	-	
3. Self-criticism	.48***	.17**	-

Note. Depressive symptoms are measured without items measuring somatic symptoms.
** $p < .005$ *** $p < .001$

A6 Separately modelled relations to self-criticism

Depressive symptoms and self-criticism

Table 14 shows that the relation between depressive symptoms and self-criticism was best represented by separate genetic and environmental factors with significant covariances between the genetic factors (β_{AA} = 0.91, 95%CI = [0.12; 1.70], p = .024) and the environmental factors (β_{EE} = 0.47, 95%CI = [0.35; 0.58], p < .001). However, the resulting model showed a non-significant variance due to genetic effects in depressive symptoms (β = 0.27, 95%CI = [–0.02; 0.57], p = .071, 7% of variance, 95%CI = [0%; 32%]), while the variance due to genetic effects in self-criticism was significant (β = 0.37, 95%CI = [0.14; 0.59], p = .001, 13% of variance, 95%CI = [1%; 34%]). For both depressive symptoms and self-criticism, the variance due to environmental effects was significant (β = 0.96, 95%CI = [0.88; 1.05], p < .001, 92% of variance, 95%CI = [77%; 100%] and β = 0.93, 95%CI = [0.84; 1.02], p < .001, 86% of variance, 95%CI = [70%; 100%], respectively).

Functional somatic symptoms and self-criticism

The relation between FSS and self-criticism was best represented by separate genetic and environmental factors with a significant covariance between the environmental factors (β_{EE} = 0.30, 95%CI = [0.14; 0.46], p < .001) and a non-significant covariance between the genetic factors (β_{AA} = 0.20, 95%CI = [–0.34; 0.75], p = .467, Table 14). Removing the covariance between the genetic factors did not result in a significantly worse fit ($\Delta\chi^2_{diff}$ (1) = 0.45, p = .504; RMSEA = 0.00; SRMR = 0.07; TLI = 1.00; AIC = 5593.18; BIC = 5612.32). The resulting model showed a significant variance due to genetic effects in FSS (β = 0.54, 95%CI = [0.38; 0.69], p < .001, 29% of variance, 95%CI = [14%; 47%]) and self-criticism (β = 0.34, 95%CI = [0.13; 0.56], p = .002, 11% of variance, 95%CI = [1%; 31%]). In addition, the variance due to the environmental effects was significant in FSS and self-criticism (β = 0.85, 95%CI = [0.75; 0.94], p < .001, 72% of variance, 95%CI = [56%; 88%] and β = 0.94, 95%CI = [0.86; 1.02], p < .001, 88% of variance, 95%CI = [73%; 100%], respectively). Their remained a significant covariance between these environmental factors (β_{EE} = 0.34, 95%CI = [0.26; 0.42], p < .001).

Table 14

Results of the step 3 genetic models

	Model fit						Model parsimony	
Model	X^2	df	*p*-value	RMSEA	SRMR	TLI	AIC	BIC
Depressive symptoms and self-criticism								
One genetic and environmental component (Fig .2)	133.01	50	< .001	0.10	0.18	0.84	5471.18	5486.50
Separate genetic and environmental components (Fig .3)	36.52	48	.887	0.00	0.06	1.00	5378.69	5401.66
Somatic symptoms and self-criticism								
One genetic and environmental component (Fig .2)	102.48	50	< .001	0.08	0.13	0.69	5653.48	5668.80
Separate genetic and environmental components (Fig .3)	39.73	48	.797	0.00	0.07	1.00	5594.73	5617.70

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